Features of "feedback" of subjective sensations of the auditory system and music therapy "Musical-energy key"

A.B. Kirilyuk
(Moscow, Russia)

When talking about the perception of sound, distinguish between its physical and psychological characteristics. One can know the frequency of the sound presented to the subject, but not know what pitch he actually hears. Subjective sensations (SB) of different heights and timbre can be very different from how an ordinary person perceives them and, for example, an opera singer. The same goes for sound intensity [1]. Feature of music therapy (MT) "Musical-energy key" (IEC) is the impact of acoustic signals recorded individually for each listener. Experimental studies of the bioelectric activity of the brain and the meridian system of the body showed the same tendencies in the influence of MT MEK for all subjects,

Since an individual musical fragment (MF) used in MT MEK is not a work of art, the associative and emotional perception of sounds (music) for the formation of an image, which belongs to the field of musical and cognitive psychology, does not matter. The sequence of sounds in the MF ordered in time and space, organized into a melodic and rhythmic structure, has physical parameters and corresponding subjective auditory characteristics that have psychophysical significance. The features of the "feedback" of CO and acoustic signals of the MF are considered from the standpoint of musical psychology (MP) and from the standpoint of psychoacoustics - the science of quantitative dependencies between external stimuli (physical parameters of sound) and sensations (psychological parameters - pitch, volume, timbre),

MT is a process of targeted action with feedback, where the problem of individual selection of acoustic signals (musical pieces) is central to increasing the effectiveness of medical procedures. In MT IEC, a synergistic approach is used to manage unstable, self-developing, complexly organized systems. The essence principles of a synergistic approach to good governance lies inorientation towards internal, immanent qualities inherent in the system itself, in this case - the human body and its SS. In this case, the main thing is “not the magnitude of the control action, but its consistency with the own tendencies of structuring the nonlinear environment, i.e. correct topology (spatial and temporal symmetry) of this impact ”. The principles of effective management, from the point of view of synergetics, the definition of the structure characteristic of each non-linear system (NS), capable of self-organization; following the natural tendencies of self-development of this structure; selection of the best optimal system development option; correct initiation of the desired direction.

The synergistic approach makes it possible to resonantly excite the correct structures in a nonlinear medium, takes into account the properties of the NN and the possible harm caused to a complex system if the impact contradicts its own tendencies of self-development [6]. To discuss the topic, the main features of nonlinear processes in the SS are considered.

Non-linear properties of the auditory system

A system is called nonlinear if the input signal differs from the output signal by the presence of additional spectral components. The reason for the nonlinearity of the SS lies in the mechanism of the inner ear (cochlea) and in the process of electrical signal conversion in hair cells [4, 7].

The nonlinearity of the SS manifests itself in the appearance of additional "phantom" tones: "subjective" or "auditory" harmonics appear when the intensity level (dB) of the primary tone increases, and the value of subjective harmonics increases sharply; “Combination subjective tones” occur when several signals with different frequencies (Hz) are exposed. Nonlinearity is an adaptation property, and the appearance of "phantom" tones is a sign of normal operation of the hearing aid, which produces nonlinear transformation of the input sound signal only in a certain range: at a very high level or at a very small one. At medium levels of frequency and intensity, the process of sound conversion in the SS occurs in a linear manner [4, 5, 7, 8].

Features of Pitch Sensing

Psychoacoustics defines pitch as "an attribute of auditory sensation, in terms of which sounds can be scaled from low to high." The dependences of pitch on frequency are called psychophysical scales. The hearing aid perceives sounds in a wide frequency range from 20 to 20,000 Hz. In music, sounds are used in the frequency domain from 40 to 5000 Hz [4] For MT IEC tasks, sounds are used in the range from 240.00–260.00 Hz to 1100.00–1300.00 Hz: for a melody - from 240.00 to 660 Hz; for harmonic accompaniment - sounds of the entire specified range. At present, a hypothesis of pitch perception is accepted, “according to which the central processor, having received information from the peripheral auditory system about the presence of components with multiple periods in the musical sound, groups them and compares them with some harmonic pattern stored in memory, in which all successive harmonics are present. For each input signal, a template is selected that suits it best ”[4]. The use of medium frequencies in MT IEC is not accidental, since the relationship between frequency and the feeling of pitch is a non-linear process and is especially pronounced at low and high frequencies.

The regularity of the SB SS to perceive the pitch movement in the process of listening to music is used in MT MEK as the main factor in individual therapy. From the point of view of the MP, the sensation of height is the sensation of "the height of sounds that form some musical movement, facing each other in one or another height ratio", while the absolute height of the sounds presented to the music listener does not matter. “The sounds themselves are not

have no individuality inherent only in the relationship between sounds, i.e. intervals ". This understanding of height is called "musical height" and is considered in the MP as an intellectual and aesthetic process of a psychoenergetic nature [9]. In the process of listening to MF, the subjective pitch of an individual sound is determined by its ratio to the pitch of the adjacent sound in the sequence of intervals (consonances and dissonances). Acoustically, the interval between sounds corresponds to the numerical relationship between the vibration frequency of the upper and lower tones [10, 14].

The concept of MT IEC is based on biorhythms of birth, therefore the sequence of intervals in the MF is individual for each listener. The peculiarity of the process of translating biorhythms into the language of music according to the principle of analogies and correspondences used in scientific research reveals connections with the mechanism of unconscious response to acoustic signals, which confirms the theory of music psychologist E. Kurt, according to which the beginning of acoustic and physiological processes of music perception is in the sphere of the unconscious , where the primary psychological excitement arises, given in the sensation of movement [11, 12]. The FR of the pitch of MF sounds in accordance with the logical scheme of the sequence of intervals is an energetic, psychological process corresponding to a harmonious reaction of the body to external and internal stimuli.

Timbre Feeling Features

Psychoacoustics defines timbre as "an attribute of auditory perception that allows the listener to determine that two sounds of the same pitch and loudness are different from each other." Timbre information is stored in memory and used in the SS for comparison with the incoming signal. The timbre depends on the volume, pitch and spectrum of the sound signal, which has individual features characteristic of each musical instrument [4]. From the point of view of the MP, timbre and dynamics (loudness) are something that can be changed during performance, in contrast to the pitch of sounds, the sequence of which remains predetermined, i.e. constant. Since in MT MEK the sense of height has a priority over the sense of timbre, it is important to answer the question under what conditions of changing the timbre the sense of height does not change.

Non-linear effects of timbre perception begin to appear when the volume is changed. This leads to changes in the sensitivity of the CC to the perception of low and high frequencies. When the volume is increased (up to 90–92 dB), the timbre becomes fuller and richer than with quiet sounds; with a further increase in volume, the timbre is distorted in the CC and in the sound source. At high frequencies, the hearing thresholds rise, and the high-frequency overtones of the sound become inaudible. In low-register sounds, overtones are amplified due to the sensitivity of hearing to mid-range, therefore low-register sounds sound fuller (for example, an organ) than middle-register sounds [4, 5]. At mid frequencies, changing the timbre does not affect the CO of the pitch. This pattern is used in MT IEC for listening to MF with different timbres. In this case, the CO of the timbre corresponds to the characteristic of the timbre of the selected musical instrument and does not change during listening. WITH

position of the MP, a sense of timbre is created when perceiving "periodic changes in pitch and intensity that are not analyzed by the ear" and is evaluated by a descriptive emotional-expressive characteristic of a particular timbre, borrowed from the field of other sensations used to characterize timbres, for example: timbre light, dark, dry, empty, full etc. [nine]. The MT IEC uses a variety of timbres. The choice of a musical instrument is carried out individually at will or is selected empirically.

Features of the sound volume feeling

Loudness is called CO, which allows the SS to place sounds on a certain scale - from sounds of low intensity ("quiet") to sounds of high intensity ("loud") [4]. Changes in the physical parameters of sound (intensity, frequency, duration) under certain conditions affect the psychological parameters that they cause. Let us consider at what dynamic changes in the acoustic signals of the CO, the pitch and timbre does not change.

The sensation of loudness in a non-linear way depends on the intensity of the influencing signal, its frequency and duration: a shorter signal is perceived as less loud, with an increase in duration, the sensation of loudness increases; as the sound intensity increases, loud low sounds seem even lower, loud high sounds seem even higher. The perceived loudness of a complex sound depends not only on its intensity, but also on the spectral composition. For example, an instrument can be made louder while maintaining the same pressure level by changing its spectrum (timbre). Exposure to prolonged loud sounds and short loud pulses is hazardous to the auditory system. With prolonged exposure to loud sounds, the sensation of loudness gradually decreases. The acoustic adaptation process starts to work for sounds with a level of 90 dB and above 20 ms after the start of the sound. Hearing is less sensitive to low and high frequencies, they need to create higher sound pressure levels. At low sound pressure levels, the estimated loudness level is frequency dependent. For medium frequencies, the dependence of the volume level on the sound intensity is hardly noticeable. The impact of sounds at medium frequencies at low sound pressure levels manifests itself linearly and does not cause changes in the perception of pitch and timbre [4, 5]. For medium frequencies, the dependence of the volume level on the sound intensity is hardly noticeable. The impact of sounds at medium frequencies at low sound pressure levels manifests itself linearly and does not cause changes in the perception of pitch and timbre [4, 5]. For medium frequencies, the dependence of the volume level on the sound intensity is hardly noticeable. The impact of sounds at medium frequencies at low sound pressure levels manifests itself linearly and does not cause changes in the perception of pitch and timbre [4, 5].

Since the sounds of an individual MF are located at medium frequencies, for MT IEC, a loudness with an intensity of 40 to 50 dB is used, which corresponds to the loudness level in a radio studio when performing solo. This loudness in musical practice is designated, respectively, as pianissimo - very quiet and piano - quiet.

The duration of the sound signal in MT MEK is related to the tempo, which is determined individually, depending on the value of blood pressure (BP) and heart rate (HR). Slow pace, within 50-60 on the metronome scale - with increased blood pressure and heart rate, moderately slow pace, from 60 to 68 - with normal and low blood pressure and heart rate [2, 11].

The perception of loudness and timbre of one signal in the presence of another can change due to the effect of auditory masking. The amount of masking decreases as the difference between the frequencies of the applied signal increases. At low frequencies - up to about 500 Hz - the degree of masking depends not on the signal frequency, but on its intensity [4, 5]. In the case of using different versions of MT MEK (melody accompanied by harmony and melody accompanied by harmony and sounds of nature), the volume ratio between the incoming acoustic signals is adjusted, giving preference to the sounds of the melody.

conclusions

In MT IEC, as in the process of targeted action with feedback, the problem of individual selection of acoustic signals is solved. From the point of view of synergetic principles, the conditions for effective management of a complexly organized NN have been fulfilled: an individual structure of influence is organized in the form of an MF, corresponding to the natural tendencies of self-development inherent in the system itself (biorhythms of birth have been translated into the language of music). The optimal variant of the system development has been chosen: the logical scheme of the sequence of intervals in the MF (according to the translation of biorhythms into the language of music) corresponds to a harmonious variant of the state of the system (organism); there is a synergistic principle of the desired effect - acoustic signals (frequency range and intensity level) are consistent with the nonlinear features of the SS. Resonant excitement arising in this case, corresponds to the parameters of the external influence of its own (internal) structure of natural harmonious functioning, laid down at the moment of birth [6]. Resonant excitation results in strong responses [13].

From the point of view of the MP, the "feedback" of the CO SS and acoustic signals of the MT IEC does not depend on the musical preferences and musical education of the listener. In the process of listening, CRMs of perception of musical MF unconsciously reflect energy and psychological processes, which leads, according to purposefully organized acoustic signals, to their harmonization. The possibilities of the method of individual MT MEK allow you to include an emotional component: to use, at the request of the listener, various rhythms and timbres, harmonic accompaniment and sounds of nature. From the standpoint of psychoacoustics, in the perception of acoustic signals of the MF, linear processes in the SS are involved, in which the predictable consequence of the applied efforts (physical parameters of sound) corresponds to the scheme: control action is the desired result.

Literature

1. Baars B., Gage N. Brain, cognition, mind. An introduction to cognitive sciences.

Vol. 1. - M .: Binom. Knowledge Laboratory, 2014 .-- 544 p.

2. Kirilyuk A.B., Makashova R.F., Maksimova R.F. Influence of individual music therapy MEK on the functional state of patients with chronic viral hepatitis // Abstracts and reports. XX International Conference "Theoretical and Clinical Aspects of the Application of Bioresonance and Multiresonance Therapy". Part I. - M .: IMEDIS, 2014 - pp. 286–163.

3. Kirilyuk A.B. The influence of music therapy “Musical-energetic key "on the bioelectric activity of the brain and the meridional system of the human body // Abstracts and reports. XXI International Conference "Theoretical and Clinical Aspects of the Application of Bioresonance and Multiresonance Therapy". - M .: IMEDIS, 2015 - pp. 383–387.

4. Aldoshina I., Pritz R. Musical acoustics. Textbook. - SPb .: Composer, 2006 .-- 720 p.

5. Vartanyan I.A. Sound-hearing-brain. - L .: Nauka, 1981 .-- 176 p.

6. Knyazeva E.N., Kurdyumov S.P. Foundations of synergetics. Synergistic worldview. - M .: Kom Kniga, 2005 .-- 240 p.

7. Gelfand S.A. Hearing: an introduction to the psychological and physiological acoustics / Per. from English - M .: Medicine, 1984 .-- 352 p.

8. Helmholtz G. The doctrine of auditory sensations as a physiological basis for music theory / Per. with him. Ed. 2nd. - M .: Book House "Librokom", 2011. - 592 p.

9. Teplov B.M. Psychology of musical ability. Psychology of music and musical abilities Reader. - M .: AST, 2005 - pp. 16–349.

10. Orlov G. Music tree. - SPb .: Composer, 2005 .-- 440 p.

11. Kirilyuk A.B. Innovative technologies and personalized music "Musical-energetic key" // Abstracts and reports. 22nd International Conference "Theoretical and Clinical Aspects of the Application of Bioresonance and Multiresonance Therapy". - M .: IMEDIS, 2016. - P.370–375.

12. Galkin O. Introduction to musical psychology. Psychology of music and musical ability. Reader. - M .: AST, 2005. - P.362–376.

13. Gall L. Bioenergetics - the magic of life. - M .: ed. AST; SPb .: Astrel - SPb, 2010 .-- 349 p.

14. Vakhromeev V.A. Elementary theory of music. - M .: Muzyka, 2006 .-- 254 p.

Kirilyuk, A.B. Features of "feedback" of subjective sensations of the auditory system and musical therapy "Musical-energy key" / A.B. Kirilyuk // XXIII International Conference "Theoretical and Clinical Aspects of the Application of Bioresonance and Multiresonance Therapy". - M .: IMEDIS, 2017 .-- S.261-267.

To favorites