



The Cone of Events in Anthropokinetics

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Abstract

The author presents the physical structure of the light cone, which divides the space-time into two parts. The information and events in the first one is connected with each other and may form the cause-effect chains. The information and events in the other one (dubbed “elsewhere”) cannot influence the run of events under consideration. The same general philosophy might be applied to the motor operation patterns in humans (and other living beings) while taking into consideration temporal constraints of various rungs of the modalities’ ladder. The latter is a mental structure originated in N.A. Bernstein’s “brain skyscraper”. Author shows at the practical manifestations of the application of the mental model termed events’ cone.

Keywords: Anthropokinetics; Modalities’ ladder; Light cone; Events’ cone

Introduction

Let us start from three simply banal statements:

A. Firstly: The only manifestation of any mental activity, and the only way to affect the environment, is the movement. Consequently, there are no other behaviors than the motor ones.

B. Secondly: The main task of the Science (with great “S”) probably most consciously has been expressed by Auguste Comte in the words “To know in order to predict; to predict in order to can” [1]. The first element of this statement may be substituted with the word “understand”. If one wants to predict, it is not enough to simply know; it is necessary to understand the essence of phenomena and processes under consideration and their mutual relations. The accurate prediction causes-nearly directly-the potentiality of realization of actions reliably resulting with desired effects. In general, “to understand” (or, may be, more precisely- “to grasp”) might be regarded as a product of philosophy, “to predict”-a product of science, and “can”-a product of technology.

C. Thirdly: Let us remember that mathematics is the science on relations, which facilitate understanding. In the non-living world, where the things passively obey the laws external against them, establishing of the net of such laws enables predicting the behavior of such things also in the future. On the other hand, in the living world the laws are not external against the entities (no longer

“things”!). In biology, just these entities contribute to creation of such relations. More, in psychological processes, where various relations are being actively and sometimes “online”, i.e., consciously shaped by living entities. Not rarely such relations act only in very short periods. Therefore, it is not possible to establish a universal net of relations, reliably governing the behavior of living entities. Therefore mathematics-being the science on relations, which may be described with a “stiff” formalism-is not eligible for description of biological phenomena, where the evolution destroys any “stiffness” of a formalism (or any “formalism-like” structure). The same concerns, more, the psychological processes, which are not prone to any “formalism-like” constraints, external against entities being described and taking no into consideration their internal determinants [2,3].

The term “anthropokinetics” from the title of this paper should be described more precisely. The position of this discipline in the general system of sciences on human motor behavior has been shown in the Table 1. It is worth noting that specific disciplines, which in such a system have been termed “sub-disciplines”, in other systems may play the function of supra-disciplines. Such a flexibility makes one of the aspects of beauty and usefulness of a system. However, in the system of sciences on motor behavior such an order seems to be the most effective.

Table 1: The system of sciences on motor behavior of living beings, especially humans (Petryński, 2019, in print).

Task	“Executor”	Sub-Discipline	Discipline	Supra-Discipline
Creation of mental representation of a motor operation	Mind	Psychology	Anthropo-kinetics	Kinesiology
Control of a motor operation	Neural system	Neurophysiology		
Execution of a motor operation	Musculoskeletal system	Physiology	Biomechanics	
Creation of motor operation effects	Environment	Physics		

The physical light Cone

In physics there is known the notion of “light cone” (Figure 1). It is “a surface in space-time that marks out the possible directions for light rays passing through a given event” [4]. Let us look closer at this cone. The basic rule of its construction is the fact that “nothing can move faster than light” [4]. Therefore, if anything lies in the distance greater than that, which during observation might be travelled by light, is located “elsewhere”, i.e., in the space, from which no information may be received by observer. Accordingly, such an information cannot influence the run of events in the space-

time region encompassed by the light cone. And vice-versa. If a given event starts a cause-effect chain, it may act only inside the light cone (Figure 1). Therefore, such a representation of reality divides the whole space-time of events into two parts. Inside the cone, there are some mutually related cause-effect chains, which shape the run of events, but the information from outside the cone (“elsewhere”) cannot influence such a run. On the other hand, the actions inside the cone have no effect on what is going on outside it. The light cone is no doubt a mathematical structure. Therefore, according to earlier statements, it should not be useful in the description of psychical processes underlying human motor behavior.

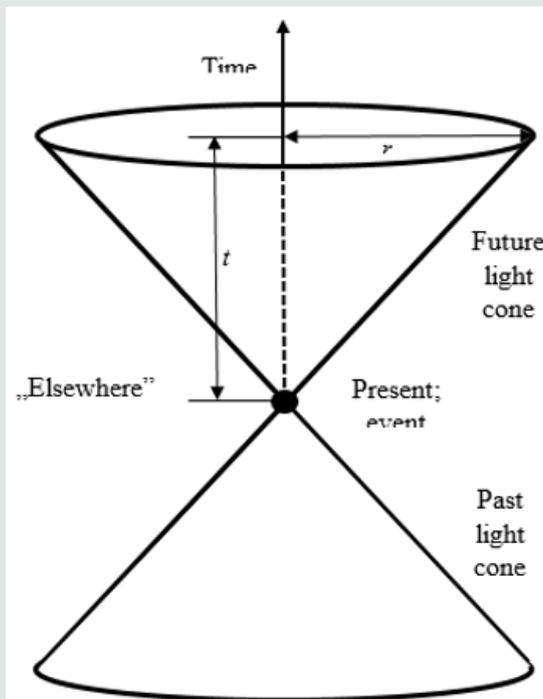


Figure 1: The light cone. The events from “elsewhere” cannot influence the events inside the cone. It would be possible only when the information from this region would be able to travel faster than light. After time “t” from the moment of event, the light will reach the distance “r” from the place of event.

Anthropokinetics and physics

However, the anthropokinetics is still young discipline, which searches for its scientific identity. Therefore, it is forced to adopt what might be termed the “Foraminifera-strategy”. The Foraminifera are one-cellular organisms, which build around their bodies the shells of sand. However, they select only such grains that under microscope their tests look as if they were polished [5]. Anthropokinetics should take any suitable “grains of knowledge”,

no matter, where they come from, either. Accordingly, let us listen to novelist Jo Nesbø, who wrote: “You can discover new things by changing your perspective and your location (in science their equivalent is the methodology-WP). You can compensate for any blind spots” [6]. Accordingly, let us try to look at anthropokinetics from slightly different perspective. Already in 19th century philosopher, Auguste Comte has divided the whole science into two parts: “physique organique” and “physique inorganique” [7]. The

former might be-roughly-identify with the biology, whereas the latter-with physics. The common element is the “physics”. Hence, one may perceive it no as a sum, but as a system. In such a situation justified seems to be the presumption that-may be-some relations are active in both these regions, but in “physique inorganique” they are better visible, whereas in “physique organique” are hidden deeper. In such a context highly illustratively sounds the statement by Niels Bohr that “It is wrong to think that the task of physics is to find out how Nature is. Physics concerns what we say about Nature”.

While coming out from such a “starting point”, one might put a question, whether the physical-mathematical structure of the light cone (or, more precisely, the philosophy underlying its mental construction) might be useful also in description of any psychological processes (in general) and anthropokinetic ones (in particular)? In other words-whether in anthropokinetics we have to do with relations independent of an individual, which executes a motor operation, which are able somehow “from outside” impose specific constraints on potentialities of performing by this individual specific motor actions? And whether to description of such a relation one might-even marginally-use a physical model?

Brain skyscraper and modalities ladder

The questions put above may be answered positively. Such external (against, e.g., an individual human) system of constraints is the “brain skyscraper”, shaped by evolution. It has been invented by Nikolai A. Bernstein [8-10], and its “intellectual daughter” is the modalities’ ladder [2,3]. The latter is fully coherent with the “skyscraper”, but devoid of evolutionary and neurophysiological components; it is mainly information-processing structure. Both are hierarchic, systemic structures. The former has five levels, the latter-five rungs. One if the main rules by Bernstein states that each motor operation has its main level of control (“master”), where the attention of the executor is being focused, and the lower ones (“slaves”) play the function of “background” (not “subconsciousness”, whatever this term might mean) and their

action does not need attention concentration. Let us emphasize: the main criterion is not a division into “consciousness” and “sub-consciousness”, but into elements, which need attention focusing and such ones, which do not need such a concentration. Before comparing the “brain skyscraper” and the modalities’ ladder, let us remember that one and only manifestation of each mental, psychical process in living beings-including humans-is the movement. This is why philosopher Andrzej Wohl wrote: “All that we dispose of, all what constitutes the resource of our culture, all the pieces of art, science and technology-all that results from motor activities” [11]. In short, there are no other conducts than the motor ones. The basis of such a behavior is the consciousness. Before further considerations, let us formulate the two definitions:

- A. Motor operation: Motor action of a living being aimed at solving of a given task in environment; it may be evoked either by extrinsic stimulus (trigger; in such a case it is the motor response), or by intrinsic motivation without any contact with environment [12].
- B. Consciousness: A dynamically changing component of a quasi-static whole; the multimodal knowledge of an individual, activated at given moment by perception directed by attention, aimed at dealing with a task at hand [3].

Let us add that the consciousness is a multifaceted phenomenon. Knowledge might be described with various codes-e.g., haptic, visual or verbal-but the general term “consciousness” encompasses all these modalities of information processing. It seems worth remembering that the term “modality” includes a specific code of information storing and processing, a logic specific to them, certain scale of phenomena and processes, the definite time period and depth of information processing. The characteristics of the “brain skyscraper” and modalities’ ladder, as well as the phenomena related to them, have been presented in Table 2. In short, the brain skyscraper has been built on structural, whereas the modalities’ ladder-on functional basis.

Table 2: Bernstein’s “brain skyscraper” and the modalities’ ladder.

Brain Skyscraper; Mental-Motor Abilities	Basic Operation; Ways of Motor Tasks Solving	Modalities’ Ladder; Operation Patterns, “Soul” of A Movement	Theoretical Description; “Physical Appearance” of A Movement
Level E, Fantastic image of reality, fantasy	No motor operation, politics („wisdom of anticipation”)	Rung E symbolic modality IDEA	Topology
Level D, true representation of reality, common sense	Performance, strategy (“effectiveness of action”)	Rung D verbal modality program	Geometry
Sub-level C2, net of muscle synergies working organs, dexterity	Habit, tactics (“measure-in-eye”)	Rung C remote modality scenario	Kinematics
Sublevel C1, net of muscle synergies whole body, agility			

Level B, two-muscle synergy, movements' harmony	Automatism, technique ("motor smartness")	Rung B contact modality template	Kinetics
Level A, single-muscle contraction strength, ("background of all backgrounds")	Reflex, strength control ("feeling-in-hand")	Sub-rung A2 proprioceptive modality coupling	Dynamics
	Tonus, posture maintenance ("body position feeling")	Sub-rung A1 kinesthetic modality consciousness	Statics

As one can see, the divisions in both these structures are not identical. The equivalent of the single A-level in "brain skyscraper" are two sub-rungs (A1 and A2) in the modalities' ladder. A single C-rung in the modalities' ladder has two sub-levels (C1 and C2) in the brain skyscraper. Some comment needs the function of the tonus (sub-rung A1) in the structure of any motor operation in a human. The skeleton of Homo sapiens amounts to about 200 bones. Each of them may move against other ones; such movements may be described with the term "degrees of freedom". In sum, human skeleton disposes of very many degrees of freedom. However, if a muscle should to move a given bone lever, then one its end has to be fixed relatively stiffly. In other words, all bones in a kinematic chain ending with this "stiffly fixed" end of the muscle should be properly immobilized; Bernstein dubbed this process "reduction of freedom degrees". It makes the main task for the muscle tonus. Thanks to it, non-controllable system has been transformed into a controllable one. Hence, the muscle tonus makes a basis for the all other motor operations. Therefore, Bernstein termed it "background of all backgrounds". In the modalities' ladder, the notion of "degree of freedom" has been generalized and encompasses the abstract "information chunks", related to movements or set of movements, specific to higher rungs of the modalities' ladder.

The anthropokinetic events cone

The modality of each rung of the modalities' ladder includes a specific type of coding, logics of information processing and temporal limits of the phenomena under consideration. Therefore, facing angry grizzly bear somewhere in Alaska, I would prefer company of experienced trapper with Winchester rather, and not ingenious Albert Einstein. Just the temporal limits, peculiar to rungs, may make a structure similar to the physical light cone. Let us term it "events' cone" (for the sake of simplicity, because it should be named "the cone of abstract representation of real events"). A given modality may effectively "deal" with events, which belong to a specific period. Hence, the events lying beyond these limits should be categorized as being "elsewhere" (Figure 1). Consequently, they cannot influence the information processing inside the events' cone. It is possible, then, to use the general rule of construction of the physical light cone, i.e., the division of the space of events into two parts. One of them includes such events, which may make parts of cause-effect chain shaping the future, and the other, which are to be found "elsewhere" and cannot influence the run of events (Figure 2).

The structure of the light cone differs essentially from that of events' cone. In the former the time axis is positioned vertically (Figure 1), whereas in the latter-horizontally (Figure 2). However, the general philosophy-division of events and information into potentially active and unable to any activity-remains the same. It is worth noting that the time axis in Figure 2 should be perceived as a logarithmic scale, and not a linear one. Nevertheless, clearly visible are time periods specific to rungs, and the fact that the higher the rung, the longer the time period for analysis of events and information processing (thinking).

As a result, one might consider the space inside the events' cone (bold dashed line) makes the room for analyses and information processing, whereas the space outside the cone represents the "elsewhere". In short, the temporal constraints-specific to rungs of the modalities' ladder-disable the events from "elsewhere" and make them ineffective in shaping of a given motor operation. The higher rung, the longer "working" period. The price, which inevitably must be paid for its extension, is higher and higher level of abstraction, i.e., getting further and further from reality. Therefore, the processes and phenomena at distant to the "tangible" reality highest rungs of the modalities' ladder cannot be tested experimentally. Therefore, at those rungs the only tools for scientific description are hypotheses and theories. The techniques of intellectual work, which may be applied in this region of abstraction, are, e.g., the logic of loops by Michał Heller [13] or "inference to the best explanation" (IBE) by Gilbert Harman (Harman, 1965). Otherwise, both of them are nearly identical. Such a "moonshine" way of science creation evokes almost contempt of "genuine scientists", i.e., the worshippers of arithmetical average and standard deviation. Nevertheless, the science is being composed of theories, and not "new, original experimental data". Their amorphous ashes may merely fertilize the intellectual ground, on which the theories should grow. This has succinctly expressed by biologist (Nobel Prize winner) Peter Medawar with the words "theories destroy facts" [14]. Unfortunately, as its physicist Edward Teller aptly stated, "A fact is a simple statement that everyone believes. It is innocent, unless found guilty. A hypothesis is a novel suggestion that no one wants to believe. It is guilty, until found effective."

However, let us look once more at the Figure 2. Let the symbols A, B, C, D and E symbolize rungs of the modalities' ladder, tightly related to Bernstein's brain skyscraper levels. The grasping of time is possible only at C-level-at that level appear remote sensory

organs, which enable observation of motion in the environment; it is the only phenomenon, which makes possible to shape the notion of time-but it does not mean that it cannot be used to description of phenomena also from the lower rungs. The bold dashed line symbolizes the anthropokinetic events' cone, including rungs of the modalities' ladder. Not without reason the borders between rungs are marked with the dotted line. In fact, they symbolize not sharp limits, but fluid zones rather. The information may cross them, indeed, but in the zone between the rungs, its modality is being transformed. This is a non-linear process, i.e., elements from one rung are differently amplified in the other one. This phenomenon

is probably responsive, to the main extent, for unpredictable, qualitatively new system effect produced by such a system. Let us notice that such a structure is generally coherent with division of memory into short-term sensory store (STSS), short-term memory (STM) and long-term memory (LTM) by Richard Atkinson and Richard Shiffrin. Roughly, STSS might be associated with the lowest rungs of the modalities' ladder, STM-with the middle ones, and LTM-with the highest rungs. The vertical relations make the system. The horizontal extension, limited by dashed line, represents the period specific to the information processing modality at a given rung.

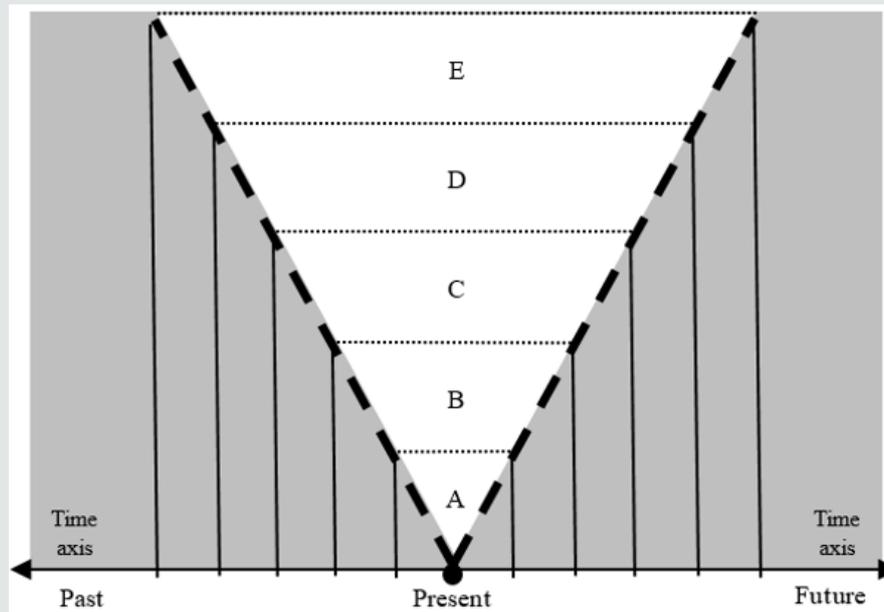


Figure 2: The events' cone in anthropokinetics. White field inside - consciousness; grey field outside - unconsciousness ("elsewhere"); bold dashed line - half-consciousness.

Consciousness, half-consciousness and unconsciousness

At that moment of our analyses appears the space for mental construction of what might be associated with the phenomenon commonly termed "sub-consciousness". This term seems to be incorrect, because it not describes the essence of the phenomenon under consideration. It may be regarded as a specific "black box", where one may put all, what scientists are not able to properly describe scientifically. In such a situation, the item put into black box termed "sub-consciousness" remains not understandable, indeed, but marvelously gains the attribute of "scientificity". However, one might imagine that the borders of the events; cone are not sharp as the cut of Japanese sword, but they make rather some fluid zones. While approaching the inside of the cone, the image of a given phenomenon or process becomes more and more pronounced, and inside the cone are completely clear. In such a model, each of the rungs-which dispose of its "own" modality of information processing and temporal limits of abstract representations of phenomena and processes-has also its own "zone of twilight of perception". Such a model would enable description of the phenomenon of gradual forgetting of a particular event. It would transfer from the inside

of the events' cone-in this region, its abstract representation is immediately accessible-to the "twilight zone". Its retrieving from this zone is possible indeed, but it is more difficult and time consuming. Finally, when it goes out from the zone of "twilight", it becomes completely forgotten. Such a "twilight zone" from the side of future one might dub "precognition", and that from the side of past- "shadows of oblivion". The representations of events in this zone exist, indeed, but they are not precise and indistinct. Therefore, the interior of the events' cone may be identified with the consciousness, the border zone-with half-consciousness, and the region of "elsewhere"-the unconsciousness.

To avoid creation of a "moonshine" term (like "sub-consciousness"), let us try to invent a rationale for what has been roughly dubbed "precognition". Motor operations are always faced towards future-closer or farther, according to the rung of the modalities' ladder. The main "processor", which produces the abstract, mental pattern of a motor operation is the intellect. It may be perceived, roughly as a system consisting of three mechanisms of information processing: intelligence, intuition, and instinct. Intelligence makes the "armed forces" of the intellect.

It is responsible for final shape of the motor operation pattern. However, to produce such a pattern, it needs full information necessary to given task solution and knowledge of all the rules of such information processing. We are very rarely in such a luxurious situation; we have not such a complete knowledge. Hence, if an information lacks, it must be guessed to get intelligence going. This makes the task for intuition. Finally, the instinct directs the searching for lacking information towards these regions of memory, where its finding seems to be most probable. The half-consciousness zone faced towards future cannot include the full information about a given task; otherwise, it would be the full consciousness. Hence, the intelligence itself cannot be effective in this region. As a result, here opens the wide field of action for intuition. The term "precognition" might be described, then, as a way of processing of not complete information, where the main tool is the intuition ("I don't know, but I suppose"), and only marginal role plays the intelligence.

The Events' cone in practice

The system presented in the Figure 2 may make sense only when the time period, assigned to a given rung, is sufficiently long to enable practical realization of the task related to this rung. Therefore, the lower rung, the simpler operation and the swifter its execution. And vice-versa: the higher rung, the more time-consuming preparation and execution of a specific motor operation. Let us imagine such a situation. During a solemn, international scientific conference, I am presenting my work. I am moving freely in the room and using a pilot for changing slides remotely. Suddenly, I take a pin, hidden in my sleeve, and acutely sting the buttock of a dignified, gray-haired scientist. What will happen? No doubt, the scientist will jump. It is natural reaction in such a situation: to take a distance from the source of pain. Does s/he realize immediately, what happened? For sure-not! Such an event would be so astonishing, so improbable, without any equivalents in the past, to which it might be related. The scientist would have to build the abstract model of the event, what inevitably must be time-consuming. Hence, at the contact B-rung the stimulus is received, response-prepared and executed, before at the verbal D-rung the stimulus is barely identified. However, if it happens, I would be far away.

The content of events' cone depends not only on information processing modality, but also on the level of pre-preparation of a needed operation pattern. In this respect instructively sound the words by Ben Johnson-mysterious racing driver "Stig" from the BBC program "Top Gear". In the interview, he stated: What defines a good driver? What attribute is necessary, and what merely useful? The anticipation. Racing driver is a person, who does not look for solutions of the problems that occur in a race. S/he knows those solutions, and when the situation comes, when the reaction becomes necessary, s/he simply performs the operations leading to its successful solving [15]. While seen from the perspective of the modalities' ladder, in this case we have to do with the D-rung depth of information processing being "pushed down" to the C-rung

temporal constraints. In daily language, such a process may be identified with what is commonly termed "experience". It has been described by Nikolai A. Bernstein [10,16].

On the other hand, if an individual has to his/her disposition C-rung time, one cannot expect the information processing with depth specific to D-rung. In such a situation suitable information processing should be located in the region of "elsewhere". For example, the analysis of car accident or ships' collision at sea, where the teams of expert witnesses have plenty of time for D-rung calculations and analyses, cannot be compared to the situation of a driver or captain, who was able to make only C-rung assessments, basing on previous experience, and had to his/her disposal merely seconds or minutes. Such a situation has been brilliantly presented in the movie by Clint Eastwood "Sully", about landing on 15th January 2009 on the Hudson River of the Airbus 320, in charge of the captain Chesley "Sully" Sullenberger.

Conclusion

Well, is it possible-based on the presented analyses-to formulate the conclusion that the laws of physics in their "pure" form may be applied also in anthropokinetics? For sure-no! One might merely assume that some mental structures, invented by physicists, may be used-after specific modifications-also in anthropokinetics. However, such an analogy reminds the similarity of the shark and the dolphin rather, and not a common law being in force in both these disciplines. It is not possible, then, to perceive it as a rule. In science there are no any well-worn, simple templates-like, e.g., calculations (not mathematics!) or any other commonly accepted methodologies"-which would release scientists from thinking. In this respect highly instructively sound the words by Niels Bohr: "You are not thinking; you are just being logical."

Philosopher Paul Feyerabend has invented an image of knowledge built by Truth and Freedom. The former has its feet firmly on the ground; the latter flies freely in the sky. Where they meet, the Science (with great "S") is being born. However, the Truth is harnessed with the stiff constraints; hence, it cannot for long remain in union with the unhampered Freedom. Hence, sooner or later, they must part their ways. Until next meeting. Analogously, also the similarity of the light cone and the events' cone should be treated as a result of a momentary meeting of the Feyerabend's Truth and Freedom, and not as a basis for formulation of more general theories.

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