

Steven Brown

The Perpetual Music Track

The Phenomenon of Constant Musical Imagery

Abstract: *The perpetual music track is a new concept that describes a condition of constant or near-constant musical imagery. This condition appears to be very rare even among composers and musicians. I present here a detailed self-analysis of musical imagery for the purpose of defining the psychological features of a perpetual music track. I have music running through my head almost constantly during waking hours, consisting of a combination of recently-heard pieces and distant pieces that spontaneously pop into the head. Imagery consists mainly of short musical fragments that get looped repeatedly upon themselves. Corporeal manifestations of imagery occur in the form of unconscious finger movements whose patterns correspond to the melodic contour of the imagined piece. Musical dreams occur every week or two, and contain a combination of familiar and originally-composed music. These results are discussed in light of theories of imagery, consciousness, hallucination, obsessive cognition, and most especially the notion that acoustic consciousness can be split into multiple parallel streams.*

Introduction

Everyone has had the experience of having a melody be stuck in their head for an extended period of time, especially just after listening to a piece of music. However, most people say that this is an infrequent event in their lives and that they rarely have music running through their heads. For some people, though, this type of musical imagery is a

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constant experience. They nearly always have music running through their heads, occasionally even during their dream time. In other words, they have what could be called a 'perpetual music track' (PMT) running through their heads, where this term refers to a state of constant or near-constant musical imagery.

To the best of my knowledge the PMT phenomenon has not been characterized in the mental imagery or music psychology literatures, and so this report might well represent the first description of it in a healthy (non-neurologically-compromised) person. I present here a detailed self-analysis of musical imagery for the purpose of characterizing the general psychological features of a PMT. The PMT phenomenon is described with regard to the constancy and content of musical imagery, general corporeal manifestations of musical imagery, and the frequency and nature of music in dreams. The music track runs more or less in parallel with verbal imagery, and so these results have important implications for theories of consciousness, mental imagery, and brain function. Most especially, they have implications for understanding the real-time experience of musical imagery. Much of the experimental auditory-imagery literature has examined the extent to which imagery faithfully represents the phenomenal properties of auditory perception (Reisberg, 1992). However, experimental approaches to this problem effectively eliminate any focus on imagery's functional role in human life, i.e., when it occurs, how it occurs, what its contents are, what stimulates it, what inhibits it, what effect it has on the imager, and so on. Such things are best studied using a phenomenological approach to imagery, something that has thus far been absent in the scientific literature devoted to the subject. The present self-analysis is the first systematic, qualitative description of musical imagery in a healthy person. In addition, it is a case study highlighting one extreme form of musical imagery, namely perpetual imagery.

Methods

Methodology

The method used here is a self-analysis based on two years of continuous observation. After having discussed this project with a large number of musicians, composers and musicologists, I have not yet been able to find another person with perpetual imagery, even after attending an international conference devoted specifically to the subject of musical imagery (see Godøy & Jørgensen, 2001). This is not to say that such people do not exist but only that they are not at all prevalent in the population of people in which one would expect to find them the

most. In doing a self-analysis, I am presenting a phenomenological profile that can be readily applied to other people. The experimental literature on musical imagery has been devoid of phenomenological detail, and so the theoretical ground covered in the current self-analysis is not explored in any other publication dealing with musical imagery or perception.

For many years now, I have been aware of the fact that I have strong and frequent musical imagery. Two years ago, I began an analysis and documentation of my imagery with the goal of developing a questionnaire that could be used for a qualitative analysis of other perpetual imagers. This began a period of continuous observation whose results are documented here. While there are unquestionably limitations in assessing the reliability of self-perceived mental processes, the phenomena described in this paper have shown minimal variability over this time period. As the PMT is something of an extreme condition, the current analysis should be seen in the same light as any case study in the literature (quite common in psychology and neuropsychology), except that the author is the subject. And as with any case study, validation of its findings will depend upon replication of the described phenomena with a larger sample of individuals.

In *An Introduction to the Psychology of Dreaming* (1997), Bulkeley discusses the vital importance of self-analysis to scientific psychology. Although his argument deals with dreaming, it is perfectly applicable to musical imagery as well:

Beginning with the pioneering self-analyses of Freud and Jung, psychologists have regularly drawn on their own dreams as one important resource in pursuing their research. This does, it must be admitted, give dream psychology the appearance of being subjective and unscientific. But the unavoidable empirical fact is that our most direct means of access to the images, sensations, and emotions found in dreams is through our own dreams. Although debate about proper research methodology continues, most dream psychologists agree that if self-analysis is combined with solid findings from other research methods, there is nothing dangerous or unscientific about examining one's own dreams. Indeed the history of modern dream psychology has demonstrated that *many of the most creative new breakthroughs have come from researchers who have taken innovative approaches to their personal dream experiences* (pp. 101–2, emphasis added).

As with any case-study approach in science, there are significant concerns about the generalizability of the findings to be presented here. On the one hand is the fact that many people have had the experience of having a tune stuck in their head at some point or another in their life. But on the other is the realization that this process has not been

analysed with rigorous scientific methods, neither in occasional imagers nor in perpetual imagers like me. Such a caveat must be kept in mind in considering the results presented below.

Subject

I am a 43-year old nonprofessional pianist and composer. I began my musical studies at the age of 7, initially aspiring to be a concert pianist. My mother is a non-professional pianist and was my first music teacher. My father has a good though untrained voice and is quite prone to singing to himself for pleasure. I play the piano one to two hours per day, specializing in the repertoire of the early 20th century, such as the Preludes of Debussy and the Sonatas of Prokofieff. About half of my playing time is devoted to improvisation and composing. I listen to music between one and two hours each day, covering a wide range of musical styles. I have good relative pitch and a strong background in music theory and history. Although I do not have absolute pitch, I have confirmed on numerous occasions that I imagine musical works in their correct key (Levitin & Rogers, 2005). This is in accord with a self-analysis done by Ward (1990; 1999) who, during the course of one year, whistled or sang into a tape recorder every tune that spontaneously popped into his head, and found that he was reproducibly ± 2 semitones from the correct key.

Results

My music track will be described with regard to four general properties: (1) the nature and constancy of musical imagery; (2) the content of musical imagery; (3) general corporeal manifestations of musical imagery; and (4) the frequency and content of music in dreams.

Nature and constancy of musical imagery

I have music running through my head nearly constantly during waking hours; my music track thus shows great 'automaticity'. The exception consists of times of high engagement with auditory stimuli, such as during conversation, music listening, or television viewing. This is not to say that the music track is silent during these times, only reduced. However, such musical imagery can be quite active while reading, writing, walking, or just thinking. These observations suggest two things about musical imagery. First, while music and speech represent two sub-modalities of acoustic cognition, their imagery tracks are more or less independent and can operate in parallel. For example, I have little difficulty attending simultaneously to a

conversation with a friend and to the background music in a restaurant. Also, during much of my reading and writing time, I attend to the music of my PMT in parallel. Second, interference with musical imagery is stronger for real acoustic stimuli than for imagined acoustic stimuli; real stimuli (of either sub-modality) compete much better than imagined stimuli for musical imagery.

My musical imagery shows a very high acoustic fidelity with regard to pitch, loudness, rhythm, tempo, and timbre, suggesting that I have good auditory long-term memory. I can differentiate various instruments, and can attain orchestral richness in my imagery. In addition, I can distinguish loud and soft passages of music and can image crescendos and diminuendos in ways resembling the amplitude contours of actual pieces of music. This is consistent with the general understanding of musical imagery that has emerged from experimental studies (Weber & Brown, 1986; Halpern, 1988a,b; 1989; 1992; Godøy & Jørgensen, 2001). It is important to note that unlike the 'inner voice' (i.e., the internal monologue of verbal imagery), the music of my PMT is almost never 'self-produced' at the vocal level: I virtually never hear myself singing (although we could probably imagine a different situation for a singer). The most common self-production consists of visual imagery of my hands playing an imaged piano work on a keyboard. This is often accompanied by visualization of a musical score.

The volume of the music track in my head depends on the extent to which music is the focus of my consciousness. When the music track is the dominant focus, its volume is quite comparable to that of the verbal imagery track, being neither greatly louder nor greatly softer. When it is not the dominant focus, the music track will play quietly in the background, occasionally becoming amplified as it pops its head into awareness. The major issue, then, is the degree to which the PMT functions in either a 'split-conscious' or 'unconscious' mode. It is difficult to give an estimation of the proportion of the time that the music track functions in each of these modes. The important point to highlight, however, is that the PMT can clearly operate in a split-conscious mode, thus arguing that musical imagery and verbal imagery are parallel and separable.

Content of musical imagery

The content of my music track consists of a combination of recently-heard music and distant (but familiar) pieces that spontaneously pop into my head. As mentioned earlier, these pieces are usually

heard in their original key even though I do not have absolute pitch recognition. Invariably, *fragments* of music rather than whole pieces are heard, and these tend to last between 5 and 15 seconds in duration. These fragments tend to get *looped* repeatedly upon themselves, sometimes for hours on end, before proceeding onto another piece or fragment of music. Alternatively, the music track jumps between different fragments of the same piece, usually looping a given fragment for some time before switching to a new fragment or a previous fragment of that piece.

The boundaries of the looped fragments are not identical between repetitions, and are in general quite fuzzy. However, they correspond more or less to phrase boundaries in the music, where the end point of the fragment is usually more stable than the starting point. A given fragment has a minimum size, say for example measures 95–100¹ of a piece. Thus, some repetitions will include only this core fragment. Others will be larger, but will include the core fragment, say measures 93–100 or 90–100. Less often will fragments occur in the form of measures 95–105 or 90–97, where the end point is violated. Likewise, a new fragment of the same piece may become switched to, say measures 42–49, and this may begin a similar process of looping before flipping back to the 95–100 core fragment. We can thus call this process ‘imprecise looping’ or ‘looping with variation’, where the loops are made up of a combination of stable and variable elements. This general ‘loopiness’ of the PMT contrasts with the ‘streaminess’ of the verbal imagery track. This distinction highlights an important difference between the natures of music and language: music is much more formulaic, redundant and repetitive than language (Lomax, 1968), and the loopiness of the PMT might be a reflection of this general property of music.

I typically hear between 2 and 10 different fragments on a daily basis although this varies quite a bit with my musical activity/listening on a given day. The vast majority of my musical imagery is involuntary. While I have the capacity to wilfully evoke particular pieces of music, to run through them in my head, and even to manipulate the sounds of the instruments/voices for compositional purposes, I eventually fall back into a mode of involuntary and automatic musical imagery, invariably comprised of repeatedly looped fragments of the type described above. The music track cannot be voluntarily turned off any more so than the inner voice can be.

[1] In British parlance, “bars 95–100” — Ed.

What determines which piece I hear at a given time? In general, the most recently heard piece of music on a particular day is the one that will be imagined first. In the absence of that, some other piece of music, usually something heard the day before, will take over. On other occasions, distant pieces spontaneously pop into my head. However, the overriding emphasis is on pieces heard or played during the preceding few days. Some pieces of music seem very 'sticky' from an imagery standpoint and are actively avoided during morning listening times. That is, they stay in my head and loop for extended periods of time without let-up. This highlights the point that I find almost nothing pleasurable about having a PMT. Rather, it is quite a distraction most of the time, the kind of thing I wish I could turn off. Interestingly, many of the fragments that get looped the most are passages of music that I find the most emotive and affecting. This often makes me feel distant from the people around me. I can be engaged in mundane conversations with co-workers while having highly moving musical passages running repeatedly through my head. This creates an undesirable psychological feeling of detachment from my social environment.

Corporeal manifestations of the PMT

Occasionally we see people in public places drumming on their laps, tapping their feet on the floor, or strumming an imagery guitar. In addition, we sometimes encounter people singing, whistling, or humming to themselves. We feel certain that they are experiencing musical imagery in a vivid way. In like manner, I have strong and frequent corporeal manifestations of my musical imagery. As I am a pianist, this takes the dominant form of strong finger movements in both hands. Every surface becomes a potential air-piano: a table, my lap, the ground, a wall, etc. These movements are automatic, unconscious, and extremely difficult to control, to the point of being distracting. Secondary effects include foot tapping, rhythmic walking, dancing in place, and humming. Such corporeal movements don't seem to be merely passive by-products of the PMT but rather function to reinforce it.

Importantly, finger movements can begin while I am consciously running through a piece of music in my head but can extend quite a bit past the time that the piece ceases to be the dominant focus of my awareness. My mind can then wander onto other subjects (via verbal consciousness) but the finger movements can continue unabated in an unconscious manner for up to 15 minutes afterwards. On occasion, I

will become consciously aware of my finger movements, and will 'consult' them to find out what piece of music is playing on my musical imagery track. This process of consulting the body for information about musical imagery is especially prominent just after waking up, when there is quite a bit of involuntary and repetitive movements of the hands and feet in synchrony with unconscious musical imagery (see below).

The most significant feature of my finger movements is that *they map out the contour of the melodic line* with nearly perfect accuracy as it would be rendered on a piano keyboard. In other words, the relative positioning of the higher and lower pitches of a melodic line is perfectly represented by the pattern of the finger movements in each of my two hands. For example, an ascending CEG triad will be played with the thumb, third finger and pinkie of the right hand (among many other arrangements) and never in some configuration that violates the contour of the musical line. This applies equally well to known music as to completely improvised melodies. Kinesthetic imagery of the hand and piano keyboard is thus highly accurate during musical imagery, at least in a relative (if not absolute) sense. As an aside, I have strong waking imagery of the computer keyboard, and will frequently image myself typing out individual words (and, more rarely, short phrases) that are spoken by friends or colleagues. This will often be accompanied by actual tapping by the fingers. As with my music track, this tends to occur in a highly repetitive manner, like a non-stop loop for a single typed word or phrase. On occasion such typed words can be 'musicalized' such that a correspondence is imagined between the positions of the keys on the computer keyboard and those of the piano keyboard, thus converting the word or phrase into a musical fragment (e.g., h-i-p can easily become D- F#-A#).

One last feature of my corporeal manifestations bears mentioning. I notice that when I am consciously running through a piece of music in my head, my breathing pattern often synchronizes with the rhythm of the music that I am imaging, as if I were actually singing the music. This can apply as much to the imagery of instrumental works as to that of vocal ones. This might suggest a role for sub-vocalization in musical imagery (Smith *et al.*, 1995, Experiment 3). Murphy *et al.* (1997) showed that vocalized speech produced a pattern of breathing comprised of a rapid inspiration followed by a long and controlled phase of expiration, but that imaged speech produced a regular breathing pattern essentially identical to that of the resting state. Interestingly, silent mouthing of speech — in which articulation occurred in the

absence of vocalization — produced a pattern that was intermediate between these two extremes, although closer to silent speech.

Frequency and content of music in dreams

Although not directly related to the phenomenon of waking musical imagery, musical dreams reveal several interesting properties of musical cognition. They will be discussed here in order to develop a more general view of musical consciousness. I can recall hearing music in my dreams once every week or two. I hear a combination of familiar music and original music (i.e., music composed in the dream), with roughly equal proportions of both. When I can remember a musical dream upon waking, I have no difficulty at all in determining whether I have dreamt a familiar or original piece. However, I have thus far never been able to access original music after waking (much to my dismay). Instead what I recall is a general feeling for the musical and affective qualities of the piece, for example its style, tempo, tonality, orchestration, or emotional tone. Although I have only ever composed music for the piano, my dreams of original music invariably involve richly orchestrated scores, often in the impressionistic or early 20th century styles, which are my styles of preference. It is usually a type of music that I find extremely beautiful and affecting. Thus I often wake up with the ineffable feeling of having dreamt something beautiful yet unattainable, something that can be put down in neither notes nor words. Interestingly, *the music in my dreams is never looped* but consists of continuous passages, thus showing a pattern similar to waking music listening and dissimilar from musical imagery. This applies to both familiar and original pieces. In addition to musical imagery, I have strikingly vivid and colourful visual imagery in my dreams, including the visualization of tremendous cityscapes and landscapes.

Musical dreams frequently have a musical scenario to them — either pleasant or nightmarish — and can involve playing an instrument or visualizing a musical score. On a small number of occasions, I have had accurate visualizations of a few measures of original musical compositions in dreams, and this is the closest I have come thus far to accessing original music after waking. Musical dreams tend to have the characteristically bizarre quality of dreams generally, and this can apply to the musical passages as well as to the background scenarios. While I can occasionally dream a completely faithful passage of music (sometimes lasting a minute or two), I more generally hear garbled pieces in a way that is typical of dream consciousness. My most unusual musical dream was one in which I heard an original piece of

music in the style of Tchaikovsky. Upon waking, I was quite aware that this was an original piece and not a known work of Tchaikovsky. In other words, I had composed in my dreams a pastiche in the style of Tchaikovsky. I could recall a characteristically Tchaikovskian chord progression, orchestration, and *tempo maestoso* to the music.

I wake up every single morning to music already playing in my head. This takes the form of what I call a 'radio effect': the imagery-track approximates a radio playing in the background in the sense that it usually takes me some time to become aware of the fact that there is music running through my head as well as to realize what piece is 'playing'. As with waking musical imagery, the wake-up piece is usually something that was heard either on the previous day or during the previous few days. The wake-up period is characterized by a great deal of unconscious and involuntary movement of the hands and, most especially, the feet (i.e., ankle flexion and extension) in synchrony with musical imagery.

One of my most unusual imagery experiences occurred on a trans-Atlantic flight. I had had the first movement of Fauré's Piano Trio running through my head during most of the flight, in which a small number of passages were being looped excessively. I went to sleep on the plane hearing the Fauré Trio in my head. When I woke up five hours later, my music track was stuck in exactly the same fragment as it was when I went to sleep. I had no recollection of hearing the music in my dreams. Such a continuity between the falling-asleep music and wake-up music happened on only one other occasion, and that was a time when I woke up in the middle of the night after having slept only four hours, thus qualifying as a very similar kind of sleep experience to the trans-Atlantic flight.

Such experiences raise the question of whether there are two distinct music tracks (i.e., waking and sleeping) or simply two modes of operation of the same track. If the same fragment can be heard upon falling asleep and waking, what happens to keep that fragment stored or primed-for-action upon waking? Why does waking musical imagery involve looping while dream imagery doesn't?

Discussion

The PMT and normal imagery

I have presented a self-analysis of near-constant waking musical imagery, a phenomenon that I call the perpetual music track. This may be a new psychological phenomenon as it has not been reported for a healthy person in the mental imagery or music psychology literatures.

Based on anecdotal evidence from colleagues and friends, I have learned that the PMT is a rare phenomenon even among professional musicians and composers. It is thus difficult for me to estimate its actual frequency in the population at large or even in the population of trained musicians.

It is of course very important to apply the current description to other people who have perpetual musical imagery and determine what properties are shared between us. It will first of all be necessary to characterize the variability of the imagery itself and determine to what extent the music tracks of other people conform to that of my own. This should include an analysis of the contents, frequency, acuity, cross-modal processing, stimulants, inhibitors, and body manifestations of musical imagery. In addition, it will be important to see if any life-history variables correlate with the presence of a PMT. This would include analysis of the following factors: personality traits, musical background (e.g., family environment, age beginning musical training), dominant musical activity (instrument playing, singing, conducting, composition, improvisation), types and level of musical skill (e.g., absolute pitch, relative pitch, level of instrumental skill, sight-reading skill, improvisation skill, musical memory, knowledge of music theory), and personal involvement with music (e.g., amount of time listening or playing per day, emotional relationship with music).

Auditory imagery is a critical facet of both the music-listening experience and the musician's art (reviewed in Reisberg, 1992; Godøy & Jørgensen, 2001). For musicians and non-musicians alike, imagery forms an important component of the expectancies involved in the perception of both melody and rhythm. Biological evidence for this comes from neuroimaging studies showing that the brain areas activated during musical imagery are the dominant ones activated during music perception (Zatorre *et al.*, 1996; Rao *et al.*, 1997; Penhune *et al.*, 1998; Halpern & Zatorre, 1999; Meister *et al.*, 2004; Halpern *et al.*, 2004). Such is the case for the imagery of both familiar and newly-heard tunes, verbal and non-verbal. For musicians, imagery serves several other functions aside from music listening including memorization and mental rehearsal. For composers, there are yet other functions, as many composers work away from instruments and compose solely in their heads. For them, active and accurate musical imagery is a critical skill for creating melodies, harmonies, rhythmic patterns, and instrumental arrangements.

Imagery therefore serves many functions for musicians. However these roles are ones that we could call *voluntary* imagery: times when

people wilfully call up musical imagery in the service of musical practice. In contrast, the PMT functions mostly on an involuntary and automatic level: it is nearly constant, it is based on incessant looping of short fragments, and it involves uncontrollable corporeal effects. It is doubtful that the PMT serves any function for the imager. For me, constant imagery is more of a distraction than anything else. One could perhaps ascribe the function of ‘mental rehearsal’ to the PMT, as a certain portion of my imagery incorporates musical works that I actually practice or compose. However, the imagery track extends well beyond such works.

Consciousness

The PMT phenomenon has ramifications for theories of consciousness. Musical imagery might thus serve as an important new source of information for theories about the nature of consciousness. At least four fundamental issues are raised by the current study:

1. The existence and nature of my PMT forces us to confront parallelism models of consciousness. Historically there have been two types of models for the operation of consciousness: ‘serial’ models strictly involve a single focus of consciousness and a sequential stream of processing; and ‘parallelism’ models involve multiple sources of information being processed in parallel and coming together in different ways during a fluctuating state of conscious awareness (Kinsbourne, 1988; 1995; Dennett, 1991). The evidence from the PMT is that acoustic consciousness can be split into parallel streams. Much of the discussion about consciousness revolves around the notion of ‘binding’ (Engel *et al.*, 1999; Revonsuo, 1999; Smythies, 1999; Humphreys, 2003): for example, how the many features of a visual scene (i.e., form, size, colour) can be integrated into a single percept. The PMT phenomenon, in contrast, focuses less on binding and more on the operation of simultaneous, parallel streams. It thus highlights how consciousness is not only bound but *split*. To my mind, the operative metaphor for consciousness is not binding but ‘coordination’, that is, how the multiple features of conscious awareness are distributed in their appropriate channels in a coordinated fashion. Thus the emphasis is not only on the ‘focus’ of attention but on the ‘division’ of attention and the contributions to awareness of multiple, parallel streams both within and between sensory modalities.

One possible criticism of this interpretation is that a phenomenon like my PMT reflects, instead of a high level of divided attention, a breakdown of executive control processes in working memory. In

reality, it might reflect both types of processes, though at different times. There are certainly times when musical imagery can be a distraction from tasks that I'm engaged in, most commonly during conversations that I am having with people. However, I would say that most of the time the imagery doesn't seem to impair my allocation of attention to other tasks and simply plays in the background as an acoustic stream.

2. The PMT is based on the looping of short fragments of music. I raised the question earlier as to whether the 'loopiness' of PMT might reflect the intrinsic formulaic nature of musical cognition, in contrast to the 'streaminess' of linguistic cognition. 'Song may be recognized and defined as more frequently redundant at more levels than any other kind of vocalizing' (Lomax, 1968, p. 13). If this property of my PMT is borne out by future studies, it would argue that musical imagery and verbal imagery may have different underlying natures, even though both processes are based on combinatorial phonological mechanisms.

3. A major part of people's experience of consciousness is the verbal monologue known as the 'inner voice'. It is interesting to compare the PMT with the inner voice. The most significant similarity is that both seem to show strong automaticity: both are perpetual acoustic tracks. Most people cannot turn off their inner voice, and I have great difficulty voluntarily turning off my music track. A significant difference is that the inner voice is a form of 'self' imagery, one which is characterized by a type of neutral emotional character. For example, loudness (intensity) is one feature which is poorly represented in the inner voice (MacKay, 1992). This is distinguished from imagery of other people's voices, which represents such amplitude modulation. In this regard, the PMT is much closer to the imagery of someone else's voice than to the self-imagery of the inner voice. In other words, it seems to represent all the acoustic features found in the ordinary perception of music. Interestingly, McGuire *et al.* (1996) showed that imagery of 'other' speaking voices engaged the same parts of the brain as those engaged by the inner voice, but also activated other areas — mainly auditory areas — not engaged by it. A follow-up study by Shergill *et al.* (2001) showed additional involvement of brain areas involved in covert articulation, such as the frontal operculum, supplementary motor area and lateral cerebellum. Imagery of 'other' voices led to greater activation of these latter areas than did imagery of one's own voice.

4. The intense creativity of my musical dreams, complete with original compositions and richly-orchestrated scores, highlights an important contrast between what one can create in one's mind and what one can actually create and externalize in the world. A good case in point is the composer Maurice Ravel who, as a result of a stroke at the end of his life, developed expressive amusic symptoms, including an inability to sing, play or notate new pieces (Alajouanine, 1948; Sergent, 1993). Ravel was apparently able to compose music at the level of mental imagery, but was completely unable to externalize this music in any form. In a like fashion, the original music of my musical dreams highlights the fact that there can be a great deal of creativity lurking within our minds that we can either not access or not externalize during our waking hours. On some occasions, people *are* able to externalize this information, and there are several well-known cases of people solving problems or coming upon creative ideas in their dreams which they were later able to put to use in their work, for example, the German chemist F. A. Kekulé's discovery of the benzene ring in a dream or Max Bruch's revelation that 'my most beautiful melodies have come to me in dreams'.² However, my case, like that of Ravel's, demonstrates more clearly the great chasm that exists between imagination and externalization.

Musical hallucinations and obsessive mental phenomena

In *The Man Who Mistook His Wife for a Hat* (1985), the neurologist Oliver Sacks described two elderly female patients suffering from temporal lobe seizures accompanied by frequent and vivid musical imagery — or what Sacks referred to as 'musical epilepsy'. Both patients likened their musical imagery to a radio playing in the background. For one of these women, the music in her head was so loud that she could barely hear environmental sounds (she also suffered from hearing loss, thus adding to this complication). For the other woman, the music track was less loud but had many properties of a PMT: it involved only three songs; these songs were looped repeatedly in endless cycles; the music track was reduced when she was engaged in other activities like conversation; and the music was most vivid just after she woke up. Her musical epilepsy was effectively treated by anticonvulsant medication. Sacks discussed these cases in light of the work of Penfield and Perot (1963) who showed that

[2] This comment was taken from a series of interviews between Bruch and the American journalist Arthur M. Abell, as published in Abell's book *Talks with great composers*. This book, which includes interviews with Brahms and Grieg, was published in 1955 although the meetings with Bruch took place between 1907 and 1912.

electrical stimulation of the awake human brain, especially the superior temporal lobe, could on many occasions elicit vivid memories for specific songs familiar to the patients, often in full score. Whether these experiences were induced by seizure or by electrical stimulation, the patients always heard a limited number of songs played over and over again. Interestingly, Penfield and Perot discussed their results in terms of split consciousness or what they called 'double consciousness'.

There is a sizable literature about musical hallucinations that is of relevance to a study of musical imagery. A series of literature searches of the term 'musical hallucinations' on the Medline and PsychINFO databases came up with around 100 publications in the last 25 years (many of them case studies and letters), at least five times more than the whole literature devoted to musical imagery in healthy people during the same period. According to Evers and Ellger's (2004) comprehensive literature review of 132 cases, musical hallucinations tend to occur overwhelmingly in elderly women, especially those suffering from bilateral hearing loss and depression. Musical hallucinations are also associated with seizure activity (Berrios, 1990) as described above for Sacks' patients. Terao and Matsunaga (1999) described an interesting case of an elderly Japanese woman who experienced not only musical hallucinations but also repeated hearings of her verbal imagery. When she thought to herself 'I am going to bed', she heard that phrase repeatedly looped one hundred times thereafter. This phenomenon is known as 'thought echo' and is characteristic of schizophrenia, although this particular patient had no psychotic symptoms. Saba and Keshavan (1997) performed a comparative analysis of musical hallucinations and musical imagery in 16 schizophrenic patients. Ten of these patients said that the music came from 'inside their head' (thus being more akin to musical imagery than to musical hallucinations), while six said that the music came from outside. Interestingly, three of the latter patients reported hearing 'unfamiliar' music, something reminiscent of the original music of my dreams. One of these patients, a 27-year-old man, reported hearing unfamiliar guitar music during a time in his illness when he was learning to play the guitar. Finally, Zungu-Dirwayi *et al.* (1999) described two cases of musical 'obsessions', in other words intrusive and repetitive imagined musical tunes. Both profiles were strikingly similar to PMT's in their constancy and repetitiveness.

It is too early to identify the threads that tie these diverse phenomena together. It is tempting to speculate that abnormal functional activity in the posterior temporal lobe is the common link. In support

of this, Griffiths (2000) performed positron emission tomography on six patients experiencing musical hallucinations secondary to acquired deafness. The neuroimaging data showed that musical hallucinations were associated with bilateral activity in the auditory association cortex of the planum temporale but not the primary auditory cortex in either hemisphere. Additional activity was found in motor-related areas such as the right frontal operculum, right basal ganglia, and bilateral cerebellum. These results jibe with current theorizing suggesting that auditory mental imagery has not only a covert sensory component to it but a covert motor-planning (i.e., articulatory) component as well (Shergill *et al.*, 2001). In sum, musical hallucinations are an important yet neglected source of information in understanding musical imagery.

Rather than hallucination, perhaps the most relevant neurocognitive concept here is that of ‘obsessive’ mental phenomena, such as those associated with non-psychotic pseudohallucinations and with obsessive mentation. Van der Zwaard and Polak (2001) actually use the example of a melody stuck in one’s head to make a point about this. I take the liberty of quoting them at length:

... the phenomenon of a melody stuck in one’s mind meets all criteria of the concept of (‘imaged’) pseudohallucinations, for it is involuntary, internal, characterised by intact reality testing, and has an as-if character. Another example is obsessional imagery, a specific form of obsession. Obsessions are recurrent, persistent ideas, thoughts, impulses, or images that are egodystonic, which the individual is able to recognize as a product of his/her own mind. Obsessional imagery (the compulsion to call images to mind of mutilation, sexual acts, and practices of war) also has a striking similarity to supposed characteristics of pseudohallucinations. Reality testing remains intact, but in contrast to normal imagery, sensory vividness is high and the experiences are almost involuntarily (pp. 45–6).

Hence, the PMT might be a reasonable example of obsessive musical imagery, characterized not only by its repetitiveness but its involuntary nature.

States of musical consciousness

Table 1 provides a comparative summary of the features of four states of musical consciousness: (1) waking music perception; (2) my perpetual music track; (3) musical dreams; and (4) musical hallucinations. The PMT shares certain important features with waking music perception and musical hallucinations. With waking music perception it shares the waking state, interference by external sounds, and the

	Music Perception	Musical Imagery	Musical Dreams	Musical Hallucinations
Waking	+	+	-	+
Perceived External	+	-	+	+
External Interference	+	+	-	+/-
Automaticity	-	+	-	+
Looping	-	+	-	+
Spontaneous Composing	-	-	+/-	+/-
Distortion	-	-	+/-	?
Corporeal Manifestations	+/-	+	-	?

Table 1: Four States of Musical Consciousness

This table presents a descriptive comparison of four states of musical consciousness according to a series of eight parameters. 'Musical Imagery' refers mainly to the data on the perpetual music track (PMT) described in this paper. Interpretation of parameters and symbols:

Waking	=	waking state (+) or not (-);
Perceived External	=	music perceived as being external (+) rather than internally-generated (-);
External Interference	=	interference by external sounds (+) or not (-);
Automaticity	=	a continuous music track (+) or not (-);
Looping	=	looping (+) or not (-) of fragments or whole pieces;
Spontaneous Composing	=	whether original music is ever spontaneously composed in this state (+) or not (-);
Distortion	=	whether familiar music ever appears in a distorted form (+) or not (-);
Corporeal Manifestations	=	the occurrence of body manifestations (+) or not (-).

existence of corporeal manifestations. With musical hallucinations it shares the additional features of automaticity and looping.³ But with musical dreams, it shares virtually nothing (at least not at the acoustic level). In fact, inspection of the table reveals that *the dream state is nearly the reverse state of the PMT*, making it more of an antithesis to the PMT than waking music perception.

[3] Whether musical hallucinations involve distortions and corporeal manifestations I have not been able to glean from the literature.

To have or to have not

Perhaps the last word about the PMT should be left for its emotional effects on the imager. As mentioned earlier, having a PMT is mostly a distraction from the business of daily living. If given the choice, I would make my musical imagery voluntary and controllable, and this applies to both the body manifestations and the imagery itself. The most ironic and paradoxical part of the phenomenon is that the musical passages that get looped most strongly are often those that tend to be the most emotive and aesthetic for me. Yet the effect of looping is to create a very disturbing and distracting situation in my daily life. We all know the old proverb that ‘too much of a good thing can be bad for you’. Apparently, this applies to the most beautiful passages of music as well.

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