Virtual reality and music therapy as distraction interventions to alleviate anxiety and improve mood states in breast cancer patients during chemotherapy

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Psychological distress is a common consequence of breast cancer diagnosis and treatment and could further exacerbate therapy side effects. Interventions increasing treatment tolerance are crucial to improve both patients’ quality of life and adherence to therapies. Virtual reality (VR) has emerged as an effective distraction tool for different medical procedures. Here, we assessed the efficacy of immersive and interactive VR in alleviating chemotherapy-related psychological distress in a cohort of Italian breast cancer patients, also comparing its effects with those of music therapy (MT). Thirty patients were included in the VR group, 30 in the MT group, and 34 in the control group, consisting of patients receiving standard care during chemotherapy. Our data suggest that both VR and MT are useful interventions for alleviating anxiety and for improving mood states in breast cancer patients during chemotherapy. Moreover, VR seems more effective than MT in relieving anxiety, depression, and fatigue.
Many scholars consider preferences for consonance, as defined by Western music theorists, to be based primarily on biological factors, while others emphasize experiential factors, notably the nature of musical exposure. Cross-cultural experiments suggest that consonance preferences are shaped by musical experience, implying that preferences should emerge or become stronger over development for individuals in Western cultures. However, little is known about this developmental trajectory. We measured preferences for the consonance of simultaneous sounds and related acoustic properties in children and adults to characterize their developmental course and dependence on musical experience. In Study 1, adults and children 6 to 10 years of age rated their liking of simultaneous tone combinations (dyads) and affective vocalizations. Preferences for consonance increased with age and were predicted by changing preferences for harmonicity—the degree to which a sound’s frequencies are multiples of a common fundamental frequency—but not by evaluations of beating-fluctuations in amplitude that occur when frequencies are close but not identical, producing the sensation of acoustic roughness. In Study 2, musically trained adults and 10-year-old children also rated the same stimuli. Age and musical training were associated with enhanced preference for consonance. Both measures of experience were associated with an enhanced preference for harmonicity, but were unrelated to evaluations of beating stimuli. The findings are consistent with cross-cultural evidence and the effects of musicianship in Western adults in linking Western musical experience to preferences for consonance and harmonicity.

Molti studiosi ritengono che la preferenza per gli accordi consonanti, così come definiti dai teorici della musica occidentale, sia basata su fattori biologici, mentre altri ritengono che questa preferenza sia condizionata dall’esperienza, ovvero dal tipo di musica a cui si è stati esposti. Esperimenti cross culturali suggeriscono che le preferenze per la consonanza vengano determinate dall’esperienza musicale, implicando con questo che le preferenze dovrebbero emergere o rafforzarsi durante lo sviluppo negli individui che appartengono alla cultura musicale occidentale. Tuttavia, si conosce ben poco di questa traiettoria evolutiva. Gli Autori hanno misurato la preferenza per la consonanza di suoni simultanei e delle relative proprietà acustiche nei bambini e negli adulti per caratterizzare il loro corso di sviluppo e la dipendenza dall’esperienza musicale. Nello Studio 1, gli adulti e i bambini da 6 a 10 anni dovevano giudicare il loro apprezzamento di combinazioni di coppie di toni (diadi) e vocalizzazioni affettive. Le preferenze per la consonanza aumentavano con l’aumentare dell’età e potevano essere predette dal cambiamento delle preferenze verso l’armonicità (il grado al quale le frequenze sono multiple di una frequenza fondamentale comune), ma non dalla valutazione dei battitumini (fluttuazioni nell’ampiezza che avvengono quando le frequenze sono vicine ma non identiche, producendo una sensazione di durezza del suono). Nello studio 2, un gruppo di adulti con istruzione musicale e di bambini di 10 anni dovevano valutare lo stesso tipo di stimoli. L’età e il training musicale erano associati con un aumento della preferenza per la consonanza. Entrambi le misure di esperienza erano associate con un’aumentata preferenza per l’armonicità, ma non erano correlate con la valutazione dei battitumini. Questi risultati sono coerenti con l’evidenza cross culturale e l’effetto dell’esperienza musicale negli adulti di cultura occidentale nel legare l’esperienza musicale alla preferenza per la consonanza e l’armonicità.
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A stimulus-brain coupling analysis of regular and irregular rhythms in adults with dyslexia and controls

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When listening to temporally regular rhythms, most people are able to extract the beat. Evidence suggests that the neural mechanism underlying this ability is the phase alignment of endogenous oscillations to the external stimulus, allowing for the prediction of upcoming events (i.e., dynamic attending). Relatedly, individuals with dyslexia may have deficits in the entrainment of neural oscillations to external stimuli, especially at low frequencies. The current experiment investigated rhythmic processing in adults with dyslexia and matched controls. Regular and irregular rhythms were presented to participants while electroencephalography was recorded. Regular rhythms contained the beat at 2 Hz; while acoustic energy was maximal at 4 Hz and 8 Hz. These stimuli allowed us to investigate whether the brain responds non-linearly to the beat-level of a rhythmic stimulus, and whether beat-based processing differs between dyslexic and control participants. Both groups showed enhanced stimulus-brain coherence for regular compared to irregular rhythms at the frequencies of interest, with an overrepresentation of the beat-level in the brain compared to the acoustic signal. In addition, we found evidence that controls extracted subtle temporal regularities from irregular stimuli, whereas dyslexics did not. Findings are discussed in relation to dynamic attending theory and rhythmic processing deficits in dyslexia.

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Neural multimodal integration underlying synchronization with a co-performer in music: influences of motor expertise and visual information

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Sensorimotor synchronization is a general skill that musicians have developed to the highest levels of performance, including synchronization in timing and articulation. This study investigated neurocognitive processes that enable such high levels of performance, specifically testing the relevance of 1) motor resonance and sharing high levels of motor expertise with the co-performer, and 2) the role of visual information in addition to auditory information. Musicians with varying levels of piano expertise (including non-pianists) performed on a single piano key with their right hand along with recordings of a pianist who performed simple melodies with the left hand, synchronizing timing and articulation. The prerecorded performances were presented as audio-only, audio-video, or audio-animation stimuli. Double pulse Transcranial Magnetic Stimulation (dTMS) was applied to test the contribution of the right dorsal premotor cortex (dPMC), an area implicated in motor resonance with observed (left-hand) actions, and the contribution of the right intraparietal sulcus (IPS), an area known for multisensory binding. Results showed effects of dTMS in the conditions that included visual information. IPS stimulation improved synchronization, although this effect was found to reverse in the video condition with higher levels of piano expertise. dPMC stimulation improved or worsened synchronization ability. Level of piano expertise was found to influence this direction in the video condition. These results indicate that high levels of relevant motor expertise are required to beneficially employ visual and motor information of a co-performer for sensorimotor synchronization, which may qualify the effects of dPMC and IPS involvement.

La sincronizzazione sensomotoria è un'abilità generale che i musicisti hanno sviluppato ai massimi livelli di performance, e include la sincronizzazione del tempo e dell'articolazione. Questo studio ha indagato i processi neurocognitivi che consentono livelli così elevati di prestazione, testando in particolare la rilevanza di: 1) risonanza motoria e condivisione di alti livelli di competenza motoria con il co-esecutore; 2) il ruolo delle informazioni visive oltre alle informazioni uditive. Musicisti con diversi livelli di competenza pianistica (compresi i non pianisti) suonavano su un singolo tasto del pianoforte con la mano destra seguendo le registrazioni di un pianista che eseguiva semplici melodie con la mano sinistra, sincronizzando il tempo e l'articolazione. Le esibizioni preregistrate sono state presentate come stimoli solo audio, audio-video o audio-anime. È stata applicata la stimolazione magnetica transcranica a doppio impulso (dTMS) per testare il contributo della cortecchia premotoria dorsale destra (dPMC), un'area implicata nella risonanza motoria con azioni osservate (mano sinistra) e il contributo del solco intraparietale destro (IPS), un'area nota per il binding multisensoriale. I risultati hanno mostrato gli effetti della dTMS nelle condizioni che includevano informazioni visive. La stimolazione del IPS migliorava la sincronizzazione, sebbene sia stato riscontrato che questo effetto si inverte nelle condizioni video con livelli più elevati di competenza pianistica. La stimolazione della dPMC migliora o peggiora la capacità di sincronizzazione. È stato poi riscontrato che il livello di competenza pianistica influenza questa direzione nelle condizioni video. Tali risultati indicano che sono richiesti alti livelli di competenza motoria pertinente per impiegare in modo vantaggioso le informazioni visive e motorie di un co-esecutore per la sincronizzazione sensomotoria, e questo può spiegare gli effetti del coinvolgimento della dPMC e del IPS.

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In the year 2000, the Mariani Foundation has added a new and important dimension to its activities: fostering the study of the multiple links between the neurosciences and music, including music education and early intervention. This significant commitment has inspired the series of “Neurosciences and Music” conferences, held in Venice (2002), Leipzig (2005), Montreal (2008), Edinburgh (2011), Dijon (2014) and Boston (2017). The next congress is planned for 2020 in Aarhus, Denmark, in collaboration with the Center for Music in the Brain. All these meetings have led to the publication of major volumes in the Annals of the New York Academy of Sciences.
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