

**SYNESTHESIA AND MUSICAL SPACE:
ON YAVORSKY'S FORGOTTEN HYPOTHESIS AND A PROPOSAL FOR AN EXPERIMENT IN ZERO
GRAVITY**

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The concept of synesthesia, as a psycho-physical phenomenon, can be characterized briefly as intersensory, intersensual association. As I have pointed out before, synesthesia is an essential sign of artistic thinking (for all kinds of art, including music) [1].

It should be particularly emphasized here that not only may exteroceptive sensations (externally stimulated sensations such as hearing, sight, etc.) act as components of synesthetic interrelationships (Fig.1), but interoceptive and proprioceptive (internally generated) sensations may also contribute. In Fig.2, points O_1 , and O_2 represent interoceptive and proprioceptive sensations, respectively.

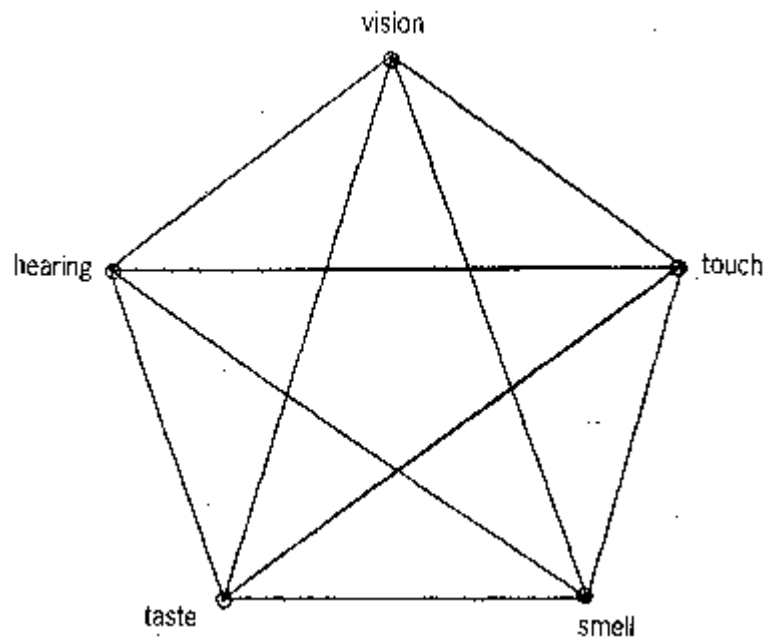


Fig.1. Rough diagram of direct synesthetic ties between external sensations.

The interoceptive receptors register the state of internal organs - well-being, for instance - and proprioceptive sensations yield such information as the position of the body in space (including muscular and weight sensations). Interoceptive sensations act on the unconscious, and they are tied to our most basic emotions. These sensations are ancient and are part of the psychologies of all people-that is why interoception-based synesthetic phenomena are the most powerful of all emotional components. This is reflected in the broad usage of such synesthetic terms as "bright" and "dark," in reference to sounds, and "warm" and "cool," in reference to colors [2].

In the past, investigators did not pay particular attention to the importance of internal sensations in the original theories of synesthesia; they generally limited themselves to studying more exotic exteroceptive intersensory relationships (such as "color hearing" in music). However, the presence of less noticeable, "dim" sensations (to use I.Sechenov's term) determines more widespread intersensual relationships. When we discuss audio synesthesias, such synesthesias are relationships between "hearing" and proprioceptive sensations (point O_2 in Fig.2).

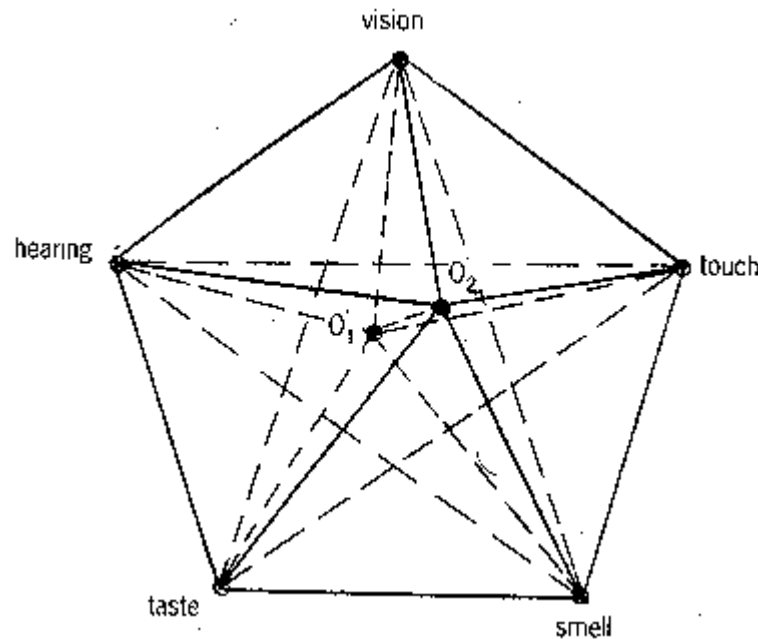


Fig.2. Detailed diagram of probable synesthetic ties between external and internal sensations. Point O_1 designates interoceptive sensations, and point O_2 designates proprioceptive sensations. Here it can be seen that, in addition to the direct routes shown in Fig. 1, external sensations can be reached through internal ones.

Analogies between melody and mechanical motion are tied to the above-mentioned audio-proprioceptive synesthesias. These analogies may be quite interesting - for instance, theories on the "kinetic energy" of sound, by E.Kurt [3]; on "sound body" and "sounding matter," by B.Asafiev [4]; and, especially, on "audio space," by G.Revesh, A.Weliek and E.Nazaikinsky [5]. Audio space may even have its own coordinates: depth (texture), vertical (melodies), horizontal (architectonics of music pieces as a whole).

In my opinion, the study of another, still hypothetical synesthetic analogy-between perception of terrestrial gravity) and modal gravity in music (suggested as far back as the 1920s by B.L. Yavorsky) [6] can help to deepen comprehension of the nature of the audio space in which the sound body moves. The analogy has remained a hypothesis until now because its proof has been impossible for traditional musicologists and psycho-physiologists, who have separately tried to determine its validity. It can be recalled that modal organization is the most specific characteristic of music, sharply distinguishing it from the other arts. Modal organization in music, along with humans' psychological ability to react to sound independently, is responsible for the phenomenon of melody - combining sequences of single sounds into integral sound configurations, which act in the perceived audio space. Let us compare such peculiarities of hearing with human vestibular apparatus functions that give information about a person's position and motion in space in response to Earth's gravitational field and acceleration.

Yavorsky believes that regular shifting between various forms of balance (stability) and imbalance (instability) in music is the key to understanding the psychophysiological bases of different constructions in art. It is well known that gravity shows its worth in all kinds of art - in painting and in architecture (compositional balance), in choreography (with its art-linguistic structures built by a continual fight against gravity in general).

In music, analogously, the propensity of imbalance to resolve into balance has basic significance in musical dynamics, namely for "mode building," where modes are thought by Yavorsky to be a sum total of gravitational pulls on the unbalanced sounds, resolving them into balanced ones [7].

Yavorsky uses the concept of audiogravity to explain other musical characteristics as well. He defines the sense of rhythm as the ability to orient oneself in time and within the earth's gravitational force. He writes:

"Breaking down the sense of gravity is a matter of being aware of its presence and mastering it as a force of nature. The process of breaking down and detecting gravity results in rhythm. . . This rhythmic process of conquering the sensation of gravity, which was revealed with sound and perceived through sound, is the genuine birth of music. . . . The process of realizing gravity, mastering it as an organizing power, is rhythm, which gives shape to the sensation of gravity and its mode; together they form "modal rhythm," which is the essence of musical language" [8].

Modal rhythm characterizes the process of modal development unfolding in time. Timbre and dynamics emphasize and accentuate the bounds of gravity, and tempo emphasizes the rate of change of these bounds, according to Yavorsky.

Yavorsky's gravitational analogies, as they relate to separate modes, are of particular interest here. He compares the aspiration of "being in a natural major" with the human propensity to stand upright, but, based on the fact that humans can function when they are in other positions, Yavorsky supports the active development of new musical methods as well.

Yavorsky compares "twice-modes" (his term), which occur when imbalance has a double resolution, both inward and outward, as in the easy soaring of an airplane when the opposite forces acting upon it are equalized [9].

Based upon all these analogies, Yavorsky's hypothesis can be supplemented. The evolution of music has involved, to a certain extent, the apparent slackening of mode-functional relationships, which, within limits, has resulted in atonality, involving the aspiration of all the tones for complete equality of their rights, and liquidation of whatever tonal center and gravitational pulls exist among them. Is it possible that this evolution of mode in music is a peculiar audio model? Or is it a subconscious and synchronous synesthetic reflection of the natural evolution of ideas relating to the possibility of overcoming Earth's gravitational forces?

This supposition and the initial hypothesis by Yavorsky can be examined with a very simple experiment. It is known that during space flight one's vestibular apparatus stops feeling the influence of gravitational forces. If, under terrestrial conditions and against a background of powerful gravitational force, the uncomfortable influence of unbalanced sound relationships (dissonant chords or intervals) displays itself to people with keen hearing, it is quite possible that the influence of music would, in the state of zero gravity, provoke noticeably negative emotions.

Astronauts on board spaceships should be given appropriate musical programs to listen to, and objective parameters characterizing the state of their vestibular systems should be measured while they are listening. If differences were detected in the "gravitative-compensative" effect in the perception of, for instance, Bach's tonal music and Schoenberg's atonal music, it could serve as an indirect corroboration of Yavorsky's analogy: "terrestrial, Earth gravity = audio, modal gravity in music."

I propose an experiment in which NASA pilots would take two audiotapes on the next Space Shuttle flight. Tonal music would be on the first tape, and atonal music would be on the second tape - the effects of these recordings on the psyches of the pilots would be investigated. I predict that tonal music will provide compensation for negative effects caused by the transition to a zero-gravity state. I also predict that listening to the atonal music will deepen these negative effects.

If these theories of synesthetically mediated reception of gravity in music turn out to be true, it will

affect our understanding of the nature of music. In addition, the results would be useful for quite utilitarian ends - for the creation of special compensative-musical programs to aid in the adaptation to the state of weightlessness.

References and Notes:

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2. *Galeyev* [1] pp. 101-103. This monograph contains references to works written by psychologists, such as A.R. Luria, B.M.Velichkovsky and V.S. Raitses, who investigated interoceptive sensations and their interrelations.
3. *E.Kurt*, Romantische Harmonik und ihre in Wagner's Tristan (in Russian) (Berlin: 1923); *E.Kurt*, Grundlagen des linearen Kontrapunkts. Bach mehrstimmiger Polyphonie (Bern: 1917).
4. *Glebov* (B.Asasfiev's pseudonym), "The Process of Shaping of Sound Materials," in *De Musica*, compiled works (in Russian) (St. Petersburg: 1923) pp. 144-164.
5. *E.O.Nazaikinsky*, On Music Perception Psychology (in Russian) (Moscow: Muzyka Publishers, 1972) pp. 86-185.
6. *B.L.Yavorsky*, "Basic Elements of Music," (in Russian) *Iskusstvo* 1 (1923) pp. 185-194.
7. *V.A.Tsukkerman*, "Mode Rhythm," *Music Encyclopedia* Vol. 3 (in Russian) (Moscow: 1976) pp. 143-145.
8. See Yavorsky [6].
9. *B.L.Yavorsky*, Articles, Memoires, Correspondence, Vol. 1 (in Russian) (Moscow: Sovjetsky Kompozitor Publishers, 1972) p. 711.

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