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FEATURES

The tick-tock principle in music

by Benjamin Martin on August 18, 2017

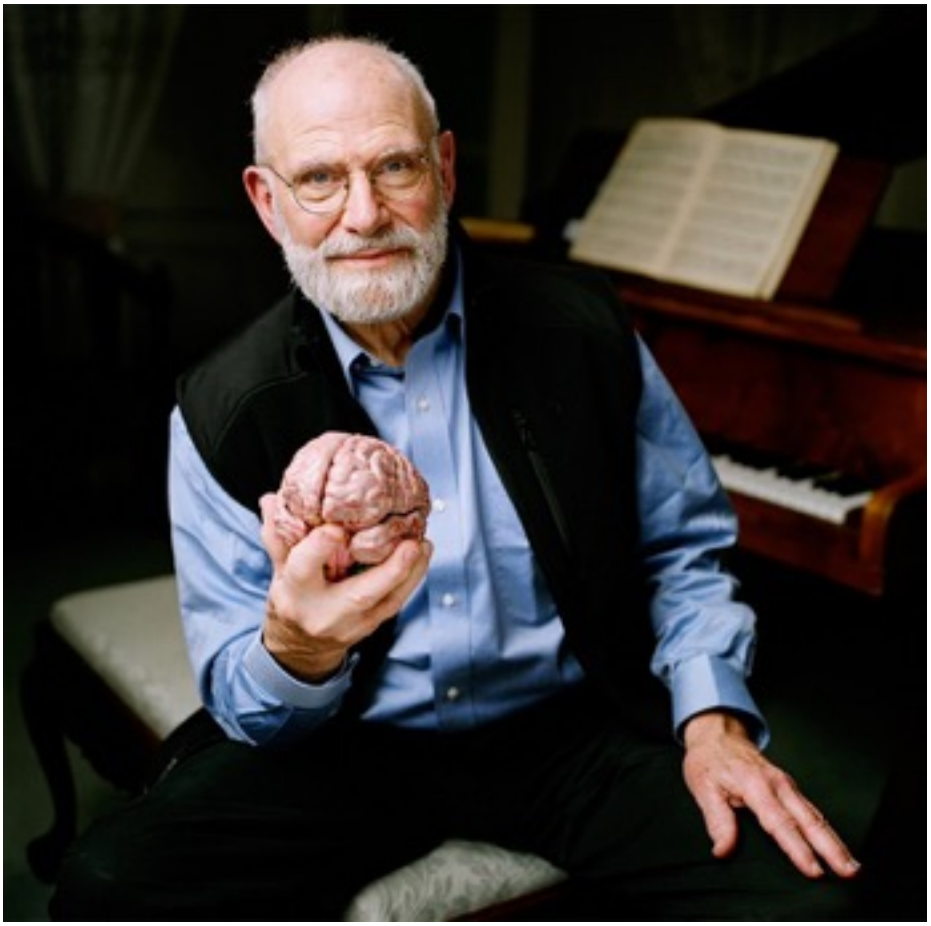
Why when a clock goes tick-tick do we hear tick-tock? An investigation into a trick of the mind throws up some surprising results.

By the time you've finished reading this article you'll probably feel as though you've been reading science fiction. Yet it often happens that enquiring into the nature of things we hardly notice, day in day out, reveals the oddest things imaginable. And in certain instances, music can facilitate such an enquiry.

Not just a tick

In his book The Mind's Eye, the late British neurologist Oliver Sacks wrote "there is certainly a universal and unconscious propensity to impose a rhythm even when one hears a series of identical sounds at constant intervals... we tend to hear the sound of a digital clock, for example, as 'tick-tock, tick-tock', even though it is actually 'tick-tick, tick-tick'." I might add to this acute summary that we, the listeners, impose an emphasis on the first of every two 'ticks'.

Neurologist Oliver Sacks



Let's try a little experiment. When only those who might understand are about, try repeating in a uniform, monotone succession the pattern 'a-b-a-b-a-b' without any hint of emphasis. But then again, perhaps this sequence is sure to lend an emphasis owing to the pattern's alphabetical arrangement? OK, try just 'a-a-a-a-a-a'. Keep it going as long as you like, allowing it to drift to the back of your mind. Did you manage to lose all sense of emphasis on the first of each group of two 'a's? Not so easy is it? Of course, perhaps you can, but that requires a conscious effort. So why do the repeated 'a's contain their own grouped emphasis? I would suggest that we are hardwired this way, moreover, that this essentially a-b relationship is perhaps the most fundamental aspect of human perception, since at the root of this inclination lies the nature of choice – a very strange creature indeed. But in order to grasp such connections we need to go deeper.

Follow your heart

A heartbeat pattern is a lot less static and arguably more musical than that of a digital clock. What if we string together a quaver-crotchet (or eighth note- quarter note) in a 3/8 pattern in a uniformly spun 'a-A' monotone sequence (the capital 'A' being that of longer duration), and take note of any implied emphasis? My guess is that, even if not at the outset, an implied emphasis will ultimately fall upon the crotchet, while the quaver works as an upbeat. (If that didn't occur, then I'd suggest that either you didn't do it for long enough, or that you didn't maintain a sufficiently uniform pulse.)

Now, in order to perceive the quaver as being the main beat you're going to have to consciously lend it an emphasis pretty well throughout the entire sequence. Only in that way can you maintain the crotchet as being the weaker of the two beats.

The mind's eye

There's something funny going on here. For one thing, why might the heartbeat version, without any imposed emphasis, produce an implied emphasis on the beat of longer value? Well, it just so happens that our hardwired tick-tock tendency plays on our spatial sensibilities as well, which in turn might tell us something.

Imagine a vertical line, and then a smaller one alongside it. Without being too clever about it, it is clear that the longer line retains a certain emphasis over the shorter one, as it literally takes up more space. Hence, the crotchet may be regarded as taking up more 'space' than the quaver, in which event it carries an implied emphasis. If this sounds a bit of a stretch, remember that this spatial aspect is intrinsic to standard musical notation, whereby a crotchet and whatever subsequent value follows will typically be separated by a bigger gap – that is, more space – than a quaver and a subsequent value. Hence, the notational system is spatially oriented towards our perception of time. Now, if we accent the quaver in order to shift the point of emphasis we effectively bring it closer to the foreground. Hence the quaver 'appears' to be bigger than the crotchet that we have left tapping away in the background. What, then, if we revert back to our original pattern of equal tick-tock values, and instead emphasise the second of each group of two – in other words 'a-A, a-A, a-A'?

What we now get is a syncopation, since, as Sacks made plain, the first of every two 'ticks' carries with it an implied emphasis, and so by uniformly superimposing a different emphasis onto the alternate beat we effectively offset what is the assumed pattern.

In fact – and here's the really odd part – we have already re-established the pattern, such that the initial 'a' of every group of two now serves as an upbeat to the second 'a'. We don't immediately recognise that 'a-A, a-A, a-A' is of course simply the old tick-tock – or 'A-a, A-a, A-a' pattern – displaced within the perceived continuum by a single 'a' (hence by one tick). We are momentarily wrong-footed, and by not immediately adapting to it we effectively get caught up in a syncopation. That makes us human.

Heading down the Rite path

To help clarify this, let's take the famous repeated chord passage that begins the section known as Augurs of Spring (following on from the introduction in Stravinsky's Rite of Spring – see above). In the first two bars of the passage, Sacks' tick-tock principle is indubitably established. Then, in the third bar the pattern is offset via an emphasis on the 'tock', while the following bar allows us just enough time to resettle into the original pattern. But in the fifth bar yet another 'tock' is emphasised and again we're thrown off, but then the sixth and seventh bar reaffirms the original pattern with accented first beats, while the eighth sounds one final syncopation.

The passage toys with our adaptive mechanisms, keeping them both in check and in a state of tension (the harmony helps, too). If we isolate and play out the syncopated third bar over and over we will eventually yield to hearing the syncopated beat as a main beat emphasis: in other words 'a-A, a-A' becomes 'A-a, A-a'. This 'switch' can take longer with musicians for the simple reason that they are more conditioned to resisting such shifts of emphasis as a result of playing works like The Rite. However, given a sufficient amount of repetitions, the switch – which involves choice (more about that later) – is inevitable. The reason is straightforward: a syncopation relies upon an emphasis that no longer exists. In actuality the emphasis has already shifted.

Fascinatin' rhythm

What? Am I suggesting that syncopations don't exist?! Yes and no. Basically, a syncopation is reliant upon memory in order to be 'felt', or have any effect. Let's say that we had a memory span of 0.3 seconds. Then the passage from The Rite of Spring might just as well be written out without any bars or accents. That would mean that instead of a 2/4 we'd get a single quaver that we'd continuously forget had already been accounted for. The reason is that we would forget everything we'd just heard – no sound would stand in relation to any other. A 2/4 meter would imply a non-existent tick-tock relationship – it would make no sense at all.

Yet in the general scheme of things our memory does enable us to recall the context of such patterns as in The Rite. Therefore we cannot help but perceive accented off-beats as syncopations, which is to say, in relation to the whole. And at a certain point, upon sufficient repetition of a uniform syncopation, we literally take a blind leap in order to re-establish the ever-familiar tick-tock pattern, or time-continuum.

I told you it would sound like science fiction, but it is the truth; the time continuum is simply the hardwired tick-tock pattern that allows us to contextualise all we hear. It is music that makes the continuum manifest by lending it expression.

Beyond measure

Yet outside of music, say, or a heartbeat, what proof exists of this supposed continuum? The main problem here is that in terms of our daily lives – and outside of music – it rarely rises to a level of consciousness, making it a very difficult thing to pin down. Yet it would seem an a priori aspect to our condition in that upon closer inspection it seemingly underpins our very mode of psychological orientation. In his book The Secret Life of the Mind, neuroscientist Mariano Sigman writes: "One of the best ways that the brain estimates time is simply by counting pulses: steps, heartbeats, breaths, the swinging of a pendulum or music's tempo. For example, when we exercise, we mentally estimate a minute faster than when we are at rest, because each heartbeat – and therefore each pulse of our inner clock – is quicker."

This is hopefully a fairly straightforward instance of how the time-continuum can influence our perception. Here's a slightly more interesting example: "When a man is walking up and down anywhere, if his thoughts are on something else he will never fail – give an inch or so – to make the same number of equal strides; but if he goes to that place with the intention of counting and measuring his strides, he will find that he will never achieve so exactly by design what he had done naturally and by chance."

The great French Renaissance writer Michel de Montaigne's observation was made well over four-hundred years ago and it withstands scientific scrutiny today, having been demonstrated many times. By unconsciously marking out near-equidistant steps, it is as though we are setting out a constant and uniform pulse so as to form an uninterrupted background for our thoughts. I would take it a step further – the pun is unavoidable – and suggest that we are in fact creating a space for our thoughts to fill up, which is to say, we ourselves form the continuum through time that allows an ideal environment for our thoughts to develop. Effectively, we act as a conduit for an idea to take shape. And the steps themselves naturally fall into a right-left (or left-right), slightly emphasised- less emphasised A-a pattern.

The toaster effect

A syncopation is typically regarded as a strictly musical event which offsets an established musical pattern. I would like to extend the definition further by suggesting that its psychological function – namely, that which offsets our sense of physical equilibrium – might be taken to exceed musical parameters. Take a familiar example. You are watching the toaster, awaiting its burnt offering... POP! Every time it gives you a jolt. Why? Well, naturally you had no idea as to precisely when it would happen. Yet the jolt is greater when you wait for it than when you don't, even if it doesn't make much noise. The reason is simply that the POP has no established context within a perceived continuum. Rather, the sense of a continuum is forestalled until the POP occurs, and so it is contextualised after the fact, so to speak. And so in effect, the unexpected POP is always felt as a syncopation. But why not as a downbeat? Because a sound perceived in isolation can never register as a downbeat, since a downbeat, or a 'tick', is only perceived as such when brought into relation via a preparatory beat, whether it be audible or not. Remember that a conductor can direct an orchestra by creating a beat – unexpected or otherwise – literally out of nowhere, which in turn creates a context for the downbeat.

Which brings me to the really interesting part. Try the 'aA-aA' syncopated pattern in your head – without anticipating a change of pattern – until you arrive at a state of 'Aa-Aa'. You may have noticed that the switch occurred at some point, perhaps around the seventh repetition, or even the 13th repetition. Yet what caused it to switch? Certainly not you – or not consciously, at any rate, if you did it properly. So what is it that chose for you? And given that the transition is at some point inevitable, do we really have a choice at all?

In an essay entitled How Our Mind Tangles Itself Up, Montaigne wrote: "It is a pleasant thought to imagine a mind exactly poised between two parallel desires, for it would inevitably never reach a decision, since making a choice implies that there is an inequality of value."

I agree, it's a very pleasant notion, and one beyond the capacity for us humans but for a single instant. We are hardwired to prefer – and therefore choose – one thing over another, even if both things are seemingly identical. Like with 'tick-tock'. This raises a tantalising question: namely, what might lead us to differentiate between two seemingly identical things if it isn't our being hardwired from the outset to impose an inequality of value where none may actually exist? And the fact that we can consciously decide to change our sense of emphasis within a musical pattern by no means explains why, if left to run its natural course, the transformation from a syncopated emphasis (a-A) to a main-beat emphasis (A-a) will occur without our making it happen.

It is therefore an event that eludes our perceptual grasp.

Ultimately, then, the moment of choice occurs in our absence.