es my concept of viractualism. C. PAUL, *Digital Art*, London, Thames & Hudson, 2006, 58. One of the images she chooses to illustrate that section of the book is my painting entitled the birth *Of the viractual* (2001). Joe Lewis, in the March 2003 issue of Art in America discusses the viractual. J. LEWIS, "Joseph Nechvatal at Universal Concepts Unlimited", *Art in America*, March 2003, 123-124. John Reed in Artforum discusses the concept in his piece #1 Joseph Nechvatal. J. REED, "Joseph Nechvatal", *Artforum Web* 3-2004 Critc's Picks, March 01, 2004. https://www.artforum.com/search?search=John%20Reed&page=7 Frank Popper also writes about the viractual concept in his book From Technological to Virtual Art. F. POPPER, *From Technological to Virtual Art*, Cambridge, The MIT Press, 2006, 122.

[6] P. OSBORNE, *Anywhere Or Not At All*, *op. cit.*, 3, 51.

[7] I developed further the concept of Viractualism in an online seminar I held from November 1st to the 15th in 2002 that was conducted as part of the Virtual Construction project at the Empyre Forum http://www.subtle.net/empyre. I thank Christina McPhee again for that opportunity.

Two key factors in the history of communicating immersive environments: mix of reality vs. cognitive realism[1]

Marcin Sobieszczanski

The history of immersive environments was strikingly presented in 2010 by van Krevelen and Poelman as a continuation of the work of Tamura.[2] Here we find the main prototypes as well as their technical progression articulated in terms of placement within the famous theoretical continuum "Reality / Virtuality", as invented in the 1990s by Milgram and Kishino.[3] But, if the philosophical speech involves the ontological status of the objects, the scientific basis that led to the technological achievements exploits the resources of the philosophy of appearance, perception and of the gnosic status of the percepts that different devices provide. Indeed, the method of 3D "look oriented" (see-through) refers to the long tradition of the philosophy of perception initiated by Brentano, Stumpf and Husserl, taken up by the psychologists of form[4] and systematized in the cognitive approach used by cognitive scientists of the environment, such as Gibson[5], and of vision, such as Marr.[6]

Moreover, it is not, curiously, the continuation of the theoretical hybridization Real / Virtual which led to the most convincing prototypes. The theoretical continuum that establishes this hybridization is based itself on the *qualitative* ideal of immersion. In fact, between 1962 and 1967 epistemological separation between two approaches in the design of simulators of environmental perception is prevalent.

On the one hand, there is a continuation of the long line of analogue machines, both electronic and magnetic, aiming to produce the most complete and the most accurate perceptual substrate as possible, in the field of cinema and education by simulacrum, in military engineering and industrial traineeship. The patent of Heilig[7] from August 28, 1962[8], is one of the best achievements of this method.[9]

On the other hand, the idea of a "dispatcher" of multimodal sensations implemented on a digital computing machine germinates. Later on this will also include some analogue mechanisms[10], as well as the functional modelling of "sensory-motor coupling" or the "retroactive subjugation" of the sensitive substrate and postural gestures and attitudes. In this second kind of approach, advantage is taken not only of that which predestines the computing machine to perform its role of being a simulator of the nervous system of animals and humans, but the *critique* of the ergonomics of cultural behaviours, both creative and receptive also is established, on the basis of the design of the perceptual substrate as *affordances* (Gibson)[11] and on the basis of perception as *enaction* (Maturana, Varela)[12]. The functional complementarity of both concepts is revealed in the simulation of perceptual mechanisms realized in the 1960s, but the effectiveness of cognitive realism they infer becomes evident only in the late 1990s.

One notices, besides, that *authenticity of the sensitive substrate* and *cognitive realism* are dependent, in this story of American technologies, on the same military and civilian sponsors, whose financial support led, in the same period (that is the second half of the 1960s), to the invention of the premises and the social uses of *digital networks*![13] The pioneer in the 3D digital interface, Sutherland, was indeed recruited at the age of 27 by Licklider, a former participant in the SAGE project (interconnection of military computers using the telephone network), who in 1962 was in charge of the ARPA's Control-Command Office.[14] This conclusion of simultaneity of 3D and Internet is very significant and could be the subject of thorough consideration.

Van Krevelen and Poelman write: "The first AR prototypes, created by computer graphics pioneer Ivan Sutherland and his students at Harvard University and the University of Utah, appeared in the 1960s and used a see-through to present 3D graphics." [15]

Sutherland himself speaks of the contracts, to which today for the most part unrestricted access, and which necessarily came from the same pool of sponsors who financed Baran:

> *"The work reported in this paper was performed at Harvard University, supported in part by the Advanced Research Projects Agency (ARPA) of the Department of Defense under contract SD 265, in part by the Office of Naval Research under contract ONR 1866 (16), and in part by a long standing agreement between Bell Telephone Laboratories and the Harvard Computation Laboratory. The early work at the NUT Lincoln Laboratory was also supported by ARPA."*[16]

But apart from these economic and political contingencies, it is the substance of the future discussion on the enactive approach which is being prepared in both technological affiliations of 3D that Sutherland proclaims:

> *"The fundamental idea behind the three-dimensional display is to present the user with a perspective image which changes as he moves. The retinal image of the real objects which we see is, after all, only two-dimensional. Thus if we can place suitable two-dimensional images on the observer's retinas, we can create the illusion that he is seeing a three-dimensional object. Although stereo presentation is important to the three-dimensional illusion, it is less important than the change that takes place in the image when the observer moves his head. The image presented by the three-dimensional display must change in exactly the way that the image of a real object would change for similar motions of the user's head. Psychologists have long known that moving perspective images appear strikingly three-dimensional even without stereo presentation; the three-dimensional display described in this paper depends heavily on this 'kinetic depth effect'".*
>
> *A computer uses the measured head position information to compute the elements of a rotation and translation matrix appropriate to each particular viewing position.*
>
> *I did some preliminary three-dimensional display experiments during late 1966 and early 1967 at the MIT Lincoln Laboratory."*

Sutherland clearly distinguishes between the brain generating the 3D effect from the optical stereoscopic substrate and the production of a depth effect by head and eye movements that create on the retina a chain of apparent contours on the observed object (KDE). The placement of the artifact at that location gives the engineer a double benefit. On the one hand this method provides, as does the stereoscopic method, "mental 3D", on the other hand it actively engages the subject of the test at the level of cognitively valuable motricity, which in return delivers the advantage of engagement in the image / motor causality function, motor function in its widest sense. As seen, the theoretical bases of the "effector picture" were laid in the 1960s and now are the current and future practices, prepared by the ludic behaviours phase, which profit.

To go beyond the purely optical approach in the construction of multimodal simulation devices, Sutherland evokes the work on KDE through the intermediary of the American psychologist B. Green[17] who was then working at the MIT Lincoln Laboratory, the unit dedicated since its creation in 1951 to the design of an air defence system, a continuation of the efforts initiated during World War II by the MIT Radiation Laboratory in the field of pattern recognition through the information that these forms "print" in different electromagnetic waves. Green was also a colleague, in 1962, of Baran at RAND Corporation. Green shows that the origin of the concept of KDE is to be found in the work of Wallach, a former assistant of Köhler, the director of the Berliner Schule für experimentelle Psychologie and the cofounder with Wertheimer and Koffka of the *Gestalt theory*. Wallach and his colleagues, O'Connell and the famous Neisser,[18] refer in turn to the article written in 1950 by Gibson.[19] Thus Sutherland pointing in the direction of the theoretical basics of manipulable 3D:

- the virtual camera determining the viewpoint in the visual scene and
- the directional lighting of surfaces.

These two mechanisms will be « motorized » in all the geometric construction software of upcoming 3D.

What is peculiar to all this plethora of works is their shared filiation: the study of forms in Germany from the early 20th century, the emigration of German scientists to the USA in the 1930s, US military research launched in the 1940s in the field of information and its treatment, and finally the taking into account of the environment of the perceiving subject, i.e. the development of the psychology of cognitive and environmental realism instead of the old laboratory-based psychology.

[1] Fragment from M. SOBIESZCZANSKI, *Les médias immersifs informatisés. Raisons cognitives de la ré-analogisation*, Bern, Peter Lang, 2015.

[2] H. TAMURA, "Steady steps and giant leap toward practical mixed reality systems and applications", in *VAR'02: Proc. Int'l Status Conf, On Virtual and Augmented Reality*, Leipzig, nov. 2002 ; D. W. F. KREVELEN (van), R. POELMAN, "A Survey of Augmented Reality Technologies, Applications and Limitations", *The International Journal of Virtual Reality* 9(2), 2010, 1-20.

[3] P. MILGRAM, F. KISHINO, "A taxonomy of mixed reality visual displays", *IEICE Transactions on Information Systems* E77-D, 12, dec. 1994.

[4] C. IERNA, "Husserl et Stumpf sur la Gestalt et la fusion", *Philosophiques* 36(2), aut. 2009, Société de philosophie du Québec, 489-510.

[5] J. J. GIBSON, *The Ecological Approach to Visual Perception*, Boston, Houghton Mifflin, 1970.

[6] D. MARR, *Vision: A Computational Investigation into the Human Representation and Processing of Visual Information*, New York, W. H. Freeman & Company, 1982 (posthume).

[7] M. L. HEILIG, "El Cine del Futuro: The Cinema of the Future", *Espacios* 23-24, 1955, repr. in *Presence: Teleoperators and Virtual Environments* 1(3), 1992, 279-294. On Heilig see H. RHEINGOLD, *Virtual Reality: The Revolutionary Technology of Computer-Generated Artificial Worlds — and How It Promises to Transform Society*, New York, Simon & Schuster, 1992.

[8] Sensorama simulator, Patent US 3050870 A.

[9] Cf. the theory of the "personal ambient diplays" by C. A. WISNESKI, *The Design of Personal Ambient Displays*, thesis, MIT, 1999. The movie viewing device is reminiscent of the "GIF collections" invented for interactive CDROM support by J-L. BOISSIER, *Moments de Jean-Jacques Rousseau. Confessions et Rêveries*, Paris, Gallimard, CD-ROM, 2000.

[10] See supra.

[11] J. J. GIBSON, *The senses Considered as Perceptual Systems*, Boston, Hougton Mifflin, 1966; idem, "The Theory of Affordances", in R. SHAW & J. BRANSFORD (eds.), *Perceiving, Acting, and Knowing*, New York, Wiley, 1977, 67-82.

[12] H. R. MATURANA, F. VARELA, "Autopoiesis and Cognition: The Realization of the Living", 1973, reed. *Boston Studies in the Philosophy of Science* 42, 30 Nov. 1979.

[13] The history of this period of US research is given in H. RHEINGOLD, *Tools for Thought: The History and Future of Mind-expanding Technology*, New York, Simon & Schuster, 1985.

[14] T. GASTON-BRETON, "Arpanet, le monde en réseau", *Les Échos*, 3-4 aout 2012, série "Saga, ces grands projets qui ont changé nos vies."

[15] D. W. F. KREVELEN (van), R. POELMAN, R., *op. cit*.

[16] I. E. SUTHERLAND, "The Ultimate Display", in *Proceedings of IFIPS Congress* 2, May 1965, New York, 506-508 ; I. E. SUTHERLAND, "A head-mounted three-dimensional display", in *Proceeding AFIPS '68* (Fall, part I), dec. 9-11 1968, ACM, New York, 757-764.

[17] B. F. GREEN, "Figure coherence in the kinetic depth effect", *Journal of Experimental Psychology* 62(3), sept. 1961, 272-282.

[18] Apart from its debate on cognitive realism versus laboratory cognition, Neisser came to the fore during the 1990s in the fight against cognitive racism visible in the reference book of Richard Herrnstein and Charles Murray, *The Bell Curve*.

[19] J. J. GIBSON, *The Perception of the Visual World*, Cambridge, The Riverside Press, 1950.