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Herausgegeben von

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Wahrnehmungskräfte – Kräfte wahrnehmen

Dynamiken der Sinne in Wissenschaft, Kunst und Literatur

Herausgegeben von
Frank Fehrenbach, Laura Isengard,
Gerd Mathias Micheluzzi und
Cornelia Zumbusch

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Ksenia Fedorova

Aesthetics of the 'Homunculus' of Science

Artistic Approach to Physiological Research in *New Anthropology*

The goal of this article is to offer some reflections on how contemporary technological and hybrid art can become an original lens on the history and nature of (psycho- and neuro-) physiological research. Artistic experimentation with human and other species' sensorium and its technological augmentation has been the focus of numerous exhibitions and academic conferences for a few decades already.[1] Less explored remain artistic research projects that have been inspired by or were done in direct dialogue with certain episodes in the history of science, be it through archival research or reinvention and restaging of the instruments of scientific research. I argue that history of science as an object of artistic endeavor opens a promising direction for aesthetic research. It is not only that the usage of tools constitutes types of experience that is worth analyzing through aesthetic lens but constructing a hypothesis or designing an experiment requires complex thinking where intuitive choices and imagination play as important a role as logical reasoning. Aesthetics is beneficially positioned to discuss the epistemic value of artistic interpretations of scientific work as it offers conceptual apparatus and disposition to investigate the elements of knowledge production that escape the attention of adjacent specialized fields, such as philosophy and anthropology of science, thus becoming complementary to them.

The inspiration for this analysis comes from the *New Anthropology*, a curatorial initiative to catalyze artistic means in order to reflect on the current research and historical heritage of Pavlov Institute of Physiology of the Russian Academy of Science in St. Petersburg.[2] In 2019–2021, a two-part exhibition was created in the former Pavlov' Museum in Koltushi consisting of works by

1 Cf. for instance Madeleine Schwartzman: *See Yourself Sensing. Redefining Human Perception*, London 2011; *Why Sentience? Proceedings of the 26th International Symposium of Electronic Art (ISEA)*, Montreal 2020, https://isea-archives.siggraph.org/wp-content/uploads/2020/10/ISEA2020_Proceedings.pdf, (August 1, 2023).

2 Cf. http://thenewanthropology.tilda.ws/naengl, (March 1, 2023).

contemporary multimedia and technological artists done in close collaboration with scientists (*New Anthropology* proper, the first floor) and site-specific works reflecting on the history of the place and scientific tradition after Pavlov (*Pavlov School,* the second floor). In this paper, I analyze selected works from this curatorial project, paying particular attention to artistic tactics of imagining new means of translation of physiological signals. I contend that it is the artists' special awareness of the constructed nature of the interface that is instrumental in generating new insights about the structures of both physiological processes of sensation, their neurological correlates and, most importantly, scientific models of these processes. Looking for the core of scientific interpretations the artists try to 'reverse-engineer' them. This recognition of the individual components and ability to reassemble them into a new construction sheds light onto the initial scientific presentation of the work of senses as also a creation, a 'homunculus' (to use the metaphor coined by *Where dogs run*, an artistic collective that ran the artist-in-residence program in 2021–2022 at the Institute). Different branches of physiological science construct their versions of how human organism and perceptory apparatus work as a system operated by complex neural networks and electro-chemical communication flows. The models that describe these processes, however accurate and empirically based, remain intrinsically human. Thus, an analogy with the old idea of a homunculus, a speculative artificially created human that can reflect to us our own behavior and allegedly offer additional knowledge, does not seem irrelevant. Scientists project their views of how an organism works onto such hypothetical 'model being', which in case of early Soviet science also had ideological underpinnings of creating a new type of human in a new type of society.

I. Perceiving Forces of Perception

With the proliferation of media experiences and rapidly changing sensibilities it is ever more important to reflect on how the world of senses informs who we are and what we as humans are capable of. Electronic sensors open up opportunities for the plethora of new types of knowledge. This includes both environmental and physiological sensing. Sensors serve as interfaces between environmental conditions, species and the world of knowledge formed by the humans. Animals and plants have their sensory capacities to communicate messages vital for their very survival. For humans, sensing (both natural and technologically mediated) is the way to know the world – to know how to orient in it and to make sense of it. It is thus crucial to realize that perception serves as a key force in the formation of both knowledge and meaning. Widely studied today techno-ecological dimension of sensing is an important impetus to look deeper into perception as an epistemological tool, how it's been historically

shaped to serve as such and where the potential may lay to generate new objects of knowledge.[3]

How to conceive of perception? Do bio-chemical and electro-chemical correlations and principles offer exhaustive answers to its definition? What kind of insights about its powers can a self-reflexive aesthetic focus provide? One of the distinguishing features of perception is that it has been the subject for both physiology and psychophysiology. Percepts, or the facts of perception manifest themselves within the body and the nervous system. Yet, how the facts of perception (or sense acts, how I call them elsewhere[4]) are interpreted *psychologically* is often beyond pure measurement and empirical observation.[5] My claim here is that conscious experimentation with the aesthetic dimensions of the work of perception can help to understand deeper the cultural framings behind knowledge production and offer ways to imagine new directions by asking new questions. Looking at the physiological and neurological substance of perceptory phenomena gives objectively provable material ground for the development of medical and pharmaceutical applications. Yet the physiological conditions are also conditions for certain mental states and reactions charged with an affective attitude, which varies widely from person to person (and thus calls for the more inclusive and multidisciplinary approach).

The key principles of the techno-scientific and media paradigm of today have been laid in the 19th century. Indexically traced connections, measurability, reproducibility of experimental results still serve as the basis for empirical science. Whereas purely physiological medical research has been long grounded in empirical observation, such a direction for the fields dealing with mental phenomena, for instance psychology, is less obvious. Since the broader aim of this article is to contribute to the more holistic take on the relations between body and mind, physiology and epistemology, and to engage art exactly for the purpose of activating these linkages, it is worth to remember

3 Cf. Chris Salter: *Sensing Machines. How Sensing Shapes our Everyday Life,* Cambridge/MA 2022; Erich Hörl: Introduction to General Ecology. The Ecologization of Thinking, in: id. and James Burton (eds.): *General Ecology. The New Ecological Paradigm*, trans. Nils F. Schott, London 2017, pp. 1–74; Marie-Luise Angerer: *Nichtbewusst. Affektive Kurzschlüsse zwischen Psyche und Maschine*, Vienna et al. 2022; Jennifer Gabrys: *Program Earth. Environmental Sensing Technology and the Making of a Computational Planet,* Minneapolis et al. 2016.

4 Cf. Ksenia Fedorova: Towards Media Ecology of Sense Acts, in: Zoltán Somhegyi and Max Ryynänen (eds.): *Aesthetics in Dialogue. Applying Philosophy of Art in a Global World,* Berlin 2020a, pp. 251–262.

5 See Kurt Danziger: *Constructing the Subject. Historical Origins of Psychological Research,* Cambridge 1990; Mitchell G. Ash: *Gestalt Psychology in German Culture, 1890–1967. Holism and the Quest for Objectivity*, Cambridge 1998; Ruth Benschop and Douwe Draaisma: In Pursuit of Precision. The Calibration of Minds and Machines in Late Nineteenth Century Psychology, in: *Annals of Science* 57 (2000), no. 1, pp. 1–25.

the intertwined histories of physiology and psychology, especially in regard to perceptory phenomena.

Empirical roots of psychology go back to the distinction initially made by Immanuel Kant between the domain of philosophy that studies general principles and conditions of human experience that can be expressed in categories and the domain of psychology as studying mental life as it is given in subjective self-awareness.[6] The evidence of the 'inner sense' would be then comparable to the evidence of external senses used in natural sciences, which goes in support of the centrality of empirical base for psychology. Wilhelm Wundt, one of the founders of psychology as a discipline in a modern sense, approached sensory experience (the ground for psychological objects) in a functional way: researching functional dependence of aspects of sensory experience on conditions of *stimulation*, such as intensity, location, and duration.[7] Physiological and mental actions were looked at in terms of their effects and not as entities. The majority of Wundt's first textbooks on the new experimental psychology was about physiology of the nervous system and research in sensory physiology.[8]

The progressive elimination of the *experience* of subjects from psychology has been studied extensively by the historians and anthropologists of science. Kurt Danziger and Jill Morawsky, among others, described the impoverished image of the experimental subject in psychology back in the 1990s.[9] More recently, Emily Martin has addressed the same issue of the negligence towards the individual experiences in psychological research: subjects would be silenced, since whatever they would say, would be considered "mentalistic and subjective."[10] The performances of the bodies are taken by experimental science in isolation from the personal histories, cultural background and thoughts. For instance, it is hard to overestimate the role of cultural and personal associations in evaluating images or sounds for emotional charge in favor of some objectifying 'common' feature. Lisa Cartwright, in her well-known analysis of chronophotography in the studies of dynamic processes like gait or gestures, observes that cinematic techniques applied to live pro-

6 Cf. Immanuel Kant: *Metaphysische Anfangsgründe der Naturwissenschaft*, Riga 1786. See further analysis in Danziger 1990 (see quot. 5), pp. 18–24.

7 Danziger 1990 (see quot. 5), p. 27.

8 Cf. Wilhelm Wundt: *Lehrbuch der Physiologie des Menschen*, Erlangen 1864; id.: *Grundzüge der physiologischen Psychologie*, Leipzig 1874. See also Robert W. Rieber and David K. Robinson (eds.): *Wilhelm Wundt in History. The Making of a Scientific Psychology*, New York 1980.

9 Cf. Jill. G. Morawski (ed.): *The Rise of Experimentation in American Psychology*, New Haven 1988; id.: *Practicing Feminisms, Reconstructing Psychology. Notes on a Liminal Science*, Ann Arbor 1994.

10 Emily Martin: *Experiments of the Mind. From the Cognitive Psychology Lab to the Worlds of Facebook and Twitter*, Princeton et al. 2021, p. 57.

cesses take away the cultural from the surface of the body and moreover, inscribe regulatory power over that body.[11] Clayed in black suits that cover the whole body, with white markings to indicate limbs and joints, the performing subjects are indeed reduced to silhouettes, visible contours without any gender or class specificity.[12]

Inner senses would then be researched primarily through external observations under controlled conditions. It is the design of these conditions and the principles behind them that interests me here. What exactly counts as 'important' and what does not? Why are certain aspects of perception prioritized and what are the implications of that? Looking at the experiments from an artistic perspective implies bringing back to the picture the value of subjective experience. Artists stage aesthetic experiences for the audience, making people conscious of what and how they are perceiving. The references to science, then, deepen understanding of what happens at the material level and yet most of artistic interpretations tend to aim towards a more holistic and critical perspective, one that embraces both the material and the immaterial, measurable and the immeasurable. Although this article does not engage with psychological experiments per se, it explores the aesthetic dimensions of the studies of perception, highlighting the relevance of subjective experience in knowledge formation.

II. Biostation and the *New Anthropology*

In Russia, the science of physiology was developing in parallel to what was happening in Europe: it was empirical research, aimed at revealing the facts about human nature, particularly about the functions of the body – facts as opposed to metaphysical interpretations. Electrophysiology was introduced by Ivan Sechenov (who worked with Hermann von Helmholtz and Claud Bernard, among others), Vladimir Bechterev contributed to experimental psychology – explaining behavior through observable traits. Then it was Ivan Pavlov whose name became associated with reflexology and the method of behavioral conditioning. Materialist and determinist base of this tradition made it very welcome by the Soviet government.

11 Cf. Lisa Cartwright: "Experiments of Destruction". Cinematic Inscriptions of Physiology, in: *Representations* 40 (1992), pp. 129–152. Cartwright describes the machinic logic of cinematic vision as inscriptive and disciplinary, insofar as it "facilitate[s] the establishment of a productive dynamic economy of the body." Lisa Cartwright: *Screening the Body. Tracing Medicine's Visual Culture*, Minneapolis 1995, p. 37.

12 See further analysis in Ksenia Fedorova: *Tactics of Interfacing. Encoding Affect in Art and Technology*, Cambridge/MA et al. 2020b.

1| Biostation, Ivan Pavlov Institute of Physiology, Koltushi, Russian Academy of Science.

In 1925, the physiological laboratory in St. Petersburg founded already in 1864 was formally named an Institute. Then in 1932–1935 the state supported the creation of an entire science-town in Koltushi, 22 km from St. Petersburg – including the Biostation of the Institute of Experimental Medicine that was initially run by Ivan Pavlov. The key laboratory was devoted to the studies of experimental genetics of the highest nervous activity, the field that was put in danger in the 1940–1950s and yet is foundational for most cutting-edge neurophysiological research these days. Since 1949 the second floor of the building of the renowned laboratory (which today is a UNESCO heritage site) has been a Memorial Museum of Pavlov. It is this building that since 2019 became home to the *New Anthropology* project – an exhibition and art-science collaboration residencies (fig. 1).

The exhibition curated by Irina Aktuganova and co-organized by the Techno-Art Center in St. Petersburg consists of the projects done by technological, media and sound artists in collaborations with the labs and science units of the Pavlov Institute of Physiology. In 2021, the exposition of the old Memorial Museum of Pavlov on the second floor of the building was substantially extended and updated by the same curatorial team, with the invitation of artists, receiving a separate title: *Pavlov School*. The unique feature of the project as a whole is the combination of site-specificity (the building where the infamous experiments on dogs and influential research on other species took place), critical and open-ended reflection on historical heritage, and thought-provoking aesthetic experimentation. Most of the exhibited artworks grew out of active exchange between the museum, current Institute researchers and artists selected through an open call. The opening of the exhibition was

accompanied by an extensive program of public talks and discussions.[13] In 2021–2022 a program of artistic residencies called *Biostation* was established, with the idea to spearhead even more intensive artistic research at the selected Institute's laboratories.[14] At the moment of writing, several residencies, educational and archival initiatives continue to take place.

The title of *New Anthropology* may give an impression of being deliberately (and somewhat idealistically) aspiring and too human-centric. It is also not immediately clear what to expect under this title. As conceived by the project initiator and curator Irina Aktuganova, the concept of 'new anthropology' is deeply rooted in the history of Russian cosmism, particularly in the ideas of Nikolay Fyodorov about evolution of consciousness and inevitable extension and expansion of life (even beyond Earth). At the same time active accentuation of the potential for possible (bio)technological interventions puts it on the posthumanist register and opens up the discussion of the connections between the living/the biological and the technological and automatic. Genetics and physiology help to ground human life and perception in the broader spectrum of biological matter and organizing principles that unite the human with many other species. Nevertheless, the project does not aim to radically shift the existing hierarchies between the human and nonhuman worlds (as has been common in the dominant posthumanist discourse[15]). Rather, it calls to reflect on human responsibility in the evolution of both nature and the human's own social world. Ongoing political and military turmoils only reinforce the urgency for reassessing the role of the human as still the most impactful actor: having created troubles we have the duty and capacity to fix them.

One of the key valuable contributions of this project is in helping to fill the gaps in reflection on the techno-scientific developments from the humanities point of view in the public discourse.[16] Artistic projects "embrace the innate theatricality and deep multiplicity of 'scientific' labour"[17] offering another lens also on the social apparatus behind institutions of knowledge production. As has been increasingly pointed out by the proponents of artistic research, such as Henk Borgdorff, Regula Valérie Burri and others, artistic ways of raising questions, thinking through material means, and creating aesthetic experiences,

13 http://thenewanthropology.tilda.ws/naengl, (March 1, 2023).

14 http://pavlov-koltushi.ru, (March 1, 2023).

15 E. g. Jane Bennett: *Vibrant Matter. A Political Ecology of Things*, Durham/NC 2010.

16 Cf. Robert Zwijnenberg: Art, the Life Sciences, and the Humanities. In Search of a Relationship, in: id. and Ingeborg Reichle (eds.): *Art in the Age of Technoscience. Genetic Engineering, Robotics, and Artificial Life in Contemporary Art*, Wien et al. 2009, pp. xiii–xxix.

17 Irene Brown: The Scientist and the Magician, in: Edward Juler and Alistair Robinson (eds.): *Post-Specimen Encounters Between Art, Science and Curating. Rethinking Art Practice and Objecthood Through Scientific Collections*, Bristol et al. 2020.

2| Lyudmila Belova: Waiting, 2019.

can be an effective means not only for science communication but for public dialogue around techno-science in general.[18]

If we analyze the works from the two exhibitions (*New Anthropology* on the first floor and *Pavlov School*), certain thematic motives can be identified in how the artists deal with the Institute's heritage and current research. One of them is obviously the ethical dimension – stories about the dogs told by their former care-takers that became the basis of the sound installation *Waiting* by Lyudmila Belova in the room where dogs were expected to be prepared for the experiments (fig. 2). These first-person chronicles give a vivid perspective not

18 Cf. Henk Borgdorff, Peter Peters and Trevor Pinch (eds.): *Dialogues between Artistic Research and Science and Technologies Studies*, London et al. 2020; Regula Valérie Burri: Doing Research by Means of Art, in: Hannah Star Rogers et al. (eds.): *Routledge Handbook of Art, Science, and Technology Studies*, London et al. 2021, pp. 183–197.

only on the dog's experiences but also on the human feelings of attachment and inner conflict of the people (mostly women) who were taking care of the dogs. The other dimension is overtly political and can be illustrated by the 'opera-installation' *Pavlovian Session* by Dmitry Shubin and Pavel Ignatiev (part of the *Pavlov School* exhibition on the second floor). Its focus is the infamous persecution of geneticists in late Stalinist period, which culminated in physiological reductionism and led to a significant scientific regression. The libretto of this multi-channel composition consists of the speeches from the 1950 conference that disgracefully denounced academics, such as Leon Orbeli, the head of the Institute of Evolutionary Physiology and Pavlov Institute of Physiology at the time, who were labeled 'anti-Pavlov' and 'anti-materialist' and as a result dismissed from their positions.[19] The visitor gets immersed in the plethora of voices that all muddle up with each other to create an oppressive and disorienting effect – all in the very office room of Orbeli. The acoustic nature of both works is not accidental: the stories told on site of the events unravel in the audience's imagination the powerful effects of presence and being witness to those events. In works by other artists (e. g. Dmitry Morozov aka ::vtol::) listening as a modality of engagement referred to the atmospheric characteristics as the causes of interference effects and noise – problematic factors relevant for most of empirical sciences.

The point of this article is not the exhibition per se but how it gives framing to (and literally makes possible) aesthetic and artistic tackling of particular themes/branches of psychophysiological research. One of such themes is translation of physiological signals.

III. Languages of the Body and (Phenomeno-)Techniques of Translation

Among the core questions in physiology, particularly neurophysiology, is the issue of communication of signals. This includes the research on senses – vision, hearing, olfaction, taste and haptics – as well as purely inner processes like metabolism, the work of individual organs and hormonal regulation. Be it at the level of a molecular membrane, where information between a cell and its environment is being exchanged in the form of protein reaction, or at the level of the organs and sections of nervous system responsible for a specific area, where feedback loops between stimulus and reaction constantly take place. Along with the role and characteristics of the medium of exchange (tissue structure, nerves connections) physiology studies logical organization

19 See also Ethan Pollock: *Stalin and the Soviet Science Wars*, Princeton 2006; Loren Graham: *Science and the Soviet Social Order*, Cambridge/MA 1990; Loren Graham: *Science, Philosophy and Human Behavior in the Soviet Union*, New York 1987.

and statistical patterns in physiological processes, something that can be perhaps called 'languages' of the body. Various scientific methods aim at revealing and registering the signals but with the higher goal to distinguish repeating motives and even laws of bodily behavior.

It has been one of the common places in philosophical studies of science to discuss the role of methods and the relations between the research instruments and research outcomes, the 'how' and 'what'. As Gaston Bachelard wrote, "the instrument is a necessary intermediary in the study of a phenomenon that has been truly instrumented or designated as the object of phenomenotechnique."[20] In *The Formation of the Scientific Mind*, he stressed the role of techniques in the very "realization" of scientific endeavor, namely that without them it would not be possible: "Science realizes its objects without ever just finding them ready-made. Phenomenotechnique extends phenomenology. A concept becomes scientific in so far as it becomes a technique, in so far as it is accompanied by a technique that realizes it."[21]

The 'techniques', or 'instruments' proposed by the artists may be speculative and even intentionally based on false premises and thus misleading. And yet, such radical altering of the very purpose of an instrument as to guide towards true objective knowledge can be still productive. The two projects discussed below offer alternative means of translation of physiological signals. This implies expansion of the modalities of information communication towards the audio-visual, haptic and multisensory.

Para-optic 8 by Anastasia Alyokhina offers a visual experience that literally reproduces the idea of vision through fingers (fig. 3).[22] An attempt to connect the eyes with the fingertips seems to be a natural idea and is based on the observations about the compensation of the sense of vision through touch by the visually impaired. Although there have been many claims of such 'extra-sensory' ability – e. g. by magicians and entertainers who would perform a trick of reading a text while blindfolded, or seeing through a closed box – all of them have been revealed as fraud.[23] Nowadays the term 'dermo-optical perception' is used for the most part in the context of parascience. Yet, there is

20 Gaston Bachelard: *Le rationalisme appliqué* [1949], Paris 1998, pp. 2–3, quoted in Hans-Jörg Rheinberger: *An Epistemology of the Concrete. Twentieth-Century Histories of Life*, Durham et al. 2010, p. 31.

21 Gaston Bachelard: *The Formation of Scientific Mind. A Contribution to a Psychoanalysis of Objective Knowledge* [1938], trans. Mary McAllester Jones, Manchester 1969, p. 70, quoted in Rheinberger 2010 (see quot. 20), p. 31.

22 https://alekhina.cc/en/para-optic-8-en/, (March 1, 2023).

23 Martin Gardner: *Are Universes Thicker Than Blackberries? Discourses on Gödel, Magic Hexagrams, Little Red Riding Hood, and Other Mathematical and Pseudoscientific Topics*, New York 2003, pp. 225–243.

3| Anastasia Alyokhina: Para-optic 8, 2019.

also research showing that with enough training it may be possible to distinguish with closed eyes objects of different colors by holding the hand half an inch over them: slight variation in heat may be sensed since colors have distinct heat-reflecting properties.[24]

With the help of technology, Alyokhina takes the parallel between sight and haptic sense further "to forcefully facilitate a physiological relationship between the retina and fingertips."[25] Based on the individual fingerprinting results a program assigns visual abilities. Putting on a headset and the custom-made wearable sensors-cameras on the tips of the fingers the participant gets the experience of literally seeing through the fingertips. The project serves as an attempt to develop a new apparatus to implement translation

24 Walter Makous: Dermoptical perception, in: *Science* 152 (1966), p. 1109; Peter Brugger and Peter H. Weiss: Dermo-Optical Perception. The Non-Synesthetic "Palpability of Colors." A Comment on Larner (2006), in: *Journal of the history of the neurosciences* 17 (2008), no. 2, pp. 253–255.

25 https://alekhina.cc/en/para-optic-8-en/, (March 1, 2023).

4| Boris Shershenkov (with scientific consultation by Oleg Vetrovoy): Neuroharmonium, 2019.

operations making fiction a reality. By its concept and technical constitution, it falls into the category of augmented vision and wearable technology. This implies a wide range of apparata designed to be worn on the body with the idea of expanding natural perception by digitally processing information received through various cameras or sensors. In 2014–2015, the technology made a big presence in public media due to Google Glass, a commercially available smart device with a head-up display allowing the wearer to continuously supplement the natural visual field with the information available via internet (the project was discontinued due to ethical concern). Less known in public sphere remain the more experimental projects that have been developed by both engineers and artists since the 1980s with the goal of creating unique sensory experiences, e. g. by letting one see via the eyes of another (*EyeTap* by the famous engineer Steve Mann), or see upside-down (*Sehmaschinen* by Alfons Schilling),

5| Boris Shershenkov (with scientific consultation by Oleg Vetrovoy): Neuroharmonium, 2019.

etc.[26] Building on the perennial human desire to cross the limits of the natural sensory abilities *Para-optic 8* by Alyokhina is another version of a networked, cyborgian body. However, in the context of the museum exhibition in the science-town in Koltushi devoted to the study of sensory phenomena, it looks like a cultural provocation: "look, it's possible in the end!"

Whereas *Para-optic 8* purposefully misguides one into the world of speculative fiction, *Neuroharmonium* by Boris Shershenkov (fig. 4, 5) has a potential of a real scientific instrument (however also still only hypothetical). The work

26 Steve Mann and Hal Niedzviecki: *Cyborg. Digital Destiny and Human Possibility in the Age of the Wearable Computer*, Toronto 2001. See more in: Fedorova 2020b (see quot. 12), pp. 219–240; Isabel Pedersen: *Ready to Wear. A Rhetoric of Wearable Computers and Reality-Shifting Media*, Anderson/SC 2013.

is conceived as a mechanism to 'play' in an auditory form the data of the mass distribution of protein in the brain suffering from different types of damage. Proteins do not only constitute molecules as one of the structural elements but also play an important role in the metabolic processes regulating adaptation of the organism to the external conditions. Hence, studying protein structures in the brain gives insight into the molecular mechanisms of brain illnesses with the potential to target specific sections of these chain mechanisms to prevent a pathology. *Neuroharmonium* references one of the methods of protein distribution analysis – electrophoresis, a technique that allows to separate proteins in polyacrylamide gel according to their electrophoretic mobility and molecular mass.[27] The information presents itself in a form of a spectrum. Given the complexity of the information, visual representation gives only partial understanding of all the connections encoded in the spectrum. The proposition behind the *Neuroharmonium* is that a human ear is a natural spectral analyzer. Every point of the image corresponds to the protein group of a certain mass but can also be a sinusoidal signal of a certain frequency. The intensity of the sound would depend on the number of proteins.

In the conversation with the artist and his scientific collaborator Oleg Vetrovoy the curator Irina Aktuganova contextualizes this work in the discourse of language and its evolution.[28] Since the beginning of the avant-garde the attention of both science and culture has shifted from entities (*what* is to be represented) to languages (*how* something can be represented). Non-figurative art, sound effects in poetry, noise in music presented languages themselves as unstable and detached from semantics. By the end of the 20th century language became perceived as a multi-purpose mediation that forms reality through its functions, such as differentiation, definition, connection, etc. She reminds us that languages are also formed within cultures, and that science is a form of culture, alongside with other ways of approaching knowledge and how it can be communicated:

> "We have a paradoxical situation: strict disciplinary language can describe less than interaction of several languages. In the process of translation new objects are formed. It does not necessarily matter what these objects are. What is important is that the objects are formed (at least) in two languages each characterized by enough level of precision and recognizability."[29]

27 This technique is currently named after Swiss biochemist Ulrich K. Laemmli.

28 Cf. http://thenewanthropology.tilda.ws/video, (July 17, 2023).

29 Ibid.

Neuroharmonium makes exactly such a translation – from the visual interpretation of the spectrum of data distribution (the technique known already since Pavlov's times) to the acoustic one, the spectrum remaining the *denotatum* and thus the 'constant'. Both the acoustic and visual languages allow for differentiation of the qualitative dimensions of the initial data. As Vetrovoy, the scientist on the team, confirms, since the visual interpretation prevailed, we simply do not know what kind of insights can be generated by applying the acoustic method. The extent to which acoustic interpretation is (scientifically) informative can be shown only statistically, after a large number of experiments, which in its turn needs time.

Explaining the role of instruments in production of knowledge, philosopher of science Hans-Jörg Rheinberger refers to the relationship of co-dependency and mutual shaping of scientific object and method explored by Bachelard in his epistemology of science:

> "The knowing mind has to externalize itself and become 'instrumental', for it is itself technically mediated, as are all its concepts, the categories of scientific knowledge not excepted. The consequence is that scientific mind and object enter into a relationship of reciprocal externalization and interiorization. [...] On the one hand the instrument embodies an already acquired knowledge; on the other, it helps produce the object as technophenomenon."[30]

By changing the technology artists change the objects of knowledge. In case of *Neuroharmonium* the studied physiological phenomenon remains the same (the spectrum of protein distribution), yet what we can *know* about it may change. The object of knowledge is not necessarily how things are by themselves (it may remain a '*Ding an sich*') but the phenomena under the condition of observation. Hence the factor of the method is so crucial to analyze. The information on the spectrum can be considered as the language of the body to be deciphered, and the new technological apparatus as a medium of translating the signals. Revealing the 'messages', within this logic, would mean their "realization" in Bachelard's sense. Phenomenotechnique presents itself here as (almost) a linguistic machine, a translation mechanism. Yet with the emphasis on perceptory modality of listening, the phenomenological – perceptual – component comes to the foreground. The external information needs to be 'internalized' in the process of listening. The scientist's own perceptory apparatus has to work in tandem with the built machine (as is often the case). Possible problems with the scientific validity of the method by Shershenkov would have to do with the particularly subjective nature of hearing (in com-

30 Rheinberger 2010 (see quot. 20), p. 30.

parison, for instance, with vision). Yet both rely on training, which is especially important in interpretation of scientific data – presented either in numerical, graphic or acoustic ways (e. g. ultrasound, CT scans, etc.).[31]

Despite the precision of the machinic labor in scientific experiments certain choices are still made based on purely *aesthetic* experiences and judgments. They are thus not immune to the modal fluctuations of the individual human sensory system that adds the qualitative and affective dimension to this process bringing it to a different register, or degree, of 'objectivity' (the one that includes both the mechanically and 'humanly' processed knowledge). My point here is not to argue for the usefulness of these instruments for science per se but rather for expanding the arsenal of perceptual tools involved in epistemic processes more generally.

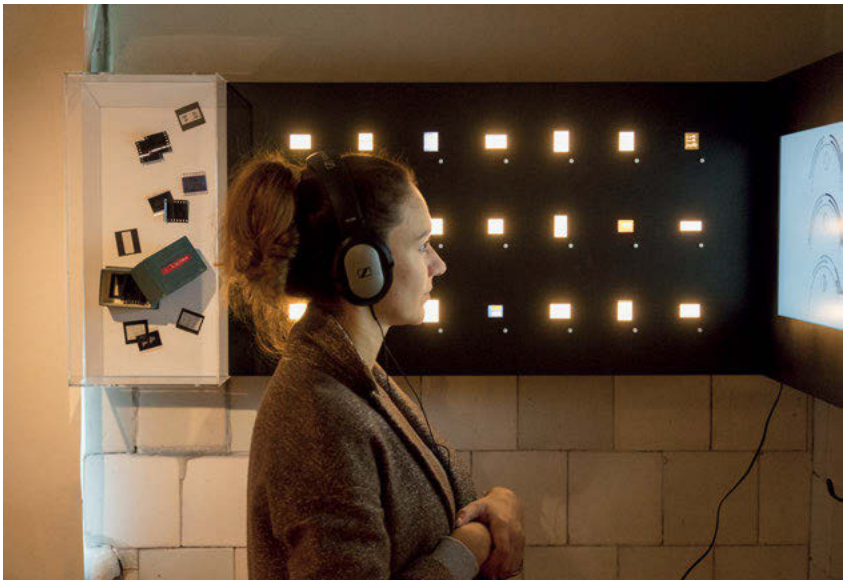
The aesthetic and experiential dimension of scientific research has not been neglected: one can consider, for instance, the work of the anthropologists of science such as Natasha Myers, Joseph Dumit, or Stefan Helmreich.[32] The forms of knowing that rely on the sensorium of the researcher (as much as on the man-made technologies) require their own methods of studying. Among the languages to master not only for the scientists themselves but also for those who reflect on their work alongside the visual and sonic are often the languages of a moving and haptic body. One needs to literally "*move with and be moved by* the energetics, affects, and movements"[33] of objects such as protein molecules, geological structures or submarine soundscapes.[34] Being 'moved by' the objects of research is a suitable example of interiorization that Rheinberger implies in relation to Bachelard's theory.

31 See for instance Catelijne Coopmans et al. (eds.): *Representation in Scientific Practice Revisited*, Cambridge/MA 2014.

32 Cf. Natasha Myers and Joseph Dumit: Haptics. Haptic Creativity and the Mid-Embodiments of Experimental Life, in: Frances Mascia-Lees (ed.): *A Companion to the Anthropology of the Body and Embodiment*, Chichester 2011, pp. 239–261; Stefan Helmreich: An Anthropologist Underwater. Immersive Soundscapes, Submarine Cyborgs, and Transductive Ethnography, in: *American Ethnologist* 344 (2007), no. 4, pp. 621–664.

33 Natasha Myers: Dance Your PhD. Embodied Animations, Body Experiments, and the Affective Entanglements of Life Science Research, in: *Body and Society* 18 (2012), no. 1, pp. 151–189, here p. 178.

34 Cf. id.: *Rendering Life Molecular. Models, Modelers and Excitable Matter*, Durham 2015; Helmreich 2007 (see quot. 32).



6| Anna Martynenko, and Varvara Semenova: We see how you hear, 2020.

IV. Models and Their Physiological and Technological Unconscious

In translating the languages of the body scientists create models. Seen in retrospect, these models may not often make the same sense as initially conceived: either due to the different premises (e. g. proven false in later research) or due to the creative approach behind their generation (decisions about color coding and other representational parameters are performed by people and can depend on subjective taste to a degree). This interstice between representation and the information it is made to connote gives room for a lot of exploration, both critical and aesthetic.

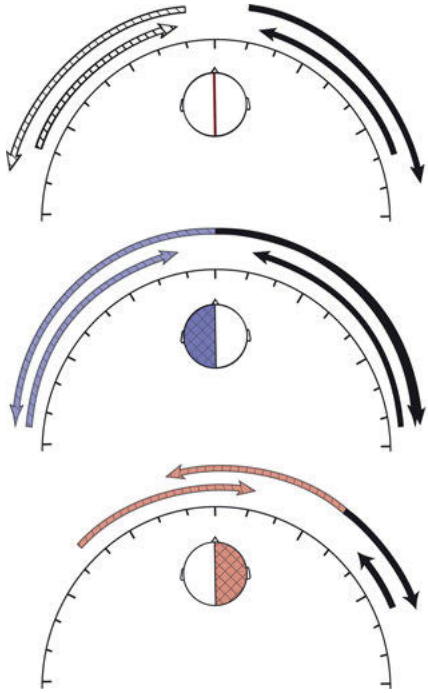
In their work with scientists, artists are keen on the work of interpretation and the forms to organize knowledge about certain phenomena in such a way so that some peculiar intrinsic qualities are kept. Their approach, similar in principle to the one by scientists themselves, can be at once procedural and holistic: the vision, or the concept, needs to be implemented step by step, element by element but all in order to give an accurate and integrative perspective on something. Taken in a different context, these elements may generate new meanings and even present the final goal of research differently.

An example of this can be *We see how you hear* by Varvara Semenova (scientist, designer) and Anna Martynenko (artist, designer) (fig. 6). The project is based on the film slides of the drawings from the 1970–1980s that were found

in the Institute's archives and served as graphical codification of reactions of the brain to acoustic stimulation. The box with the slides was marked by the name of Yakov Altman, the head of the laboratory for the studies of auditory perception and acoustic orientation from the 1970s till 2010s. At this point, it is unknown what precisely the initial sounds were or how exactly they were located. To reconstruct the sound input a double effort was needed: to decipher the meanings of the visual code, and to devise the possibly corresponding sounds. The visitor of the exhibition can then choose a slide out of a selection and play its animated version with the corresponding reconstructed audio, supported by a short scientific description about the meanings of the experiment.

The slides documented a series of experiments that for the most part had to do with the question of how the brain registers the spatial position and direction of sound, as well as identifies one sound in the multitude of others (see fig. 7 for an example[35]). What is studied is both conscious perception and electrical reactions of the brain (via electroencephalography). The visualizations include information such as the level of decibels, i. e. the intensity of the sound, voltage, i. e. electrical signals from different brain areas, as well as time parameters. The experimental subjects could have been asked to locate the sound as it appeared to them mentally on a given curve, a procedure that evinces the highly individual nature of sound perception. Yet, the mental image needs to be correlated with the model curve (a semicircle line indicating space around the head) presented by the scientist. This measuring tool is necessary to bring the diverse acoustic image experiences to the 'common denominator', to make them scientifically valid. One can argue that ability to distinguish a particular sound within the sound field (when an additional layer of 'noise' is added to deliberately 'mask' the main sound signal) is even more dependent on subjective factors, which would include both training but also predisposition for attending to particular types of sounds. As in the case of psychological experiments described by Emily Martin and mentioned above, these experiments also cannot fully account for these possible idiosyncrasies (and reasons behind them) and rather focus on the measured facts, calculating the most accurate average out of the wide spectrum of results.

35 The image illustrates a perceived trajectory of moving sound stimuli after unilateral seizure. The subjects were psychiatric patients who underwent unilateral shock therapy as part of their treatment. During the experiment, they listened (in headphones) to the sound signals moving rightward or leftward from the head midline or towards the center from left and right. Every participant would have a subjective sense of the sound movement. Abrupt shortening of the trajectories of this perceived movement and their leaning to the right was observed in cases of the right-sided seizure, which gave reasons to assume a leading role of the right hemisphere in spatial sound perception.



7| Anna Martynenko, and Varvara Semenova: We see how you hear, 2020, Sample graphic from one of the slides: Trajectory of moving sound stimuli after unilateral seizure. Legend: hatched part of the head – a damage side, arrows – type of sound stimuli and length of trajectory.

Reconstruction of the sounds done by Varvara Semenova (with assistance of her colleagues at the Institute, Dr. Ekaterina Petropavlovskaya and Dr. Lidia Shestopalova) does not explicitly aim to challenge this paradigm. Yet by prioritizing the aesthetic dimension of both the diagrams and their acoustic correlates it confronts the visitor with the very specific question: how do we hear? We are thus invited to pay attention to the nuances of perception that too often go unnoticed as automatic reactions. Taken to the forefront of awareness they then become a source of new impressions and meanings. Electroencephalograms and the graphic notations based on them capture the preconscious reactions, but we are nevertheless welcome to think further about what such acoustic experiences *do* to us. For instance, the images show clearly that the peak component of the sine wave that represents neural activity corresponds to the moment of cognitive registering of the input (i. e. when we realize that we hear something). If 'they' "see *how* you hear" you may as well want to ask yourself *what* you hear and *why*. Reconstructing an experiment in neurophysiology of auditory perception can be considered as an attempt to peak into the unconscious dimensions of sensory experience making them manifest, but in a technologically mediated way.

The question of 'how' and 'what' we hear is tackled in a very different way by another project – *Reflexology of a Russian Poem* (*Reflexologia russkogo stikha*)

by the philologist and poet Pavel Arseniev (part of *Pavlov School* on the second floor). An inquiry into the history of science and the history of avant-garde poetry, it tracks connections between experimental phonetics and sound poetry, exemplified by the futurist movement Zaum'. The project takes the form of a website that presents various chapters about the key figures and historical facts, as well as theoretical observations by Arseniev about the implications of these connections.[36] Touching on the sphere of language, namely more culture specific and not purely physiological, empirical studies of speaking patterns are very different than neurophysiology of perception. Yet, what informed the initial research was exactly the tendency to 'naturalize' culture, to reduce to measurable characteristics something that is inherently linked to social exchange, cultural identity, and self-expression.

Physiological research into phonetics was conducted since the 19th century most famously in France (e. g. the dialects studies by Michel Bréal) and later beyond.[37] In analogy with the other technologies for real-time bio-signal tracking and graphical representation (cardiography and miography of Marey), methods have been developed to record precise data about phonetics. Parameters such as position of the chin, shape of the mouth, etc., have been already studied since the mid-19th century but with the help of the phonograph the very sounds could also be recorded and analyzed. In that endeavor, as Arseniev rightfully suggests, Ferdinand de Saussure's structural linguistics met Thomas Edison's invention: the work of abstract formal qualities of language received its empirical support.

As we know from Friedrich Kittler's analysis, phonograph has a special relation with the Real (at least its physical expression) and thus opens the way to talk about the 'technological unconscious': technology can capture more than human consciousness and sensorium, it can let manifest features of the

36 Cf. Pavel Arseniev: *Reflexology of a Russian Poem*, http://arsenev.trans-lit.info/?p=-1329&lang=ru_RU, (February 10, 2023). The projects builds on more extensive academic research by Arseniev. Cf. Павел Арсеньев: *Литература факта и проект литературного позитивизма в Советском Союзе 1920-х годов*, Москва 2023, pp. 153–167 (Pavel Arseniev: *Literature of Fact or the Project of Literary Positivism in Soviet Union in the 1920s*, Moscow 2023, pp. 153–167); Павел Арсеньев: Постановка индексальности, или Психо-инженеры на театре, в Юлия Лидерман, Валерий Золотухин (ред.): *Theatrum Mundi. Подвижный лексикон*, Москва 2021 (Pavel Arseniev: Staging Indexicality, or Psycho-engineers in Theatre, in Yulia Liderman and Valery Zolotukhin (eds.): *Theatrum Mundi. Movable Lexicon*, Moscow 2021).

37 In the spirit of the time, Bréal proposed to "record facts" instead of "a priori statements". Cf. Michel Bréal: Les Lois phoniques. À propos de la création du laboratoire de phonétique expérimentale au Collège de France, in: *Mémoires de la Société de linguistique de Paris* 10 (1898), pp. 1–11. See also: Barry Heselwood and J. J. Mark: Historical overview of phonetics, in: *The Bloomsbury Companion to Phonetics*, London 2013, pp. 5–20; Philip Lieberman and Sheila E. Blumstein: *Speech Physiology, Speech Perception, and Acoustic Phonetics*, Cambridge 1988.

world that are impossible to reveal and grasp otherwise.[38] Once again, the question of interpretation is the hardest. Machinic sensing (be it kymograph, phonograph, encephalograph, or nanomicroscopy) can be called self-contained in a sense that part of the meaning is brought in along with the medium. For instance, according to John Johnston, machine vision presumes "not only an environment of interacting machines and human-machine systems but a field of decoded perceptions that, whether or not produced by or issuing from these machines, assume their full intelligibility only in relation to them."[39] Even though it stretches the borders of perception, this type of vision is self-referential in that it creates 'maps' that can be comprehended and interpreted only with enough knowledge of the logic of the apparatus, but even then, the 'messages' themselves may remain too obscure.

This problem of interpretation and the value of aesthetic features that are generated by the medium, serving as units of meaning, is at the center of Arseniev's comparative project. He writes: "In contrast to French science about language, Russian futuristic poetry only vaguely guesses its technological unconscious but stubbornly resists losing its ties with the Real."[40] The key figure of the Zaum' movement, Alexey Kruchyonyh, experimented with phonetic effects of words to the extent that some of his poems consisted purely of sounds and not recognizable words.[41] A neologism 'zaum' means 'beyond reason', non-sensical. By focusing only on the auditory characteristics of language (*parole*) Kruchyonyh points towards the hidden messages within this very formal perceptible layer. Not part of the standard semantics and linguistic conventions (syntagms), they are 'beyond semantics' (and yet still represent a certain Real), making unique sense to everyone individually. No one knows for sure what exactly these sounds may mean, hence one can engage only with the *potential* meanings, guessing, imagining them. Moreover, these acoustic components, for Kruchyonyh, at once reflect and condition the psyche. It is this 'conditioning' effect that inspires Arseniev's analogy with physiological reflexes, indicated in the title of his research project. Culture gives us specific behavioral codes to be able to operate in society (language being the major one), but it also leaves enough room for creative interventions into the existing code systems. The poetic take on linguistic conditioning implies breaking the arbitrary adopted reflexes, becoming more conscious of their unconscious automatic

38 Friedrich Kittler: *Grammophon Film Typewriter,* Berlin 1986.

39 John Johnston: Machinic Vision, in: *Critical Inquiry* 26 (1999), no. 1, p. 27.

40 Arseniev: *Reflexology of a Russian Poem* (see quot. 36), ibid.

41 Paraphrasing Boris Pasternak's account on Zaum' Arseniev posits that Kruchyonyh "galvanizes" words, just like a frog was galvanized: words were divided onto phonemes, literally dismembered and "physiologized".

nature by creatively exploring alternative forms of bodily expression and communication.

Another intriguing figure of Arseniev's research, Zaum' poet Alexander Tufanov, went as far as making direct references to Pavlov and Bechterev and even proposing to establish a phonetic laboratory in GINKHUK (State Institute of Artistic Culture ran by Kazimir Malevich, Vladimir Tatlin and Mikhail Matyushin, among others, in 1923–1926 and conceived as the first institution to serve 'scientifically' oriented avant-garde). Just like Matyushin in his artistic research and experimentation with visual perception used Helmholtz' investigations in psychophysiology of vision, Tufanov aimed at employing phonograph to study psychological impacts of phonetic sounds. As Arseniev concludes, "the same laboratory equipment was creating a unified hybrid body, a laboratorial homunculus of sort."[42] We can, then, take this thought one step further by saying that such vision of the human implicated the lens of double perceptory apparatus: the natural human sensorium is augmented by the technological one in order to discover its own potential. In case of physiological experiments, the technological extension and 'homunculization' was literal, while poets like Kruchyonyh and Tufanov pushed the technological analogy (a medium bringing its own 'message') into the world of language.

Both *We see how you hear* and *Reflexology of a Russian Poem*, however different, tackle the problem of the usage of scientific equipment to get closer to the perceptual processes of the body that lay beyond the threshold of consciousness. The former uses creatively designed data visualizations to reconstruct an acoustic image, and the latter reveals the aesthetic dimensions of spoken language caught at the moment of reimagining and re-assembling itself (when no common meaning can be identified behind a series of made-up phonemes). Both projects invite to concentrate on what happens at the interstice of conscious awareness, technological tracking of physiological processes, and imagination. All three components seem to be needed to make sense of the experiences – be they about the act of listening or the act of speaking.

42 Ibid.

V. 'Homunculus' of Science

A mythical humanoid creature, homunculus traditionally metaphorizes human endeavor of creating an artificial being.[43] It has been most famously associated with alchemical accounts of the attempts to produce such a creature and thus dismissed as fantastical and belonging to the sphere of the esoteric, hermetic, and occult. As modern science, to some degree, grew out of alchemical experimentation, the image of homunculus keeps haunting it. Most often today it figures only as a trope of cortical homunculus, a distorted representation of the human body drawn to reflect the relative space that various sensory functions occupy in the brain. Yet, the alchemical origins can yield still rich and inspiring associations.

Homunculus as a conceptual framework on physiological research originally was the idea by the art collective *Where dogs run* who planned to use it as an informal theme of the artist residency program at the Biostation in Koltushi, an innovative initiative that had to be put on pause because of the war in Ukraine.[44] Having studied rigorously the current research directions at the Pavlov Institute and reflecting on potential opportunities for artists, they sensed the presence of the hermetic dimension. "We [humanity at large, and scientific community in particular, K. F.] don't know what to search for but we cannot not do it."[45] In this quest, scientists, according to them, come up with the databases of possible chimera and create models of non-existing, speculative essences. "New forms of life generate new forms of sentience. This includes biotechnological creations, as well as altered states of mind that psychotropic drugs can provoke."[46] The key questions for them were about the ontological and epistemological status of these externalized and abstracted 'forms of life' – knowledge about bodies separated from the bodies themselves.

43 Cf. William Royall Newman: *Promethean Ambitions. Alchemy and the Quest to Perfect Nature*, Chicago 2004; on the history of concepts and ideas of the homunculus, especially since the 18th and 19th centuries, see also Andrea Albrecht and Marcus Willand: Lemma "homunculus", in: Carsten Rohde, Thorsten Valk and Mathias Mayer (eds.): *Faust-Handbuch. Konstellationen – Diskurse – Medien*, Stuttgart 2018, pp. 535–543; for an analysis of the idea of the homunculus in recent neuroscience and neurology see Gurpreet S. Gandhoke et al.: Edwin Boldrey and Wilder Penfield's Homunculus. A Life Given by Mrs. Cantlie (In and Out of Realism), in: *World Neurosurgery* 132 (2019), pp. 377–388; Sabina Hotz Boendermaker: Das „Menschlein" im Laufe der Zeit – Homunkulus, in: *Ergopraxis* 15 (2022), no. 1, pp. 32–37.

44 For an example of the artists' documentation of their visits to various laboratories see: http://pavlov-koltushi.ru/vnd, (July 17, 2023).

45 Interview with the members of the art group Olga Inozemtseva and Natalia Grekhova, June 6, 2022.

46 Ibid.

As powerfully shown by Goethe in *Faust II,* homunculus, among others, stands for the eternally complicated relations between the material and the immaterial, body and spirit. Goethe's Homunculus, a pure spirit, entelechy, an incorporeal life force, epitomizes knowledge and yet is longing for embodiment.[47] The goal of an alchemical aspiration that Goethe alludes to with the story of Homunculus and its tragic but sublime end is not gold or philosophers' stone (in its material sense) but rather the unity of matter and spirit, the striving of the human soul to perfect itself by imagining such forms of being as the character of Homunculus exemplifies.[48]

The idea of homunculus can apply to the context of modern science in several ways. The more generous one would be in line with Goethe's respectful vision: it can be seen as our own 'other', our spiritual and bodily potential that science tries to understand through its simulations, a version of ourselves that we don't fully know yet. Every scientific model about human organism, while based on empirical observations and indexical tracking, is an abstraction, a technological and cognitive 'othering'. It gives a coherent version of how a system works but is not the same ontologically. Discovering something 'real', new facts about human physiology, scientists also unavoidably project their social and cultural positioning and personal predispositions. Hence a homunculus is not one idealized being (as it may seem from *Faust II* and alchemical philosophies) but is multiple. Each subfield creates its own databases and models that pose different questions and may not even directly correspond to each other. (This exactly was the observation of *Where dogs run* when they interviewed the members of various laboratories at Pavlov Institute).

Moreover, today humans learned to create new species using genetic engineering techniques, or technologically augment existing beings (with neuromorphic chips, electronic implants, synthetic tongues, engineered retinas,

47 This interpretation is based on the words of Goethe reported by Riemer and later reproduced in many studies of the tragedy: "In my answer to my question, what Goethe meant to represent in Homunculus, Eckermann said: 'Goethe thereby meant to present the pure Entelechie, an Aristotelian word signifying the actual being of a thing, the Reason, the Spirit as it enters life before experience; for the soul of man is highly endowed on its arrival, and we by no means learn everything, we bring much with us.'" Z. Düntzer: *Goethes Faust*, Leipzig 1857, p. 525; Wilhelm Gottfried Hertz: *Natur und Geist in Goethes Faust*, Frankfurt/M. 1931, pp. 143–144.

48 As Dan Latimer points out, "Insofar though as one can see this self-sacrifice as both a death and a birth, one can see Homunculus as an embodiment, among other things too, of course, of Goethe's doctrine of *Stirb und Werde*: one dies and passes out of one phase of existence into another; in the ideal life, there is constant striving, constant movement. […] Homunculus is a foil to Faust, then, insofar as he reverses Faust's early angelism in his striving for a body, yet at the same time Homunculus is a Faust-like creature, if only through his constant, restless striving." Dan Latimer: Homunculus as Symbol. Semantic and Dramatic Functions of the Figure in Goethe's Faust, in: *MLN* 89 (1974), no. 5, p. 818. See also: Joachim Müller: *Die Figur des Homunculus in Goethes "Faust"*, Berlin 1963.

extended limbs, etc.). These interventions into nature reflect the idea of homunculi creation in a very literal and hence limited ways. Nevertheless, they exemplify a certain perpetual trend: to direct the abstract knowledge in a pragmatic vein with the purpose of altering the naturally given bodies or even creating new ones upon our own design conceptions.

The heritage of Soviet physiology included several episodes of what later proved to be pseudo-scientific theorization that was influenced not even by transhumanist ideals (typical for today's Western tech corporations) but by ideological stands of building a new social order and a new type of human. Most well-known examples of that include Olga Lepeshinskaya's theory of 'live substance' from which new cells emerge (which contradicts the fact that cells multiply via division)[49] and Trofim Lysenko's harsh rejection of Mendelian genetics.[50] These kinds of theories, although not directly about the human, often prioritized human control over natural logic.

Relevant to mention here are also Russian-Soviet physiologists informed by a very different value system and agenda, namely those associated with the Cosmism philosophical tradition, such as Alexander Bogdanov (with his 'techtology' and ideas of rejuvenation via blood transfusion), or Alexander Chizhevsky (famous for his heliobiology). Their contributions, often still contested, are seen mostly positively exactly due to their more holistic approach.[51] Whereas the vision of the 'founding father' of Cosmism, futurologist Nikolay Fyodorov about eventual immortality and resurrection of the dead was quite radical, the system-thinking of Bogdanov, which implied dynamic equilibrium and contradictions as essential factors of any system behavior (social or natural), or Chizhevsky's studies of the impacts of solar energy on organisms help to appreciate the interconnectedness of living and non-living forms of being, matter, energy and the higher organizing principles behind them.[52]

49 Cf. И. В Созинов И. В: К вопросу о формировании лженаучного учения О. Б. Лепешинской. События 1919—1940 гг., in: *Историко-биологические исследования* 15 (2023), no. 1, pp. 101–128 (I. V. Sozinov: To the Question of the Formation of Pseudo-scientific theory of O. B. Lepeshinskaya. Events of 1919–1940, in: *Historical-Biological Investigations* 15 (2023), no. 1, pp. 101–128.

50 See also Loren Graham: *Lysenko's Ghost. Epigenetics and Russia*, Cambridge/MA; *Философские вопросы физиологии высшей нервной деятельности и психологии*, Moscow 1963 (*Philosophical Questions of the Physiology of Higher Nervous Activity and Psychology*, Moscow 1963).

51 Cf. Boris Groys (ed.): *Russian Cosmism*, Cambridge/MA et al. 2018.

52 Cf. George M. Young: *The Russian Cosmists. The Esoteric Futurism of Nikolai Fedorov and His Followers*, New York 2012; Giulia Rispoli: Sharing in Action. The Systemic Concept of the Environment in Aleksandr Bogdanov, in: *Cultural Science Journal* 13 (2021), no. 1, pp. 129–139.

VI. Conclusion

The purpose of bringing in the metaphor of homunculus in the context of this article was to draw a parallel between the work of artists reflecting on the issues of science and scientific practices dealing with perceptive forces (*Wahrnehmungskräfte*). As the projects above demonstrate, the artists operate on the horizon of imagination: imagining new connections between vision and haptics (*Para-optic 8*), proposing alternative aesthetic modalities for interpreting scientific data (*Neuroharmonium, We see how you hear*), expanding the system of language and its phonetic expression (Zaum' poetry). Yet this work is also an analytical one. To come up with their ideas, artists must understand the basic grammar and elements of physiological functions in which they intervene. It is through this deconstructive work that many processes reveal themselves as projections of human conceptions and paradigms. In the end, scientific generalizations of facts are also constructs, having as their basis visualizations and externalized models, but – most importantly for us here – also visions. If homunculus encapsulates the idea of inquiry and human quest for self-improvement, an analogy with scientific models may be not too far-fetched. These models may belong to both applicable biomedical knowledge and the more disputable program of radical modification of nature and transhumanism. Uniting them is an attempt to imagine and to foster alternative scenarios of natural development, while using the knowledge of perceptory apparata – both technological and human.

In this text, I focused only on a few examples, and there is more work that can be done by art to offer ways to challenge scientific imagination with further ideas on the means of data translation and questions to ask, such as: what counts as data and what does not? Artists can be overtly critical of the media of creating and communicating knowledge about the senses, proposing to shift perspective and to explore alternative methods. One of the questions for this brief investigation was the value of experiential and aesthetic layer of scientific work. As any empirical research, studies of perception require their own perceptual methods. If properly integrated into a method, subjective dimension doesn't have to contradict but can enrich the 'neutral' and 'objective' endeavor. There is still a difference between the use of aesthetic means in the *making* of science and in perceiving the *results* of scientific research. Among the works analyzed here, *Neuroharmonium* would correspond to the former, and *We see how you hear* to the latter. Yet, this distinction is not always very strict. For instance, in case of Martynenko's and Semenova's project, whose material was graphic models of acoustic perception, aesthetic choices had to be made both during setting up of the experiments and later – while recreating the sounds for the audience. In this sense, physiological research concerning perception always borders on psychophysiological investigation.

This proves to be even more so when culturally and individually specific forms of physiological expression, such as language or body movement, are concerned. Arseniev's *Reflexology of Russian Poem* sought to expose these connections, also highlighting the relations between techniques of measuring (via phonograph) and natural techniques (such as speech). By his research, he showed how Zaum' poetry forced its readers towards the unconscious behind the speaking apparatus, while phonograph, as in Kittler's famous analysis, would keep us accountable to the very Real. Curiously, one can say that Kruchyonyh, aiming to expand the scopes of language and with that, of what can be expressed, was generating his own 'phenomenotechniques' – facts of meaning emerging via creative reorganization of the apparatus of speech.

Whatever is evoked by these technoutopian scenarios, we cannot go too far from ourselves. Yet, we also cannot help but using technologies to both understand ourselves better and to creatively expand our capacities. The alchemical figure of homunculus bequeaths us with the serious conundrum informed by the perennial dialectics of the material and the immaterial, objective and subjective, measurable and immeasurable, knowable and unknowable. Artistic imagination, in dialogue with science, can help to navigate this existential quest of what we know and don't know about ourselves, how we model our behavior onto a speculative 'data-other' and how we want to envision our destiny.

Bildnachweise

Frank Fehrenbach, Laura Isengard, Gerd Mathias Micheluzzi, Cornelia Zumbusch
Abb. 1: Mit freundlicher Erlaubnis und Bereitstellung der Abbildung durch Heike Müller, © Bibliothek des Christianeums Hamburg.

Robert Jütte
Abb. 1: The Sephardic Journey. 1492–1992, Ausst.-Kat. (Yeshiva University Museum, New York), New York 1992, S. 129, Fig. 84.

K. Lee Chichester
Abb. 1: The Book Guide, 1970, S. 6; University of Edinburgh, Library Special Collections, Conrad H. Waddington Papers, GB 237 Coll-41/2/2/5.
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