Music and dementia: individual differences in response to personalized playlists

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Personalized music playlists are increasingly being used in health-care contexts to address the psychological and behavioral symptoms in people with dementia. However, there is little understanding of how people with different mental health histories and symptoms respond differently to music. A factorial experiment was conducted to investigate the influence of depression, anxiety, apathy, and cognitive decline on affective response to music. Ninety-nine people with dementia listened to three music playlists based on personal preferences. Activation of facial action units and behavioral observation were measured continuously. Results demonstrated that people with high levels of depression and with symptoms of Alzheimer's type dementia demonstrated increased levels of sadness when listening to music. People with low depression but high levels of apathy demonstrated the highest behavioral evidence of pleasure during music listening, although behavioral evidence declined with severity of cognitive decline. It is concluded that as well as accounting for personal preferences, music interventions for people with dementia need to take mental health history and symptoms into account.

Una playlist di musica personalizzata è un metodo sempre più utilizzato nei contesti di cura per risolvere problemi di natura psicologica o comportamentale in persone con demenza. Tuttavia, non è chiaro come persone con differenti storie di malattia mentale rispondano in modo diverso alla musica. È stato condotto un esperimento fattoriale per investigare il ruolo della depressione, dell’ansia, dell’apatia e del declino cognitivo nella risposta emotiva alla musica. 99 soggetti affetti da demenza sono stati esposti all’ascolto di tre diverse playlist musicali basate sulle preferenze personali. L’attivazione di unità di azione facciale e l’osservazione comportamentale sono state misurate di continuo. I risultati evidenziano che le persone con alti livelli di depressione e con segni tipici della demenza di Alzheimer mostravano un incremento dei segni di tristezza quando ascoltavano la musica. Le persone con basso punteggio di depressione, ma con alto livello di apatia mostravano la più significativa evidenza di piacere durante l’ascolto della musica, sebbene gli indici comportamentali
The severe hearing loss problems that some people suffer can be treated by providing them with a surgically implanted electrical device called cochlear implant (CI). CI users struggle to perceive complex audio signals such as music; however, previous studies show that CI recipients find music more enjoyable when the vocals are enhanced with respect to the background music. In this manuscript source separation (SS) algorithms are used to remix pop songs by applying gain to the lead singing voice. This work uses deep convolutional auto-encoders, a deep recurrent neural network, a multilayer perceptron (MLP), and non-negative matrix factorization to be evaluated objectively and subjectively through two different perceptual experiments which involve normal hearing subjects and CI recipients. The evaluation assesses the relevance of the artifacts introduced by the SS algorithms considering their computation time, as this study aims at proposing one of the algorithms for real-time implementation. Results show that the MLP performs in a robust way throughout the tested data while providing levels of distortions and artifacts which are not perceived by CI users. Thus, an MLP is proposed to be implemented for real-time monaural audio SS to remix music for CI users.

Perdite di udito severe possono essere talora trattate fornendo a queste persone un impianto cocleare (CI). Coloro che sono impiantati però hanno difficoltà a percepire segnali audio complessi come la musica. Tuttavia, precedenti studi hanno dimostrato che i portatori di CI trovano la musica più godibile quando le voci vengono esaltate rispetto alla musica di background. In questo studio sono stati utilizzati algoritmi di separazione di sorgente (SS) per remixare canzoni, amplificando la voce cantata principale. Tale lavoro utilizza algoritmi di codificazione "deep learning" convoluzionali, un percorptron multistrato (MLP) e una matrice di fattorizzazione non negativo che viene valutata oggettivamente e soggettivamente attraverso differenti esperimenti percettivi che coinvolgono soggetti con udito normale e con impianto cocleare. Questa valutazione indaga la rilevanza degli artefatti introdotti dalla modifica con algoritmi SS considerando il tempo di computazione, dal momento che questo studio propone uno degli algoritmi per un’implementazione in tempo reale. I risultati mostrano che MLP funziona molto bene per tutti i dati sottoposti a test, mentre fornisce livelli di distorsione e artefatti che non vengono percepiti dai portatori di CI. Quindi, gli Autori concludono che MLP possa convenientemente essere implementato per la SS audio monoaurale in tempo reale per il remix della musica nei portatori di CI.
Individuals with autism spectrum disorders (ASDs) often present atypical auditory perception. Previous work has reported both enhanced low-level pitch discrimination and superior abilities to detect local pitch structure on higher-level melodic tasks in ASD. However, it is unclear how low and high levels of auditory perception are related in ASD or typical development (TD), or how this relationship might change across development and stimulus presentation rates. To these aims, in the present study, children with ASD and TD were tested on a low-level pitch direction discrimination task and a high-level melodic global-local task. Groups performed similarly on both of these auditory tasks. Moreover, individual differences in low-level pitch direction ability predicted performance on the higher-level global-local task, with a stronger relationship in ASD. Age did not affect the relationship between low-level and high-level pitch performance in either ASD or TD. However, there was a more positive effect of age on the high-level global-local task performance in TD than ASD. Finally, there was no effect of stimulus rate on the relationship between low-level and high-level pitch performance in either group. These findings provide a better understanding of how perception is associated across levels of processing in ASD versus TD. This work helps to better understand individual differences in auditory perception and to refine ASD phenotypes.

Individui con disordini dello spettro dell'autismo (ASD) spesso presentano una percezione uditiva atipica. Studi precedenti hanno riportato sia un'aumentata discriminazione a basso livello delle altezze, sia abilità superiori nel distinguere la struttura locale delle altezze negli esercizi di riconoscimento melodico ad alto livello. Tuttavia, rimane poco chiaro quanto livelli di percezione bassi o alti siano legati allo sviluppo di ASD o allo sviluppo tipico (TD), o in che modo questa relazione possa cambiare nel corso dello sviluppo e della velocità di presentazione degli stimoli. A questo scopo, bambini con ASD e TD sono stati testati con un test di discriminazione di basso livello della direzione dell'altezza e con un test melodico globale-locale di alto livello. I due gruppi hanno mostrato la stessa performance in entrambi i test uditivi. Inoltre, le differenze individuali nella capacità di discriminazione di direzione delle altezze di basso livello erano predittive della performance nel test globale-locale di livello più alto, con una correlazione più forte negli ASD. L'età non influenzava i risultati in entrambi i gruppi, anche se si rilevava un effetto più positivo dell'età nella performance relativa al test globale-locale nei bambini con sviluppo tipico rispetto a quelli con ASD. Infine, non si riscontrava nessun effetto della velocità dello stimolo sulla relazione tra la performance di basso o alto livello in entrambi i gruppi. Questi studi consentono di approfondire il livello di elaborazione e di percezione nei bambini ASD rispetto ai TD e aiutano a comprendere meglio le differenze individuali e a definire il fenotipo ASD.

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Piano training enhances the neural processing of pitch and improves speech perception in Mandarin-speaking children

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Musical training confers advantages in speech-sound processing, which could play an important role in early childhood education. To understand the mechanisms of this effect, we used event-related potential and behavioral measures in a longitudinal design. Seventy-four Mandarin-speaking children aged 4-5 y old were pseudorandomly assigned to piano training, reading training, or a no-contact control group. Six months of piano training improved behavioral auditory word discrimination in general as well as word discrimination based on vowels compared with the controls. The reading
group yielded similar trends. However, the piano group demonstrated unique advantages over the reading and control groups in consonant-based word discrimination and in enhanced positive mismatch responses (pMMRs) to lexical tone and musical pitch changes. The improved word discrimination based on consonants correlated with the enhancements in musical pitch pMMRs among the children in the piano group. In contrast, all three groups improved equally on general cognitive measures, including tests of IQ, working memory, and attention. The results suggest strengthened common sound processing across domains as an important mechanism underlying the benefits of musical training on language processing. In addition, although we failed to find far-transfer effects of musical training to general cognition, the near-transfer effects to speech perception establish the potential for musical training to help children improve their language skills. Piano training was not inferior to reading training on direct tests of language function, and it even seemed superior to reading training in enhancing consonant discrimination.

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