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Time Scales of Observation and Ontological Levels of Reality

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Abstract My goal is to conceive how the reality would look like for hypothetical creatures that supposedly perceive on time scales much faster or much slower than that of us humans. To attain the goal, I propose modelling in two steps. At step one, we have to single out a unified parameter that sets time scale of perception. Changing substantially the value of the parameter would mean changing scale. I argue that the required parameter is duration of discrete perceptive frames, or snapshots, whose sequencing constitutes perceptive process. I show that different standard durations of perceptive frames is the ground for differences in perceptive time scales of various animals. Abnormally changed duration of perceptive frames is the cause of the effect of distorted subjective time observed by humans under some conditions. Now comes step two of the modelling. By inserting some arbitrary duration of a perceptive frame, we set a hypothetical scale and thus emulate a viewpoint for virtual observation of the reality in a wider or narrower angle of embracing events in time. Like changing lenses of a microscope, viewing reality in different temporal scales makes certain features of reality manifested, others veiled. These are, in particular, features of life. If we observe an object in an inappropriate interval, we may not notice the very essence of a process it is undergoing.

Keywords Bergson · Biological species · Cosmology · Event · High-speed and time-lapse cinematography · Levels · Mental experiment · Perception of time · Psilocybin · Psychedelics · Quantum · Subjective time · Time scales · Virtual observation

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1 Perceptive Frame

My study is driven by the following question: What shall we see if we view reality in other temporal scales—other than the normal temporal scale in which human perception is performed? ('See' and 'view' in the sentence are words metaphorically denominating any form of cognition, not being limited to vision). In considering this question, I draw upon the conception of *Lebenswelt* (German, meaning lifeworld). Estonian zoologist J. von *Ü*exküll created the conception of *Lebenswelt* in the 1930s, having forestalled modern theory of embodied embedded cognition. Different kinds of living beings inhabit their own *Lebenswelten*, in which the subjective factors and the external conditions are mutually ground. Faster or slower tempo of living and perceiving is one of the parameters that shape the entire *Lebenswelt* of a living being. The other parameters include the body size and a space niche a living being inhabits, the concrete set of senses and relative importance and spectrum of each sense, predominant physical forces shaping the body structure and the locomotion scheme. Out of these, I focus in this article on the parameter of temporality.

The key idea underlying my further discussion is that incoming perceptive data in the brain are processed in the discrete mode. There is a flow of discrete perceptive frames, or snapshots, with a specific standard duration of a frame. H. Bergson was first to envisage the existence of such a mechanism:

> We take snapshots, as it were, of the passing reality. […] Perception, intellection, language so proceed in general. Whether we would think becoming, or express it, or even perceive it, we hardly do anything else than set going a kind of cinematograph inside us. We may therefore sum up what we have been saying in the conclusion that the mechanism of our ordinary knowledge is of a cinematographical kind. (Bergson 1913).

F. J. Varela showed on an experimental basis in the 1980s and the beginning of the 1990s that there is a real neurophysiological structure that corresponds to the elementary act of visual perception. He called it frame. According to Varela, frame is formed by a spatially distributed, but temporally synchronized constellation of a large number of neurons. Frame is a structure formed by synchronicity in time, not by localization in space. "The neuronal synchronization hypothesis postulates that it is the precise coincidence of the firing of the cells that brings about unity in mental-cognitive experience." (Varela 1999, p. 275). In a sense, the neurophysiological frame resembles the movie frame. Frame is a discrete unit within which nothing happens, in terms of the whole process; everything happens only in the sequence of frames.

Although Varela based his conception only on the experiments with visual perception, he did assert that the conception of temporal frames is applicable to other modes of perception and probably to all cognitive activity. "For every cognitive act, there is a singular, specific cell assembly that underlies its emergence and operation. […] Cognitive act from perceptuo-motor behavior to human reasoning." (Varela 1999, pp. 274–275). Generalizing Varela's conception even

further, I would suggest that discreteness is an essential and inalienable property of cognitive process as such.

Alpha rhythm in the human brain (8–13 Hz) can be identified with the flow of visual perception frames. Thus, the time span of about 0.1 s corresponds roughly to the normal duration of each visual frame. The discerning ability of hearing is about ten times finer than that of vision: 0.01 s instead of 0.1 s. The fineness of hearing is determined by the brain's need to compute time disparities of signals coming from two ears in order to spatially localize the source of sound.

Along with the Varela's model, there exist some other models of perceptual framing in the brain. The model of resynchronization of desynchronized fragments of the incoming perceptive data related to one and the same external object with the help of perceptual framing was elaborated by S. Grossberg and associates in the 1990s (Grossberg and Grunewald 1997). E. Pöppel and E. Ruhnau explained the mechanism through which the correlation and integration of streams of visual and auditory information is accomplished. Their explanation rested on their conception of atemporal zones, or windows of simultaneity, similar to Varela's conception of frame as a 'perceptive time quantum' (Ruhnau and Pöppel 1991; Pöppel 1997).

I believe that the temporal frames conception can explain the neurophysiological mechanism by which the normal speed of perception is maintained, and how deviations from the normal speed occur. My central explanative assertion is that the speed-up perception corresponds to a shorter duration of each frame, and thus to a speedier flow of perceptive frames. The shorter each frame duration, the finer the perceptive temporal grain, so the better external signals are discerned and are more quickly reacted to. The longer the frame duration, the coarser the discerning ability for the signals closely placed in time, the slower the reaction.

The duration of a frame, characteristic to particular animal species, is a stable value only in average, as a mean norm. A frame is not stiff in its duration, and can get adjusted to features of the perceived world. Evidence for that is found in the photic driving effect in electroencephalography. Stimulation by repetitive light flashes with a frequency in the range from 5 to 30 per second causes rhythmical activity of the same frequency in the back areas of the brain, responsible for vision. That means that the brain tries to adjust its discerning ability to the incoming stimulus.

I come up with the two theses that will be explicated and supported by experimental data in the next sections. (1) Different normal durations of perceptive frames and so different normal tempos of the frames flow are inherent to various animal species, calibrating their perceptive time scales. (2) Accelerated subjective time or accelerated perception with humans result from abnormally accelerated tempo of neuronal frames flow in the brain.

2 Varying Speed of Perception with Animals

J. von Üexküll described two experiments on identifying the duration of the elementary act of visual perception with fish and snails. The first experiment, in Üexküll's own description, consisted in the following:

> The fighting fish were trained "to snap toward their food if a gray disc was rotated behind it. On the other hand, if a disc with black and white sectors was turned slowly, it acted as a 'warning sign', for in this case the fish received a light shock when they approached their food. After such training, if the rotation speed of the black and white disk was gradually increased, the avoiding reactions became more uncertain at a certain speed, and soon thereafter they shifted to the opposite. This did not happen until the black sectors followed each other within 1/50 of a second. At this speed the black-and-white signal had become gray. This proves conclusively that in the world of these fish, which feed on fast-moving prey, all motor processes—as in the case of slow-motion photography—appear at a reduced speed." (Üexküll 1975, p. 30).

> In the second experiment, "A vineyard snail is placed on a rubber ball which, carried by water, slides under it without friction. The snail's shell is held in place by a bracket. Thus the snail, unhampered in its crawling movements, remains in the same place. If a small stick is then moved up to its foot, the snail will climb up on it. If the snail is given one to three taps with the stick each second, it will turn away, but if four or more taps are administered per second, it will begin to climb onto the stick. In the snail's world a rod that oscillates four times per second has become stationary. We may infer from this that the snail's receptor time moves at a tempo of three to four moments per second." (Üexküll 1975, pp. 30–31).

K. von Frisch, the famous researcher of perception and behavior of bees, wrote: "A motion picture for bees would have to have a tenfold greater frequency of succession of pictures to prevent the image from flickering. The deficient power of spatial resolution of their eyes is compensated for by a high resolving power in time…" (Frisch 1967.)

It is clear that Üexküll's 'elementary acts of visual perception' and von Frisch's 'succession of pictures' are actually the same units that would be later labeled the 'perceptive frames'.

We have the following spread in values of the visual perception speed among the considered species. The duration of an elementary act of visual perception of a bee is 0.01 s; it is 0.02 s for a fish and 0.25 s for a snail. For humans, 0.1 s is suggested to be the normal average duration of an elementary act of visual perception. So the span of the visual perception speeds of the very fast and the very slow of the mentioned living beings is 25-fold. A human is somewhere in the middle of the interval.

Creatures at the polar sides of these bounds actually live in their own specific temporal *Lebenswelten*, perceiving and interacting with physical surroundings differently. If we take the 'champions' from the very fast and the very slow sides, a bee and a snail, the bridge stick from the cited experiment, moving four times per second, would seem, strange as it may be, stationary for both—though because of the opposite reasons. It would seem stationary for a snail because the stick moves too fast, melting into a single gray strip; for a bee the stick would seem stationary because it moves too slowly. A bee, having had picked a moment, would have easily

managed to fly through in between the phases of the bridge stick moving back and forth. So the door, looking and actually being open for the fastest species, looks and actually is closed for the slowest ones.

The frame conception has drawn my attention as promising to provide a skeleton for the desired abstract model. So far, I was presenting the frame conception only in its simplified version that is sufficient for the tasks of my abstract modelling. The simplified version does not reflect, however, the full complexity of real cognitive process. So I will go into some sophistications of the frame conception here.

Objects of external world are both relatively stable and enduring, and perpetually changing. The task of any cognitive apparatus is to construct an inner image that would both represent persistence of an external object and follow its evolution in time. To reflect changes by letting frames replace each other is not enough. A complementary task is equally important in order not to get lost in ever fluxing shapes. It is needed to extract and capture some core identity of an object that withstands transience.

It was shown in experiments in visual perception (J. J. Gibson) that a 'film shooting' model of perceptive process as a tape moving strictly forward in time by some equal minimal lapses is essentially incomplete. Elementary shots are not 'glued' to each other edge to edge, rather, they are integrated by multiple overlap of larger frames. Overlaps provide smoothness and stability of an inner image, corresponding to stability of an external object, notwithstanding that the mediator between them two is restlessly running discrete chain. A new portion of information becomes meaningful only after it gets recognized and integrated with some formerly acquired perceptive patterns. So, the real process in its complexity is not only the irreversible move forward of a frames sequence, following the natural advancement of events in time, rather, there is a perpetual rolling back and forth of a cognitive weaving shuttle.

3 Heightened Density of Subjective Events in Time and Short-time Memory Discontinuity

Most psychoactive substances are similar in making the pace of external time less perceptible and significant. The outer time seems to freeze or to become indifferent, while the intensity of inner sensations rises. I will discuss only a few less known or highly relevant personal experience reports. Comprehensive phenomenology of altered temporality under psychedelics, particularly Ayahuaska, is given in Shanon (2001).

The first example is the classical report by Baudelaire on the action of hashish. I mention this report because it clearly conveys the impression of the heightened density of events happening in mind, rather than of accelerated time as such, which supports my view on the mechanism of the effect. He wrote: "The proportions of time and of being are completely upset by the multitude and intensity of the sensations and ideas. It is as if one lived several lives in the space of an hour." (Baudelaire 1926).

There is an interesting report of Polish writer S. Witkiewicz, which, as far as I know, is not accessible in English yet, so I consider worth translating some passages from the book published in Russian. The writer has documented his experiment with taking the mescaline-containing peyote extract. For 12 h after that, the bright visual hallucinations like three-dimensional ornaments, fantastic monsters, and faces and silhouettes of familiar or unfamiliar persons were in constant rapid kaleidoscopic change. In the primary unedited report, which he managed to dictate to his wife or to write down himself almost all the time the substance was working, he stated this.

> "The speed is horrifying. It seemed as if hours (days?) have gone—but it is only a quarter of an hour that passed." A little further: "I switch off the lamp and decide to take no more notes. I cannot. Ages are gone, but my watches show only seven minutes past half-past one." (Witkiewicz 2003, pp. 185–186). Drawing on this primary report of 1928, the more elaborated essay was published in 1932 under the working title 'Narcotics'. He wrote in the essay: "Later, I became certain of how delusive estimation of duration of the peyote-induced visions is. I have called it in my 'peyote language'—'the swelling of time.'" (Witkiewicz 2003, p. 134). "Above all, there is this truly devilish refinement of details of the visions. The peyote reality looks like ours, if viewed through a microscope—in a sense of 'sharpness' and 'exactness' of its finishing." (Witkiewicz 2003, p. 136).

As far as we can interpret Witkiewicz, the shift to the accelerated time scale is accompanied by the transition to the finer spatial scale. The swelling of time, as he describes it, looks not as an increase of speed as such, but rather as deepening inside of a second, and microscopic peering into a millimeter.

Coleridge (1908) once suggested that "The delicious melodies of Purcell or Cimarosa might be disjointed stammerings to hearer whose partition of time should be a thousand times subtler than ours." This is exactly the effect that a reporting person has experienced after taking an extremely high dose of 10 g of dry Psilocybe cubensis mushrooms.

> [A] terrible setting—that of a public rock concert amidst about 18000 people. I went alone. […] At that point the mushroom accelerated me—what I mean is, in an outdoor theater of 18000 packed partiers previously jamming to their favorite band, suddenly I (I still was I) was the only person moving. Everyone else had slowed to a very gradual slow-motion weave or had stopped moving-frozen in time. It was the freakiest thing I had ever seen […] I looked down at the band […] They would play one note—a lone sound from a guitar or keyboard and then stand there. After what seemed like ten minutes later, another lone note would emanate. They stood motionless and let their arms and heads hang down toward the ground like the robot on 'Lost in Space' when someone 'unplugged him'. I could not fucking believe this! Meanwhile, as there was no music to focus on (just a disconnected note seemingly every few minutes) all I could hear were the attacking 'voices'. It was horrible! […] Was I actually accelerated in time, as it most completely appeared? It was like that episode of Star Trek when Kirk got accelerated by some weird aliens and

> the rest of the crew stood there for hours as he walked right by them! (Anonymous report, 2006).

Now I turn to explanations of the described phenomena. "Drugs that shorten or lengthen subjective time may exert their influence either by speeding or slowing a pacemaker or by altering the number of mental and external events that are registered," writes W. J. Friedman (2000). I think, however, that the two variants of explanation do not exclude each other. In the frame conception, both elements are present: there is a pacemaker, being a regular frames sequencing in the brain, and there is a rise in number of the registered events in time, caused by acceleration of this very sequencing.

If a frame duration becomes, say, two times shorter, then twice as many frames manage to sequence each other in the brain within a second, thus, the density of the frame flow doubles. What rises is the absolute volume of the incoming unfiltered data. It is this overflow that is commonly described as acceleration of subjective time, and, respectively, a seeming slowing of the pace of external material events. Since movements of one's own body and even physiological processes like heartbeat might be perceived as external to psychical events, the former may also seem uncommonly decelerated.

It is somewhat confusing to distinguish what is actually accelerated and what is decelerated here. To clarify notions, I would say that the flow of events in the head gets accelerated, and this is neurophysiological reality, on which background movements of external objects seem slowed, and this is illusion.

The same ambiguity is met in talking on the time warp cinematography. We shall make distinct shooting of a film and playing of a film. The film may be shot very slowly, with long time lapses between shots, each shot by itself, however, being made with short standard exposition. Then the film is played in the normal tempo and we see the slow process as if compressed and accelerated. Contrary to that, a film may be shot with a high-speed camera. Many very rapid shots are made within very short lapse of time. Then the short clip is played slowly, extending the momentary event to a longer time and letting us see otherwise unnoticeable swift details. There is the third variant, when shots are made regularly, but with prolonged exposition each, so the smeared extended trajectories of moving objects are fixated and made visible.

I will discuss now the so-called trail effect that is sometimes observed under hallucinogens. The effect is expressed thus: normally continuous and uninterrupted visual trajectory of a fast moving object is fragmented into single visual shots as if left hanging in the air after the object is gone, very much alike to the shining dotted line after the tracer bullet.

Here are two personal experience reports from the Erowid website on the trail effect observed under LSD.

> "I was also noticing some slight tracers in moving objects. I had a brightly colored rubber ball, and when I threw it in the air and caught it again it left a definite trail. On a personal note, these tracers were not the streaks of bright light I expected them to be. The ball left transparent, picture-perfect images of itself in the air where it had just been. These took a second or two to fade and were really interesting to observe." (Anonymous report, 2001). "I couldn't

> break my gaze at his eyes until suddenly he blinked… and his huge eyelids came down and back up in what seemed to be a series of still photographs taken milliseconds apart." (Anonymous report, 2000).

In terms of the temporal frame conception, the explanation for the trail effect might be this. Under the substance's influence, the duration of the visual perception frame might have been shortened from the normal 0.1 s to, say, 0.05 s. If the ball falls within a lapse of 0.2 s, the normally functioning brain manages to take only two snapshots of it, while the treated brain takes already four snapshots or more. Taking more snapshots within the same lapse of time may lead to going under the threshold that secures the movie-type alloying of the content of separate frames into a smoothly changing visual image. The visual shooting mechanism would start to catch out a bigger number of fixed images out of the total event of the ball falling down. Therefore, the trajectory of falling used to be seen as blurred would be viewed as a row of separate pictures.

Two recent laboratory experiments on alterations in subjectively perceived time and in interval reproduction under psilocybin shed new light on the mechanism of the effect and make reassess the overall explanative validity of the frame flow acceleration hypothesis.

> Our investigation clearly revealed that the 5-HT2A/5-HT1A mixed agonist psilocybin alters time perception and temporal control of behavior in humans. These results confirm self-reports that hallucinogens cause strong alterations in spatial and temporal perception […] Psilocybin was found to affect an individual's capacity to accurately reproduce interval lengths longer than 3 s, synchronize a motor response (finger tap) to regular auditory beats with intervals longer than 2 s, and to slow down the personal tapping tempo (preferred tapping rate). No impairment of performance was observed for shorter lengths on the sensorimotor synchronization and the reproduction task […] [T]he disturbed timing abilities for sensorimotor synchronization and duration reproduction we show here could reflect impairments of short-term memory, attention or decision-making mechanisms … rather than the alteration of the pacemaker-accumulator clock (the basic internal timing mechanism). (Wittmann et al. 2007).

Findings that support the cited results of the 2007 paper were reported in another publication of 2008 (Wackermann et al. 2008).

The discovered threshold of about 2–3 s under which no alteration of motor reaction speed, hence inner estimates of time, were found indicates that the effect should have more to do with deficits in short-time memory than with deviations in the frame flow tempo. The basic duration values of visual frames and, more generally, of the supposed cognitive frames for humans are estimated very roughly from 0.1 s as alpha-rhythm to perhaps 0.03 s as gamma rhythm. So, if the basic deviation supposedly occurs and exists on the level of 0.1 s and probably shorter, why does it get manifested only starting from 2 s and longer, so that all the quicker part of the temporal spectrum falls out of the range of the effect? The frame acceleration hypothesis seems not to work here.

In line with the reservations concerning the overall validity of the frames flow acceleration hypothesis are the author's own observations under psilocybin. The effect was similar to that of viewing trails or discrete shots instead of the normally uncut trajectory of a moving object, though in my case the object was my whole body. It was quite a bizarre sensation. After I left, say, the wash stand where I had been located a couple of seconds before I laid on the bed, I did continue to sensate and mentally see my body as still placed by the wash stand. At the same time, I felt myself residing in all those locations that I passed on my way to the bed, say, taking looks in the window and at the entrance door. So for up to, very roughly, 5 s, I continued to feel myself dispersed between several discrete locations in the room, simultaneously having my remnant silhouettes in all of them, including the final mental image of myself subsiding in the bed.

I would explain the effect as the inability of the short-time memory to erase duly the interim traces of the movement, as it does in the normal state. This kind of erasure failure might be involved in producing the trail effects of a falling ball as well. It is not shortage of remembering; on the contrary, it is keeping in memory for unduly longer time of what, in norm, should have been instantaneously erased as the brain's 'temporary' 'hidden' files.

The dysfunction of the short-time memory can also explain the feelings of time got frozen, ages passing by, etc., induced by psychedelics. The reports of getting into the realm of eternity sound particularly enigmatic, pressing one to believe in the mysterious qualities of psychedelic substances. All of the named effects, however esoterically they might be labeled, can be explained fairly this worldly. Due to transient neurophysiological changes, the short-time memory is unable to string together the continuously following pieces of sensations and to patch up intervals between them, as it commonly does in the normal state. So, for such a fragmented mind, the sequence of time seems to have 'fallen out of joint'. Ontologically, though, the effect indicates only the absence of a subjective temporal joint, not the appearance and getting into some objectively existing temporal state like 'eternity.'

Let us look at this amateur experiment with time dilation under LSD. It is really difficult to distinguish whether the effect is caused by acceleration of inner pacemaker, or by inability to keep in memory as consistent and consecutive the lapses longer than a couple of seconds.

> 'Ok, start...now!' Cory said. '1 and... 2 and... 3..', I thought but was then distracted. 'I'm sorry Cory,' I apologized, 'there's no way I can do 30 seconds... We've got to cut it down to 10 seconds...' 'No, keep going Greg, you can do it...' 'No, seriously, there's no way I'll make 30 seconds...' Cory smiled, 'I'm still timing you!' 'Stop! Stop! Now!' I shouted. Cory looked at the watch and wrote down the elapsed time. 'What's your estimated time?' Cory asked. 'Oh my gods! At least 5 minutes have gone by!' I exclaimed. Cory shot me a strange look, wrote down my time, and said, 'Actual time...11 seconds...' Cory didn't believe me, he thought I was just pulling his leg. So he became person B and I became the recorder. 'Ok, start... now!' I said as the second hand reached 12. Cory started to talk to our friend Sean. They talked and talked. All of a sudden Cory looked alarmed and turned towards me,

> 'Stop! Stop! Oh no! I forgot all about the experiment!' I wrote down the actual time and asked him for his estimated time. He replied, 'Oh man! At least 15 minutes have passed by!' I grinned, 'Actual time: 15 seconds!' The time dilation was fantastic! (Anonymous report, 2000).

My conclusion is that the effect of alteration of subjective time is a multifaceted phenomenon, with several independent mechanisms seeming to be involved in its causation. It makes sense to combine and utilize both of the above described hypotheses: of the denser flow of frames and of the short-time memory failures.

4 Setting a Hypothetical Time Scale of Observation

Even in the altered states of consciousness, the temporal scale of human perception is only slightly shifted as compared with the normal scale. The normal and the altered scales do overlap and basically coincide. In respect of really remote temporal scales, it is possible to emulate hypothetical perception within them only by indirect means such as mental experiment, slowed film shooting and rapid replay, and computer imitation of very fast and very slow processes.

H.G. Wells undertook a kind of such mental experiment in the short story 'The New Accelerator' (1905). The plot is that an inventor and his friend have taken a substance that extremely accelerated all processes in their organisms. The usual surroundings have drastically changed to them. A bee was sliding down the air with wings flapping slowly and at the speed of an exceptionally languid snail. Frozen people in the park stood erect: strange, silent, hung unstably in mid-stride, promenading upon the grass. Nothing but a sort of faint patter was to be heard: analyzed sounds, disarticulated vibration of the park band's music. Friction of the air was so strong that the experimenters' trousers were going brown and nearly burst into flames. "We had lived half an hour while the band had played, perhaps, two bars. But the effect it had upon us was that the whole world had stopped for our convenient inspection." (Wells 1966).

H. Bergson was also fascinated with viewing the world in other temporalities. The fascination brought him to elaborate the idea of the durations of different tensions. Two important excerpts from his 'Matter and Memory' are worth citing.

> "The duration lived by our consciousness is a duration with its own determined rhythm, a duration very different from the time of the physicist, which can store up, in a given interval, as great a number of phenomena as we please. […] We must distinguish here between our own duration and time in general. In our duration,—the duration, which our consciousness perceives,—a given interval can only contain a limited number of phenomena of which we are aware. Do we conceive that this content can increase?" (Bergson 1978, pp. 272–273). "In reality there is no rhythm of duration; it is possible to imagine many different rhythms which, slower or faster, measure the degree of tension or relaxation of different kinds of consciousness, and thereby fix their respective places in the scale of being. To conceive of durations of different tensions is perhaps both difficult and strange to our mind. […] And

> would not the whole of history be contained in a very short time for a consciousness at a higher degree of tension than our own, which should watch the development of humanity while contracting it, so to speak, into the great phases of its evolution? In short, then, to perceive consists in condensing enormous periods of an infinitely diluted existence into a few more differentiated moments of an intenser life, and in thus summing up a very long history. To perceive means to immobilize." (Bergson 1978, p. 275).

The average speed of perception of a living being of a particular species is set by and adjusted to the speed of its bodily reactions. The latter, in its turn, is determined by 'the way of life' of an individual species and its mode of obtaining food. Out of the whole presumably multiple set of auxiliary neuroframe flows in a creature's brain, we have to single out the one corresponding to the ability to sequentially fix positions of the moving external objects. The basic time scale-setting value is the number of 'shots' of external objects one's brain makes within a second in order to trace the external movements. In the same way, in terms of our modelling, by setting a certain hypothetical duration of temporal frame, we set a certain temporal scale of hypothetical observation.

5 Hypothetical Temporal Scale of Biological Species and Paradox of the Zoom "now"

Evolutionary biologist Ernst Mayr (1988) assumed biological species to be real living entities. It logically follows from Mayr's conception that, being living entities, species should possess some features of cognition. It was also biological ethologist K. Lorenz who admitted the possibility to ascribe features of cognition not only to single individuals, but also to macro-biological entities like genome. He wrote:

> The cognitive mechanism of genome is not able to give due to quick changes of the outer world. For, it cannot 'know' about the success of some of its experiments before at least one generation goes through its life circle. That's why the genome in its behavior can make adjustments to only those conditions of the outer world, which are retained with statistically sufficient permanency for the longer period of time. (Lorenz 1973).

One can see that the genetic evolution of species, likewise to a neuronal perceptive process of an individual, is accomplished in a discrete way. There is no genetic change within a generation, only between generations, with a single generation (roughly 20 years with humans) being a frame in a genetic flow. Lorenz did neither resolutely defend the idea of the reality of a genome, and by association, of species, as a cognitive subject, nor denied it, as is seen from his quotes for 'know'.

For purposes of discussion, let us hypothetically suppose that biological species do somehow perceive and cognize the reality. How, then, would the reality look to them? What would be the specific species' picture of the reality? I am not going to prove here the ontological reality of species as subjects of cognition, although I consider this hypothesis plausible. What I only aim at is to reconstruct the temporal

angle of view and hence the picture of reality that would be presented to species be they able to perceive and cognize, or presented to any virtual observer entering species' observational slot.

For species as hypothetical observers, we have to introduce an alternative field of events, in which only those events take place that are 'visible', or 'perceivable', by species. If we take a 20-year-long frame as a minimal perceptive unit, or grain of discerning, then, from the species point of view, no single animal or single plant, no seasons change, etc., would be perceived. All events happening on those less extensive time scales would fall under the species' perceptive quantum level and would be smeared into some homogenous background. Instead, what would exist and move in its picture of reality, i.e., appear as fields of events, are only areals of confronting species, or biomass clusters covering the Earth, expanding and squeezing, emerging and disappearing. This is the *Lebenswelt* species would inhabit.

I will consider the paradox of the zoom 'now' that is linked to the idea of entering the alien time scales.

From the point of view of neurophysiology of human vision, 'now' lasts for about 0.1 s. From the point of view of psychology of human perception, 'now' is roughly ten times longer, and lasts for about 1–2 s. Within this period, the unity of mental and perceptive experience is achieved ('I recognized my friend approaching'), but no memory and no imaginative functions, no distinguishing between the immediate past and the immediate future, are involved. The third and the longest level of cognitive 'now' lasts about 10 s, within which simple reflective acts are accomplished. (I follow here the Varela's scheme of three levels of the 'specious present'.)

But if no concrete perceptive and cognitive process is involved, then it seems that no criterion for cutting out a 'now' lap out of the total temporal tissue of reality is given. The paradox is that the lap of 'now' can in this case embrace, be widened or squeezed up to any arbitrary time interval.

We get a kind of a 'rubber time machine' that seems to provide a time travel at least into the past. Just suppose that the 'now' lap is not a second, not a day, and not a year, but 40 years—why, actually, not? And your grandmother does still exist 'now'.

Another sophistication in handling the notion of "now" is what I would call the 'circle ripples on the water vs. flying bullet' dilemma. The 'circle' option seems to promise the time travels to the future too. Why?

We have assumed the arbitrariness of singling out any moment of 'now'. It may be taken as a millisecond, one tenth of a second, an hour, a day, and so on. Hence, 'now' may be presented as a circle drawn on the time arrow with arbitrarily variable diameter, zooming in or zooming out to a sharper or a wider focus. If we place ourselves in the center of this circle, it may seem that its boundaries are spread equally back and forward in time. If we take 'now' as 0.1 s, then there seem to be 0.05 s back and 0.05 s forward segments. No one can say that only one half of such 'now' is given, otherwise it would be not 'now', it would be just the past; as to 'now', its essence is that it is placed exactly in between the past and the future.

Thus, by widening a circle of 'now' and embracing therein the wider scope of events, both of the past and of the future, we seem to be able to creep into the future.

For extended entities with a larger frame, our future seems to be given already as their present. So, the task is to become able to tune to these entities, to step into their wider frame of 'now', and to draw information on our own future there from. This is what seems to give natural explanation to all kinds of the foreteller phenomena.

More traditional view implies that the future objectively doesn't exist at all and to nobody, hence the future blackout frontier is absolute for entities of any frame duration. Frames may stretch whatever far into the past, but none of them outstrip others for any fraction of a second into the future. Complying with this more traditional view is the model of 'now' that resembles not widening and mutually including circles, but a bullet flying through the air. All 'now' is actually in the past—like a long trace of a bullet having cut the air, no traces being in front of it.

I am not going to exclude the possibility that for the extended entities our future is given as their present, and so basically one can look into the future by attaching oneself somehow to these entities. There are at least two problems here, though.

We can conventionally assume that someone is able to enter the temporal worlds the more extended entities inhabit. But, firstly, the ones entering the alien extended world won't be allowed to smuggle their normal this-world bodies and consciousnesses. Having found yourself in a world where life processes are cut into no less than, say, 40 years quanta, you would have to undergo some weird transformation of your body. Your body—rather, the particles it consists of—will get smeared all over the locations you were and are going to be present for 20 years back and 20 years forth from the moment that had been current in the world you left. You will find yourself abiding all over those places simultaneously. You will have to dismiss your consciousness, too, which works within, at largest, from 0.001 s to 10 s framing range.

Secondly, you will hardly procure information concerning yourself anyway. You've entered the reign where there is, undoubtedly, an information turnover, but the smallest coin of its currency is molded for this very, not lower level. You will neither join the currency turnover, nor take its coins back, nor decipher unintelligible signs on it. The extended frame doesn't contain information that would be accessible to you; it is information, but information in the alien register.

6 Observer and Reality

I will present now in the more abstract view my understanding of how an observer and the observed are interrelated. The starting point for me is that reality does exist by itself, i.e. independently of existence or non-existence of an observer within it. Outside an observer, or irrespective of its viewpoint, reality is an all-containing entity.

Any observer can perceive reality only in a certain temporal scale of observation, characteristic to its bodily action and perception. A certain temporal scale of observation corresponds to a certain temporal contour of the objective reality. This, and only this contour of reality, or, in other words, reality in this very

contour, as discerned out of all its contours, is presented to an observer in response to its educing 'appeal'. In one temporal scale of observation you see reality in one contour; in another temporal scale you see reality in another contour. With a different temporal scale of observation you have a different ontological picture of reality.

If no particular temporal scale of observation is set, no reality at all may happen to be seen. One sees the empty reality, or the reality in 'non-optioned' mode. An explanative illustration could be found in computer practice. When you want to open a file, some file extensions and directories are prompted. But if you choose no extension or directory, the list of files may seem empty, as if none of them existed.

But is reality cut into temporal contours in itself? Are there distinguished spectral lines on the overall temporal range of the Universe, which correspond to these contours? The answer I propose is that not any arbitrary position of a knob on a temporal wave band receiver will give a meaningful picture, but only those corresponding to certain 'stations', i.e. objective temporally ordered layers of reality. There are gaps between those discrete layers in the hierarchical all-encompassing micro–macro dimension of the Universe, on which matter clusters itself in ordered form. There are rooms of 'nothingness' periodically interrupted by islands of self-referentially compounded 'something'.

How these stratified and temporally coherent conjunctions of matter occur? I assert that only those material entities would belong to a certain objective temporal structure and be involved in a temporal contour, which are influencing and determining each other, i.e. which mutually interact. By their interaction, a certain self-sustained and self-referential material framework is formed, with its inherent order and shared temporality.

Shared temporality is only one of the set of factors making a material system and the hierarchical level of reality it exists on conjunct and coherent from within. Two other factors are physical forces predominant in ordering matter on this level and giving material systems their steady shape, and the spatial dimensions, within which those physical forces remain active and the characteristic speed of interaction lets the distant parts of the system act as a conjunct whole.

This is the very general answer to the question of how a temporally ordered structure coagulates from within. The question now is how it detaches and distinguishes itself from the total manifold of hierarchical layers and objective temporal contours?

I will try to explain it with the same idea of observation that I am explicating in the paper. We may metaphorically assume that the ability of material entities to interact can be viewed upon as the ability to 'feel' and to respond to the signals of another material entity. In a sense, material entities by their interacting do 'notice' and 'observe' each other, and in this way mutually confirm each other's existence and the 'membership' in some common ordered structure.

I have said that an observer selects, or discerns from reality as a whole a contour that corresponds to, or falls within the limits of, its own temporal scale of perception and bodily action. So we had a situation of an observer interacting with the reality. If we take now a situation of a material entity interacting with a material entity, we can follow the same line of argumentation. Namely, that a material entity selects

from the total multitude of material entities those and only those, which it is able to interact with.

So, material entities, mutually cutting themselves out of the total mass of irrelevant physical tissue, behave as 'observers' to each other.

As an illustration, let us take two colliding billiard-balls. Roughly, there are two levels of interaction in their case. The first is the atoms and molecules interactions, keeping the ball together as a conjunct solid body unit. The second is the balls, which strike each other and roll aside. Of course we can say that the surface atoms of both balls come in touch with each other. But it would be just irrelevant to say that atoms of one ball have interacted with the second ball. Atoms cannot recognize ball as a ball, they only recognize other atoms. It's not for them the entity to interact with. Atoms 'choose' to interact with atoms, balls 'choose' to interact with balls. Atoms, although constituting the rolling ball, keep on moving within the ball in their own atomic tempo.

7 Interface of Adjoining Time Levels and the Distinction of Events and States, or Qualities

In this section, I will draw a hierarchy of three adjoining time levels and try to see how phenomena of one level are represented on all three of them: on the equal level to an observer's residence, then on the upper, more embracing level, and on the lower, the finer, level.

With the help of my scheme, I will attempt to infer some clues on what might constitute the reality's own temporal grid of events and grain of temporal discernibility. I am going to show that, contrary to absoluteness of Planck values, values of grid and grain are relative and depend on interrelation of levels. Vanishingly small for one level, the same absolute value might be infinitively large for another level.

I would go even further and suggest that the conception of quantum character of reality, which is commonly attributed to only one distinguished type or level of the physical reality, can be made relative and be attributed to specific interrelation of a higher level to the lower one in any batch of adjoining levels within their total hierarchy. I would suggest that when looking from one's own level at the phenomena of the lower emergent level, any observer sees them as quantum phenomena.

Speaking of scales, we have to distinguish a) a scale from which we observe, and b) a scale of what is observed. Observing reality in a different scale would mean both. First, putting on uncustomary glasses for viewing our customary reality, second, trying to take a look at the levels of reality that are alien to us. In the latter case, again, we either deliberately retain our observational standpoint within the human scale and look at aliens with our own eyes, or try to identify ourselves with aliens and look at them with their eyes. To attenuate the difference between the subjective and the objective, it is convenient to call the scale of observation—a scale proper, and a scale of existence—a level.

Let's place ourselves at the level taken as the middle one and look horizontally, then up and down. What we see on our own level, that is, in the proper scale of observation, are events. We see reality on our level as events. Events are distinguished and meaningful fragments of change by some parameter. Annual seasons are events, day and night are events, and the change of a hare's zigzag running is an event for a wolf. Our body motion and cognition share temporality with the field of events, we are able to experience changes on this very temporal scale; we depend on these changes and can influence or utilize their course.

Events proceeding on the higher level are represented to us as states, or qualities, although on their proper scale they are events. Actually, we are witnessing one and the same lasting event, which began to unfold itself as a change long ago and which is yet far from finishing the initiated phase. We are inside the event; it is frozen for us, and there is no meaningful or perceivable change for us. A season is a state for a butterfly, but an event for the species that a single butterfly belongs to. The view of the sky is frozen for us, although on its proper level the tissue of astral locomotions constitutes the field of events.

Events proceeding on the lower level are also represented to us as states, or qualities, being themselves events. But they are states not as a single event having begun to unfold, but as a statistical mass of events having multiple times folded and unfolded within a single phase of an event of our scale and a frame of our perception. The statistical mass of events smears into a common background with the events themselves undistinguishable to us.

I want to stress that going under the discernibility threshold, that is, quantum level in its relative sense, is not only the matter of observation, but of material interaction. The distinction of events as events is not absolute and is not conditioned by a level itself, rather, by the levels that are boundary to it from below and from above. By 'abstaining' from interaction with improper, higher or lower, material units, the unit designates, 'settles down' its own field of interaction and of events. In this way it calibrates its proper grain of events and the thresholds under and over which events become states.

I would give two explaining illustrations.

Let us take watches, with hands for hours, minutes, and seconds. When we follow minutes, having selected the minute scale as important, the coming of every new minute is an event. It gives us information, which we consider relevant. There is something happening on this level. The current hour is a state, namely, of being two o'clock. Turning to the hour hand would give us no new information. The same hour lasts. Neither would the pace of seconds be called events, even more so tenths or hundredths of a second, which are a smeared background. Although in different situations those ruled out become the field of events.

Let us also take a geographical map in different scales. Descending or going up through scales, we bring into focus different objects and make them the domain of events. The grain, or the quantum threshold, is the minimal event visible and meaningful. Indicating a city is a frozen 'over-event', finding a street name among others is an event, while scrolling through house numbers on the street are 'under-events'.

8 Features of Reality Revealed and Veiled by Observing it in Different Temporal Scales

Viewing one and the same reality, since we admit its wholeness and unity as an all-containing reservoir, in different temporal scales makes certain objective features of reality educe, and others veil.

Bergson imagined how in the course of our transition to a lower scale the quality of red color would dissociate and turn into oscillations as a set of repetitive events, having no sign of 'redness' in them already.

> If we could stretch out this duration, that is to say, live it at a slower rhythm, should we not, as the rhythm slowed down, see these colors pale and lengthen into successive impressions, still colored, no doubt, but nearer and nearer to coincidence with pure vibrations? In cases where the rhythm of the movement is slow enough to tally with the habits of our consciousness,—as in the case of the deep notes of the musical scale, for instance,—do we not feel that the quality perceived analyses itself into repeated and successive vibrations, bound together by an inner continuity? (Bergson 1978, pp. 268–269).

Following the way of mental experimenting originated by Bergson, one may say that looking at the events of a certain inherent temporality in an improper observational time scale, i.e. in the scale substantially narrower or wider to that of events, may lead to the disappearance of an essence or a meaning of a process from the observer's view.

(a) Features of life.

Looking in proper or improper time scales may lead to disclosing or hiding the features of life. Biological processes on Earth pass in their specific scale of duration. If we observe an object in an inappropriate interval or with an inappropriate speed of frame change, we would not notice the very essence of a process. We would not be able to say whether we are dealing with a material object only, or with this very object, but as a living being. Inappropriate may mean a very small duration, making us able to see only the molecule interaction without its biological 'filling', or too long a duration, when a living being may be born and then die within one and the same temporal 'shot'—so where was the life?

We may try to search for features of life taking the Universe as a putative living body. If there are some processes of biological nature on the level of stars, galaxies and their clusters, they should be of an extremely slow timing of at least a million years for each elementary act of interaction. We would have to introduce an extremely large hypothetical interval and frame duration. Suppose we managed to draw the suggested past and future trajectories of astral objects by computer simulation. The main problem would remain: how do we identify these imaginative lines with biologically loaded interactions? To emulate trajectories of movements of astral objects (clashes, spiral spinning, etc.) even in their proper temporal scale, that is, as if they vividly move, does not mean finding yet what objective meaning stands behind these visual physical transformations.

(b) Ontological reality or non-reality of some durable entities.

These are: biological species, existing for hundreds of thousand years, human nations, existing for centuries and thousands of years, national states, existing for centuries, and human personality within its total life span. A national state, viewed in too short a cross-section, looks like nothing else as a collection of individuals, which ontologically is not true.

(c) Localization of a body.

When 'photographed' with too long an exposition, let us say, 3 s, a body will appear to be both 'here' and 'there', spread over several meters trajectory, i.e. delocalized, because it has made some move during this lapse of time. Human eye is able to fix a falling meteorite not in its real form, as some round stone, but only as a trajectory. In the same way, a star, being fixed on a photo shot with an exposure of an hour, is seen only as a line.

In a slowed film shooting, a car can be seen as having stopped simultaneously at two traffic lights at the different ends of a street, because both positions fall into the same shot.

If a ball of 1 m in diameter runs with a speed of 60 km per hour in the field of view of a man with his eyes fixed still and not following the movement, the form of the ball cannot be determined within a normal visual frame duration of 0.1 s, and it appears as spread along the whole field of view.

In a frame of a 1-year duration, the Earth trajectory around the Sun will be seen as a closed circle (ellipse), if a hypothetical observer moves with the same speed as the Sun. If an observer is placed outside the solar system, the movement of the Earth around the Sun together with its following the Sun will look like a spiral.

In the movement with a speed faster than a speed of observational frames change, we see not a body in its real form, but an observational field of view, with the trace of the moving body spread within it. So in the case of bodies moving in a faster temporal scale than our observational scale, we see a mosaic interplay of discrete spatial cells, marked, or lightened up, by the presence of the fast moving bodies somewhere within a cell, not bodies themselves.

(d) Wholeness of a body.

Forces that keep human body together are, at the last instance, of electromagnetic nature. So, if we take the speed of light and assume for the purpose of convenience a human body length to be 3 m, we will find that a body exists as an interacting whole only within a time interval of 10^{-8} s and longer. In the time intervals shorter than that a body does not exist as a whole, since the fastest possible electromagnetic signal from legs cannot reach head and vice versa, not to mention the real nerve signals, that are far slower. The minimal temporal interval, below which a material body seizes to exist as a whole unit with its interrelated parts, can be determined for any other entities, including cosmic objects.

(e) Aggregate states of matter and resilience of a body.

Such states of a physical body as firm, liquid, and gas, depend on its inner molecular structure. But these states exist, or are manifested, only in a particular temporal scale. In the shorter time intervals, we will find not a liquid body following laws of hydrodynamics, but an aggregate of molecules, moving independently in different directions. Also relevant is the speed with which a body as a whole unit comes into contact with another body. If you fall into the water at a high speed, a liquid is perceived as nearly a firm body. Actually, it is firm for the fast moving body, remaining liquid for a body being still.

(f) Presence or absence of a meaning.

If you play a 5 min piece of music very slowly, say, stretch it to half an hour, you would manage to hear it to the end, missing none of its sounds, but the melody will blur and vanish away. If you replay a 5 min piece very quickly, say, within 5 s, you will hear some continuous average tone only. So, to meaningfully reproduce and perceive a melody, you should present a sequence of sounds within a certain temporal scale.

9 How the Universe may look Like in its Own Time Scale?

Let's imagine that we are placed outside the Solar system and observe the Earth rotation around the Sun with a sequence of frames of the 5-year duration each. In objective terms, this would correspond to an assumption that 5 years is the minimal discernable grain of events.

What follows is that the earthly ball disappears from our picture of reality. We don't see any balls at all in their spherical shape any more, and are not able to see them. The shape in which we now start to see the whole Sun-Earth bundle in its motion is a sequence of discrete fragments of their interwoven trajectories, each fragment constituting a five convolutions cork-screw body of the Earth with the slightly curved, due to its own rotation with a sleeve of the Galaxy, axis body of the Sun. The Earth's and the Sun's former strictly localized spherical solid or gas bodies become spread within their 5-year lines of motion; they are here and there, at the beginning and at the end of the line, simultaneously.

Why should we think that celestial bodies interact with their peers on their proper scale of motion as spherical, localized and slow moving objects, so as they are presented to us in the sky? Our temporal scale of seeing them as 'billiard-balls' might be inadequate to their proper motion and the way of interaction, and, in fact, obscuring. Wouldn't it be logical to imply from the said above that the basic units entering the process of interaction on the proper celestial scale are not balls, but fragments of their trajectories? Or trajectories as wholes, if we depart from the minimal grain level and take a look at the celestial physical tissue in a wider range. For, only in the physical appearance of trajectories, assigned by the extended temporal grain of discernibility, not of balls, are celestial objects recognizable and 'interactable' to each other.

Now, what are trajectories, drawn by periodically rotating and onward moving objects? Aren't they oscillation structures, which means, waves? If to agree with

that, the inference comes that the whole celestial tissue in its proper time scale does exist in form of wave structures and general wave field. What would be predominant for formation and activity of celestial objects, are wave interactions, resonances, interferences, etc., not classical mechanical and gravitational interactions. It's the features of their motion as waves, developed on the extended time scale, that determine their shape and orbits as classical mechanical objects, presented on the scale we see them.

It's not because of their large size and mass in the absolute values that the wave side of the celestial objects' motion never gets an overt expression, according to Louis de Broglie formula of the matter wave; it is because we have to look for this expression on a different time scale, where it's always there. That would also imply that for each level we might have its own objective Planck-type values of the quanta bottom line of energy, length, and time.

Having hypothetically assumed trajectory to be a basic interactive unit, I have to call my assumption in question. How would you interact with a trajectory? In any case, you will have to interact with the plotter drawing a trajectory, that is, the ball itself. If you think you touched the whole trajectory as a single unified object, poking your 'cosmic finger' into it, you have actually touched the ball, which is somewhere on the trajectory, not everywhere. Can one fragment of an object's trajectory interact or be resonating to other fragments of the same trajectory, somehow solidifying it as an extended chain whole within some even larger frame? Can an object's trajectory overlap and interweave with the tail of another object, having had flown through the same space location some time before? For, if duration of an opened frame still lasts, both objects should be recognized as embraced by the same frame and being present in their shared location.

In a word, the whole set of typically quantum puzzles comes into force. With the only difference that quantum puzzles are applied here to matter on a cosmic scale, actually to any scale—far not solely to micro-scale, as is traditionally suggested.

Let's look back at the stops in our imaginative travel through hierarchy of levels, and then go on with ever widely embracing view on cosmic matter. We have departed from the common-sense view on the Universe as an aggregate of solid bodies, 'balls' as classical mechanical gravitational objects, or liquid 'drops', freely falling in space and thus attaining their spherical form. We've passed by the intermediate stage of presenting the stellar matter as a statistical liquid-like medium with its whirls and turbulences. Then, by using the more extended temporal frame or grain, we have shifted to its tentative wave representation.

Now, by applying even greater temporal frame or grain, we can come again, on even higher level, to the Universe's appearance as a mechanical solid bodies' medium. We can even get such attributes of a mechanical medium as 'cosmic' sound, produced by mechanical vibrations of its particles. What would constitute those particles in the cosmic space? They might be clusters of galaxies, as definitely detached and roughly equally spread over the space clods of matter.

How does it come out?

Let's introduce an unlimited multitude of particles, a number of them being squared within a spatial frame. Let's start to consecutively enlarge the embracing square of our frame, dimension of particles themselves and distance between them

remaining the same as at the beginning. On step one, there were, say, ten particles within our frame, on step two there were one thousand particles already, and so on. With every step of a frame square enlargement, particles get more and more densely crowded within a frame, until the frame's content, instead of being dispersed loosely, begins to act rather as a medium able to transfer mechanical vibrations, i.e. sounds.

It were us for whom the quality of sounding appeared as an emergent one at some stage of our consequent frame enlargement. Meanwhile, the quality of sounding itself did innately exist on the ontological level we have eventually attained. On particular levels of organization of matter and within a particular magnitude of framing, sound is always there.

The hearer arises where there is something to be heard. On the level where matter is presented as a medium to conduct a signal liable for being perceived, a perceiving subject is likely to arise. This may explain why the terrestrial living beings inhabit more or less neighboring space and time niches. This could also tell us in which domains of organization of matter can we look for the entities of life and cognition of a cosmic scale.

Sound is only an explanative example here; I mean abstractly any quality that potentially exists on and for an ontological level before and irrespective to our having climbed to it. For the entire reality, all the qualities are given simultaneously. It is an observer who climbs or descends to a level and thus educes this or that quality.

To ask: 'what is reality?' without mentioning: to whom, is as meaningless as to ask how one hand claps. The clap is made only by two hands, although one is right, the other left.

10 Conclusion

I will point at the general problem existing for the proposed type of modelling. We are looking for some qualitatively new properties of reality, and we suppose to detect them with the help of the hypothetical scales modelling. But would we not get at the output nearly the same as we have inserted at the input? We shall see nothing else than what we do see already, although in a somewhat transformed look. There seem to be principle limitations to our desire to view events on non-human scales as they really are on themselves. Whatever alien are the worlds we tried to enter, we have to eventually remanufacture all our catch for being digested by this-world stomachs, like the x-ray shot ought to be reproduced in the palette familiar to human eye. This circumstance doesn't undermine the heuristical value of the proposed type of modelling, but brings due reservations.

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