

# Jakob and Lorenz

## An Imaginary Conversation

*Jakob von Uexküll (1864-1944) was born, under Virgo, into an Estonian squire's family and, after basic Zoology, he researched physiology at the University of Heidelberg, and in Paris, and marine biology at Naples. He was Professor of Biology, Institute Director, and Zoo Director at the University of Hamburg for many years in later life. His important conceptual work was overshadowed by the force of experimental biology and positivism in science in his lifetime. He was a strong, square, man with a thick, bristling, moustache and heavy, dark, eyebrows, but his face was friendly and open and often wore a smile, particularly when speaking of his work.*

*Lorenz Oken (1779-1851), also known as Okenfuss, was born, under Leo, into a poor farming family in the Black Forest region, but became the most outspoken and prolific "romantic biologist" of his time and is also known as the "father" of the scientific congress or meeting. Many brief appointments at Göttingen, Jena, Munich and Erlangen marked by violent polemics were followed by a long period as Professor of Natural History at the new University of Zurich. Fine-boned and very handsome, with a stern, sharp chin and deep blue eyes, he was fierce in his espousal of many fundamental ideas in biology.*

*The scene is a resting-place beside a forest trail somewhere outside Heidelberg in Germany. It is a sunny afternoon in early summer. The time is the present. There are two wooden seats, close together, but their occupants cannot be seen.*

**Jakob** - My dear Professor Oken, do you like this place where I have brought you? It is beautiful, yes?

**Lorenz** - What is this . . . ?

**Jakob** - Well, it is bare compared with what it was. I remember it bustling with life. This is where I used to come when I was at the old University in Heidelberg, but, apparently, that was more than 100 years ago. So much has changed, but I sense that Nature's magic is here still.

**Lorenz** - (SHOUTING) What is this outrage . . . ?

**Jakob** - Keep calm, my friend. I read that you were fiery-natured. As a matter of fact, it was here, in this spot, that I first read your magnificent 'Elements of Physio-Philosophy', the principles you published in 1803. I am honoured, indeed, to meet you.

**Lorenz** - I require an explanation . . .

**Jakob** - It was the epitome of Biology in your time. So much had changed by the time I wrote my own 'Theoretical Biology', a hundred years further on. I suspect we had forgotten much of what you said - there was so much new knowledge, in Physiology, especially - but I have the feeling that your foundation stones remained largely intact.

**Lorenz** - Mein Gott! I should hope so! But I am disorientated and confused. It

seems that I am speaking with a scientist from a century after my lifetime and that we are now in a time beyond even your experience, but what is the meaning of it - and who are you, indeed?

**Jakob** - How it happened I won't question now, because I am excited to meet you. I am Jakob von Uexküll. Like you, I devoted my life to Biology. I caught specimens here in this forest. The smell of damp earth rekindles the excitement. Mostly, I walked here - strolled through the worlds of animals and plants - and made my observations, from which I prepared my papers about those living worlds. One can partake in Biology here. And in you, Herr Professor, I recognise a kindred spirit.

**Lorenz** - But are you of the Naturphilosophie? Should I be familiar with your work, as you seem to know of mine?

**Jakob** - I had thought we might have access to all knowledge, across the history of Science, but alas, I see that is not so. I find we must still speak strictly from within our own worlds, knowing only what we have each experienced (or said) in our respective lifetimes and saying only our own reflections on that now.

**Lorenz** - Well, of course, Professor - are you so dumb-witted as to question it? That is the very nature of our Physio-Philosophy - which is also called Biology. I am surprised that a thinker on Life would not know this.

**Jakob** - I had thought that perhaps our words might have become part of a more universal knowledge since we lived . .

**Lorenz** - But they are only our words, are they not? You see, I stated it clearly in my time: our Philosophy is only a logical conception, although it may perhaps conduct us toward the real conception, of the world. It is not reality itself.

**Jakob** - Perhaps in your day, Herr Professor, but we often say that our science has come much closer to reality, today. We have so many instruments and techniques which you lacked. Still, I must confess that my understanding of the Umwelt - the self-world of living things - compels me to believe in other than our so-called scientific reality.

**Lorenz** - Herr Doctor, you offend my sensibilities on this matter! It is nothing to do with your observations and experiments that there is other than our material world. This I have explained very carefully, and if you will now listen, I will show why I define it thus: There is something we call Spirit, which is the notion of mathematical ideas, and something we call Nature, which is their actual manifestation in life. The Philosophy of the Spirit represents the movements of ideas in consciousness, while the Philosophy of Nature deals with the phenomena we observe which are the manifestations of those ideas. So the world consists of two parts: one apparent, real, or material; and one non-apparent, ideal, or spiritual, in which the material is not present. Accordingly, there are two divisions of Philosophy: Pneumato- and Physio-Philosophy.

**Jakob** - In what you call Physio-Philosophy, Herr Professor, can we then ignore the spiritual aspect?

**Lorenz** - Mein Gott! No! Indeed, we cannot! If it is to succeed at all, Physio-Philosophy will have to show how the material took its origin, or how something derived from nothing, which is the generative history of the world. It also has to show that the laws of Spirit are not different from the laws of Nature; that they are transcripts or likenesses of each other. This is absolutely

fundamental - to demonstrate the parallelism that exists between the activities of Nature and the Spirit. Physio-Philosophy may be called the conversion of Spirit into Nature. The substance of Physio-Philosophy must be of one kind with the form of Mathematics.

**Jakob** - Yes . .

**Lorenz** - Indeed, the definition of Biology follows from this: Physio-Philosophy is divisible, therefore, into three parts. The first of these treats spiritual matters; the second, the individual phenomena, or things in the world; the third, the continuous operation of the spirit in the individual things. The first division is the doctrine of the Whole (de Toto) - or Mathesis. The second, that of the Singulars (de Entibus) - or Ontology. The third, that of the Whole in the Singulars (de Toto in Entibus) - Biology. The Whole in the Singulars is the living or organic, which then can be divided into the plants and animals and so on.

**Jakob** - Ah yes, yes, yes! The Whole in the Singulars - it is a beautiful idea and one which, I believe, underpins my own study of living things. But, we do not express it in these terms. The connection with mathematics is implicit in our explanations, but we do not speak in such a mystical way about it.

**Lorenz** - I would not call it mystical - this is the Philosophy which is the pinnacle of our thought, based on the words of our great compatriots, Hegel and Schelling. To understand it we must begin with the Whole (the Mathesis). The highest Mathematical idea is the zero which is, in itself, nothing.

Everything which belongs to Mathematics can be derived from no other source than zero or nothing. In order to practise this Mathematics, to see it manifest, we must create, through propositions which subdivide this highest principle into details, something out of nothing. The first act towards this realisation (the becoming of something) is the creation of the Many. Nature can only manifest itself in multiplicity. That which belongs to the Many is definite, finite and limited. The Singulars, or details, reside in an ideal, not a real, manner in the zero; they are not actual, only potential. The real and ideal are one and the same, but exist under different forms. The ideal is the same under an indefinite, eternal, single form, while the real is the same under the form of quantity and multiplicity. Zero is not real, but only ideal. It is infinite intensity while numbers are infinite extensity. The latter is only expanded intensity; the former is concentrated extensity. Numbers are identical with zero in that they are zero in a state of extension; just as zero represents the numbers in a state of intensity.

**Jakob** - Yes, but the importance which you place on numbers, as principles out of which natural laws have arisen, reminds me of the thinking of Pythagoras, to whom numbers were something of a religion, in the sixth century BC.

**Lorenz** - No, there is nothing mystical about particular numbers. I speak of a Philosophical conception through which the way that the real arises from the ideal can be expressed. Realisation is not the origin of something that has not previously been, it is only a manifestation or a process of extension taking place in the ideal. Zero has emerged out of itself and become apparent. The real has not merely arisen out of the ideal, it is the ideal in a condition of definition and limitation. Therefore, there is a sense in which everything is identical. This identity of all manifolds, amongst themselves and with the highest unity, is the essence of things, whereas their limitation and definition

is their form. Limitation is what creates form, but it is, itself, an ideal relation. All Singulars are united through their essence with the Whole and their diversity resides merely in their form, limitation or manifestation.

**Jakob** - I see a contrapuntal, or a complementary . .

**Lorenz** - Numbers are different forms of one unchanging essence. The ideal zero is the absolute unity; not one individual thing as the number one, but a unity without distinction. It is eternal; it succumbs to no definition of time and space; it is neither finite nor infinite, large nor small; it is and it isn't all things - this is the concept of eternity. As Mathematics possesses this eternal principle, so must Nature possess it and be a manifestation of it. There is a certain connection with that aspect of Pythagorean cosmology in which the Limited and the Unlimited were regarded as the two primordial principles which combined to produce the One. But there the similarity ends.

**Jakob** - What about your notion of form? It seems that this may also differ from the Platonic idea of an eternal form which is reflected in Nature.

**Lorenz** - Yes, it does. I do not refer to form in a transcendent sense, but to something which is immanent in the manifest Nature; it has more in common with the way Plato's student, Aristotle, referred to the Soul. The first form of manifestation is the plus and minus which affirm and deny, respectively. All realisation is based on positing and negating which is an act or function; a ceaseless process of doing (acting or performing). The form which plus and minus create takes its substance from the zero. Once affirmed it becomes one. One and zero are identical, the only difference is that one has been affirmed. Nothing, once posited, is one. Zero must be endlessly positing itself because it is unlimited, eternal, and it is an act. The business of Mathematics is the endless repetition of positing and negating nothing.

**Jakob** - It still has a quaint air of mystery about it to me. I suppose that your notions of affirming and denying could be equated in my Biology to stimulation and suppression; excitation and inhibition. Are we still talking about the Whole in the Singulars?

**Lorenz** - Yes. I will complete my proof. The zero is an eternal act and the numbers are repetitions of this act. These two tendencies are present in the primary act, striving into binary antagonism, the plus and minus, affirming and denying. The positing and posited act are of one kind - though one is ideal and one is real. And the act of positing is also an act of negation. The being is therefore a self-manifestation. It is a two-fold act: a manifestation, but a manifestation of itself. Arising out of nothing, it must return to nothing also. The complete principle of Mathematics consists of these three ideas: the primary principle (0), resolving itself into two (+ and -), each resembling the other in essence, but differing in form. It is one and the same essence under three forms, the three-in-one, or Trinity.

**Jakob** - Aha! Now I see the threads of the Christian-Aristotelian synthesis - that which Thomas Aquinas and others wove so tightly in mediaeval times. What is most interesting is that the subsequent great surge of mechanical science in the Renaissance, which I think revived the Pythagorean and Platonic traditions, does not seem to have influenced your Biology much at all. Your thinking seems to me to epitomise what is not mechanical about the living organism.

**Lorenz** - It is not mechanical, like Kepler's mathematical vision of the Universe, nor sharply divided between the spiritual, human mind and non-

spiritual, animal body, as Descartes has said, but it is in accord with the Holy Trinity, that is true. As it is given in the complete principle of Mathematics, so it is in Nature also. Every singular has arisen out of the trinity and contains the qualities of the three-in-one. Being is an act, and of a threefold nature.

**Jakob** - I see the Naturphilosophie developed by Frederick Schelling come through very . . .

**Lorenz** - (IRRITABLY) Yes, it is like the Naturphilosophie of Schelling - that was a foundation of my work - but, first Fittke's Doctrine of Science, which preceded him, and then myself, made this into a Biology - I wrote more on this and did more to define this clearly than any other man!

**Jakob** - Yes, that is granted. Please continue.

**Lorenz** - There are three forms of action: rest, motion and expansion. Rest is the Spiritual, which declares itself in everything and yet always remains the same. Motion is the ceaseless repetition of the primary act, out of which emerges Time. Time is no stationary quantity, nor a continuous stream, it is a universal property of things which arises, as the things themselves do, from the repetition of the primary act. There are no moments of time without the suppression of these positions; no single force, but only the polarity of the essence. Every single thing is a duplicity. The law of causality, which is the generative act, and valid only in time, is the law of polarity. All motion has originated from polarity; it is the succession of polarities.

**Jakob** - I think the so-called Laws of Motion, which Isaac Newton expounded more than a century before your work began, may have been intended more in this direction than as the basis of the mechanical view of science which they have now come to represent.

**Lorenz** - That is true. Newton's grand synthesis of the movement of worlds and the things in the world - what an elegant and powerful Philosophy it is - his principle of the gravitational force, was clearly known by him to be an "aspect of God." This had been overlooked already in my time. (MORE SLOWLY) Motion has emerged from the Eternal and the primary motion is circular. Space is not different in essence from time; they are the one kind of quality, the point being the geometric equivalent of the arithmetical (or temporal) zero. Space is everywhere as time is ever, but the eternity of space depends, not on duration, but on extension or expansion, which is the third form of action which I mentioned. (AFTER A LONG PAUSE) The motion of finite things by polarity may, in a wider sense, be called life; for life is equivalent to circular motion. Polarity produces a constant retrogression into itself. Without life, individual things retreat into the absolute. (A PAUSE) Every living thing is twofold in character; it is one persistent in itself and one immersed in the Universe. Nothing individual can persist eternally, but it must eternally move itself, striving to become itself the Universe. A natural thing is nothing but self-moving and its motion is circular. Do you see? Man is a twofold being, compounded of freedom and necessity. Man is free in his manifestation, but not in his end or object to be obtained. That is a necessity borne out of the nature of the living.

**Jakob** - Are you talking about a purpose in the process of living? This is an area which has caused great difficulty in Biology.

**Lorenz** - Yes, at great length we discussed this when I was at Jena - with Goethe himself and the others. It was one issue on which I didn't quarrel with Goethe.

**Jakob** - I know that Aristotle took pains to consider four different kinds of causality, the final, or teleological, cause being the goal toward which the process is directed. However, I have found that we must make a clear distinction between what we are doing when we are attributing purposive behaviour to an organism and what we are doing when we are discerning the governing plan of Nature.

**Lorenz** - Perhaps you are right. The direction lies in the way we represent the nature of life itself. An individual (total, self-included) body, excited and moved by itself, is what can be defined as Organism. The self-excitation of the individual elements of which I have been speaking is what is defined as life. Life is not different from organism, for life is the vital or organic process. Organisms are the products of ceaseless polarisation. Only the world-organism is eternal and devoid of change - except in its polarisation. No individual organism is eternal, because it is only a changing of poles. There is no constancy in the individualities; only change is persistent.

**Jakob** - There is only the constancy in change. Claude Bernard, who came to prominence soon after yourself, was famous for having said that the constancy of the milieu interieur was the essential condition of life. Professor Bernard mentions your work, along with that of Goethe and Darwin, in his writing.

**Lorenz** - Yes, this is important. Organisms are a synthesis of minute changes. Therefore, the theory of generation is synthetical and epigenetic, not analytic. Generation is successive formation. As the process of motion is the phenomenon common to the fundamental organic processes, so is the whole organism characterised by it. The essence of the organic depends on its automatic or self-motion. Self-motion is the only, but essential and ultimate, distinction between the organic and the inorganic. All other distinctions that have been advanced do not suffice because they do not comprehend the totality of the organism, nor the three fundamental processes in one phenomenon.

**Jakob** - But what about the organism's responsiveness to its surrounding world?

**Lorenz** - The ability of organic bodies to apprehend polar excitation and to move themselves simply by its means, is what we call irritability. Irritability depends entirely on sensation and there are many different kinds of sensations. In animals there is a tegumentary sense, an intestinal sense, a pulmonary sense, and olfactory, auditory and visual senses which are the nervous senses. There is also the sensation of self; in fact, the animal is a Whole in Singulars only through the feeling of self. In sensing self, the animal senses its relationship with Nature, from which it is distinguished only by the process of being in constant severance or liberation from it; while this severance requires a constant conversion of the Nature into the animal. This constant seeking of the assimilation of Nature unto itself, in order to maintain itself, is known as excitation. When the self-motion is added to this excitation, this is the irritability. Thus, there originates a double polarity in the animal: one between the world and the animal, which gives the feeling of sensation; and one between the exterior of the animal and its interior, which gives the motion. In the sensation, the animal transcends itself; in the motion, the animal remains within itself; but the self-sensation proceeds from both conditions. In the self-sensation, the world and the world-within-the-animal come together. The animal is itself the Universe and, at the same time, comprehends the Universe.

In feeling, it turns itself toward the world in order to adopt this spiritually into, or repel it from, itself; in motion, it turns itself toward the world in order to materially adopt or repel it. In both cases, it turns itself toward itself. This is the essence of what is the animal in a living body.

**Jakob** - Nowadays, many Biologists speak of instinct and innate behaviour patterns and attempt to explain the mechanisms which these entail. I believe that this talk is a product of our perplexity in that many cannot accept the nature of this plan of which you speak. When I observe the recurrence of patterns of behaviour, or the magical way in which a bird has found its way across the world, I reflect on this cyclic self-motion to which you refer; it is like an inbuilt melody that keeps time with its world plan.

**Lorenz** - The animal periodicity and the world periodicity are closely linked. A special form of co-vibrating is what constitutes hearing. Melody has been written in sound to represent the retrogression of the formed world into the primary world; through melody, the spirit of the world is revealed. It is the voice of the Universe, proclaiming its innermost essence. That which melodises proclaims its spirit; as you say, the melody of animals displays their internal law. The musical system of all animals is speech. Through speech, man is able to delineate himself in spiritual outlines or sketches which, devoid of material covering, lie purely before the sensation.

**Jakob** - What we are doing here is essentially an act of self-expression in our language; a sharing of our individual worlds by means of the music of our conversation.

**Lorenz** - When conversing, man is a self-manifestation unto himself whereas, prior to speech, self-consciousness could not exist. Through speech, man appears as double essence; which is to say that manifestation is only possible through self-manifestation; through a doubling of itself, or through its expression. With speech, man creates unto himself his world. Without speech, there is no world. Through speech, man becomes acquainted with, or learns to know, himself; through it he becomes a self-substantial essence which creates for itself its world and recognises itself; in other words, which speaks. Words which are connected together according to organic laws form an organic system, are at once alive, and therefore have a meaning. Speech originates gradually just like the growth of the organism.

**Jakob** - Thus, we see its development in the human infant and throughout evolutionary time.

**Lorenz** - Indeed. And this is how we can speak with certainty of what we, ourselves, are. It is fundamental to our speaking of any matter in Biology.

**Jakob** - There is much in your Philosophy which has influenced my thinking, Herr Professor. I have long reflected on how little we know about the worlds in which all other kinds of animals must live. The way I think of it is to imagine a soap bubble around each different creature to represent its particular world, filled with the perceptions which it alone knows. We would find, on entering this world, that many colourful features of our world have disappeared, while others have formed different relationships. It is a new world which I have called the self-world of the animal. I regret to say that, to many in Science, today, it remains invisible.

**Lorenz** - Why is this? Please tell me about the attitudes of Biologists in your time? Are they still as argumentative as ever, yes?

**Jakob** - Ah! Perhaps. It is because the mechanists have pieced together the

sensory and motor organs of animals like parts of a machine, ignoring the way they are held together in their functions of perceiving and acting. I say that all that a subject perceives (his perceptual world) and all that he does (his effector world) together form a closed unit, which is the Umwelt. The Physiologist investigates the workings of living things as if they were objects in a human world, whereas the true Biologist sees each individual as a subject, living in a world of its own, which is not composed of separate objects, but of its own relationship with them. It is more like the engineer than the machine. No part of the organism has the nature of a machine; everywhere operators are at work.

**Lorenz** - Of course! Could this be in dispute?

**Jakob** - There is, in Science, a movement towards objectivism and positivism, I think it is called, but - ah! I have despaired at times. I reject this as fervently as I reject idealistic subjectivism which is metaphysics. I see that object and subject are not separate, but contrapuntal. They exist in mutuality - define themselves in one another. Let me be more specific. You see, each animal has perceptual or receptor signs and impulses or effector signs which are specific to it. The separate receptor signs, or sensations, unite into perceptual cues which constitute the attributes of external objects and are the real basis for our actions; for example, the sensation of blue becomes the blueness of the sky. Similarly, the isolated impulses are combined into a smooth action as what I call the effector cues. So it is as if every animal grasps its objects in two arms of a pincer: one investing the object with perceptual meaning and the other providing operational meaning. Thus, the effector meaning will extinguish the receptor meaning. The subject and object are dovetailed into one another to form a systematic whole. This is the first principle of Umwelt theory; and it means that all animals are fitted into their unique worlds with equal completeness.

**Lorenz** - I am beginning to see why you called me a Romantic Biologist - if your contemporaries have difficulty with this understanding of the whole organism in its world.

**Jakob** - Ah, yes. You know, I have studied the simple bush tick, which may fall or brush onto our bodies here in this forest. For a very simple animal like this, I can describe her life history and show that all the world around her has been shrunk to the scanty framework of just three receptor cues and three effector cues - which is her Umwelt. It is like this: After mating, the young female lives on the tip of a twig or bush at such a height that she can either drop onto, or be brushed off by, any warm-blooded animal which passes. The approaching prey is revealed to this blind and deaf highwaywoman by its smell of butyric acid; no other stimulus affects her. Then, reaching its hairy surface, the smell cue is extinguished and a tactile cue determines that she moves quickly towards the skin. Finally, the heat of the skin elicits a burrowing action and she obtains the blood without which her life cycle could not have been completed. Careful experiments have shown that these three receptor cues and three effector cues are necessary and sufficient for the survival of the tick. The very poverty of this world is what guarantees the unfailing certainty of her actions; and security is more important than wealth, would you agree!

**Lorenz** - Ha! Yes. Tell me, this raises questions about the perception of time and space. Have your Biologists also lost their way regarding space and time?

**Jakob** - There have been great developments, by Einstein and others, concerning the relativity of space and time, but Biology is currently unaffected by this. The point I make is that, without a living subject, there can be neither space nor time. Only by acknowledging this does Biology begin to establish its true connection with the doctrine of Immanuel Kant. Like you, I take from Kant - or more particularly from your own mentor, Schelling - the prime value of the Naturphilosophie in our thinking. We are so easily deluded into believing there is only one world and therefore only one space and time for all living things. We can only really consider the Umwelt of an animal in relation to our own world. But even our own functional concept of space can be divided into different categories - such as operational space, tactile space and visual space. Animals which have semi-circular canals like us appear to live in a three-dimensional operational space where we are always aware of a coordinate system in three planes; we know which direction is which. The antennae of insects seems to act as a compass in operational space, too. For most nocturnal animals, like rats and cats, local signs perceived through tactile hairs seem to be more important than directional signs in their perception of space. It is interesting that in visual space, unlike tactile space, the size of an object is variable. This space is surrounded by an impenetrable wall called the horizon, or farthest plane, which varies greatly for different animals. This is like the soap bubble, enclosing the individual world of each living thing.

**Lorenz** - And what of time?

**Jakob** - Time is also the product of the subject. A man whose writings influenced me greatly in my early years, Karl Ernst von Baer - no doubt you know of him, at least as the discoverer of the mammalian egg - has made this very clear. In 1860, already he had shown that time is not what we would call objective, nor subjective; it is a biological property. The humble tick of which we spoke has (to us) an extraordinary metabolism which fits it for long waiting in the forest for its host to arrive. It survives without food for at least 18 years, this being a particular moment in time for that animal. Our time is made up of a series of moments, these being the briefest time units in which the world stands still for us. This can easily be measured. For example, we have found that the human moment is 1/18 of a second because pictures, sounds or taps to the skin can only be discriminated if applied more slowly than this rate. Now, in a snail's world, a rod that oscillates four times per second will be treated as stationary, indicating that the receptor time of the snail has a tempo of three to four moments per second. Therefore, all motor processes in the snail's world occur much faster than ours and its own motions would seem no slower to the snail than ours do to us. And the moment for a fighting fish is three times shorter than our own - and so on. Space and time per se are of no immediate use to the subject. They simply provide the temporal and spatial framework within which the receptor cues can be distinguished. The most simple animals - such as a Paramecium - with a single receptor and effector cue, have no need for this framework. Even in the reflex behaviour of a sea urchin there is no need for a relationship between individual perceptual cues. In higher perceptual worlds, form and motion appear as perceptual cues. We tend to think of form as the more important and motion as secondary, but for many birds and marine creatures, a stationary object is invisible and motion is the only cue. The simplest organism which appears to distinguish broken from unbroken form is the bee.

**Lorenz** - In your comparative studies of many different beings, you have much cause to consider this matter of their particular goal or plan, of which you spoke before.

**Jakob** - Since we humans are accustomed to labour from one goal to the next, we tend to think that animals live in the same fashion. This fallacy has led our research astray. Many experiments with animals demonstrate that actions directed towards a goal do not occur at all. The same sensory cue can produce consistently different behaviour in different animals. Fabre observed male moths swarming onto a paper where a female had left her scent, ignoring the presence of the female herself under a glass bell nearby. Reflecting on this we may certainly discern a governing plan, but, as I said before, the plan of nature is something quite different from purposive behaviour in an organism. We may not know the precise nature of the plan in every detail, but the idea of a plan is simple: a plan will not hammer a nail into the wall, nor will swinging a hammer do so, without a plan.

**Lorenz** - Well, then, how do you explain the fact that the same receptor signs appear to result in quite different behaviours?

**Jakob** - Well, it is because the perceptual image furnished by the sense organs is modified by a functional image according to the action which it elicits. For example, a dog that has been trained to jump up on a chair and sit will still do so on command if there is another object on which it can sit, such as a box - something which has the same functional tone. We often do not know how to use particular tools until we are shown the effector or functional tone. In the same room there could be a huge variety of objects with different "colours" for a human, but not so many for a dog and fewer still for a humble fly - because their range of functional tones is limited.. The best way to find out that no two Umwelten are the same is if I were to take you along this path - here in the forest - which is very familiar to me, but which you have never seen before. There are a thousand spatial cues for me which you do not notice. I might describe it to you: walk between the big trees, follow the rocky ledge, turn left and so on. Many animals can be seen to show a strong preference for their familiar path. But this is not a property of the path, of course, it is a property of the animal.

**Lorenz** - It has been observed that many animals recognise a certain area as their own particular domain, also.

**Jakob** - Yes, the matter of home and territory is similar to this. Observations of territoriality show how vital it is to behaviour, but the closest scrutiny of the environment itself often provides not the slightest clue to its existence. Some animals mark their territory, but this is only with respect to other animals with which their lives are closely related.

**Lorenz** - Yes, it is apparent to me that the relations between living things depend entirely on their perceptions.

**Jakob** - Some animals bond with others as their inseparable companions. A beautiful example of this was young Konrad Lorenz and the jackdaw called Jock who appeared to want Konrad to fly with him (amongst other things!). Clearly, there is no uniform perceptual image for a companion in the jackdaw's world; nor could there be, since the role of the companion changes all the time. There are a great many other examples. For many animals it could be that the line between different living creatures is drawn differently according to personal experience; that the functional image is more important

than the perceptual.

**Lorenz** - There is also what we might call the world of imagination. What about this?

**Jakob** - Yes, this has interested me greatly. One way of looking at it is that there can also be a search image or search tone. Sometimes, we simply cannot see things that are right in front of us and we also see things which are not really there. Dogs, in particular, appear to have such images, for example, when they are asked to find a stick or a bird which is not immediately visible to them. The Umwelten are built up by the animals themselves and filled with the objects of their perception. While many can be attributed to recognisable receptor signs, such examples as the familiar path, home territory and the search image cannot be explained in this way. We might call these magical worlds; the way a dog perceives its master, for example, is difficult to analyse simply into cause and effect. Where animals carry out a typical behaviour in the absence of obvious stimuli or follow an, apparently innate, familiar path - for example, insect larvae or migratory birds - we would still say that the familiar path has become manifest in that animal's Umwelt, but instead of the receptor and effector signs succeeding one another, they have occurred together, in some magical way. There exists an invisible bond between them like the connections which sound in some inborn melody. The farther I progress in my study of Umwelten, the more convinced I am that effective factors occur in them, to which no objective reality can be ascribed. They are the subject's manifestations; this alone makes them into real objects; their object qualities are the product of their bearers only. I would say that whoever denies the existence of subjective realities has not yet recognised the foundations of his own Umwelt.

**Lorenz** - Yes, it is as I said before regarding speech. In this manner, we produce our particular reality. It is your world and mine which have been established and blended together in this meeting and this occurred by our speaking.

**Jakob** - You know, it fascinates me, that the relationships between different Umwelten - and the same subject considered as an object in another Umwelten - are vast unknowns awaiting conceptual formulation. There was an oak tree in my garden which was involved, in different ways, in the Umwelt of some ants, beetles, foxes, squirrels, owls, the woodcutter who wanted to remove it and the little girl who saw the faces in its bark. Should we attempt to epitomise all the contradictory properties which the oak tree as an object displays, only chaos would result. And yet they are all parts of a subject firmly structured in itself, harbouring all these Umwelten, which are not comprehended or discernible to the builders of the Umwelten themselves. So, too, in comparing the Umwelten of different Scientists. The Astronomer, with transformed eyes, sees circling planets and stars; the Chemist reads nature with his elements; the Physicist visualises constellations of particles or sees waves in light - which to the Physiologist become colours with different laws of their own; or waves in sound - which to the Musician become tones. In the Behaviourist's Umwelt, the body produces the mind; in the Psychologist's world, the mind builds the body.

**Lorenz** - Your world has become even more complex than mine. However, there are many things about this attitude which I do not particularly like.

**Jakob** - To combine all these as objective qualities would bring chaos, as I

said. (QUIETLY) And yet all are harboured and borne by the One that remains forever barred to all Umwelten - eternally beyond the reach of knowledge, the subject itself - Nature.

**Lorenz** - (CALM NOW) It must be so in order for the Spirit and its Biological manifestation to be completely in accord.

**Jakob** - Because, in the end, we simply cannot know it all, just as we cannot know how we have been able to spend this time together, today, when our living, seemingly, ended long ago.

**Lorenz** - You and I may not be living, now, but there could be something living in our conversation.

*The sun has now set behind the forest. The two wooden chairs are empty.*

*Where possible, the scientific content of this dialogue between Lorenz Oken and Jakob von Uexküll consists of their own words, taken from the principal sources below, but references to other people and connecting threads in the conversation have been added.*

OKEN L. (1847) Elements of Physio-Philosophy. Trans. A. Tulk. Printed for the Ray Society, London.

VON UEXKÜLL J. (1934) A Stroll Through the Worlds of Animals and Men - A picture book of invisible worlds. Trans. By C. Schiller in Instinctive Behaviour (1957) International Universities Press, New York.