

The Genesis of a Tune in the Mind: An Interview Study About Novel Involuntary Musical Imagery Repetition

Georgia A. Floridou¹ , Iris Mencke², Francesco Caprini³
and Daniel Müllensiefen¹

Abstract

Musical creativity, as a cognitive process, is inherently associated with musical imagery. Several composers have claimed to have composed music based on creative ideas that emerged involuntarily in their minds in the form of musical imagery. Research on musical imagery has been growing steadily, yet studies exploring its link to creativity have been scarce. Furthermore, although reports in the musical imagery literature reveal the existence of novel involuntary musical imagery repetition (IMIR, i.e., music that comes to the mind spontaneously and repeatedly), research to date has focused on familiar IMIR. In a semistructured interview with six composers, we investigated the internal and external experience of the novel IMIR. Based on grounded theory analysis, two descriptive models emerged: the first model indicated that the intramusical features of novel IMIR were described in terms of musical, technical, and linguistic dimensions. The repetition within novel IMIR was related to functional outcomes associated with experience, and there was a sense of familiarity when experiencing novel IMIR. The occurrence of novel IMIR was more likely when individuals reported being in specific mental and physical states. Finally, the emotional valence associated with the novel IMIR was classified as mainly positive. The second model indicated a variety of methods to aid the translation of internal novel IMIR into external musical composition and a range of factors that influence the success of that translation. The findings are discussed in the context of existing literature on creativity, musical imagery, and spontaneous cognition.

Keywords

Composers, creativity, earworms, musical imagery, novel involuntary musical imagery repetition

Submission date: 31 October 2022; Acceptance date: 3 September 2023

Musical imagery, that is, the ability to imagine a melody or song, is a crucial part of the creative process of musicians. The vast majority of research on creative cognition has focused on visual imagery (Campos & Gonzalez, 1995; Forisha, 1978) and, although it has improved our understanding of the creative processes associated with mental imagery, this research has a distinct visual bias. One stream of research on musical imagery has focused on how it may be used in musical practice and performance (Bishop, Bailes, & Dean, 2013; Brodsky, Henik, Rubinstein, & Zorman, 1999; Fine, Wise, Goldemberg, & Bravo, 2015; Hubbard, 2019; Kosslyn, Ganis, & Thompson, 2001) and on its relationship to perception in professional musical life (Bailes, 2002). Another stream

¹ Psychology Department, Goldsmiths, University of London, UK

² Max Planck Institute for Empirical Aesthetics, Germany

³ Centre for Brain and Cognitive Development, Department of Psychological Science, Birkbeck, University of London, UK

Corresponding authors:

Georgia A. Floridou, Department of Music, University of Sheffield, 34 Leavygreave Road, Sheffield S3 7RD, UK.

Email: g.floridou@sheffield.ac.uk

Georgia A. Floridou is now at the Department of Music, University of Sheffield, Sheffield, UK. Preliminary findings of this study have been disseminated at the 25th Anniversary Conference of the European Society for the Cognitive Sciences of Music (ESCOM), Ghent, Belgium.



of research has also explored the behavioral and neural correlates of the experience (Halpern, 2001, 2003; Hubbard, 2010; Zatorre & Halpern, 2005). However, research on musical imagery and creative cognition is still limited.

Lately, the main focus of research has been on involuntarily retrieved musical imagery forms (Liikkanen & Jakubowski, 2020; Wammes & Barušs, 2009). Involuntary musical imagery repetition (IMIR) describes musical imagery that is retrieved spontaneously and repeatedly (Liptak et al., 2022). In the literature, there are dispersed reports of “novel” IMIR, which can be defined as IMIR involving music that is believed to be unfamiliar; meaning, that, to the best of an individual’s knowledge, the music heard is completely new (Bailes, 2007; Copeland, 2019; Liikkanen, 2012; Wammes & Barušs, 2009; Williamson & Jilka, 2013). Nevertheless, it is more common to experience familiar than unfamiliar or novel music as IMIR (Hyman et al., 2013, 2015; Liikkanen, 2012). Novel IMIR is associated more with musicians than nonmusicians (Liikkanen, 2012) and is assumed to be part of creative cognition. In the realm of creative concepts, “novelty” stands out as a pivotal trait, making it a fundamental element of creativity, as highlighted by Sarkar and Chakrabarti (2008). This can be exemplified by Davis (1992), who suggests that creativity can be viewed as a distinctive form of mental engagement, distinguished by its novelty. Such composers as Beethoven, Schumann, and Mozart reported “hearing” novel music in the “mind’s ear,” and using such music in their compositions (Agnew, 1922). However, whether these episodes of “hearing” music were repeated or not, so that they could be characterized as IMIR, is unknown. So far, the only existing information relates to individuals who experience novel IMIR and where the latter may come from, but no further details are known. To the best of our knowledge, there are no studies focusing specifically on novel IMIR.

How might novel IMIR arise? Wammes and Barušs (2009) reported two items related to the experience of novel musical imagery, based on the “Musical Imagery Questionnaire” (MIQ), which they developed, one related to waking states and one to dreams. These items were included in the “Unconscious” factor of the MIQ, something that the authors attributed to the individual being unaware of the IMIR source. A more explanatory conclusion about where novel inner music originates is given by Williamson and Jilka (2013), who found that, over time, extemporizations may be added to familiar IMIR; this could explain novel IMIR occurrence as arising from a memory but developing into a new musical form.

Previous studies have shed light on the links between spontaneous and creative cognition. Reported similarities between these two forms of cognition relate to the reduced cognitive control required for both (Fink & Neubauer, 2006; Razumnikova, 2007), the brain networks (such as default mode and memory networks) activated in both (Jung-Beeman et al., 2004; Kounios et al., 2006), and the patterns of biochemicals released (Chamberlain, Muller, Blackwell, Robbins, & Sahakian, 2006; Heilman,

Nadeau, & Beversdorf, 2003). A seminal study (as reported in Williamson et al., 2012; Williamson & Müllensiefen, 2012) focused on the circumstances preceding IMIR episodes. Among the identified themes, musical exposure was the most prominent factor, as well as memory triggers and affective states, such as mood, stress, and surprises, which acted as antecedents to IMIR episodes. Lastly, the “low attention states” theme described situations where individuals experienced minimal cognitive engagement with external activities. The link between low attention states preceding IMIR occurrence has been further confirmed by other studies (Floridou & Müllensiefen, 2015; Floridou, Williamson, & Stewart, 2017). These findings on low attention states further suggest the similarities between spontaneous cognition and IMIR in terms of the cognitive states preceding both and hint at a potential link between IMIR and creative cognition. A logical next step is to investigate novel IMIR and its relationship with creative cognition, which is assumed to stand between spontaneous and goal-directed thought (Christoff, Gordon, & Smith, 2008).

A hypothesized similarity between creative cognition and IMIR could also lie in the moment of insight. “Insight” is a term introduced by gestalt psychologists to describe the abrupt discovery of a resolution to a specific problem (Dorfman, Shames, & Kihlstrom, 1996). It is an unforeseen realization for the individual, and the period leading up to it is also known as incubation. The existing literature recognizes insight as a vital aspect of the creative process in music composition and improvisation. It is often described as a sudden and transformative experience that leads to the emergence of fresh and meaningful musical ideas. Neuroscientific investigations, exemplified by the study conducted by Berkowitz and Ansari (2008), have shed light on the neural mechanisms underlying creative insights. Berkowitz and Ansari discovered that instances of insight in music composition are associated with heightened activation in brain regions responsible for cognitive control and attention. This suggests that insight is connected to increased cognitive processing and a state of heightened awareness, even when disengaged from external activities. Researchers have also explored the subjective experiences of musicians during moments of insight. For instance, the study by Zheng and Leung (2023) examined the experiences of pianists and found that insight is accompanied by a sense of joy and discovery. Musicians reported experiencing heightened flow, inspiration, and a strong emotional connection to the creative process. Moreover, investigations into the role of insight in the compositional process, such as the study by Burnard and Younker (2004), have demonstrated its significance. Composers described moments of insight as pivotal in making creative decisions, generating new ideas, and resolving compositional challenges, ultimately shaping the direction of musical compositions. Overall, these studies underscore the importance of insight for music creativity. Insightful experiences are characterized by their sudden and transformative nature, involving heightened cognitive processing,

increased awareness, a sense of joy, and the generation of fresh musical ideas. These characteristics resemble similarities to the emergence of novel IMIR in composers, which this study aims to investigate further.

The Study

This study has been motivated by the lack of information about novel IMIR in the literature. The aims of the study were (a) to describe the phenomenological aspects of the novel IMIR experience and how it contributes to the generative phase of creative thought and (b) to explore how the internal experience is translated to an external experience, that is, music. This study is based on interviews with six music composers. We focused on composers, since it was hypothesized that the experience of novel IMIR will be more prevalent among composers than in the general population, since novel musical imagination is a crucial aspect of their creative process. Furthermore, composers could provide us with unique insights into how novel IMIR experiences can be translated from internal and imagined phenomena into external and creative output.

A semistructured interview was the preferred method, since it overcomes many of the limitations of a survey by permitting a personal and adaptable form of data collection in the investigation of a previously unexplored phenomenon. Because the study was not driven by specific hypotheses and was exploratory in nature, seeking new information, data were analyzed using grounded theory (Bryant, 2002; Glaser, 1978, 1992, 1998, 2001; Martin & Turner, 1986), which is suitable for understudied topics, such as novel IMIR, and for looking for regular patterns within the data in order to develop emergent theories.

Method

Participants

A total of six individuals took part in the interview, ranging in age from 20 to 35 ($M = 25$, $SD = 3.6$). Three participants (P4, P5, and P2) stated that they experience novel IMIR infrequently (1–3 times a week) and the other three (P6, P1, and P3) stated that they experience novel IMIR very often (from several times a week to several times a day). All participants, except for P1 were students of Goldsmiths, University of London and all but P1 and P2 were studying music. P1 was a professional musician and P2 was an undergraduate psychology student who also worked as a composer. The musical genres of the composition of the participants varied from pop and trip hop to jazz and classical music. Their scores in the “musical training” factor of the Goldsmiths Musical Sophistication Index (Gold-MSI; Müllensiefen, Gingras, Musil, & Stewart, 2014) were between 39 and 49, indicating a highly musical sample.

Four participants (P3, P4, P5, and P6) replied to an advertisement, distributed at Goldsmiths, University of London to recruit people who had experienced novel

tunes repeatedly in their minds. P1 and P2 replied to an email sent directly by the researcher, asking them if they experience novel IMIR. All but one participant received monetary compensation.

Materials

The initial step was the development of the questions. The main body of the interview was in two parts. In the first part, participants provided general information about the music they usually compose and experience as IMIR.

The second part of the interview focused on their novel IMIR experiences. The first questions addressed the experience of the generation of the new idea and were related to: (a) the frequency of novel IMIR (*How often do you experience novel INMI*),¹ to see how regular it is; (b) the activities participants are engaged in when they experience it (*Can you give me some examples of what kind of activities you're engaged in when you get novel INMI?*), to explore the cognitive state at the moment of the occurrence; (c) the sense of familiarity with the tune (*Do you have a sense of something familiar but not known is experienced when you experience the novel INMI in your head?*), to investigate the idea that extemporizations may be added to familiar tunes; (d) the feelings participants have when they experience IMIR (*How would you describe the emotions that you feel or the mood you're in when experiencing that phenomenon, the moment of insight?*); (e) the form that the novel IMIR usually takes (*What kind of musical structure is the novel INMI usually? E.g., only melody? Only chord sequence? Sounds? Full song?*); and finally (f) the role of repetition (*Is the element of repetition useful in any kind of way? How would you describe it?*). The remaining questions were about the externalization of novel IMIR into music and were about (a) the way the IMIR was captured (*Can you describe to me how you capture them? E.g., smartphone application, instrument?*) and (b) the level of difficulty in externalizing the novel IMIR (*Are there times when what you have in mind can't be actually recorded or played?*).

The interview schedule was the same for all participants; however, because of the semistructured nature of the interview, additional questions arose for each interviewee, depending on the flow of the conversation. The questionnaires employed included (a) the Involuntary Musical Imagery Scale (IMIS; Floridou, Williamson, Stewart, & Müllensiefen, 2015), measuring a range of emotions, behaviors, and evaluations toward IMIR (*negative valence, movement, personal reflections, and help*), as well as IMIR frequency and length, and (b) the Gold-MSI (Müllensiefen et al., 2014), measuring five factors (*musical training, active engagement, perceptual abilities, singing abilities, and emotions*).

The Interview

The same two researchers conducted each interview session (G.A.F. and I.M.). The interview started with an

introduction about who the researcher was and some general information about IMIR and the novel IMIR. To confirm that the participants had understood these concepts, they were asked to describe to the interviewer the difference between IMIR and novel IMIR and to give examples of each. The interview continued once a clear definition was given. Then the participants were asked for permission to film or record the interview and to transcribe it later, rather than taking notes during the course of the interview.

One researcher was responsible for leading the discussion and the other filmed the interview and waited until the end to ask any additional questions that arose as a result of the interview. At the end of each interview, participants completed the IMIS (Floridou et al., 2015) and the Gold-MSI (Müllensiefen et al., 2014). Interviews lasted between 40 and 90 min and were recorded and filmed.

The Analysis

The first step in the analysis of the interview data was to transcribe the audio recordings of each participant into text. Transcriptions were divided into two parts. The first part included the answers related to influences on composition, composition techniques, and familiar IMIR. The second part, which was considered as the body of the interview, included the answers on the novel IMIR. The text was coded by the same two researchers who conducted the interviews, using the grounded theory analysis method, which was based on the work of Charmaz (2008) and a series of studies by IMIR research group (Williamson & Jilka, 2013; Williamson et al., 2012; Williamson, Liikkanen, Jakubowski, & Stewart, 2014).

The analysis followed three stages (Glaser & Strauss, 1967; Strauss & Corbin, 1990): (a) open coding, which involved reading transcripts line by line and identifying and coding the concepts found in the data into “themes”; (b) axial coding (i.e., organizing the concepts and making them more abstract), and (c) selective coding (i.e., focusing on the main ideas, developing the story, and finalizing the grounded theory).

According to this method, and to guarantee consistency across a large amount of data, the first researcher conducted the initial open line-by-line marking of the text and created codes, classifying the answers to each question of the interview, to summarize the large amount of data in a few words (Charmaz, 2008). The remaining stages of the analysis were shared between the researchers, with the aim of achieving consensus, so as to minimize individual biases in interpretation. The researchers worked with the codes independently, but at the same time and location, looking for emerging themes and subthemes on novel IMIR phenomenology. Dominant themes were based on the interview questions and were presented in one or a few words, while subdominant themes represented the range of categories answering each question and were also summarized in a few words. In some of the subthemes, some further subcategories were also developed. In the second stage, the two

researchers compared the themes they generated and the links they had developed, explaining and justifying them according to the data. In case of any disagreement, the researchers mostly consulted a dictionary (as this was mostly a language issue, since both of the researchers are bilingual) or an external subjective observer, or they tried to find literature which supported one theme against the other. In the final stage, the researchers combined the themes they generated; they revised them after a week and developed the final theory and models based on memos they shared throughout the analysis (Charmaz, 2008), finally producing the models shown in the results section (Figures 1 and 2).

Results

The results are presented in two sections: First, general IMIR information, which comes from questionnaires and an additional question from the interview, and, second, the results from the main body of the interview, focusing on novel IMIR, and presented as (a) internal experience and (b) external experience.

General IMIR Information

All participants had experienced IMIR and were able to identify it and its difference from novel IMIR when asked, by giving examples of both phenomena to the researcher. The IMIS (Floridou et al., 2015) scores and information about the frequency and length of familiar IMIR, as well as the frequency of personal compositions experienced as IMIR, for each participant are given in Table 1.

Novel IMIR

Internal Experience. The first model presents five dominant themes centered on the basic theme of the novel IMIR and shows phenomenological aspects that characterize the onset of the experience and qualities of the inner music and of the subjective experience. In the following, dominant themes will be presented in bold italics and subdominant themes will be presented in italics. Dominant themes represent the interview questions related to different aspects of the experience and are numbered as follows: (1) **mental and physical states**, (2) **feeling**, (3) **familiarity**, (4) **form**, and (5) **repetition**. Subdominant themes represent the main categories answering each question; in some cases, they include subcategories (e.g., *form*). For each subdominant theme, an example will be given from a participant’s statement. A model of the dominant themes and their relationship to subdominant themes can be seen in Figure 1.

Mental and Physical States—Situations When Novel IMIR Occurred. The activities in which the participants were engaged when novel IMIR occurred were related to a range of **mental and physical states**. Three subdominant

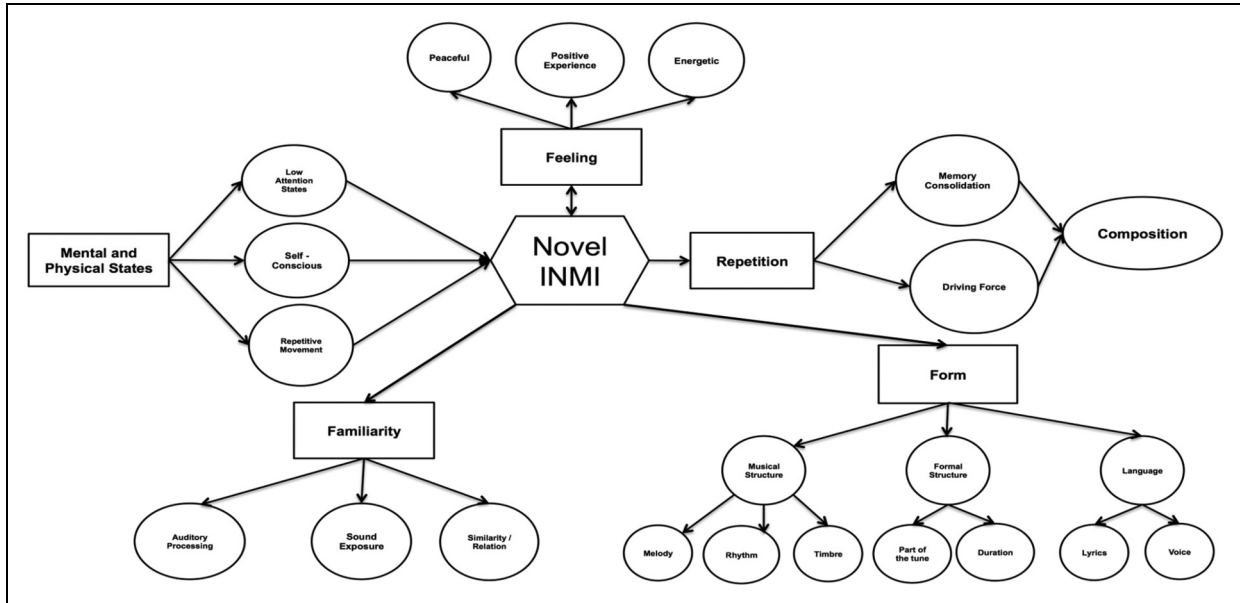


Figure 1. Phenomenological aspects of the novel IMIR experience. Dominant themes are represented by rectangles, subdominant themes are represented by ovals, and basic themes of novel IMIR are represented by a hexagon. Single-directional arrows indicate hierarchical links, while bidirectional arrows illustrate reciprocal relationships.

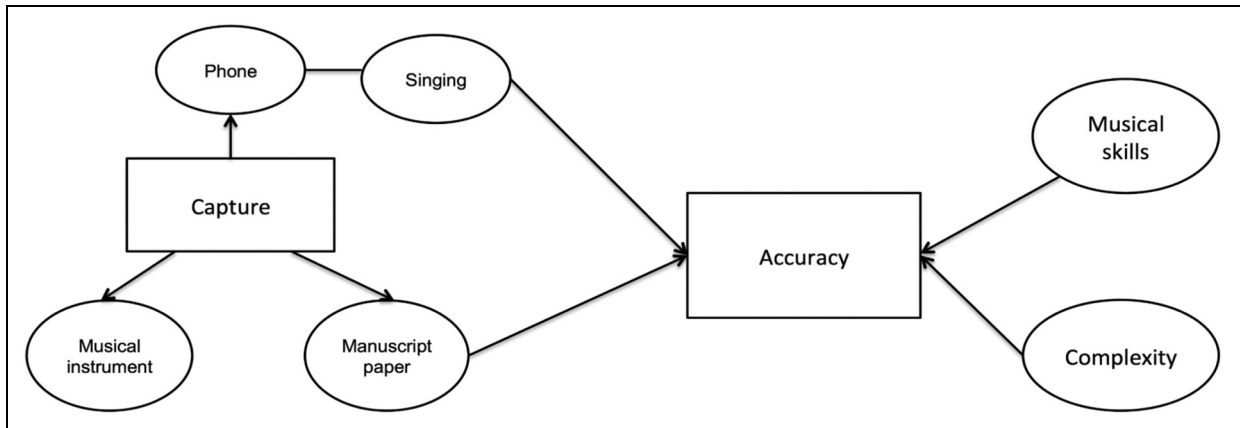


Figure 2. How novel IMIR is externalized into music. Dominant themes are represented by rectangles and subdominant themes are represented by ovals. Single-directional arrows indicate hierarchical links, while bidirectional arrows illustrate reciprocal relationships and straight lines represent associations.

Table 1. Participants’ frequency and length of familiar IMIR and frequency of personal compositions experienced as IMIR.

Measure	Participants					
	P1	P2	P3	P4	P5	P6
IMIR:						
Frequency	Several times a day	Several times a week	Several times a day	Once a week	Several times a week	Several times a week
Length, section	5–10 s	<2 s	5–10 s	5–10 s	>1 min	5–10 s
Length, episode	1–3 h	1–3 h	10–30 min	1–3 h	½–1 h	½–1 h
Personal compositions as IMIR	Sometimes	Every day	Quite often	Not very often	Often	Sometimes

themes emerged: *low attention states*; *self-conscious*; and *repetitive movement*.

In the case of *low attention states*, three participants reported that novel IMIR occurred when they were not fully engaged in the activity they were doing:

P6: When I'm doing something in which I have to be rationally engaged, it doesn't happen. If I have some degree of automation, it will start.²

In most cases, participants described situations in which they were also *self-conscious* (i.e., feeling they were connected with themselves):

P5: I think it is more like connecting to your inner self. It is more like having the space to.

P6: It's to do with your capacity, at the moment your mental availability to put lots of effort and focus at the right moment. If you have it, maybe you can do lots of complicated things. And grab it and put it down.

Another subtheme that emerged was that of activities, specifically relating to *repetitive movement*. The participants explained that the onset of the novel IMIR is associated with activities characterized by moving in a repetitive way:

P3: When I went away, I would be constantly having these things going around in my head, because I was on my own a lot, and I was walking or swimming, or doing something quite repetitive.

Feeling—How the Novel IMIR Experience Would Make Participants Feel. Participants were asked to identify the *feeling* they experienced once the novel IMIR occurred. In some of the cases, instead of describing their *feeling* at the moment the novel IMIR occurred, they reported how the *feeling* of the novel IMIR would affect them and make them feel. Within this dominant theme, three sub-themes are identified.

All participants except one ascribed a positive evaluation toward the novel IMIR, labelled as a *positive experience*:

P2: It is a very positive experience. I think it is just a quite wonderful thing you can have. You have these sounds in terms of sounds and constructing as well, which is in both senses, both of novel and normal IMIR.

The other *feeling*-related subtheme participants described was that of being *peaceful*:

P1: It's like a little glimpse of stillness really, even if I don't know if I can stay still...

At the other end of the arousal continuum, the subtheme of being in an *energetic* mood emerged:

P6: The majority of the time, because I'm walking, it just feels great. It's really, a very strong driving power. I'll start probably walking like a lunatic but, well, that's another thing.

Another theme, which can be seen in the model as represented by the bidirectional arrow connecting *novel IMIR* and *feeling*, was that of an interaction between the emotion that the novel IMIR conveyed and how it was making the participants feel. The opposite relationship was also reported, where the mood of the participant at the moment the novel IMIR occurred would affect the mood of the novel IMIR:

P3: But, saying that, maybe the melodies that come into my head, these little things are, dependent, you know; they change depending on my mood, like it might be like a nice little happy thing that goes around, around, around, if I am in a particularly good mood.

P4: I feel each thing as a mood. Hmm... each different melody has its own mood.

Familiarity—Whether the Novel IMIR Experience Can Be Identified as Familiar. One of the key aspects of novel IMIR is that the endogenous musical pattern experienced is original. When participants were asked about elements of familiarity in the novel IMIR, all but one (P4) identified a familiar sense:

P6: So, yeah, familiarity. I feel it when I have the newest idea of mine. It feels like it's part of something already. Like it's part of a piece I haven't done yet but I already know it's going to be, how it is going to be.

P4: Yeah, it's very new. It can be. Ohh, it's definitely, it's always new. It's never like a twist on something else. It's always something completely fresh and friendly.

A subdominant theme on how the sense of *familiarity* is explained is that of previous *sound exposure*:

P2: It would be something that you heard before I guess, so yeah, a belonging feeling. But I wouldn't be able to articulate or identify it.

In one case, a sense of *similarity/relation* was identified, which contributed to *familiarity*:

P6: So everything that comes to my head that is sticky enough to stay has strong relations with everything that I know. A completely unrelated thing would never be an earworm to me.

In other cases, more detail was given regarding *auditory processing* following *sound exposure*:

P5: I mean it is like an aural reanalysis, analysis of your perceptions... It's our perception brings the data inside, and the brain processes it.

Form—The Parameters That Describe the Novel IMIR. All participants predominantly reported the *musical structure* of the novel IMIR, resulting in three subcategories, namely, *melody*, *rhythm*, and *timbre*:

P4: OK, so they normally come to me as a melody line. Pretty much just the melody.

P3: Yeah, so I've had like a beat, like literally just like a beat, but I am really bad. The thing about beats is that I cannot do beats, like if I get a beat in my head, I have no idea how to, like, put that down.

P3: And I've had it with cello, I had cello melodies, like the cello was playing that I could hear it playing over and over again, and it was like someone turning down the volume when it went away, and then turning it up again.

Technical aspects of the tune, such as the specific *part of the tune* that was experienced and the *length* of the novel IMIR, comprised the subdominant theme of *formal structure*:

P1: Usually a refrain. The refrain will come in first and then you build something around it. But it's usually the refrain. The catchiest part of the song comes to the mind first.

P3: Um, and they are very short, and they will be really short and then I start singing it to myself and I just stay, yeah.

A final subdominant theme within *form* was that of *language*. Participants reported a linguistic aspect when describing their novel IMIR, either related to *lyrics* or *voice*:

P3: I guess, probably just hear when it's novel, it's usually just like me singing it to myself in my head.

P2: But that would be lots of string sounds and nice con-flowing rhythms, and there has been a voice sometimes.

P6: Cause sometimes it will be like a lyric, it will be a sort of like a series of words or lyric in a melody that will be going round and round.

Repetition—How Repetition Within the Novel IMIR Is Perceived and Why It Is Useful. All participants but one stated that repetition is beneficial for *memory consolidation* purposes:

P5: So like, because it's looped you don't forget it. And this is, this might be one of the reasons why it is looped because your brain knows that you will forget it, otherwise. And I do forget my earworms if they don't loop. But it's not voluntary, it just happens.

Two participants reported that repetition had a *driving force* effect:

P4: The more repeatable an earworm is, the more it drives you to compose and get it out of you.

External Experience. In this section, we focus on how novel IMIR is translated from an internal to an external experience as a musical outcome and on the accuracy of the externalization, whether in the capture method or in the composition. The model in Figure 2 represents this process.

Capture—The Means Used to Capture Novel IMIR. The most prevalent way of capturing novel IMIR is by recording it on a *phone*:

P5: Yeah, with an iPhone; it's so much easier with technology. Yeah, I use an iPhone these days.

Another subtheme observed was that of the *manuscript paper*.

P4: I have a cute little book. I'll just show you to know what I mean. And it's just a manuscript paper.

Another subdominant theme within the theme of *capture* was the use of *musical instrument*:

P3: Sometimes, I'll play on the piano and just try to remember it by playing on the piano and might not even write it down, but try to remember it on the piano.

Accuracy—On What the Accuracy of the External Version of the Novel IMIR Depends. All participants reported that the similarity between the final composition of the tune that included the novel IMIR and the original inner experience varied, depending on various factors:

P1: Sometimes these melodies must just stay the same. That's what it was there, that's the seed of the song, and it must stay in your head. And anything could change around it, but that needs to stay because that was the point of the song.

One of the factors affecting the *accuracy* of the composition is the *musical skill* of the individual:

P5: Of course, when something is made with my own instrument, which is voice or guitar, I know exactly how I want it to sound and because I am so experienced in that instrument I can actually, I can, the approximation is much better.

Another participant reported that *accuracy* depends on the *complexity* of the novel IMIR:

P5: Now, if it's something minimal, with few instruments, of course, it's easier, OK. The more the instruments, the more the harmony creates shades of sounds that are not easy to reproduce at all, at all.

The way participants capture the novel IMIR, such as *singing* and writing down on *manuscript paper*, also affected the accuracy of the outcome:

P6: Sometimes I try to just realize it with my voice, which already completely changes it. Singing, singing... It's the most immediate thing. Even if it's rhythmical stuff.

P4: It works for me. I tend, I tend not to use the iPhone too much. Umm. I have recorded things down. I used the voice memo application as well but, umm, I tend not to do that because I don't have such a replicable representation.

Discussion

The experience of novel IMIR has been reported in previous studies (Bailes, 2007; Liikkanen, 2012; Wammes & Barušs, 2009; Williamson & Jilka, 2013); however, it seems that no further investigations have been conducted to shed light on its phenomenological characteristics. This article presents, we believe, the first interview study to investigate novel IMIR as experienced by composers. The study focuses on two key aspects of the novel IMIR experience: phenomenological aspects, and how this internal experience is translated to an external outcome.

Novel IMIR

Internal Experience. The first model that was developed from the interview data revealed important information about the phenomenological aspects of the novel IMIR experience. The activities that an individual engages in when novel IMIR occurs were grouped into an abstract dominant theme, that of *mental and physical state*, which was further subdivided into three subdominant themes: *low attention states*, *self-conscious*, and *repetitive movement*.

Previous literature regarding activities enabling IMIR onset has highlighted the importance of those described by low attention states and concurrent cognitive load (Floridou & Müllensiefen, 2015; Floridou et al., 2017; Hyman et al., 2013; Liikkanen, 2012; Williamson et al., 2012). Findings from this study are in concordance with this notion, as described in the *low attention states* activities. Whether familiar or novel, IMIR onset is favored by such situations. Similar findings come from the literature on mind-wandering, where the onset of episodes is associated with less cognitive load and engagement (McVay & Kane, 2009; Smallwood & Schooler, 2006). This is also in concordance with literature on creative thought, where defocused attention is a key aspect in enabling its onset (Gabora, 2002, 2003; Heilman et al., 2003; Howard-Jones & Murray, 2003; Mendelsohn & Mendelsohn, 1976).

Low attention states are not the only prerequisite for novel IMIR occurrence. A new finding of this study is that being *self-conscious*, (i.e., focused on inner experiences, Fenigstein, Scheier, & Buss, 1975), hence being in a better position to observe the novel IMIR the moment it occurs, is a crucial characteristic for almost all the study participants. Findings from neuroimaging studies on

creative thought have identified activation not only of the default mode network (Beaty et al., 2014; Shofty et al., 2022), which is associated with spontaneous cognition, but also of networks that require more control and focused attention (Carlsson, Wendt, & Risberg, 2000), a finding that may be explained by such a dual process, with external attention being decreased, while the internal focus is increased. This process is similar to mind-wandering episodes, where the internal stream is insulated from external distraction and is termed “perceptual or attentional decoupling” (Smallwood, 2013; Smallwood & Schooler, 2006). Similarly here, activities are found that are associated not only with spontaneous cognition but also with internal cognitive states. Future studies should include an examination of whether there are differences in private self-consciousness scores, as measured by the Self-Consciousness Scale, Revised (Scheier & Carver, 1985), between people who experience novel IMIR and those who do not.

The *repetitive movement* subtheme, where novel IMIR occurs, describes a repetitive activity similar to that reported by previous studies on IMIR (Williamson et al., 2012). This could be explained by the low attention states describing practised and repetitive activities. Floridou, Williamson, Stewart, and Müllensiefen (2015) explained that the IMIS factor “movement” revealed the tendency of individuals to move to the beat when experiencing IMIR from familiar music. However, in this study, the relationship is in the opposite direction, with novel IMIR occurring when individuals perform repetitive movements. A finding in support of this theme comes from the literature on creativity, which has been described as fluid thinking because of its similarity to the movement of fluids and their flexibility and ease of movement (Hofstadter, 1995; Sternberg, 1985). A greater generation of fluid creative thinking has been associated with fluid movement (Leung, Kim, Polman, Ong, & Qiu, 2012; Slepian & Ambady, 2012). These findings highlight an important relationship between movement and creative ideas like novel IMIR, indicating a relationship between motor experiences and cognitive processes. This finding falls under the embodied cognition topic, where states of the body modify states of the mind and, more specifically, embodied creativity and embodied musical creativity, phenomena that, at the moment, are understudied.

Contrary to popular belief, familiar IMIR is mostly evaluated as pleasant (Beaman & Williams, 2010; Halpern & Bartlett, 2011; Williamson & Jilka, 2013). The results reported here agree with this by presenting novel IMIR as a positive experience. Beyond describing the experience itself, participants also reported how they felt at the moment that novel IMIR occurred. They described two widely different types of feeling, namely, being peaceful or, in some cases, energetic. This finding is in concordance with the finding, described by Floridou and Müllensiefen (2015), that mind wandering causes mood changes, which result in the same two extremes of feeling (i.e., peaceful or energetic). Different feelings, depending on the situation,

could be associated with a more associative and creative mood. Another interesting finding relates to the description by participants of an interaction between the mood of the tune and the mood the participants were in. It is possible that novel IMIR may act as a means of emotional self-regulation, something that has been previously suggested for familiar IMIR (Jakubowski, Farrugia, Halpern, Sankarpandi, & Stewart, 2015) as well as for music (Thoma, Scholz, Ehlert, & Nater, 2012.), although the opposite is also possible, with the feelings of the individual giving rise to the feeling of the tune.

Although novel IMIR represents an original experience, most of the participants reported a sense of *familiarity*. They attributed this to having been exposed in the past to sounds that their brain processed, decomposed, and then composed into novel material. However, although the novel IMIR felt familiar because of its similarity and relation to previously heard material, as well as because of the participants being able to identify relations, the participants were not able to identify where the novel IMIR originated. This is in agreement with the suggestion of Liikkanen (2008) that “new imagined music may not be unexpected incident but a natural outcome of the way our brain processes information.” Similarly, Williamson and Jilka (2013) suggested that novel IMIR could be the result of subconscious musical extemporization, adding the idea that novel IMIR is not a virgin idea but the result of additions to familiar IMIR over time.

The *musical structure* of the novel IMIR reflects similarities to familiar IMIR but also to voluntary musical imagery, where the *melody*, *rhythm*, and *timbre* are the most prevalent experienced musical features (Bailes, 2007; Halpern, 2007). Furthermore, instances of the structure of novel IMIR seem to be experienced with complex instrumentation. This report contradicts previous results about the simplicity of the structure of familiar IMIR (Beaman & Williams, 2010; Halpern & Bartlett, 2011; Kellaris, 2001). However, the finding agrees with the results of other studies, where some individuals experienced more complex forms of familiar IMIR, such as symphonies and operas (Bailes, 2007; Williamson & Jilka, 2013). This variability could be driven by higher levels of musical training of the individuals experiencing IMIR, who could mentally reproduce more complex forms of imagined music, as compared with untrained individuals. This explanation is also supported by the literature on voluntary musical imagery, where musicians report multiple components of musical imagery (Aleman et al., 2000; Zatorre & Halpern, 2005). An additional explanation about the structural differences of IMIR in harmony and melodic expectations, in terms of complexity, could be related to the various musical genres to which participants in different studies are exposed. Findings about the *formal structure* and *language* of novel IMIR also agree with familiar IMIR literature, where short length, chorus (Beaman & Williams, 2010; Hyman et al., 2013), and lyrics (Byron & Fowles, 2013; Halpern & Bartlett, 2011;

Hyman et al., 2013, 2015) or own voice (Williamson & Jilka, 2013) characterize the IMIR experience. Future research should employ experience sampling methodology (both probe and self-caught) to investigate these characteristics at the moment the experience occurs and to explore their relationship to the musical training and engagement of the individual.

One of the two defining IMIR characteristics, *repetition*, seems to be important for the consolidation of the novel IMIR in memory (*memory consolidation*), which in turn leads to composition. Mountain (2001, p. 276) also observed a similar process in composers, although in a voluntary manner: “By mentally ‘playing back’ the auditory image repeatedly to oneself, it can become ‘engraved’ more firmly into memory.” The subtheme of *driving force*, which leads to *composition*, could mediate memory consolidation, since items, words, and images that elicit high arousal can be better remembered (Bradley, Greenwald, Petry, & Lang, 1992; Burke, Heuer, & Reisberg, 1992; Butter, 1970). However, it is noted that the same effect has not been found for music. *Positive experience*, which although not captured in the *repetition* theme but in the *feeling* theme could play an additional role in the consolidation of the novel IMIR, as previous studies have shown in relation to music and positive feelings (Eschrich, Münte, & Altenmüller, 2008). Repetition and arousal seem to play an important role in the development of a strong memory for novel IMIR that will last and lead to composition. Future behavioral studies should explore this finding by presenting originally composed tunes to participants and investigating the number of repetitions (externally and internally) required for a new tune to be consolidated in memory and the level of arousal and valence elicited by the music in the ability to create an IMIR.

External Experience. The most common way to capture novel IMIR is by phone and particularly by *singing* and recording it. One disadvantage elucidated by singing was that it distorted the *accuracy* of the novel IMIR that participants experienced. A similar finding comes from Williamson and Jilka (2013), who, while finding that familiar IMIR is similar to the original music in terms of form, also reported that singing affected the fidelity between the two by altering the original voice in the tune to their participants. In contrast, writing down on *manuscript paper* resulted in the outcome of the externalization being closer to the original form. The lack of general *accuracy* could be explained by the fact that, although repetition helps in memory consolidation, novel IMIR is not strongly embedded in memory, in the same way that familiar IMIR is, and is not easily reproduced in its initial form.

Accuracy was a more dominant theme, regarding the outcome of the composition compared with the novel IMIR. *Musical skills* of the composer and *complexity* of the novel IMIR seem to be key elements in how veridical the composition will be to the novel IMIR. According to Mountain (2001, p. 280), “The extent to which the original stimulus is manifest in the final composition is almost

exclusively dependent on the intentions (and skills) of the composer, though naturally some stimuli are more transferable into the musical domain than others.” This qualitative mismatch corresponds to what Bailes and Bishop (2012) call translation from a musical image to sound and the composers’ skills as fluency. In future studies, it will also be interesting to explore how much of the novel IMIR content is present in the final composition, as currently we only have limited information about how much, if any, novel IMIR content is present when externalized. Additionally, composers could also rate the accuracy of the novel IMIR content and externalized part. Furthermore, in an attempt to evaluate the creativity in the external output, we also recommend, in future studies, that naive external evaluators rate the quality and originality of the composition.³

Limitations of the Present Study

A number of limitations of the study are acknowledged. First, the findings are based on a small sample size of six composers. This is a common limitation in interview studies of this kind (Mencke, Seibert, Brattico, & Wald-Fuhrmann, 2022). Future studies need to have larger samples, of individuals with various levels of background musical experience, including lack of experience. Secondly, the interview focused on composers to increase the probability of finding individuals who experience novel IMIR and could externalize the experience into an output. This does not mean that individuals who are not composers, or do not have musical training, do not experience novel IMIR. Furthermore, since the interviewees were experienced musicians and composers, the findings cannot be generalized to a sample of nonexperts or to all composers. Future research should take into consideration all types of individuals for a more heterogeneous sample and explore various levels of composers (e.g., established ones vs amateurs), as well as shed light on everyday forms of creative cognition experienced by the general population. Finally, the musical experiences of all composers in the study come from the Western musical culture and training; this limits the cultural interpretation of the findings. Future studies would benefit from the inclusion of individuals with more diverse musical cultural backgrounds for cross-cultural comparisons and generalizability of the findings.

Conclusion

This article introduced, to our knowledge, the first interview study about novel IMIR, focusing on its phenomenology as an internal experience translated into an external one. The results of this study highlight parallels between the novel and familiar IMIR and creative thought in terms of mental and physical states related to the genesis of both, the feeling associated with their occurrence, and their structure. It also reveals new insights regarding repetition and its relationship to memory consolidation, which may be the first functionality identified in the IMIR phenomenon. Finally,

our findings show how fragile novel IMIR is when externalized into music.

The results presented in this article lead to testable hypotheses for future studies that will help us understand better why novel and familiar IMIR occur, but also highlight our creative capacity, as manifested in everyday life, which could be exploited in music education.

Action Editor

Solange Glasser, University of Melbourne, Melbourne Conservatorium of Music.

Peer Review

One anonymous reviewer

Laura Bishop, University of Oslo, RITMO Centre for Interdisciplinary Studies in Rhythm, Time and Motion

Contributorship

GAF and DM researched the literature, conceived the study, were involved in the study design, and gained ethical approval. GAF, IM, and FC were involved in participant recruitment and data analysis. GAF wrote the first draft of the manuscript. All authors reviewed and edited the manuscript and approved the final version of the manuscript.

Data Availability

Owing to the sensitive nature of the data, information created or analyzed during the current study is available from the corresponding author (Dr. Georgia A. Floridou, g.floridou@sheffield.ac.uk) on reasonable request to bona fide researchers.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical Approval

The Ethics Committee of the Psychology Department of Goldsmiths, University of London approved the study protocol. All participants gave written informed consent for the study.

Funding

The authors disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: GAF was funded through the Program “Scholarships Following Individualized Evaluation, 2012–2014” of the Greek State Scholarships Foundation, from resources of the Operational Program “Education and Lifelong Learning” of the European Social Fund and the National Strategic Reference Framework, 2007–2013.

ORCID iD

Georgia A. Floridou  <https://orcid.org/0000-0003-1666-8083>

Notes

1. The terms INMI (involuntary musical imagery) and earworms will be used only when referring to interview

questions, since these terms were prevalent at the point of the interview.

2. When “it” is presented in participants’ responses, this refers to IMIR.
3. We thank an anonymous reviewer for this suggestion.

References

- Agnew, M. (1922). The auditory imagery of great composers. *Psychological Monographs*, *31*, 279–287. <https://doi.org/10.1037/h0093171>
- Aleman, A., Nieuwenstein, M. R., Böcker, K. B., & de Haan, E. H. (2000). Music training and mental imagery ability. *Neuropsychologia*, *38*(12), 1664–1668. [https://doi.org/10.1016/S0028-3932\(00\)00079-8](https://doi.org/10.1016/S0028-3932(00)00079-8)
- Bailes, F. (2002). *Musical imagery: hearing and imagining music* [PhD thesis]. University of Sheffield.
- Bailes, F. (2007). The prevalence and nature of imagined music in the everyday lives of music students. *Psychology of Music*, *35*(4), 555–570. <https://doi.org/10.1177/0305735607077834>
- Bailes, F., & Bishop, L. (2012). Musical imagery in the creative process. In D. Collins (Ed.), *The act of musical composition: Studies in the creative process* (pp. 53–78). Aldershot, UK: Ashgate.
- Beaman, C. P., & Williams, T. I. (2010). Earworms (stuck song syndrome): Towards a natural history of intrusive thoughts. *British Journal of Psychology*, *101*(4), 637–653. <https://doi.org/10.1348/000712609x479636>
- Beaty, R. E., Benedek, M., Wilkins, R. W., Jauk, E., Fink, A., Silvia, P. J., & Neubauer, A. C. (2014). Creativity and the default network: A functional connectivity analysis of the creative brain at rest. *Neuropsychologia*, *64*, 92–98. <https://doi.org/10.1016/j.neuropsychologia.2014.09.019>
- Berkowitz, A. L., & Ansari, D. (2008). Generation of novel motor sequences: The neural correlates of musical improvisation. *Neuroimage*, *41*(2), 535–543. <https://doi.org/10.1016/j.neuroimage.2008.02.028>
- Bishop, L., Bailes, F., & Dean, R. T. (2013). Musical expertise and the ability to imagine loudness. *PloS one*, *8*(2), e56052. <https://doi.org/10.1371/journal.pone.0056052>
- Bradley, M. M., Greenwald, M. K., Petry, M. C., & Lang, P. J. (1992). Remembering pictures: Pleasure and arousal in memory. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *18*, 379–390. <https://doi.org/10.1037/0278-7393.18.2.379>
- Brodsky, W., Henik, A., Rubinstein, B., & Zorman, M. (1999). Inner hearing among symphony orchestra musicians: Intersectional differences of string-players versus wind-players. In S. W. Yi (Ed.), *Music, mind, and science* (pp. 370–392). Seoul National University Press.
- Bryant, A. (2002). Re-grounding grounded theory. *Journal of Information Technology Theory and Application*, *4*(1), 25–42.
- Burke, A., Heuer, F., & Reisberg, D. (1992). Remembering emotional events. *Memory & Cognition*, *20*, 277–290. <https://doi.org/10.3758/BF03199665>
- Burnard, P., & Younker, B. A. (2004). Problem-solving and creativity: Insights from students’ individual composing pathways. *International Journal of Music Education*, *22*(1), 59–76. <https://doi.org/10.1177/0255761404042375>
- Butter, M. J. (1970). Differential recall of paired associates as a function of arousal and concreteness-imagery levels. *Journal of Experimental Psychology*, *84*, 252–256. <https://doi.org/10.1037/h0029094>
- Byron, T. P., & Fowles, L. C. (2013). Repetition and recency increases involuntary musical imagery of previously unfamiliar songs. *Psychology of Music*, *43*, 375–389. <https://doi.org/10.1177/0305735613511506>
- Campos, A., & Gonzalez, M. A. (1995). Effects of mental imagery on creative perception. *Journal of Mental Imagery*, *19*(1–2), 67–76.
- Carlsson, I., Wendt, P., & Risberg, J. (2000). On the neurobiology of creativity: Differences in frontal lobe activity between high and low creative subjects. *Neuropsychologia*, *38*, 873–885. [https://doi.org/10.1016/S0028-3932\(99\)00128-1](https://doi.org/10.1016/S0028-3932(99)00128-1)
- Chamberlain, S. R., Muller, U., Blackwell, A. D., Robbins, T. W., & Sahakian, B. J. (2006). Noradrenergic modulation of working memory and emotional memory in humans. *Psychopharmacology*, *188*(4), 397–407. <https://doi.org/10.1007/s00213-006-0391-6>
- Charmaz, K. (2008). Grounded theory as an emergent method. In S. N. Hesse-Biber & P. Leavy (Eds.), *Handbook of emergent methods* (pp. 155–172). Guildford Press.
- Christoff, K., Gordon, A., & Smith, R. (2008). The role of spontaneous thought in human cognition. In O. Vartanian & D. R. Mandel (Eds.), *Neuroscience of decision making* (pp. 259–284) New York, NY: Psychology Press.
- Copeland, N. E. (2019). InMI and its potential originality–musical creativity in composers’ minds. *Interdisciplinary Studies in Musicology*, *19*, 41–52. <https://doi.org/10.14746/ism.2019.19.3>
- Davis, G. A. (1992). *Creativity is forever* (3rd ed.). Kendall Hunt Publishing Company.
- Dorfman, J., Shames, V. A., & Kihlstrom, J. F. (1996). Intuition, incubation, and insight: Implicit cognition in problem solving. In G. Underwood (Ed.), *Implicit cognition* (pp. 257–296). Oxford University Press.
- Eschrich, S., Münte, T., & Altenmüller, E. (2008). Unforgettable film music: The role of emotion in episodic long-term memory for music. *BMC Neuroscience*, *9*(48). <https://doi.org/10.1186/1471-2202-9-48>
- Fenigstein, A., Scheier, M. F., & Buss, A. (1975). Public and private self-consciousness: Assessment and theory. *Journal of Consulting and Clinical Psychology*, *43*, 522–527. <https://doi.org/10.1037/h0076760>
- Fine, P. A., Wise, K. J., Goldemberg, R., & Bravo, A. (2015). Performing Musicians’ under standing of the terms “mental practice” and “score analysis.”. *Psychomusicology: Music, Mind, and Brain*, *25*, 69–82. <https://doi.org/10.1037/pmu0000068>
- Fink, A., & Neubauer, A. C. (2006). EEG Alpha oscillations during the performance of verbal creativity tasks: Differential effects of sex and verbal intelligence. *International Journal of Psychophysiology*, *62*(1), 46–53. <https://doi.org/10.1016/j.ijpsycho.2006.01.001>
- Floridou, G. A., & Müllensiefen, D. (2015). Environmental and mental conditions predicting the experience of involuntary musical imagery: An experience sampling method study. *Consciousness and Cognition*, *33*, 472–486. <https://doi.org/10.1016/j.concog.2015.02.012>

- Floridou, G. A., Williamson, V. J., & Stewart, L. (2017). A novel indirect method for capturing involuntary musical imagery under varying cognitive load. *Quarterly Journal of Experimental Psychology*, 70(11), 2189–2199. <https://doi.org/10.1080/17470218.2016.1227860>
- Floridou, G. A., Williamson, V. J., Stewart, L., & Müllensiefen, D. (2015). The involuntary musical imagery scale (IMIS). *Psychomusicology: Music, Mind, and Brain*, 25(1), 28–36. <https://doi.org/10.1037/pmu0000067>
- Forisha, B. L. (1978). Creativity and imagery in men and women. *Perceptual and Motor Skills*, 47(3_suppl), 1255–1264. <https://doi.org/10.2466/pms.1978.47.3f.1>
- Gabora, L. (2002). Cognitive mechanisms underlying the creative process. Paper presented at the Proceedings of the Fourth International Conference on Creativity and Cognition, Loughborough, UK.
- Gabora, L. (2003). Contextual focus: A cognitive explanation of the cultural transition of the Middle/Upper Paleolithic. Paper presented at the Proceedings of the 25th Annual Meeting of the Cognitive Science Society, Hillsdale, NJ.
- Glaser, B. G. (1978). *Theoretical sensitivity: Advances in the methodology of grounded theory*. The Sociology Press.
- Glaser, B. G. (1992). *Emergence vs. forcing: Basics of grounded theory analysis*. Sociology Press.
- Glaser, B. G. (1998). *Doing grounded theory: Issues and discussions*. Sociology Press.
- Glaser, B. G. (2001). *The grounded theory perspective: Conceptualization contrasted with description*. Sociology Press.
- Glaser, B. G., & Strauss, A. L. (1967). *The discovery of grounded theory: Strategies for qualitative research*. Aldine Publishing Company.
- Halpern, A. R. (2001). Cerebral substrates of musical imagery. *Annals of the New York Academy of Sciences*, 930(1), 179–192. <https://doi.org/10.1111/j.1749-6632.2001.tb05733.x>
- Halpern, A. R. (2003). Cerebral substrates of musical imagery. In I. Peretz & R. Zatorre (Eds.), *In the cognitive neuroscience of music* (pp. 217–230). Oxford University Press.
- Halpern, A. R. (2007). Commentary on “Timbre as an elusive component of imagery for music.”. *Empirical Musicology Review*, 2(1), 35–37. <https://doi.org/10.18061/1811/24477>
- Halpern, A. R., & Bartlett, J. C. (2011). The persistence of musical memories: A descriptive study of earworms. *Music Perception*, 28, 425–443. <https://doi.org/10.1525/mp.2011.28.4.425>
- Heilman, K. M., Nadeau, S. E., & Beversdorf, D. O. (2003). Creative innovation: Possible brain mechanisms. *Neurocase*, 9(5), 369–379. <https://doi.org/10.1076/neur.9.5.369.16553>
- Hofstadter, D. R. (1995). *Fluid concepts and creative analogies: Computer models of the fundamental mechanisms of thought*. Basic Books.
- Howard-Jones, P. A., & Murray, S. (2003). Ideational productivity, focus of 212 attention, and context. *Creativity Research Journal*, 15(2-3), 153–166. <https://doi.org/10.1080/10400419.2003.9651409>
- Hubbard, T. L. (2010). Auditory imagery: Empirical findings. *Psychological Bulletin*, 136(2), 302–329. <https://doi.org/10.1037/a0018436>
- Hubbard, T. L. (2019). Some anticipatory, kinesthetic, and dynamic aspects of auditory imagery. In M. Grimshaw-Aagaard & M. Walther-Hansen, & M. Knakkegaard (Eds.), *The Oxford handbook of sound and imagination* (Vol. 1, pp. 149–173). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780190460167.013.8>
- Hyman, I. E. Jr., Burland, N. K., Duskin, H. M., Cook, M. C., Roy, C. M., McGrath, J. C., & Roundhill, R. F. (2013). Going gaga: Investigating, creating, and manipulating the song stuck in my head. *Applied Cognitive Psychology*, 27(2), 204–215. <https://doi.org/10.1002/acp.2897>
- Hyman, I. E. Jr., Cutshaw, K. I., Hall, C. M., Snyders, M. E., Masters, S. A., Au, V., & Graham, J. M. (2015). Involuntary to intrusive: Using involuntary musical imagery to explore individual differences and the nature of intrusive thoughts. *Psychomusicology: Music, Mind, and Brain*, 25(1), 14–27. <https://doi.org/10.1037/pmu0000075>
- Jakubowski, K., Farrugia, N., Halpern, A. R., Sankarpani, S. K., & Stewart, L. (2015). The speed of our mental soundtracks: Tracking the tempo of involuntary musical imagery in everyday life. *Memory & Cognition*, 43(8), 1229–1242. <https://doi.org/10.3758/s13421-015-0531-5>
- Jung-Beeman, M., Bowden, E. M., Haberman, J., Frymiare, J. L., Arambel-Liu, S., Greenblatt, R., Reber, P. J., & Kounios, J. (2004). Neural activity when people solve verbal problems with insight. *PLoS Biology*, 2(4), 500–510. <https://doi.org/10.1371/journal.pbio.0020097>
- Kellaris, J. J. (2001). Identifying properties of tunes that get ‘stuck-in-your-head’: Toward a theory of cognitive itch. *Proceedings of the Society for Consumer Psychology, Winter 2001 Conference* (pp. 66–67). American Psychological Society.
- Kosslyn, S. M., Ganis, G., & Thompson, W. L. (2001). Neural foundations of imagery. *Nature Reviews Neuroscience*, 2, 635–642. <https://doi.org/10.1038/35090055>
- Kounios, J., Frymiare, J. L., Bowden, E. M., Fleck, J. I., Subramaniam, K., Parrish, T. B., & Jung-Beeman, M. (2006). The prepared mind: Neural activity prior to problem presentation predicts subsequent solution by sudden insight. *Psychological Science*, 17(10), 882–890. <https://doi.org/10.1111/j.1467-9280.2006.01798.x>
- Leung, A. K. Y., Kim, S., Polman, E., Ong, L., & Qiu, L. (2012). Embodied metaphors and creative “acts”. *Psychological Science*, 23, 502–509. <https://doi.org/10.1177/0956797611429801>
- Liikkanen, L. A. (2008). Music in everymind: Commonality of involuntary musical imagery. In K. Miyazaki et al. (Eds.), *Proceedings of the 10th International Conference on Music Perception and Cognition (ICMPC10)* (pp. 408–412). Retrieved from http://i.org.helsinki.fi/lasial/files/publications/080904-Music_in_everymind_pdf.pdf
- Liikkanen, L. A. (2012). Musical activities predispose to involuntary musical imagery. *Psychology of Music*, 40, 236–256. <https://doi.org/10.1177/0305735611406578>
- Liikkanen, L. A., & Jakubowski, K. (2020). Involuntary musical imagery as a component of ordinary music cognition: A review of empirical evidence. *Psychonomic Bulletin & Review*, 27(6), 1195–1217. <https://doi.org/10.3758/s13423-020-01750-7>

- Liptak, T. A., Omigie, D., & Floridou, G. A. (2022). The idiosyncrasy of Involuntary Musical Imagery Repetition (IMIR) experiences: The role of tempo and lyrics. *Music Perception: An Interdisciplinary Journal*, 39(3), 320–338. <https://doi.org/10.1525/mp.2022.39.3.320>
- Martin, P. Y., & Turner, B. A. (1986). Grounded theory and organizational research. *The Journal of Applied Behavioral Science*, 22, 141–157. <https://doi.org/10.1177/002188638602200207>
- McVay, J. C., & Kane, M. J. (2009). Conducting the train of thought: Working memory capacity, goal neglect, and mind wandering in an executive-control task. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 35, 196–204. <https://doi.org/10.1037/a0014104>
- Mencke, I., Seibert, C., Brattico, E., & Wald-Fuhrmann, M. (2022). Comparing the aesthetic experience of classic-romantic and contemporary classical music: An interview study. *Psychology of Music*, 51(1) 03057356221091312. <https://doi.org/10.1177/03057356221091312>
- Mendelsohn, G. A., & Mendelsohn, G. A. (1976). Associative and attentional processes in creative performance. *Journal of Personality*, 44(2), 341. <https://doi.org/10.1111/j.1467-6494.1976.tb00127.x>
- Mountain, R. (2001). Composers and imagery: Myths and realities. In R. I. Godoy & H. Jorgensen (Eds.), *Musical imagery (Lisse)* (pp. 271–288). New York, NY: Routledge.
- Müllensiefen, D., Gingras, B., Musil, J., & Stewart, L. (2014). The musicality of non-musicians: An Index for assessing musical sophistication in the general population. *PLoS ONE*, 9(2), e89642. <https://doi.org/10.1371/journal.pone.0089642>
- Razumnikova, O. M. (2007). Creativity related cortex activity in the remote associates task. *Brain Research Bulletin*, 73, 96–102. <https://doi.org/10.1016/j.brainresbull.2007.02.008>
- Sarkar, P., & Chakrabarti, A. (2008). Studying Engineering Design Creativity- Developing a Common Definition and Associated Measures. In: Invited Paper in the Proceedings of the NSF Workshop on Studying Design Creativity John Gero (Ed.).
- Scheier, M. F., & Carver, C. S. (1985). The self-consciousness scale: A revised version for use with general populations. *Journal of Applied Social Psychology*, 15, 687–699. <https://doi.org/10.1111/j.1559-1816.1985.tb02268.x>
- Shofty, B., Gonen, T., Bergmann, E., Maysseles, N., Kom, A., Shamay-Tsoory, S., & Ram, Z. (2022). The default network is causally linked to creative thinking. *Molecular Psychiatry*, 27(3), 1848–1854. <https://doi.org/10.1038/s41380-021-01403-8>
- Slepian, M. L., & Ambady, N. (2012). Fluid movement and creativity. *Journal of Experimental Psychology: General*, 141, 625–629. <https://doi.org/10.1037/a0027395>
- Smallwood, J. (2013). Distinguishing how from why the mind wanders: A process occurrence framework for self-generated mental activity. *Psychological Bulletin*, 139, 519–535. <https://doi.org/10.1037/a0030010>
- Smallwood, J., & Schooler, J. W. (2006). The restless mind. *Psychological Bulletin*, 132, 946–958. <https://doi.org/10.1037/0033-2909.132.6.946>
- Sternberg, R. J. (1985). Implicit theories of intelligence, creativity, and wisdom. *Journal of Personality and Social Psychology*, 49, 607–627. <https://doi.org/10.1037/0022-3514.49.3.607>
- Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Sage Publications.
- Thoma, M. V., Scholz, U., Ehlert, U., & Nater, U. M. (2012). Listening to music and physiological and psychological functioning: The mediating role of emotion regulation and stress reactivity. *Psychology & Health*, 27(2), 227–241. <https://doi.org/10.1080/08870446.2011.575225>
- Wammes, M., & Barušs, I. (2009). Characteristics of spontaneous musical imagery. *Journal of Consciousness Studies*, 16(1), 37–61.
- Williamson, V. J., & Jilka, S. R. (2013). Experiencing earworms: An interview study of involuntary musical imagery. *Psychology of Music*, 42(5), 653–670. <https://doi.org/10.1177/0305735613483848>
- Williamson, V. J., Jilka, S. R., Fry, J., Finkel, S., Müllensiefen, D., & Stewart, L. (2012). How do “earworms” start? Classifying the everyday circumstances of involuntary musical imagery. *Psychology of Music*, 40, 259–284. <https://doi.org/10.1177/0305735611418553>
- Williamson, V. J., Liikkanen, L. A., Jakubowski, K., & Stewart, L. (2014). 231 Sticky tunes: How do people react to involuntary musical imagery? *PLoS ONE*, 9(1), e86170. <https://doi.org/10.1371/journal.pone.0086170>
- Williamson, V. J., & Müllensiefen, D. (2012). Earworms from three angles: Situational antecedents, personality predisposition and the quest for a musical formula. Paper presented at the ICMPC- ESCOM 12, Thessaloniki, Greece.
- Zatorre, R. J., & Halpern, A. R. (2005). Mental concerts: Musical imagery and the auditory Cortex. *Neuron*, 47, 9–12. <https://doi.org/10.1016/j.neuron.2005.06.013>
- Zheng, Y., & Leung, B. W. (2023). Perceptions of developing creativity in piano performance and pedagogy: An interview study from the Chinese perspective. *Research Studies in Music Education*, 45(1), 141–156. <https://doi.org/10.1177/1321103X211033473>