Mini Review

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AI assisted multimedia learning protocols: the cases of special education for the impaired in hearing and music learning for chanting

Introduction

A tremendous breakthrough in the therapeutic approach for patients suffering from severe to profound sensorineural hearing loss has emerged with cochlear implantation. Cochlear implants are expensive, miniature scale electronic devices that work as an artificial ear, surpassing damaged or ill-functioning parts of the hearing organ and stimulating directly the acoustic nerve. Therefore, hearing "acoustic" waves is transformed to bionic sensing, using an analysis - reconstruction mechanism. Input is coded and parameterized. Then, a suitable representation of sound is transferred to the patient's cochlea.[1] The whole process of medical rehabilitation usually takes quite a while, commencing from the difficulties of early and in-time diagnosis, especially when very young patients are involved, ongoing afterwards to waiting lists, when the surgical resolution depends solely on public health funding resources, and concluding with the lengthy rehabilitation process, which usually takes place in special schooling habitats.[2] The impact of the progression towards this direction is tremendous for the Quality of Life indices.[3] Predominantly, impaired in hearing patients have obvious problems with their phonological processing. Readers of this research should be familiar with the image of newscasters for the deaf, appearing in a small «window» of the TV screen during major broadcast events, using gestures for conveying speech communication information into the sign-language for the deaf. This treatment may be eradicated entirely soon, since bionic hearing prosthetics of any kind promise massive delivery of sonic sensing to the community of some hundreds of millions impaired in hearing worldwide.[4] However, especially for young patients, the whole process of recovery disrupts the sequential constructivistic block chain of institutionalized education for pre-schooling or elementary school children. As a result, patients receiving normal schooling are unable to timely process written words or properly develop oral communication skills. Based on practice rather than theory, it is recorded that a multitude of neurophysiological disorders usually accumulates, causing impaired schoolers to develop difficulties in learning to read or in properly interpreting coherent letters.[5] Furthermore, if emotional and cognitive deficiencies are not early diagnosed and cured, psychological implications evolve,[6] and linguistic rehabilitation becomes a long-term priority serviced in special education departments. In this case, the return to normal schooling becomes dystopian; in persistent deficiencies after elementary schooling, assistive activities have to be provided to secondary school patients having the form of extra school classes, in situ or on-line.

The Cochlear Implantation Unit of the AHEPA University Hospital in Thessaloniki coordinates medical processes with educational treatments, for patients statistically ranging from 6 to 82 years of age (http://www.ahepaci.gr). Younger subjects are treated with home schooling oriented therapeutic processes. Pure tone audiometry scores, speech recognition scores and acoustic performance scores of children and adults for a period of at least 2 years are combined with ear training applications and diagnoses, like Average Electrode Voltages (AEV), Electrically Elicited Stapedious Reflexes (ESR),

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Electrical Auditory Brainstem Responses (EABR), Electrically Evoked Compound Action Potentials (ECAP), Neural Response Telemetry (NRT) and rehabilitation is partly committed with computer aided multimedia learning, either off line, with standalone tools, or guided with utilities and protocols delivered by a therapists over the Internet.[4] The committed research does not aim to diagnose dysmusia or musical dyslexia.[7] However, subjects are asked to sing tunes; by assessing melodic, rhythmic and dynamic recitals, phonological and morphological biases of neurological processes are revealed. For instance, the accuracy of loudness in a singing voice, which relies on the control over subglottic pressures, or the ability to manage the laryngeal muscles that determine the phonation frequency,[8] lead the factor analysis research on Brain-Computer Interface (BCI) models.[9] Overall, by arduous medical, phonological, musicological and pedagogical "stress tests" researchers may extrapolate their findings for critical aspects of human communication as far as its accomplishments through speech and hearing are concerned. The conceptual structures of these scientific procedures are transferred to the field of characteristic musicological training, in the field of chanting and choral recitation.[10] Interactive multimedia processes are developed, aiming to advance adequate skills through practice and instruction to learners, making them capable of recognizing by hearing notes, tones, pitches, intervals, melodies, chords, rhythms, tempo, and other musical features of Byzantine Music cantillation (http://byzmusiconline.ddns.net). As ear training combines elements of music theory (scales, notes, chords) with an adequate understanding of vocal music techniques, it provides the context for evaluating fundamental neuromusicological factors involved in strenuous neurobiological efforts for accurate, in tune chanting.[8] Even further, on-going research explores the perception of color, sound and motion and the correlation by the combination of the above in the senses and perceptions of the individual. Music kinetic research is providing feedback to areas such as medicine, psychology, art, and science in general, by analyzing the phenomena of kinesthesia and synesthesia, as perceptions of space and multisensory anticipation of movement differentiate from person to person or culture to culture.

To provide online instruction over the globe at master class levels, an integrated multimedia learning portal has been promoted with scientific information, learning objects (LOs) and videos about Byzantine Music as its main subject. It aims at developing users' skills and abilities, improving their musical performance, and assessing the cognitive level of users after the completion of the prerequisite courses. The portal provides important tools for interaction, synchronous communication and collaborative learning with easy access and use. Emphasis is given on the versatility and ease of learning offered to the user by any device, at the place of his choice, at any time and in diverse groups of people. These conjugate learning centers, the Cochlear Implantation Unit and the Byzantine Music Online Learning initiative, aim to transfuse the best practices, the best training methods to learners that otherwise would be deprived of the instruction of experts in the field. For both situations, as one moves from big learning centers, like the country capital or a region's major cities, the pedagogical potential decreases steeply and training is in most cases unreliable or misleading. These initiatives aim to provide master-class level instruction and tutoring for fields that will be of invigorating quality for many people: as cochlear implants get cheaper and cheaper millions of people will seek to take advantage of them, but the skilled personnel for the medical treatment or the rehabilitation process will not be readily available everywhere; within the same notion, learning properly to chant Byzantine Music, in scientific terms, is restricted to inclusive points of metropolitan areas. Both conjugate activities are overburdened with emotional and cognitive impediments that hinder stable performance: it is difficult to the same degree for an impaired subject to return successfully to normal schooling after cochlear implantation as it is for an average student to excel in singing classes. The fail ratio in both cases is indicative of the striving psychokinetic and intellectual efforts needed for accomplishment.

Artificial Intelligence enters the field by offering automated "machine" learning support. As learners are expected to make many mistakes, on-line tools and interactive apps provide largely automatic operations that support distinct functions of phonatory performance.[8] As for example a word processor provides grammatical and syntactical support, by correcting or suggesting better morphosyntactic formations, these multimedia tools reinforce ameliorated performance schemes for the speaking and singing voice. Readers are suggested to visit the documentation centers, i.e. the portals of these initiatives. Vast scientific evidence has been methodologically collected, classified and assessed, inviting the scientific community to a journey in extreme auditory transformations.

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Conflict of interest

The author declares there is no conflict of interest.

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