

# Editorial

## Music: A Basic Drive or a Key Element in the Human Brain?

Music is a transcultural phenomenon so widespread that it suggests the existence of a basic cerebral drive to make music or listen to it. Throughout history, music has been a means of non-verbal expression and communication. Because of its effects on emotions and motivation, it has frequently been used as therapy for some mental conditions.

For the sake of brevity we shall not address the neurophysiological details, but it is a known fact that human beings, save for rare exceptions, do not perceive pure, isolated tones. The auditory cortex has to combine and integrate tone-grouping units, motifs further grouped into phrases – hence with a temporal component – which can be identified when they reappear in a given composition. A motif is similar in structure to a word, which consists of a sequential grouping of different sounds (phonemes). It has therefore been suggested that music borrowed its form from the spoken word, although specific circuitry is required to process musical information, which suggests that there could be a dual neural system for sound information.

This idea is borne out by specific complex genetic conditions, such as specific disorders associated with mental retardation, autism-spectrum disorders, or Williams syndrome, in which language ability is also modified. The changes in the brain induced by the genetic conditions of these patients lower their IQ, or intellectual quotient, and handicap performance in visual-spatial tasks, mathematics, abstract thought, and learning at large, with an ensuing moderate degree of mental retardation. Yet these very alterations also give rise to their special musical ability. In fact, many of them possess

absolute pitch, also known as ‘perfect pitch’ – the ability to identify the exact pitch of a given note without using another as reference. Absolute pitch is a perceptual-cognitive ability that enables those who possess it (Mozart, for one) to identify notes with total ease and accuracy.

Neuroimaging studies have shown that when musicians with perfect pitch hear a sound, the frontal region of the cortex is activated, as well as one of the cerebral regions most closely linked to language – the planum temporale. This is a particularly interesting point, as musical training gives rise to palpable changes in the brain, quite possibly in the areas physiologically involved in musical execution, creation, or appreciation.

In fact, we know that professional musicians have different brain structures compared to nonprofessionals. It is not yet known whether this is the result of changes brought about by musical experience or whether there is a certain innate element that shapes brain architecture. Musicians undergo long and intensive motor, perceptual and cognitive training, hence it is not far-fetched to suppose that this might give rise to structural changes in both motor and non-motor regions of the brain.

How do these changes in the brain bear on daily life? This is not a question we can answer at present, but a number of studies have shown distinct cognitive and affective differences in creative persons, and in fact the cerebral cortex is actually the region most sensitive to this type of plasticity. This fact is of particular interest when we consider mental retardation, as the neocortex is the area most affected in these cases, and plasticity is one of the functions most disturbed in such disorders.

Music doubtless wields a special power over the human spirit. It may recall to memory specific situations or feelings, and it can change the listener’s mood or perception of space and time through harmony and rhythm; the specific architecture of a given piece thus creates specific activation patterns in the brain’s neural networks and probably also at the cellular level.

As far as the intellect is concerned, music develops a capacity for attention, fosters creativity and imagination, enhances concentration as well as short- and long-term memory, and develops a sense of order and analysis. It facilitates learning by keeping neurons active in the brain, and provides intellectual exercise, as it is conducive to the use of several concomitant lines of reasoning when its elements are perceived as distinct and yet brought together in the perception of a single, integrated, logical, beautiful message.



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