

More Music Science

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Hand-to-ear link in brain established after minutes of piano learning

Contrary to what your music teacher told you, it does not take decades of piano practice to learn to play phrases on the piano without looking at your fingers. A brain map linking finger movements with particular notes begins to form within minutes of starting training, according to research published this week in BMC Neuroscience. Recent brain imaging studies of professional musicians have demonstrated that silent tapping of musical phrases can stimulate auditory areas of the cortex and hearing music can stimulate areas of the motor cortex. Moreover, according to anecdotal evidence, hearing music can cause pianists to move their fingers involuntarily. To find out how fast links between these two brain areas could be formed Marc Bangert and Eckart Altenmüller, from the Institute of Music Physiology and Musicians' Medicine in Hanover, examined the effects on the brain of taking up a musical instrument from scratch. Their results showed that patterns of brain activity when listening to music or silently tapping a keyboard could be altered after just 20 minutes of piano practice. These changes were enhanced after five weeks of training. Two groups of beginner pianists undertook ten 20-minute training sessions over the course of five weeks. In these sessions they learned to play back musical phrases they heard on a digital piano. No visual or verbal cues like tone names or score notation, or even their own hands visible on the piano keys, were allowed during training. This policy ensured that the training exercise involved only auditory and motor skills. The two groups differed slightly in their training regime. The first group (the 'map' group) used digital pianos where the five neighbouring keys had appropriate notes assigned to them. The second group (the 'no-map' group) used pianos where the assignment of notes to the five keys was 'shuffled' after each training trial. The researchers explain: "The 'no-map' group was not given any chance to figure out any coupling between fingers and notes, except the temporal coincidence of keystroke and sound. In other words: these subjects were not given any opportunity to establish an internal 'map' between motor events and auditory pitch targets." Before and after the first session and after the fifth and tenth sessions the novice pianists were asked to listen passively to short musical phrases and, in a separate test, to arbitrarily press keys on a soundless piano keyboard. During these test sessions the researchers monitored the electrical activity of the students' brains in 30 different places using a technique called electroencephalography. This enabled the researchers to build up maps of brain activity. The patterns of brain activity after five sessions varied considerably between the two groups. For example the 'map' group activated the motor area for the hand when they were listening to music, whereas the 'no-map' group did not. The researchers also identified another area of the brain, in the right anterior

region, which was more active in the 'map' group than the 'non-map' group. This area could be where the note to piano key 'map' is established. Previous research has suggested that this area is involved in the perception of melodic and harmonic pitch sequences. Bangert says, "Interestingly, the respective area in the left hemisphere is where you would find Broca's area, where much of our speech processing happens."