

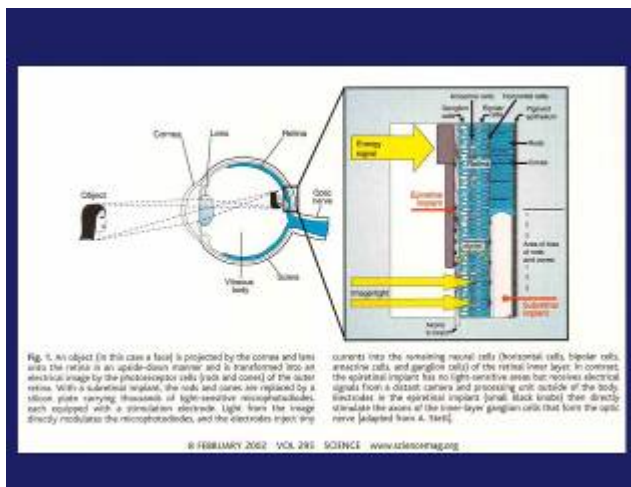
Vision Engineering

Sensory Aids between Artistic Avant-garde and Modern Technoscience

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I want to start with an anecdote, an ethnographic observation, so to speak, from a discussion at a recent conference on the state of affairs regarding visual prostheses. This is currently a field of highly competitive research. The basic concept is to implant a photosensitive microchip into the blinded eye where it is hoped the chip will stimulate the neurons in the retina just as the degenerated sensory cells, the cones and rods, had done so before. I do not want to go into too many details here, suffice to say, there exist mainly two different strategies for achieving this, but I have to explain a little about these two opposing approaches. The first is to simply replace the output of the degenerated cones by miniature photosensitive diodes at the outer surface of the retina where they stimulate the still functioning neurons in the retina; this is the so-called subretinal approach. The other strategy is to replace the entire data capture plus information processing going on in the eye and to beam the lost information directly into the ganglion cells that form the optical nerve – the so-called epiretinal approach as the prosthesis is implanted at the inner surface of the retina where the axons of the ganglion cells leave the retina to become the optical nerve.



What at first appeared to be a mere technicality – whether the ganglion cells are best stimulated from the inside or the outside of the retina – has now turned into a major philosophical issue. Whereas the epiretinal prosthesis exhibits many features typical for the radically modernist way of the total

replacement of a biological function by a techno-artifact operating according to specified

needs, the subretinal prosthesis is conceptualized as an implanted chip that is totally integrated into the physiology of the sensory organ and becomes part of the perceptual process. I am not so sure whether one should call this a postmodern approach. But I'd argue that this trend "to go natural" implies a break with the paradigmatically modernist approach.

Teams in the United States, Germany, and Japan pursuing one or the other approach have meanwhile finished with pilot studies and reached the stage of clinical trials. At the conference I happened to be present at, the principal investigator of the German team proudly reported on the concept of his group (the subretinal approach), the promising results of their pilot studies and the preparations for a clinical trial. He certainly made sure not to miss the opportunity to demonstrate how the subretinal approach mimicked nature, employed the great advances of modern nanotechnology for getting as close as possible to the biological, insisting several times on how strictly this approach adhered to physiological principles. In the following discussion, however, a colleague designing brain-computer interfaces asked whether the group also planned to implant devices extending the visible spectrum into infrared light in order to provide patients with better orientation in the dark. The question may seem far-fetched, but in fact, common photosensitive elements differ from the human eye in the wave length at which they activate, a phenomenon employed by infrared cameras, for example. Why should the potential operative range of prosthetic devices be limited when the full range would possibly benefit patients?



However, all of a sudden the atmosphere at the conference changed. The scientist presenting the prosthesis tried to contain his surprise and irritation by underlining how natural the entire project was, involving nothing but a technological replacement for a natural process, a device limited to the very specifications of the physiological. Apparently, the question had touched upon a literally "sensitive" issue. When technoscience goes science fiction, it becomes all the more

important, so it seems, to police the borders and to insist on the naturalness of the scientific project.

Is this a generalizable trend? Based on the evidence of this example, it is tempting to argue that nowadays, e.g. in postmodernity, all kinds of cyborgian fictions can become true as long as they do not look so strange and can be presented as something that comes naturally. Today's fantasies of techno-biological mimicry differ strikingly from the visionary projects of the atomic age when (the obvious example) the complete eradication of microbes was discussed and (hopefully not so well known) the slogan for Montreal's Expo was „We're going to stop the world so you can get on.“ Arranging the examples to this persuasive juxtaposition, it seems as if an almost complete reversal has taken place; while modernity's visions conceived of the biological as a radically malleable space according to physical principles and social needs, postmodern visions revolve around the idea to mould physical and social structures according to biological principles.

There is another reason why I wanted to start with science fiction and that is that it points already into the appropriate direction, in my view, for investigating how the cyborgian fusions of bodies and technology became modernity's promising project in the first place. If science fiction's mode of operation is to transgress by poetic license the realm of the scientifically possible and technologically feasible, it takes its own power from the artistic interplay of fact and fiction rather than from the progress of science and technology. The modernization of prosthetic research in the more specific sense of its engagement in exploring the no-man's land beyond the physiological is an example that transgresses in a somewhat similar vein the limit of the experimental space of the scientific and industrial laboratory. The most radical projects with visual perception were those undertaken by the artistic avantgarde of the interwar period. The concern for the “naturalness” of an intervention may be new, but the very phenomenon that a prosthetic intervention produces ambiguity is certainly not. The avantgarde embraced prosthetic technology for that very reason, because of its innovative artificiality.

At first glance, research on visual prostheses appears to simply follow the obvious trajectory described for many areas of research in the twentieth century. Scientific discoveries and technological breakthroughs paved the way for the construction of devices converting light into sound by means of electricity. Technologically, the

beginning is marked by the discovery of how light affected the electrical conductivity of the chemical element selenium. At the turn of the century and in close connection with the commodification of electricity into all kinds of household appliances, the idea was born to use a photosensitive element as a guiding device for blind people. In 1912, *Scientific American* reported on such an instrument as invented by the British physicist E. Fournier d'Albe in Birmingham.



Here, the Optophone, as the instrument was called, was a mobile wooden box with an aperture allowing light to enter and to elicit an acoustic response. The blind person that here listens how a match is lightened was supposed to scan his environment for obstacles along the path to the light. The technical details are not

relevant here for my talk, I simply want to mention the workshop character of the instrument that apparently had just been manufactured here at the bench, or better: tinkered together, from mundane workbench equipment and on an ad-hoc basis.



Just eight years later, *Scientific American* ran a cover story on the Optophone. In the meantime, the instrument had changed dramatically. With the new design came a different purpose. Now, the Optophone was constructed as a reading devices, converting print into a form of melody or musical pattern.

Obviously, this was a much more sophisticated instrument as the new purpose required a much more advanced technological approach. The mobile wooden box changed for a complicated opto-mechanical apparatus with regulated directions of movement that would allow to strictly follow the printed line of text and to jump from the end of one line to the beginning of the next in order to translate every letter into a tone. Not only the optics and mechanics had changed, also the electronics that now employed filter

algorithms and resonance effects to convert the minimal changes in electric conductivity in relation to the different letters of the alphabet into discernible tunes.

As the text explained, this was still only a prototype but certainly not anymore a makeshift solution on the lab's bench. The instrument was envisioned for series production. Several generations of technological development and industrial manufacturing separate the two devices *Scientific American* reported on; this gulf was brought about by World War I. It had contributed to the massive investment in the development of the Optophone in at least two ways. Technologically, the war had led to the mass fabrication of vacuum tubes that mark the beginning of electronics and with it electronic communication technologies in all its variants. This formed the material basis for the circuitry of the new Optophone. Of equal if not greater importance, however, was the mass fabrication of blindness among soldiers by the industrialization of warfare. The demand, of hitherto unknown scale, to re-integrate disabled soldiers into life and society by means of adding a technological fix to their maimed bodies moved the Optophone to the brink of series production. To my knowledge, this is exactly how far the Optophone got, and in terms of the history of the prosthetic device not much happened until the next war.

The example presented here shares many of the different facets of modernization that the history of prosthesis research provides, but across all variation, prosthesis was conceived as a replacement for the lost function of vision. The prosthesis remained, so to speak, within the limits of the biologically given, no tinkering with infrared or extrasensory perception. This is, where the artistic avantgarde comes in, e.g. the Berlin Dadaists aiming to revolutionize art and life.



In the same year 1920, when *Scientific American* reported on the type-reading optophone, Raoul Hausmann published a brief text “Prosthetic Economy” in *Die Aktion*, one of the major pacifist journals. In this short text, he engaged in what one could call cynical realism:

Every child knows what a prosthesis is. Today, a prosthesis is required by the man from the street as hitherto his beer, the Berliner Weisse. The arm of the proletarian becomes noble as soon as a prosthesis is attached. Prosthetic man, therefore, is the better man, made aristocratic, so to speak, by merit of the Great War. ... Yes, the Brandenburg artificial arm: It fits everyone and everyone wants it. There are so many things to do with such an arm. Pouring boiling water over it without scalding one's hand, for example. What natural arm withstands that? The artificial arm type Brandenburg is an engineering marvel and an act of grace. Even shots go through without hurting.¹

The vitriolic irony of pieces such as this one hurts quite literally; sarcasm has been turned into a form of shock therapy. In its use of slang and abbreviated sentences, the German text resonates with the firing of guns it describes; it engages in a mimetic approach to its subject. The writing performs a salvo of gun shots, bursting into the orderly structure of language, severing many of the sentences and leaving them grammatically incomplete, i.e. crippled. Walter Benjamin's description of Dadaism comes to mind: "The work of art of the Dadaists became an instrument of ballistics. It hit the spectator like a bullet, it happened to him, thus acquiring a tactile quality."²

This radical, political critique of prosthesis seems to be in perfect congruence with how Hausmann employed the new medium of photomontage. In a talk on photomontage that Hausmann delivered on the occasion of an exhibition on this new genre in Berlin, he declared: "Dada ... was a kind of criticism of the culture. ... [The Dadaist] were the first to use photographic materials to create a new unity that wrenched from that period of war and revolution a vision-reflection that was optically and conceptually new, ... an image of the chaos of an age of war and revolution."³



The example here, "Tatlin at Home," seems, at first glance, to testify to this objective. Tatlin was a Russian constructivist of whom the Dadaists in Berlin knew little more than that he produced "machine art" which sufficed to celebrate him. Here, we look into

Tatlin's workshop, as it seems, where a drawing of a technical object hangs on a wall next to a map, a human body is present in form of an anatomical model standing on the floor next to a metronome. In front of these materials, a male human figure dominates the montage. This male human being looks directly at us but only with one human eye, as the other is part of a machine. A combination of mechanical tools make good for the eye, the upper part of the face and the brain. It is a partly technological, partly surgical reconfiguration of a human body. Vis-à-vis *Tatlin at Home*, Hausmann once remarked "I preferred to portray a man who had nothing in his head but machines, automobile cylinders, brakes, and steering wheels."⁴ The instruments replacing the head resonate with the tools and machines from the contemporary period of industrialization. And it seems as if Hausmann used his photomontage technique to come to terms with an environment that had been wrecked by the machinery of destruction.

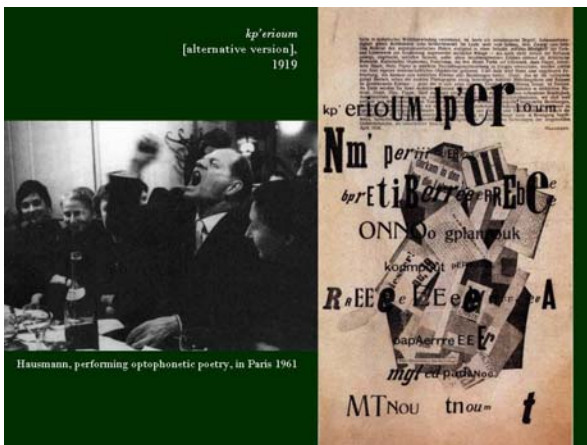
But behind this drastic critique of prosthesis lurked fascination. The photomontage foreshadows a much more positive engagement with prosthesis, Hausmann was to develop in the following years. There are various writings by Hausmann where he delves into a utopian concept of prosthesis as a form of body engineering. I quote from his note *PRÉsentismus* from 1921:

We want to get transformed ... through mechanical consciousness, by the bold inventions of the forward-pushing engineer. Why can we not anymore paint like Botticelli, Michelangelo, Leonardo, or Titian? Because man has completely changed in our consciousness. [...] [We have been liberated by means of] Railway, airplane, photography, x-rays [...] to new forms of optical perception and for an extension of optical consciousness for a creative design of life.⁵

The prosthetic devices that have been attached to the human body challenge its physiological mode of operation – as extensions of the body, as consciousness enhancing technologies, they transform the biological. This transformation of the human senses was the purpose for which Hausmann envisioned and designed his Optophone.

Here, however, it is important to notice one more change of media that literally mediated between photomontage and prosthetic design in Hausmann, his experimentation with typography and the so-called optophonetic poem. Hausmann derived his acoustic poetry from a play with typography, as shown here with "*kp'erioum*" from 1919. In poems such as this one, the signs on the representational space of the paper functioned by

themselves, so to speak, as instructions or guidelines for a performance of the poem, with small letters indicating a more quiet sound, large or bold ones a louder voice, and with the spacing pointing to the intervals and duration of each individual sound. Typography transformed into a system of sound notation by redefining the representational space of the printing paper in topographical terms. With the extinction of semantics, typography turned into an exploration not of the symbolic organization, but of the materiality of speech and language. The individual letters, separated from the order of meaning, dissected phonetic structures. In doing so, the typographic poem connected with the performing body



corresponded with a bodily interplay of the various senses and faculties involved. Thus, Hausmann’s exploration of optophonetic poetry exhibits a trajectory similar to the one exhibited by his photomontages. Optophonetic poetry had started as a typographic play and resulted in an exploration of human physiology, or in the words of Hausmann, “Typography is an intermediate stage between art and technology, seeing and hearing, and one of the most perceptible means in the continuous psychophysiological self-education of man.” In this way, the performance of optophonetic poetry revealed, above all, the disabilities of the human body and limits in the “logic of the organs of the human body.” For Hausmann, this incongruence between optophonetic poetry and human abilities did not sum up to a failure of the new medium of art. On the contrary, it called the human body into question.

The future belonged to “a mechanical intensification our natural faculties.” The Dadaist embarked on the construction of a sense-enhancing perceptual device. This was Hausmann’s path to the optophone. The instrument he envisioned was the materialization

of synaesthesia in form of a universal symphony of light and sound. The optophone operated in a gap between two human senses, where human evolution still had to go. – So then, Hausmann's optophone *was* a prosthetic device, though not for the blind, but for physiologically disabled humans. It is precisely here that art intersects with the history of prosthesis and the ambiguities of the “natural.” Raoul Hausmann’s work does probably not offer any straight-forward advice for dealing with the irritation which so suddenly erupted at the conference mentioned before. But his art operates in a space which transgressed 80 years ago the very ontology the scientist so desperately wanted to see remaining in place although (or because) his experiments were constantly undermining this ontology of naturalness.

References

¹ Raoul Hausmann, “Prothesenwirtschaft,” in Michael Erlhoff (ed.), *Bilanz der Feierlichkeit, Texte bis 1933, Bd. 1*, Munich 1982, pp. 137-138. All translations from Hausmann’s original German are mine unless stated otherwise.

² Walter Benjamin, *Illuminations*, London 1992, p. 231.

³ Raoul Hausmann, “Photomontage,” *Studio International*, 181, April 1971, p. 161.

⁴ Hausmann as quoted in K. G. Pontus Hultén, *The Machine as Seen at the End of the Mechanical Age*, New York 1969, p. 111.

⁵ Raoul Hausmann, “PRÉsentismus,” in Michael Erlhoff (ed.), *Sieg Triumph Tabak mit Bohnen, Texte bis 1933, Bd. 2*, Munich 1982, p. 28.