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ABSTRACTS

The Abstracts section of Leonardo is intended to be a rapid publication forum. Texts can be up to 750 words in length with no illustrations, or up to 500 words in length with one black-and-white illustration. Abstracts are accepted for publication upon the recommendation of any one member of the Leonardo Editorial Board, who will then forward it to the Main Editorial Office with his or her endorsement.

EXPERIMENTING WITH COMPUTER GRAPHICS: IN SEARCH OF AESTHETIC OBJECTIVITY

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I was given an exciting proposal by Sonal and Abhay, the organizers of the State of the Art exhibition held in Bombay in January 1991, to experiment with new images on an Apple Macintosh personal computer. It was exciting

because it provided an opportunity for me to enter into a new area of visual experience. With the computer, it is possible to combine scientific precision with aesthetic approximation in creating art. Although I knew nothing about computers, I was curious so I accepted the proposal. There was a certain fear in my mind of losing creative freedom in this completely mechanical process. On the other hand, the computer offered countless possibilities in colours, textures and multiple variations of form, which was encouraging. However, super-glow colours and weird perspectives do not interest me, so I decided to limit myself to two-dimensional graphic possibilities.

With Sonal and Abhay's help, I began experimenting with different juxtapositions of the visual material of my choice, such as a leaf, a safety pin and a clock hand. Once the image was finalised on the computer, it was then enlarged with a laser printer and I transferred it to the canvas manually. After this, I had freedom to paint with my usual enamel paints. I preferred this process because the body of color that is

apparent with enamel paints, I noticed, was missing in the computer print—it resembled a glossy magazine print, without the dignity of oil colour.

In *Eighty-Five Safety Pins* (Fig. 1), formal variations of safety pin size and the interrelationships of pin groups were based on chance assembly, similar to a random falling together of the pins. The curves of the safety pin, achieved through short, straight lines, created a different visual reality, akin to the visual character of a typewritten word in relation to handwriting. I feel that a commonplace object like the safety pin becomes aesthetically meaningful when we look at it objectively. In a way, this is how the computer sees it—objectively, without indulging in any emotional bias.

COMPUTER USERS' REPORT: ART IS STILL ART

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Received 21 December 1990. Accepted for publication by Roger F. Malina.

We believe that the only possible way that computer graphics can be used within a fine-art context is for artists to utilize them within their existing practices. The artist visualizes the primary concept, then sets about making an artifact of this concept. If the artifact is not made tangible, there can be no dialogue with the viewer, as it is more difficult to experience an intangible piece of information than a tangible, accessible artifact. This artifact, then, is not only physically engaging, but has the potential to be placed in the broader spectrum of visual communication and contemporary art practice.

The computer system and related software are the facilitators, not the dominators, of projects. It is here that a parallel and a distinction between artists and mathematicians can be drawn. A mathematician has an equation (concept). It is then processed through a computer, which assists in visualising the concept. With the aid of the computer's graphic

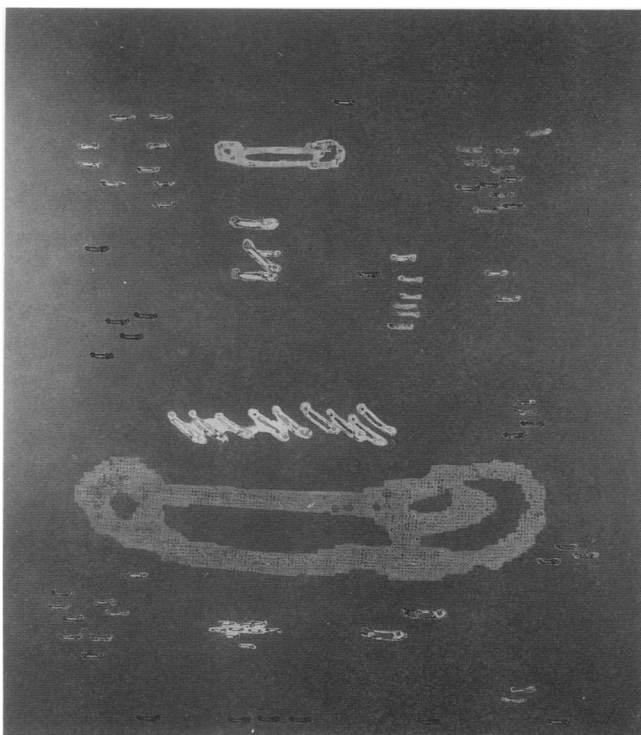


Fig. 1. Prabhakar Barwe, *Eighty-Five Safety Pins*, enamel paint on canvas, 150 × 120 cm, 1990. This work presents a unique formal structure hidden in commonplace objects.

and “number-crunching” abilities, the equation is made into an on-screen image. The mathematician is generally satisfied to leave the visualised equation on the screen, whereas the (traditional) artist generally is not.

The artist’s intention is to produce an image that manifests the artist’s concepts and visual communication style. With this in mind, it is important to us to make use of a computer-graphic system that will yield a high-resolution image. (A high-resolution image is one that will not reveal individual pixels unless the artist chooses to utilize them within the work.) We desire to create both on- and off-screen imagery that is, for all intents and purposes, “seamless”—an image that has no apparent method of construction. These artifacts are not the final product, as they then can be either placed back in the digital environment or incorporated into a large variety of media. The flexible nature of computer-graphic systems makes this possible. The computer image can be incorporated into video, photography and film, lithography and etching, painting and drawing, robotics, installations and other three-dimensional work.

This raises more questions. What is it we are seeing when we look at the image being represented on screen? It can be all of the above and more. It is here that the traditional media boundaries are evaporating.

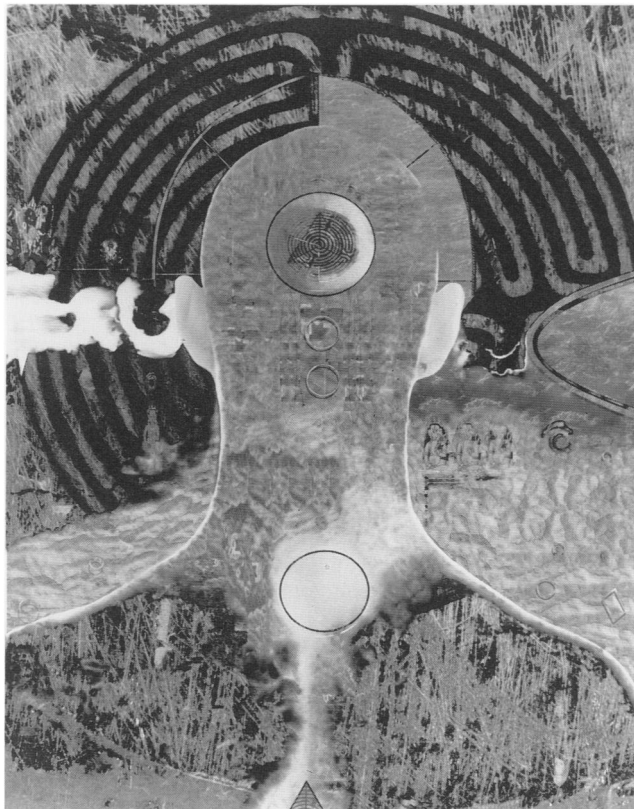
Learn To Walk Backwards

When looking for an appropriate system, we have found that the best practice is to look at the end product first. Being aware of one’s destination or output inevitably sets certain parameters when working within digital space. These parameters need to be established before the first move can be made. The paradox is that one must first explore the system in order to define the parameters.

Iconographic Diary

The suite titled *Headlands—Mnemonic Notations* (Fig. 2 and Color Plate A No. 2), by Phillip George, is a body of images in a state of perpetual change. These images have been developed on a computer-graphic workstation, taking advantage of the ability of the system to file away images and then recall them intact. This retrieval process is similar to using a bookmark. The system provides the artist with a fluid and malleable surface that can retain its surface integrity and can be likened to an ever-present

Fig. 2. Phillip George, *Headlands—Mnemonic Notations*, one in a series of computer-manipulated images realized as a color-laser copy with gouache on canvas, 2.3 × 1.6 m, 1991. In this work, alternative spaces are contemplated. The “man-totem” sits and, from within the sitting, generates/materialises its own environment, migratory thought patterns, both imagined and realised.



canvas, which can be reworked and re-addressed (similar to a wet diary—always there and always ready). The computer memory is not subject to the ravages of the human condition—it has a clear and irrefutable memory function. In part, this body of work uses the aid of the artificial memory of a computer system to deal with human memory.

Past, present and future thoughts, desires, needs and wants jump in and out of conscious speculation, with short periods of grasping an idea, then jumping to another thought, sparked by a smell, a short glimpse of an image—information by installment rather than a continuous flow of ideas and thoughts—this is the way of human consciousness. The use of a computer-graphic system empowers the user with a memory process that is without distraction—a focused and reliable reference point.

The suite of images from *Headlands—Mnemonic Notations* has been developed from one computer file. This file has been continually edited, added to and modified in an intuitive manner, which *itself* replicates/documents a particular mode of thought. When the metamorphosed file has been developed to the desired degree, it is output. Having completed this process, George then re-addresses, re-works and, again, outputs the file existing on the hard-drive (the

master file). The images consist of time denotations, collections of mnemonic icons, organically generated debris—detritus frozen and downloaded for the spectator—made artifact before moving on.

Archaeology of Illusion

Touch the Changing World of Observable Objects (Fig. 3), a series of works by Lynne Roberts-Goodwin, has evolved as a consequence of her interest in the shifting nature of cultural and fictive experience, as well as her interest in the illusory sensation of the appearance of objects. On another level, the images are a consequence of her manipulation of surfaces and textures and the blurring of media and materials she finds appropriate to the work—merging, layering, combining and manipulating, in such processes as photographic collage and painting.

This series of images, created from elemental materials, both synthetic and natural, comprises raw images, or ingredients, that combine to be reconstituted as photographic media, without trace of their mechanised/digitised journey. The imagery, its curious relationship to the “known” and to recognizable forms and objects of our experience, is intended to reveal itself as paradoxical when contemplated over

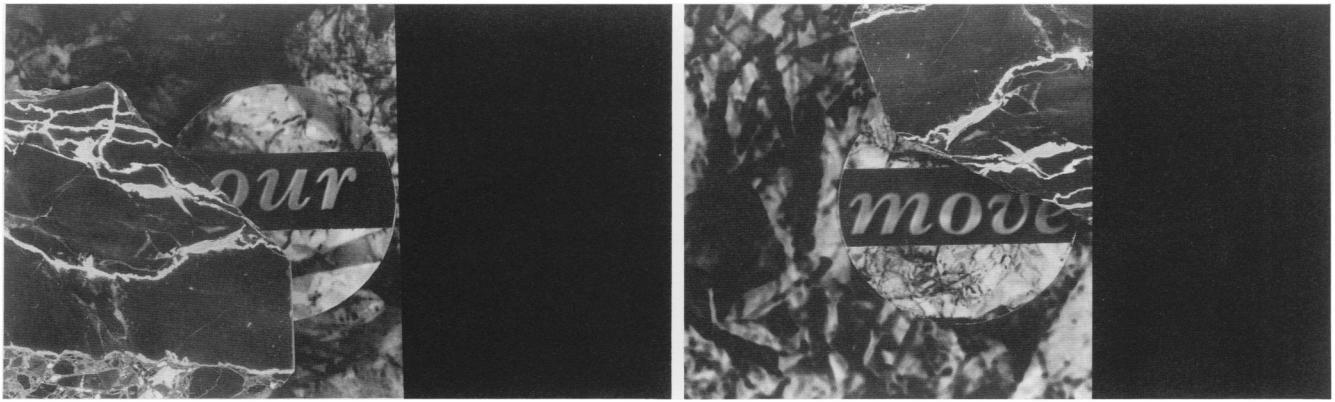


Fig. 3. Lynne Roberts-Goodwin, *SURFACE 1*, from the series *Touch the Changing World of Observable Objects*, computer-manipulated images realised as photographs, 13 × 12 in each, 1991. This series is about the nature and desire to create, mechanically and digitally, an illusory and deceptive surface—a surface that belies its process.

time. The use of high-resolution images overlaid in the digital environment creates the seamlessness of photographic representation.

The work is concerned with the philosophical and cultural positioning of language. Its boundaries, limitations and personal relevance are paramount to the artist, who speaks through the work of the diaristic fictional journey or path that individuals pursue. This path is represented in many of Roberts-Goodwin's works by linear text or a band of space—creating a black void.

This combination of image, object, illusion, text and void creates, within the work, an inscribed surface, which is photographic in material and process yet bears the gestural marks of traditional forms of representation. The nature and desire to create, construct and manipulate photographic imagery, is, *in itself*, a pursuit of illusion and intangibility. The surface belies the process.

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PAINTING WITH DONGBA PICTOGRAPHS

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Received 17 July 1991. Accepted for publication by Roger F. Malina.

Human culture originates in ancient art. Lijiang is the capital of the Naxi Autonomous Prefecture in Northwest Yunnan Province. It is also the center of the Dongba religion, which is ancient and incorporates elements of shamanism. Dongba religious texts are written in ancient pictographic characters. Because these pictographic characters are only

understandable to Dongbas (Naxi ritual practitioners) and only Dongbas are able to write these texts, this form of writing is called Dongba writing. Dongba pictographs are known for their distinctive and expressive style. Dongba literature consists of several beautiful myths and legends. Dongba texts also include information on Naxi philosophy, history, astronomy, geography and medicine, as well as Naxi music, dance, painting and ancient forms of art. Because of the vast scope of knowledge contained in Dongba texts, many contemporary scholars refer to this as "Dongba culture"—considered a unique phenomenon that is ancient, primitive and rich. In recent years Dongba culture has attracted the attention of many scholars from abroad who are interested in conducting research on Naxi culture.

The painting shown in Fig. 4 is a creation inspired by Dongba legends. It incorporates aspects of legend and Dongba pictographic characters. The five pupils of Dingba Shilo, a central fig-

Fig. 4. Xu Zheng Qiang, untitled, oil painting, 80 × 50 cm, 1989.





Fig. 5. Xu Zheng Qiang, pictographic characters: (top row, left to right) a person carrying rice, autumn, light; (second row) a cock crowing, moonlight, stars; (third row) a male and a female, a woman feeding a chicken, a couple chatting at home; (bottom row) a man plowing a field with two bulls, a person harvesting rice.

ure in Dongba culture and an ancestor of the Naxi, are portrayed in this painting. The five pupils hold bamboo brushes sent to them by a golden deer. Inspired by a bluebird, they are facing a rough bark book. The background of the painting consists of Dongba pictographic characters that depict a person carrying rice, autumn, light, a cock crowing, moonlight, stars, a male and a female, a woman feeding a chicken, a couple chatting at home, a man plowing a field with two bulls, and a person harvesting rice (Fig. 5).

I created this painting to illustrate the method used in Dongba paintings—through exaggeration of the Dongba pictographs. In it, I sought to make expressive images come alive without striving at realism—ultimately producing mysterious illusion. Soft shades of grey contrast with darker, deeper colors. Five figures are set in a chaotic composition against a pale yellow background. The most significant image is of a powerful dance. This is a dance of sharp and syncopated movements.

With this painting, I strived to give the viewer a sense of something primitive and ancient yet also of something new. I see the cultures of ethnic minorities and ancient peoples as sources of inspiration as well as important influences on contemporary aesthetics. In this way, through my painting, the golden brush is used to speak the heart's story.

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

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Received 29 May 1991. Accepted for publication by Roger F. Malina.

The concept of synesthesia, as a psychophysical 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. 6), but interoceptive and proprioceptive (internally generated) sensations may also contribute. In Fig. 7, points O_1 and O_2 represent interoceptive and proprioceptive sensations, respectively.

The interoceptive receptors register the state of internal organs—well-being, for instance—and proprioceptive sensations yield such information as the posi-

tion 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. 7).

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. Wellek and E. Nazaikinsky [5]. Audio space may even have its own coordinates: depth (texture), vertical (melodics), 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 psycho-physiological 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 audio-gravity 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 Schönberg's atonal music, it could serve as an indirect corroboration

Fig. 6. Bulat M. Galejev, rough diagram of direct synesthetic ties between external sensations.

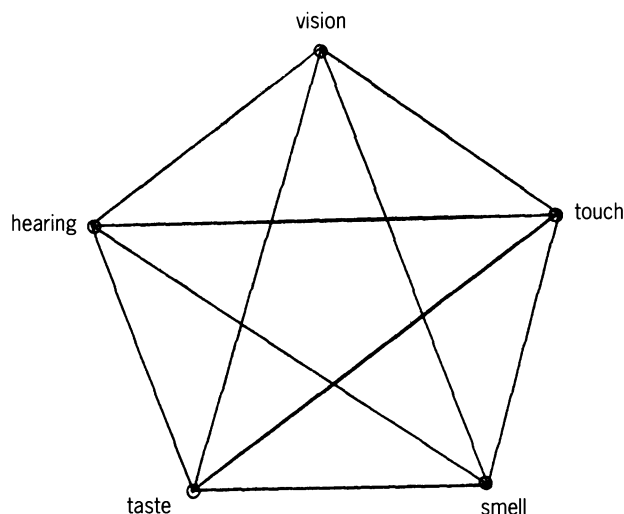
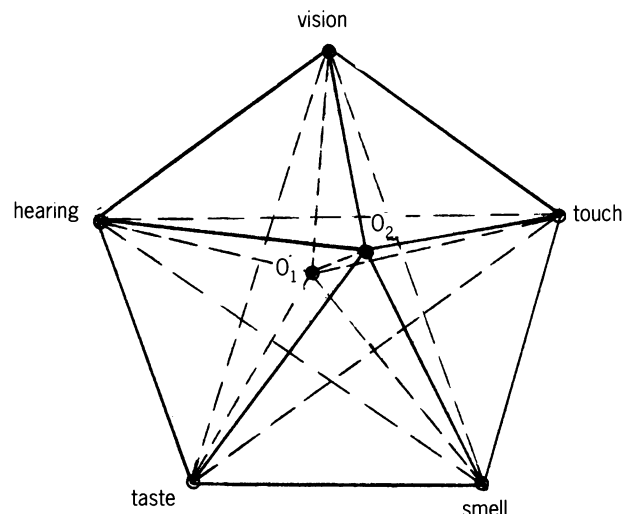


Fig. 7. Bulat M. Galejev, detailed diagram of probable synesthetic ties between external and internal sensations. Point O_1 designates interoceptive sensations, and point O_2 designates proprioceptive sensations. Here it can be seen that, in addition to the direct routes shown in Fig. 6, external sensations can be reached through internal ones.



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.

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8. See Yavorsky [6].

9. B.L. Yavorsky, *Articles, Memoires, Correspondence*, Vol. 1 (in Russian) (Moscow: Sovjetsky Kompozitor Publishers, 1972) p. 711.