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Predictive Listening in Music Comprehension and Music Training

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Abstract

The development of predictive listening abilities in a given music tradition is an important but, a commonly overlooked part of music education. This paper describes a methodology to help students cultivate music understanding by developing their predictive listening abilities. As an example, we will outline how one particular method develops predictive listening abilities by having children amass a tonal vocabulary (that is, learn tonal patterns) from most common patterns to less common, thereby systematically internalizing the statistics of the "language" of classical music, an idea generalizable to other music traditions.

Keywords

Ear training, predictive listening, music comprehension.

1. An introduction: inner hearing and the deaf-composer puzzle

In the summer of 1801, in a letter to Franz Wegeler, Beethoven wrote:

> For the last two years I have avoided all society, for it is impossible for me to say to people, "I am deaf." Were my profession any other, it would not so much matter, but in my profession it is a terrible thing; and my enemies, of whom there are not a few, what would they say to this? To give you an idea of this extraordinary deafness, I tell you that when at theatre, I am obliged to lean forward close to the orchestra, in order to understand what is being said on the stage. When somewhat at a distance I cannot hear the high tones of instruments, voices. (Forbes 1967, p. 284)

Beethoven was losing his hearing and would instead hear a humming noise in his ears. And yet, after 1801, Beethoven wrote over 200 new pieces, including the "Moonlight" sonata (1801), "Für Elise" (1810) and the Ninth Symphony (1824). With the exception of his first symphony, which he completed in 1800, Beethoven wrote all of his symphonies after 1801, despite having become virtually deaf.

Is 'deaf musician' not an oxymoron? How was Beethoven, along with Smetana and Fauré and a number of other musicians with damaged hearing, able to continue composing music despite being unable to hear? The answer is inner hearing. Inner hearing is something we have all experienced to a lesser or greater extent. An "earworm" is a familiar example. An earworm is a catchy piece of music which you continue to hear in your head long after it is actually played. If a friend complains to you about a song being stuck in her head, this is what she means. Inner hearing goes well beyond earworms and can mean being able to hear in one's head an entire symphony or being able to "pre-hear" what's to come when hearing a new piece for the first time.

Inner hearing is critical not only for composers, deaf and non-deaf alike, but also for active listeners. Inner hearing is the musical imagination's playground. It is where musical imagination unfolds and is what makes predictive listening possible. That's because predictive listening is not about registering the sound waves as they land on your eardrums, but about what happens in your imagination (Lotze 1886; Hanslick 1891; Aiken 1951). The same note can sound differently depending on what notes you heard a moment ago (Meyer 1956; Huron, 2006). Put another way, melodic expectations matter. Hermann Lotze, for example, some hundred and thirty years ago wrote:

> [S]uitable enticements should be furnished to this natural play of our imagination, by putting expectation on the stretch…by surprising effect, by combining a variety of elements into a whole that admits of easy intuition. (Lotze, 1886, p. 4)

In more recent years, the idea of expectation in music was extended to cognitive science (Huron, 2006) and to building stochastic models of music (Temperley 2010). The idea of melodic expectation can also be applied to rhythm, chord progressions, and other musical elements. Syncopated beats or offbeat rhythms, for example, surprise expectations when at a rhythm position where we anticipate a beat we find none.

Music-training methods are typically classified into two categories: performance methods and ear-training methods. Performance methods are those that teach someone to play a musical instrument. Suzuki's method is an example. Ear-training methods are those that involve lessons in solfeggio, Brainin's and Gordon's methods for example (Brainin, 1998, 2004, 2008, 2009; Gordon 1997, 2000). For the purposes of this paper, the relevant distinction is not between performing and listening, producing and consuming. Instead, the relevant distinction is between understanding music and not. When re-conceptualized in this way, Gordon's, Brainin's and Suzuki's methods all have something important in common: they either explicitly aim to or happen to develop, to a lesser or greater degree, predictive listening abilities necessary for music understanding. Whatever the merits and demerits of each of these methods, this is an important commonality. While music has other legitimate uses, such as creating an atmosphere, changing emotions, relieving stress, and matching one's own current emotional state (Juslin & Västfjäll, 2008), this paper is about understanding music.

2. Predictive listening as internalized statistics

So, what is predictive listening? The idea is intuitive. Have you ever found yourself finishing someone else's sentences? If so, then what you were experiencing was predictive listening. In the context of music, predictive listening means intuitively guessing the next note, finishing someone else's musical phrases, or having other anticipations about what's to come. If you finish someone else's phrases in your head, then this employs inner hearing. Some degree of inner hearing is necessary for predictive listening, and predictive listening is in turn necessary for music comprehension—that is, to understand music.

Probability and statistics are an important element of developing predictive listening. In a given music tradition, a listener familiar with that tradition will have some expectations about what the next musical elements will be given what has already been played. These might be guesses about what notes and rhythms will sound next. Whether we completing an unfinished phrase or filling in

the missing bits, the idea is the same. Consider an example taken from Pit–Claudel (2016). A competent educated English speaker, for example, has no trouble filling in the missing letters in the following snippet:
“Th_ onl_ wa_ to ge_ ri_ of a tempta_____is to yie___to it. Resi___it, an_ you_ soul gro___sic_ wi___ longi___fo_ th_ thin___it ha_ forbi_____to itse_. (Osc_Wil_, The Picture___________________)”

This idea of internalized statistics that explains how we are able to predictively read and listen has its roots in information theory (Shannon, 1950) and was soon extended to music perception (Meyer, 1956).

When we listen to a musical composition without any expectations about what’s next, we are like someone listening to a message in a foreign language. If from time to time we make random guesses on the text to follow, we are like foreigners who know some words from the language of the message. But if we subconsciously make guesses based on our expectations—regardless of which of our expectations are fulfilled—we are like a native speaker familiar with the relevant context who receives the message in a language or dialect she knows very well. Moreover, sometimes it is good that our expectations go unfilled. The composer, like an author of a criminal story, might do her best by violating or leaving unfilled our expectations in a way that makes sense, at times postponing our gratification, to maintain our interest and not bore us.

1. Learning tonal patterns, starting with the most common

Music understanding requires predictive listening. Predictive listening in turn requires having internalized the relevant statistics. A music-training method can then be helpful if it can help internalize the relevant statistics more efficiently.

How can a method help internalize relevant statistics more efficiently? We propose the following approach: order musical elements from most common to less common, by the frequency of their occurrence, and expose students to these elements in that same order. For melodic elements, this means having students learn (e.g., by ear, by learning to sing) the most common melodic elements first and only then learn the most common variations of those elements, and then the most common variations of those variations, and so on.

A melody is, for our purposes here, too big a unit to be a musical element. The goal isn’t to have students learn a collection of melodies. Instead, the idea is to empower students to be able to form expectations about where the melody will “go” — to anticipate its movement through the pitch space and the degrees of scale embedded in that pitch space. Melodic elements are smaller than a melody. They are a melody’s constituent parts, ordered as a sequence of notes. The first songs that children learn in Brainin’s method, for example, are composed of just two notes. These two notes are the dominant (the 5th scale degree) and the scale’s home key: the tonic (the 1st scale degree). The tonic and the dominant are very common building blocks of much of Western music. Duke Ellington’s C Jam Blues is built on these two notes:

What we are interested in, in particular, is the opening of a melody, not the entire piece. As the building blocks of a melody's opening, some combination of a dominant under a tonic is also very common. This note combination is also a common opening in many classical pieces of the 18th to 20th centuries. For example, Leporello's aria from Mozart's Don Giovanni ("Notte e giorno faticar…").

While the ostinato of C Jam Blues goes up from a dominant to a tonic, the opening of Leporello's aria goes down from a tonic to a dominant. These are two of the many variations of the same idea: using, as a melodic opening, some combination of a tonic and a dominant (while keeping the interval between them a fourth). Given how fundamental the dominant and the tonic are, they are the first "words" of tonal vocabulary that the Brainin Method teaches by having children learn "songs" (motifs) composed of various combinations of these two notes.

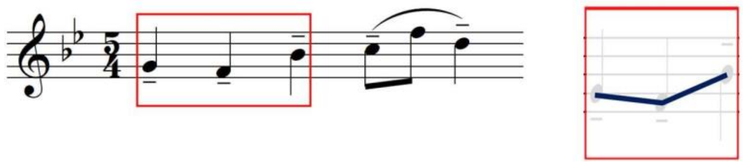
Once children become comfortable with the vocabulary of the dominant and the tonic, other scale degrees are inserted between the tonic and the dominant. Children are introduced to two metaphorical characters: Fairy Variation and Grandpa Metronome. Fairy Variation likes change, whereas Grandpa Metronome does not. Fairy Variation, much to the dismay of Grandpa Metronome who is conservative and is averse to change, introduces a variation to this tonal pattern by adding the 6th degree of a scale. Once children are comfortable with the 1st, 5th and 6th degrees, the 7th scale degree is added (i.e., inserted). And so on.

As more degrees are added, children's tonal vocabulary grows. The statistics the children internalize by learning to sing these motifs are probabilistic rather than deterministic. The fifth, for example, might be followed by another fifth or by the first or the sixth.

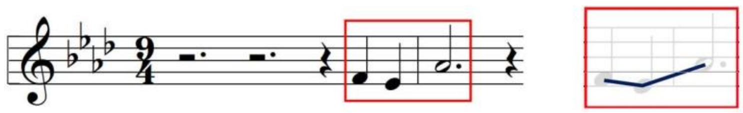
Moreover, once children have learned the 6-5-1 tonal pattern, they have amassed enough melodic vocabulary to be introduced to their first classical works which utilize these particular melodic elements: the opening of Rachmaninov's Lilacs. Later, after Lilacs, children learn Mussorgsky's "Promenade" from Pictures at an Exhibition, and after that they learn Tchaikovsky's "November" from The Seasons, which utilizes a larger tonal vocabulary. All three pieces, whatever their key, start with 6-5-1:

Tchaikovsky:

Mussorgsky:



Rachmaninov:



You can see in the rightmost column above is always the same: down a little, then up a bit. Given the keys of the pieces, this movement of the melody in fact happens to be the 6-5-1 tonal pattern. The opening melodic pattern is the same in all three pieces.

There is a deeper reason why 5-1 is the order that is statistically suggested to be the most common. Western music, starting with the Middle Ages and leading up to early twentieth century, is based on the diatonic scale and the dominant (5th degree of the scale) and the tonic (1st degree of the scale, the home key) are the most important structural elements of the diatonic scale. But whatever the structural causal reasons that generate the statistics of the given musical "language", the idea is to start with the most common patterns of that language, get students to form a stereotype that this most common pattern is the only pattern they should expect, then proceed to violate this expectation by getting students to form a new (probabilistic) stereotype, then in turn violate the expectations dictated by this stereotype, and so on. The idea is to do this systematically by arranging the patterns, these stereotypes, in a statistical order from most common in the actual works of the given musical culture to the less common. This is the process for designing a method's curriculum for a method which aims to help the student develop predictive listening abilities and do so efficiently. Our practical recommendation is that, to internalize these patterns, students should vocalize them—that is, learn to sing them by heart. The reason this is more effective in practice than playing the melody on the keyboard is because it is impossible to feign understanding of the melody's movement here by merely memorizing mechanically which of the keyboard's keys to press.

The three powers needed for music understanding are: (1) being able to listen actively rather than passively by being able to listen predictively, (2) being familiar with the culture of the given music tradition (which includes being familiar with its seminal works), and (3) being able to discern the elements of music by ear. (An argument for why these three powers are needed for music understanding is given in the bigger version of this paper.) The example above illustrates how predictive-listening abilities can be developed by teaching students to discern melodic elements by ear and how students can be introduced to seminal works of the given musical culture very early on, using melodies made up solely for pedagogical purposes in tandem with real classical works. While this example is about melodic elements (and discussing rhythm and harmony falls outside the scope of the current paper), the technique it illustrates is generalizable to rhythm and harmony.

3. Conclusion

In this paper, we described a methodology (that is, a class of methods) which has two defining characteristics. First, the purpose of a method in this class, with respect to a given music tradition for which the method was developed, is to help develop the capacity to understand music in the given music tradition. Second, it does so by developing predictive-listening abilities in that music tradition. As an example of a method in this class of methods, we used the Brainin Method. We outlined how the Brainin Method develops predictive listening abilities by having children amass a tonal vocabulary (that is, learn tonal patterns) from most common patterns to less common used in classical music, thereby systematically internalizing its statistics—an idea generalizable to other music traditions.

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