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RENEWING OUR VIEW OF THE ANIMAL WORLDS. FROM JAKOB VON UEXKÜLL TO JEAN GAGNEPAIN[1]

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Abstract

Relatively marginal in relation to the central currents of biology, the work of Jakob von Uexküll attracted the attention of philosophers very early on and continues today to inspire certain currents in the human sciences, including Augustin Berque's mesology. The present article originates precisely in a reading of mesology through the prism of Jean Gagnepain's theory of mediation, reinforced by a methodological reflection on how to account for "animal worlds". He retains the distinction, central to Uexküll, between "surroundings" (*Umgebung*) and "environment" (*Umwelt*), but deplores the fact that Uexküll remained trapped in a "cognocentrism" that tended to reduce all the components of animal worlds to meaning (within the framework of a *Bedeutungs-lehre* or "theory of meaning"). The article then proposes to move away from cognocentrism in order to better account for the complexity of animal worlds, which is also made up of motor skills, affectivity, proprioception and orientation in space and time. Finally, it calls for a renewal of observations which takes advantage, in other animal species as in man, of the dissociations resulting from cerebral lesions and major psychopathological syndromes.

Introduction: surroundings (*Umgebung*) and environment (*Umwelt*)

Jakob Johannes von Uexküll was born in 1864 in Keblaste, now Mikhli, Estonia, into a family of the German Baltic nobility[2]. In 1884, he enrolled in the Faculty of Natural Sciences at Dorpat University (Tartu) and chose zoology as his main subject. Inspired by his reading of Kant, which dated back to his years as a *Gymnasium student*, he became interested at an early age in the way animal species perceive

[1] The author is particularly indebted to C. de Guibert and F. Kohler for their careful proofreading and bibliographical information. The study day "Ethics and Anthropology: From Sensitive Worlds to Worlds of Representation", organized in Nanterre by the second on October 10, 2014, was the starting point for this article.

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[2] The following biographical information is taken from Brentari, 2015.

their environment: it seemed possible to him to extend to animals the transcendental analysis developed by Kant, provided of course that appropriate empirical means of observation were used. In his first year of university, he began in this perspective to study marine fauna, then abandoned zoology for physiology, with a thesis in 1890 on the parietal eye ("third eye") of the frog. In 1888 he became assistant to Professor Kühne in Heidelberg and from April 1891 he made frequent visits to the Naples Zoological Station, where he worked more particularly on octopuses and sea urchins. In 1899, he stayed in Paris in the laboratory of Étienne-Jules Marey, one of the inventors of chronophotography, where he used this technique to study the movement of fishes and butterflies. The same year, he published an article in which he proposed replacing the anthropocentric vocabulary used until then by physiology with a more objective vocabulary. Rather than "sight" and "smell", he proposed, for example, to speak of "photoreception" and "stibo-reception". But Kühne's death in 1900 made his university situation very precarious because Kühne's successor was not interested in his work. He had to finance by himself his stays in marine research centers (Beaulieu-sur-Mer, Berck-sur-Mer, Biarritz, Roscoff[3]). This constraint led him to turn to theoretical reflection, as evidenced by the publication in 1902 of the article "*Im Kampfe um die Tierseele"* ("*In the Battle* over the *Soul* of the *Animal*"), in which he proposed an application of Kant's philosophy to the biology, and next, in 1909, by the book *Umwelt und Innenwelt der Tiere* ("Environment and Inner World of the Animal"), reprinted in 1921. On the eve of the First World War, he still did not have a permanent academic position. When the war broke out, he stayed on his wife's property in Schwerin, Mecklenburg. He had a Russian passport (Estonia was part of the Russian Empire since 1710), but the German authorities took into account his ethnic origins and allowed him to stay in Germany. The Russian revolution of 1917 led to the confiscation of his Estonian estate and to the collapse of the value of the government bonds in which he had invested his fortune. All he had left was his wife's income, which forced him to reduce his empirical research even more. He took the opportunity to write *Theoretische Biologie*, a book published in 1920 and quickly translated into English, which brought the word *Umwelt* into the language of biology, but which appeared too metaphysical to most biologists and would never really be accepted by the academic world. Uexküll, who, as one of his French translators, Martin-Freville, points out, was "a scientist rather than a transcendental philosopher" (Uexküll, 2010a, p. 106), nevertheless obtained in 1923 an invitation to the Edinburgh Physiology Congress with the support of Otto Cohnheim[4]. The latter also allowed him to be recruited as a "scientific assistant" by the University of Hamburg with the task of managing a laboratory and an aquarium. It was on this basis that Uexküll succeeded in creating in 1927 an Institute for

[3] According to our own investigation, Uexküll stayed in Roscoff (Brittany, France) from July 8 to August 3, 1911 (archives of the Roscoff Marine Station, List of visitors from 1872 to 1926 and Report book of the station for the period from June 19, 1911 to May 31, 1918).

[4] On Otto Cohnheim, see Matthews, 1978.

Environmental Research, administratively attached to the Faculty of Zoology, whose work interested Konrad Lorenz, who probably went there in the first half of the 1930s.

During the 1920s Uexküll's work also aroused the interest of philosophers[5], including Ernst Cassirer and Martin Heidegger. The latter published *Sein und Zeit* (Being and Time) in 1927. In the second part of his course of the year 1929-1930, he was very strongly inspired by the notion of environment or ambient world (*Umwelt*), as it was developed at the same time by Uexküll[6]. Heidegger used this notion in particular to affirm that "[1.] the stone (material object) is worldless; [2.] the animal is poor in world; [3.] man is world-forming" (Heidegger, 1995, § 42, p. 177). This idea of a poor in world animal could seem to be reinforced by Uexküll's analysis of the tick environment at the beginning of a new book published in 1934, *Streifzüge durch die Umwelten von Tieren und Menschen* (A Stroll Throught the Worlds of Animals and Men)[7]. Uexküll indeed writes that "the whole rich world surrounding the tick is constricted and transformed into an impoverished structure that, most importantly of all, consists only of three features an three effect marks – the tick's environment – *Die ganze reiche, die Zecke umgebende Welt schnurrt zusammen und verwandelt sich in ein ärmliches Gebilde, das zur Hauptsache noch aus 3 Merkmalen und 3 Wirkmalen besteht - ihre Umwelt"* (Uexküll, 2010a, p. 51 and 1983, p. 13). The reading of the two authors shows, however, that if Heidegger had well understood the innovative aspect of the biologist's approach for ecology, he was pursuing a very different task, a purely philosophical one, which very quickly lost interest in what makes the specificity of the environment of each animal species. Uexküll, on the contrary, was trying to provide himself with both theoretical and empirical means of describing this specificity. In *Streifzüge*, he developed a theory of environments (*Umwelten*) that opposes a physiological conception in which the living being is a thing, a machine in the sense of Descartes, and his own conception, which he called biological, according to which "each and every living thing is a subject that lives in it's own world, of which it is

[5] On the reading of Uexküll by Cassirer and Heidegger, see also Jui-Pi Chen, 2006.

[6] This course was published in 1983 only under the title *Die Grundbegriffe der Metaphysik. Welt - Endlichkeit - Einsamkeit*. Its English translation (*The Fundamental Concepts of Metaphysics. World – Finitude – Solitude*) was published in 1995.

[7] Completed in 1940 by the *Bedeutungslehre* (Theory of Meaning), this book has been translated into several languages, which have largely contributed to the dissemination of the author's ideas. The first English translation, *A Stroll Throught the Worlds of Animals and Men. A Picture Book of Invisible Worlds* (Claire H. Schiller Ed, 1957), only reproduces the work of 1934. But the second English translation, in 2010, completes it with the work of 1940 (*A Foray Into the Worlds of Animals and Humans with A Theory of Meaning*). The first French translation by Philippe Muller, in 1965, also brings together the two books (*Mondes animaux et mondes humains*, followed by *La théorie de la signification*). The second French translation, by contrast, that of Charles Martin-Fréville, published in 2010 under the title *Milieu animal et milieu humain*, reproduces only the work of 1934.

the center" (Uexküll, 2010a, p. 45). The task of the biologist, from there, is to try to reconstitute what the world can be for a given animal, from the particular characteristics of this animal as a subject.

A very important theoretical distinction in this perspective is Uexküll's distinction between the concepts of *Umgebung* (the "surroundings" or the "surrounding world" in the last English translation) and *Umwelt* (the "environment" in the last English translation). It already appeared in the quote we gave above, about the tick. It is reaffirmed by Uexküll a few pages later: "the animal's *environment*, which we want to investigate now, is only a piece cut out of its *surroundings*, which we see stretching out on all sides around the animal. - *Die* Umwelt *des Tieres, die wir gerade erforschen wollen, ist nur ein Ausschnitt aus der* Umgebung*, die wir um das Tier ausgebreitet sehen"* (Uexküll, 2010a, p. 53 and 1983, p. 15 – underlined by us). This theoretical distinction was taken up by the Japanese philosopher Watsuji Tetsurô, who attended Heidegger's courses in Germany in 1927 and 1928. In a collection of articles published in 1935 under the title *Fudô. Ningengakuteki kôsatsu* (*Environments. A Humanological Study*), Watsuji makes a distinction between *kankyô* (natural surroundings) and *fudô* (human environment), similar, in the case of humans, to that made by Uexküll between *Umgebung* and *Umwelt* in the case of animal species (Watsuji, 1979). It was Watsuji's reading that led Augustin Berque to take an interest in Uexküll, the distinction between *Umgebung-kankyô and Umwelt-fudô* becoming a crucial distinction for mesology (Berque, 2000). And it's from Berque's work that we have grasped the importance of this distinction in Uexküll (Le Bot, 2014b). This distinction is indeed indispensable for him to get out of the anthropocentrism of ordinary physiology which, by confusing the environment and the surroundings, comes to attribute to the animal an environment which is not its own. Uexküll goes even further by affirming that "these surroundings are nothing else but our own, human environment" (Uexküll, 2010a, p. 53). He had well understood, in other words, that the sciences of nature, although they claim to describe the environment in all objectivity, independently of any particular subject, do not reach the world in itself. The natural world, as reconstructed by the natural sciences, is relative to the human point of view, the scientific point of view being only a special case: it depends on the scientific "categories of the understanding" – this reference to Kant, as we have seen, being entirely justified in the case of Uexküll – as well as on the equipment used. This is why the regularly renewed description of the natural world that sciences provide is necessarily part of the human environment[8]. *Streifzüge*'s conclusion was very clear on this point, underlining the fact that the different sciences, with the help of their theories and instruments, construct as many different environments (*Umwelten*), "fostered and borne along by the One that is inaccessible to all environments forever" (Uexküll, 2010a, p. 135).

[8] Uexküll is well informed here of the debates of his time in science, while physics, with the theory of relativity and quantum mechanics, rediscovered the importance of the observer in observation. See in particular Uexküll, 2010a, p. 54.

What is most important for this article is to remember that different environments (*Umwelten)* will correspond to the same surroundings (*Umgebung*), insofar as each species selects in the surroundings the characteristics that correspond to its physiology. As Uexküll shows from the tick example, it follows that the subject and its environment are always adjusted to each other. It is one of the fundamental propositions of environmental theory: "all animal subjects, from the simplest to the most complex, are inserted into their environments to the same degree of perfection" (Uexküll, 2010a, p. 50). The environment (from the point of view of humans) can be very hostile, "pessimal" according to the term Uexküll takes from Bodenheimer[9], but it is nevertheless an optimal environment for *the animal that* lives in it (ibid., note 5, p. 250). This is a point that Berque regularly emphasizes, adding that it has been confirmed since by the discoveries of biology. His favourite example is that of the so-called extremophiles – for instance species found in hot springs or hydrothermal vents of oceanic ridges – that live in conditions (*Umgebung*) that would be lethal to most other organisms but that constitute their preferred environment (*Umwelt*)[10].

Having thus underlined the importance of this distinction, we will continue by first highlighting Uexküll's tendency towards cognocentrism in what he himself called a "theory of meaning" (*Bedeutungslehre)*. Some of his observations, beginning with those concerning motor skills, indicate however that the environments or animal worlds are not only the product of sensation and perception. They are also 1° the product of the specific motor skills of the different species, 2° the product of affectivity, 3° the product of proprioception and of the ability of orienting oneself in space and time. These three abilities, we argue, are not reducible to "meaning" (*Bedeutung*). We will then justify the need to distinguish these different abilities by presenting a method that has proved its worth in the field of human psychology: that which consists in identifying the different mental functions and faculties from the dissociations resulting from cerebral lesions and major psychopathological syndromes. In the third part, we will present some lines of research opened by this method in the field of the study of animal environments.

1 Getting out of cognocentrism

In the seminar *Vices de forme* of December 7, 1995 (published in this same issue of *Tétralogiques*), Jean Gagnepain evokes the sensori-motricity to say that it "goes back to a naive psychology of the back and forth": a stimulus received by a sensory receiver is transmitted to a motor center and triggers a movement. However, the way in which Uexküll accounted for the animal worlds remained largely dependent on such a sensory-motor scheme, developed by his predecessors to describe

[9] Probably the Israeli entomologist and zoologist Shimon Fritz Bodenheimer (1897-1959).

[10] See for instance Augustin Berque, "What is the world for mesology?", University of Neuchâtel, Conference of October 29, 2013. Online: http://ecoumene.blogspot.fr/2013/10/quest-ce-que-le-monde-pour-la-mesologie_30.html (last accessed May 4, 2021).

the functioning of the reflex arc. "Every animal subject", wrote Uexküll, "attacks its objects in a pincer movement – with one perceptive and one effective arm" (Uexküll, 2010a, p. 48-49). The "functional circle", in such a scheme, connects a "perception world" and an "effect world" through a "perception organ" and an "effect organ". To reconstruct the particular world of each species, it is therefore necessary to identify the stimuli that the receptors of this species (perceptual cells) allow to pass through, as well as the possibilities of action given to it by its effectors (active cells) in order to deduce the perceptual and active characters attributed to the objects in the environment. The perceptive cells of the tick, for instance, are sensitive to the butyric acid released by the mammal's skin glands and this sensation is "transposed outward" as an olfactory characteristic attributed to these mammals (ibid., p. 50*)*. This is also what led Uexküll to the statement already mentioned above: "the whole rich world surrounding the tick is constricted and transformed into an impoverished structure that, most importantly of all, consists only of three features an three effect marks – the tick's environment*"* (ibid., p. 51). Our aim, obviously, is not to question the existence of perceptive (or more exactly sensory) cells and organs nor the existence of motor cells and organs. As Gagnepain also said in the quoted seminar, these cells and these organs have been well described in many species, just as the various disorders of sensation as well as the various disorders of motricity have been described in the human case.

But this emphasis on sensation and motor skills has long been accompanied by less attention being paid to two other equally important registers: affectivity on the one hand, and proprioception on the other (although psychoanalysis, in its own way, has been particularly interested in affectivity with the notion of drive). Gagnepain's criticism of neurologists and psychologists is also valid for Uexküll. It is all the more so because the latter, starting from a model, that of the functional circle, combining perception and action, tended, by orienting itself towards a theory of meaning (*Bedeutungslehre*), to abandon the study of motor skills and action and to focus solely on sensation and perception. See for instance, in the second chapter of *Streifzüge*, how Uexküll argues that "the first task of research on such environments consists in seeking out the animal's *perception signs* and, with them, to construct the animal's environment" (ibid., p. 53 – underlined by us). Everything for him tends to become a matter of *Empfindung (*"sensation"), *Sinnesempfindung (*"sensory perception" or "sensation"), *Bild (*"image"), *Merkbild (*"perceptive image" or "image-perception"), *Wirkbild (*"active image" or "image-action"), *Bedeutung (*"significance"), surrounding objects being referred to as *Bedeutungsträger* ("carriers of meaning"). In short, there is in Uexküll, if not a "logocentrism" (difficult to support in the case, for example, of the tick), at least a "cognocentrism" (Schaeffer, 2007), which reduces all experiences, whatever the species, to a matter of "knowledge", whether in the form of "sensation", "perception" or "signification". In this perspective, some environments are only poorer than others: if the environment of the bee, for example, contains "perceptual images", this is not the case for the scallop, earthworm and tick environments (Uexküll, 2010a, p. 84). The series of neologisms constructed by Uexküll on the basis of the German verb *merken* is part of this cognocentrism: *Merken* ("perception"),

Merkwelt ("perceptive world"), *Merkzeichen* ("perceptive signal"), *Merkmal* ("perceptive signal", "perceptive sign"), *Merkorgan* ("perceptive organ"), *Merkzellen* ("perceptive cells"). In the French translation by Philippe Muller, which dates from the mid-1960s, this cognocentrism is further reinforced by the translation by "connotation" of the German word *Ton* ("tone", "note") used by Uexküll in compound words like *Wegton or Wurfton* (in Muller's work, these become respectively "path connotation" and "projectile connotation" while the translation by "tone", which we have chosen, is also chosen by Martin-Freville). This may be explained by the place of semiology at the time of this translation, when, with Roland Barthes, everything became a matter of "connotation"[11]. And this cognocentric tendency has been further increased among those of Uexküll's heirs (including his own son, Thure von Uexküll) who have focused on developing a "biosemiotic".

However, Uexküll's observations invite us to move beyond this cognocentrism to develop a more complete and, we hope, more accurate vision of the complexity of the animal worlds. For everything, starting with the activity, is not a matter of sensation, perception or meaning. As we have seen, the functional circle diagram presented by Uexküll in Chapter 1 of *Streifzüge,* which is based on the case of the tick and its environment, attached as much importance to "active characters" as to "perceptual characters". But the former tended in the rest of the book to be sidelined or to be treated in terms of an "active image" (*Wirkbild*). It was only in passing that Uexküll was interested in the specific motricity of the different species that appear in his examples: barnacle or limpet, snail, spider, bee, jackdaw, stickleback... This question of motricity however deserves to be treated for itself, at the same level of finesse as the question of perception, if only to make more meaningful a statement like the following: "when a dog runs, the animal moves its legs. When a sea urchin runs, its legs move the animal" (ibid., p. 76). The same applies to affectivity: Uexküll pays even less attention to it than to motricity. But it appears in some of his observations, however, as a "perceptual signal". Thus he tells us that "sharp teeth" in humans "are always a danger for our tongue, one which is only avoided by the activation of the perception sign of pain in the central organ, for pain inhibits the act that causes pain" (ibid., p. 76). Affectivity, in the form of fantasy, also appears in the example of the girl who runs away terrified because she saw in the wrinkles of an oak bark a wicked face looking at

[11] Uexküll's first French translator, Philippe Muller (1916-2001), was a professor of psychology and philosophy at the University of Neuchâtel (Switzerland). He founded the Institute of Psychology, which he directed until 1973, before taking over the direction of the Center for Hegelian and Dialectical Studies at the same university. Muller precises in a footnote that he took up, to translate Uexküll's neologisms such as *Merkwelt* or *Wirkwelt*, "the equivalents suggested by Henri Piéron" (p. 21). The same note allows us to understand that Piéron was the author of an article devoted to "zoological psychology" in Volume VIII, Issue 1 of the *Nouveau Traité de Psychologie* published by the Presses Universitaires de France in 1941 in which he probably discussed the theories of Uexküll. Henri Piéron (1881-1964) taught the physiology of sensations at the Collège de France from 1923 to 1951.

her (ibid., p. 128). It is because the environment, at least for humans, also functions as a kind of Rorschach test on which to project anguish and desires. There is of course, in the example of Uexküll, a representation (the girl *sees* a face in the bark). But representation is distinct from the associated affect (see Freud, 1984, p. 152, who distinguished the "idea" - *die Vorstellung* - and the "instinctual energy linked to it" - *die an ihr haftenden Triebenergie*). Finally, in the examples given by Uexküll, we find observations that refer not only to the field of proprioception, but also to the way an animal subject orients himself in space and time. An experiment conducted on bees (Uexküll, 2010a, p. 57-58) allows him, for example, to dissociate visual space (*Sehraum,* depending on their visual impressions) and effect space (*Wirkraum*, depending on a "compass" in which the antennas participate). There is thus a *space* of the insect, a *time* of the snail, a *familiar path* of the jackdaw, a *home* and *territory* of the mole, etc. that cannot be reduced to a question of perception.

2 Clinical deconstruction (analysis)

In order to get out of cognocentrism and to identify, as we have just done, among Uexküll's observations, questions pertaining to other registers than that of sensation and perception, it is necessary to have an adequate method. This method exists. In humans, it consists in particular (but not exclusively, as we will see later) in observing the consequences of brain lesions, whatever their etiology, in order to identify and isolate from each other what Luria (1966) called the "cortical functions"[12]. An example borrowed from Oliver Sacks will illustrate the principle (Sacks, 1995). This is the case of a man, Mr. I, who was a painter by profession. He had worked in particular on the realization of painted sets for the cinema. At the age of sixty-five, he was the victim of a traffic accident. The immediate and lasting consequence of this accident was a total loss of color vision. "My vision was such", he wrote to Sacks, "that everything appeared to me as viewing a black and white television screen. […] My brown dog is dark grey. Tomato juice is black. Color TV is a hodge-podge" (Sacks, 1995, p. 3). Clinical examination excluded a retinal problem. It therefore led to a diagnosis of total color blindness caused by brain damage. This rare case was the one known in the neurological literature as cerebral achromatopsy. People with such achromatopsy have had a colorful vision of the world but have lost it. They frequently describe their new world – it would not be an exaggeration to talk about their new *Umwelt in the* sense of Uexküll – as misty, greyish, "dirty". This loss of color vision often results in a disgust with things and beings that lose their attractiveness, desirability (the patient described by Sacks initially avoided sexual intercourse with his wife because her flesh, like his, repelled him with its greyish hue, recalling, he said, "the color of rats").

[12] A methodological principle to which Lévi-Strauss was attentive. In his 1972 lecture on "Structuralism and Ecology", he relied on the work of Luria to point out that the ability to analyze phonemes is distinct and independent from that involved in musical hearing. A lesion of the left temporal lobe destroys the first but leaves the second intact (Lévi-Strauss, 1992, p. 116).

The *Umwelt* of these people, therefore, is very different from that of birth achromatopsic subjects, who, having never seen in color, have never experienced any loss in this respect. In the case of Mr. I, the fact that he was a painter made him particularly sensitive to his new vision, which also concerned mental images, those he could imagine by closing his eyes or those of his dreams. He therefore tried to describe it as accurately as possible. The reference to black and white television that he had first used was not entirely accurate. The paintings he painted to try to share with others what he saw were different from these usual black and white images. Made in a whole range of greys, they had, said Sacks, a particularly macabre effect. On the other hand, the theoretical knowledge about colors that Mr. I had retained from his profession as a painter was no longer of any use to him. He claimed to "know" which color to use to produce this or that image, but the result, when he painted in color, was incomprehensible to people who had kept their vision normal.

The interest of such a clinical picture is to inform us about the internal complexity of the vision mechanism itself. At the most general level, it confirms that vision is not only an ocular phenomenon. In this case, color vision is lost while the retinal receptors are intact. Vision is therefore also a brain phenomenon. But these clinical pictures make it possible to go beyond this general observation by producing a kind of deconstruction of the internal complexity of the brain processes involved. Mr. I has lost his vision of colors. He did not lose the vision of the forms, nor that of the value (luminosity). But the latter appears to him only as gradients from white to black and all shades of grey. Further observations by Sacks in collaboration with an ophthalmologist and a neurophysiologist led to the conclusion that Mr. I was still able of wavelength differentiation but could no longer translate it into colors (on this distinction see also de La Sayette, 1995, pp. 24-25)[13]. After a few months of depression, following the feeling of loss, Mr. I started to paint again, but in black and white, relying on this preserved faculty of wavelength differentiation. The initial depressive state was itself an indirect result of the fact that he was aware of his particular blindness, in contrast to other patients in whom the primary visual cortex is destroyed bilaterally (these patients are blind but do not know that they are blind).

The case of Mr. I shows that the different components of vision, namely the perception of shapes, colors and wavelengths, are independent of each other. We can lose one without losing the other. And normal vision results from the joint functioning of all these components. But such a conclusion was not self-evident. In his description of the case, Sacks points out that neurologists at the end of the 19th century, based on a "sensationalist" conception inherited from Locke, denied in advance the possibility of an isolated achromatopsia, despite the description of such a case by the Swiss ophthalmologist Louis Verrey. It is only with the experiments of Semir Zeki in the early 1970s that achromatopsia was definitively recognized. These

[13] In this area of vision too, Levi-Strauss was attentive to the teachings of these neurological dissociations (Levi-Strauss, 1992, p. 116 sqq., 1997, p. 130 sqq.)

experiments carried out with the help of microelectrodes implanted on the visual cortex of previously anaesthetized monkeys made it possible to highlight precise cerebral areas, known as V4, whose cells reacted especially to the color, but not to the wavelengths (whereas previous observations had shown that the cells of the area known as V1 reacted to the wavelengths but not to the color). After the publication of Zeki's article in 1973, interest in this question was renewed among neurologists and several cases of cerebral achromatopsias were described in the medical literature, which new brain imaging techniques made it possible to associate with lesions generally located in cortical areas analogous to the V4 areas of monkeys[14]. That's what allows Sacks to say that Mr. I's vision, like that of other cerebral achromatopsic subjects, was only the result of the functioning of the cells of the V1 area, sensitive to wavelengths, without further processing by the cells of the V4 area, which normally generate a coloured perception: "his brain damage had made him privy to, indeed trapped him within, a strange in between state – the uncanny world of VI – a world of anomalous and, so to speak, prechromatic sensation, which could not be categorized as either colored or colorless" (Sacks, 1995, p. 34). This quote from Sacks underlines the compatibility of his approach with that of Uexküll. Indeed, we can take from the latter the notion of *Umwelt* to say that, since Mr. I's brain had changed, his world (*Umwelt)* had also changed[15]. This compatibility still appears when Sacks observes that, about three years after his accident, Mr. I had adapted to his new world "and again found it coherent and complete" (ibid., p. 39)[16].

But this clinical example also allows us to underline the fruitfulness of the approach consisting in observing the consequences of different cerebral lesions in order to identify the principles or mental processes that account for the complex and heterogeneous constitution of the

[14] Zeki's experiments allowed him to observe that cells in an area adjacent to area V4 were especially responsive to movement. This observation was in turn corroborated by the description in 1983 of a case of "visual motion blindness" in a woman (Zihl, von Cramon and Mai, cited in Sacks, 1995). Zeki gave an overview of his work and results in Zeki, 1993. This book was recommended to me during a laboratory seminar by Olivier Sabouraud, a few months before his death in 2006. This note is therefore also intended as a tribute to him.

[15] In this article, it seemed convenient to use the words "environment" or "world" in a generic sense, similar to the word *Umwelt* in Uexküll. But we have proposed in another publication to distinguish "milieu", as the product of individuation, from "environment", designating the product of somasia (Le Bot, 2014b, p. 95).

[16] This reminds us of Uexküll's formula that "all animal subjects, from the simplest to the most complex, are inserted into their environments to the same degree of perfection" (Uexküll, 2010, p. 50). Formula that Berque connects philosophically to the conclusion of Plato's Timaeus where the latter describes the world as "most great and good and fair and perfect" (*megistos kai aristos kallistos te kai teleotatos*), what the tick, like any animal, could as well say of its world. But it is necessary to take into account, of course, the experience of loss and mourning, at the end of which this coherence and completeness can be reconstructed in the case of accidents such as the one that occurred to Mr. I. Of course, the way of going through these experiences is itself diverse and has its own conditioning.

Umwelten. In this particular case, the experiments and localization techniques associated with clinical observation, by showing that one component of vision can be lost without necessarily losing the others, by showing that color vision is distinct and independent of wavelength vision, made it possible to identify and isolate processes that in principle complement each other to produce a human being's normal vision. But this method of using dissociations produced by pathologies, with or without observable lesions, in order to theoretically dissociate mental functions is not only fruitful in the visual domain. More broadly, it makes it possible to identify each of the mental processes that reflect the complexity of the worlds, both animal and human. This is the method that was systematically implemented on the subject of language by linguist Jean Gagnepain, from the beginning of his collaboration with a neurologist, Olivier Sabouraud (Sabouraud and Gagnepain, 1963). It proved to be very heuristic in allowing them to construct an overall picture of human reason within the framework of what Gagnepain called the "theory of mediation" (Gagnepain, 1990 and 1991). Gagnepain and Sabouraud started from the distinction of two main types of aphasia: Broca's aphasia, which results from a lesion located in the frontal cortex, and Wernicke's aphasia, which results from a lesion of the temporo-parietal cortex. However, beyond anatomical considerations, it remained to understand and explain the specificity of these two aphasias. Roman Jakobson had proposed to account for the different verbal productions of Broca's and Wernicke's aphasics by the loss of different modalities of grammatical analysis (Jakobson, 1957). Wernicke's aphasics would have lost the ability to *select* or choose linguistic entities, according to a principle of similarity, whereas Broca's aphasics would have lost the ability to *combine* these entities, according to a principle of contiguity. These hypotheses put research on a promising path insofar as there is indeed something resembling a loss of selection process in Wernicke's aphasia and a loss of combination process in Broca's aphasia. They did not, however, make it possible to give a fully satisfactory account of the internal logic of these two large groups of aphasic productions. The work of Gagnepain and Sabouraud made it possible to refine Jakobson's model by explaining the verbal productions of Wernicke's aphasics by a loss of differentiation of seme identities and those of Broca's aphasics by a loss of segmentation of word units. But the work of Gagnepain and Sabouraud did not stop there. The observation of writing disorders sometimes associated with an aphasia but which can also exist alone allowed them to identify a tool capacity distinct and independent from the sign capacity affected by the various aphasias. They called atechnias these disorders of the capacity of tool, corresponding more or less to the ideatory apraxia of the neurologists. While they can be observed in writing, they affect in reality any tool-based behavior, from dressing to the use of cutlery (fork, knife, etc.), including knitting, screwing, nailing, etc. Any "making kit" can be used to test and highlight an atechnic disorder. This is the case for the paper-pencil set, the candle-matches-matchbox set, the screwdriver-board set, etc. For the linguist, the main lesson is that the sign, the mental capacity that presides over the grammaticality of statements, is distinct from the tool, which presides (among others) over

writing. The aphasias, alone, are language disorders, whereas the atechnias are disorders that can have an impact on language as it is written, but that do not affect language itself. Confrontation with psychiatric disorders (because the clinical method is not limited to neurological disorders) made it possible to identify two other sets of disorders that could affect language in an incidental way without being language disorders: psychotic disorders on the one hand, where what is in question is not language as such but communication, and neurotic disorders on the other, which, as Freud had seen, affect the regulation of the "drive energy" which, in "discourse", can be attached to words as well as to representations: words that become taboo, that one does not dare to pronounce, or words that arouse, that one pronounces with a particular emotion, etc.

We have limited ourselves, in the above paragraph, to the distinction of four major registers of human psychology: that of the sign and aphasic disorders, that of the tool and atechnic disorders, that of the person and psychotic disorders, that of the norm and neurotic disorders. But clinical observation allows us to understand in greater depth how each of these fields is structured. In the same way that there are different aphasias (the distinction between Wernicke's aphasia and Broca's aphasia being complicated by the existence of phonological aphasias, affecting the analysis by the signifier of distinctive features and phonemes, distinct from semiological aphasias, affecting the analysis by the signified of semes and words[17]), there are different atechnias, different psychoses (to which we can associate perversions – cf. Le Bot, 2013) and different neuroses. Their review will not be useful here. What is useful, however, is to observe that in the field of knowledge, aphasias, which are disorders of the sign, are distinct from agnosias, which are disorders of perception, which themselves are distinct from disorders like achromatopsia, which are disorders of sensation. This is where we can talk about three levels (in humans): 1° – a sensory level with its internal complexity (vision/audition, etc. but also, in the field of vision, wavelength/color, etc.), 2° – a perceptual level with another internal complexity (neurologists distinguish, for instance, visual and auditory agnosias) and 3° – a rational level with, again, an internal complexity (analysis of the signifier versus analysis of the signified, differential analysis versus segmental analysis). These levels are found in the field of action with the distinction of 1° – motor disorders, 2° – praxis disorders and 3° – tool disorders. They are also found in the field of emotions and behavior with 1° – pain aversion disorders ("pain asymbolia" or "analgognosia"), 2° – motivation disorders (abulia, loss of psychic self-activation) and mood disorders (bipolar disorders...), 3° – repression disorders, either by excess (inhibited behaviors of neuroses), or by default (disinhibited behaviors of the psychopathic type). All this is resumed in the following table:

[17] For a general presentation of this question of aphasia, one can refer to Sabouraud, 1995, as well as to the issue 19 of *Tétralogiques* (2012) entirely devoted to Hubert Guyard's work on language and aphasias.

Register	**Level 1** **"Primary" functions**	**Level 2** **"Gestaltic" functions**	**Level 3** **Rational faculties**
Knowledge	Sensation (sight, hearing, smell…) Disorders: peripheral or cerebral blindness, achromatopsia, etc.	Perception (gnosia) Disorders: agnosias	Sign Disorders: aphasias
Action	Motion Disorders: paralysis....	Praxia Disorders: apraxias	Tool Disorders: atechnias
Behavior	Affect (aversion to pain) Disorders: pain asymbolia....	Bulia (organization of affects into "drives" creating motivation) Motivation disorders (abulia, loss of psychic self-activation...) and some mood disorders (bipolar disorders)	Norm Disorders: neuroses, psychopathy, some disinhibitions due to brain damage (see Phineas Gage, described in Damasio, 1994)

This table gives an extremely schematic and simplified presentation of the lessons that can be drawn from the human clinic. This presentation is moreover incomplete, because within the limited scope of this article, we have chosen not to include the disorders of the person which would require a detailed discussion on their own (but one can refer to Le Bot, 2013, 2014a, 2014b). The inclusion of these disorders in the table would have required the addition of an extra line, which we could have called the condition register. As it stands, however, this presentation seems sufficient to shed light on the question of the heterogeneous constitution of the *Umwelten*. In its extreme schematism, it is sufficient to show that the human clinic makes it possible to distinguish independent registers (a disorder of one does not necessarily imply a disorder of the other) within which it is possible to distinguish levels which are also independent (an aphasia, for example, is independent of an agnosia, itself independent of a disorder of sensation, such as an achromatopsia)[18]. The heterogeneity and complexity of

[18] This does not exclude, for example in the case of important and extensive cerebral lesions, that several disorders, theoretically independent, are associated.

human worlds (which social and cultural anthropology helps to describe) result from the simultaneous and "unconscious" functioning (since we are not aware of what our brain is doing when we write a text or make a decision) of all these functions and faculties. But what can this human clinic tell us about the animal worlds that interested Uexküll?

Back to the animal worlds

Attempting to answer this question requires first making a complementary observation, related to the above table. To designate the different "levels", independently of the registers concerned, we have proposed the generic expressions of "primary" functions, "gestaltic" functions (a term proposed by Gagnepain in reference to the psychology of form or *Gestaltpsychology,* which has allowed for advances in the understanding of the processes of perception) and rational faculties. Of these three levels, only the first two appear to be common to humans and other animal species, at least in the most complex species. Everything seems to indicate that the third level, that of rational faculties, is specific to the human species. This is no longer in doubt in the register of knowledge, where, in spite of numerous experiments and observations, it has not been possible to demonstrate the equivalent, even in the great apes, of a sign capacity identical to that which exists in human species. This may seem more questionable in the register of action where many studies speak about animals using tools. But the problem here comes from a generally very vague definition of what can be called a "tool". Here again, the clinical approach allows us to gain in precision. In this approach, the question is that of the difference, classic in neurology since Liepman's pioneering work (1900), between ideomotor apraxia and ideatory apraxia. The first one concerns gestures such as the military salute or the sign of the cross. The tests intended to highlight it are composed of gestures of this type (such as crossing hands behind the back). The second is observed in gestures involving objects. But it is not so much the presence of the object that counts as the fact that the latter has a sort of "internal program". The screwdriver, for instance, includes a relatively complex program, as evidenced by the difference between the handle, which is used for gripping, and the shaft, the end of which is designed to fit a certain type of screw. The internal program of the screwing kit (the screwdriver and the screw) also includes the rotational movement that distinguishes this kit from the woodcarving kit (the wood chisel and the piece of wood). It is this "internal program" – which Uexküll, by cognocentrism, reduced to a "meaning" – which is no longer controlled in ideatory apraxia. People with ideatory apraxia do not have problems with grasping, they can also name objects and their use, but when it comes to the actual use, they may for example grab the screwdriver by the shaft without knowing what to do with it (Le Gall, 1998, p. 136) or they may no longer be able to distinguish between the screwdriver and the chisel (i.e. between their

respective internal programs)[19]. It is only in cases where there is an internal program controlled by the user that we will speak of a tool. In cases, on the other hand, where an object is used independently of any internal program, as when a young child pulls on the tablecloth to catch an object placed on it, we will speak of an instrument[20]. The use of instruments can be very skillful, but it does not transform instruments into tools. It is therefore not enough to show the undeniable skill of chimpanzees in the use of branches or stones to talk about tools in this case. It would also be necessary to show the mastery of an internal program in these "tools" as well as the possibility of distinguishing, in chimpanzees too, between apraxia (or "ideomotor" apraxia) and atechnia (or "ideatory" apraxia).

These reservations being made, the table above, even overly simplified, still has a heuristic value. It makes it possible to systematize observation by making hypotheses about what remains to be discovered, a bit like Mendeleev's table allowed to predict the existence and properties of certain elements before they were empirically isolated. It is indeed probable that the mental functions of animals, at least for the species closest to the human species, are not organized in a radically different way from the mental functions of humans[21]. Zeki's work, which we quoted above from their reading by Sacks, shows, for example, that the identification of two visual areas in macaques, area V1 which allows the vision of wavelengths and area V4 which allows the vision of colors, is consistent with what clinical observation also allows to dissociate in humans. Other observations point in this direction.

As early as 1964, in the treatise on animal psychiatry directed by Abel Brion and Henri Ey, carrying out a sort of assessment of knowledge on behavioral abnormalities consecutive to brain lesions (experimentally induced) in animal species other than the human species (generally rats, cats or various monkeys), Professor Georges Thinès, from the faculty of psychology at the University of Louvain (Belgium), dealt separately with sensory functions and motor behavior (Thinès, 1964). This distinction, which corresponds to what we have called the registers of knowledge and action, was already classic and well documented. A special section was also devoted to emotional behavior. The behavioral and anatomical observations which were reported in this book attest the independence of this register (that of behavior *stricto sensu* in our terminology). At the level of what we have called the "primary" functions, the difference and independence of these three registers (knowledge, action and behavior) seems therefore established.

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[19] This loss of control of the internal program should not be confused with the behavior of the hurried handyman who may sometimes use a screwdriver instead of a chisel for small jobs.

[20] See for instance Le Gall, 1998, Osiurak 2007, Osiurak et al., 2007, 2008a, 2008b, 2009, 2010, Jarry 2013, Jarry et al., 2013. See also their contribution in this issue of *Tétralogiques*.

[21] Let us precise that in speaking here of functions, we are referring to what we have called above "primary" functions and "gestaltic" functions, thus excluding rational faculties.

Nevertheless, we are probably very far from knowing precisely the exact modalities and modal extensions of each of these registers in all species, even at the level of "primary" functions[22]. The table therefore invites further exploration.

This is undoubtedly even more true at the level of what we have called the "gestaltic" functions. It is this level that makes it possible to account for intelligence and learning processes in animal species, as we tried to show in a previous article, based on the discussion of an experiment consisting in teaching a whole "vocabulary" to a border collie (Le Bot et al., 2012). In the register of action, Georges Thinès refers to Buytendijk's experience in the 1930s, which may suggest acquired apraxia. It shows that it is possible to create a lesion in the motor cortex of rats without causing a primary motor disorder (paralysis). Rats continue to "walk, run and even stand on their hind legs" (Thinès, 1964, p. 348). What is lost in this case, says Buytendijk, is the coordination of movements: "thus it is clear that the sensory-motor intelligence is reduced to a lower plane" (Buytendijk, quoted by Thinès, ibid.).

Other observations on the consequences of frontal lobe injuries in monkeys, show behaviors that could be explained by an alteration in emotivity (Thines, ibid, p. 349). But the author, based on a review of the literature available in the early 1960s, is cautious about these frontal lesions, "evaluated on the basis of behavior whose description is too vague or too general" (ibid., p. 350). From that time on, some authors, reasoning from the surgery of the frontal lobe in humans, were led to believe "that an adequate conception of the role played by [this] lobe must increasingly tend to consider certain mental functions as qualitatively independent" (ibid., p. 351). The works of the theory of mediation on the subject go in this direction, by distinguishing within the frontal syndromes 1° – those which affect the regulation of the drives (disinhibition, as in the case of Phineas Gage for instance – see Damasio, 1994, but also the cases of "loss of psychic auto-activation" described by Laplane, 1990) and 2° – those which affect what Sabouraud proposed to call the "social mediation" (Sabouraud, 1995). This provides at least one hypothesis on the basis of which it is possible to rethink the observations already accumulated. All we can say at this stage, based on Thinès' previous assessment, is that it has been observed that certain frontal lesions in animals affect emotional behavior, showing that the frontal lobe plays a role in the regulation (inhibition/ disinhibition) of "inferior" behaviors (such as aggressiveness) (Thinès, ibid, p. 340-341), while other lesions, still in animals, result in a disorganization of "the stability of certain habits", of "the perception of the temporal relationships of certain acquisitions" (ibid., p. 351) or of

[22] Uexküll used the term "modality" to refer to the different sub-domains (e. g. sight or hearing in the sensitive domain) and the expression "modal extension" to refer to their extent (e. g. audible frequency ranges, which can be very different from that of the human species).

the ability to orientate oneself in space (case of rats having suffered an experimental lesion of the frontal cortex which no longer manage to orient themselves in a labyrinth) (ibid., p. 352). The observations accumulated in the literature do not contradict our hypotheses, although it is obviously not possible to state, after such a brief examination, that they confirm them.

Conclusion

This article was intended only to be programmatic, indicating a method for identifying the mental functions constitutive of animal and human environments (*Umwelten*), based mainly on the observation of clinical dissociations. This method combines a "monism of causalities" (brain determinisms that are in all cases a matter of biology) and an attention to the internal complexity of mental universes, resulting from the combined action of independent functions, which makes it possible to underline the similarities or analogies between the animal and human worlds (similarities and analogies linked to the identification of similar or analogous functions) but also the differences. It does not reject the identification of "levels" (the sensory level must be distinguished from the perceptual level and, in humans, from the rational level), but avoids a somehow unidirectional scheme where all the constituent functions of the different worlds would be arranged on a single scale of levels. On the contrary, it is attentive to the independence of large registers between which it is not possible to establish a hierarchy. Only the logocentric and cognocentric bias that has characterized Western thought since the Greeks allowed to make knowledge something superior or more evolved than, for example, action or behavior. It is however more accurate to speak of different and independent registers, which function in parallel while at the same time overdetermining each other. Gagnepain's clinical anthropology thus finds a new application by allowing a renewed look at other species for a better description of the animal worlds. It can, in other words, facilitate the "foray" (*Spaziergang*) in the "bubble" (*Seifenblase*[23]) of each species.

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[23] These two words, *Spaziergang* and *Seifenblase* (literally "soap bubble"), are used several times by Uexküll in *Streifzüge*.

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