

## **The second project for the 21-th century student: Let us try to use Schrödinger's hypothesis about the role of neg-entropy for life to help in solving the problem of hooliganism**

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Abstract: This is a second (after [1]) suggestion of a topic for a project for a student who wishes to look forward in the wide thematic (here a biological measuring) of modern electronics. The idea is motivated by brochure [2] by Erwin Schrödinger, connecting life with negative "entropy". Not having as pure a psychological background as in [1], but extending the idea of [2] the present work touches the psychology of personality in the sense of a collective societal influence.

The point is to fight against hooliganism in its modern organized version expressed in the *days of violence*, via the correct understanding of the causes of this very serious social phenomenon, and, consequently, to develop a just attitude to the defined "hooligans".

The project's target is to check the state of the brain activity of different humans when they are receiving the "typical" information from radio or TV, and to develop relevant recommendations for the editors of the news.

### **1. Introduction: a physiology-mind analogy**

When digesting food, our body finally lets the new molecules be absorbed by the existing body's structures. That is, the body makes an order, or decreases the entropy (complexity, disorder) of the intermediate situation with the molecules supplied by food. This is our normal physical digestion, given us by Nature, which will be never changed.

We accept that similarly to the physiological digestion, the *information that we receive* also has to be well (normally) treated ("digested"). That is, the mind's logical system has to decrease the entropy of our thoughts, caused by the received impressions, making the thoughts more ordered.

Though the analogy between the physiological and the intellectual "digestions" seems to be very limited, it is undoubted that every living organism resists any serious increase in the complexity of its physiological *and* logical-operation structures, thus ensuring that the functioning of the structures be successful, and the very structures unchanged.

It follows that we must be "fed" by information that is readily treatable ("digestible") by us. The systematic reception of information that one cannot treat may be compared to physically forced-feeding someone with food that he cannot digest, which would, undoubtedly, cause aggressive responses, and this is the main point of the adopted analogy, see also [3-5].

In his book [2] ([http://whatislife.stanford.edu/LoCo\\_files/What-is-Life.pdf](http://whatislife.stanford.edu/LoCo_files/What-is-Life.pdf) "*What is life?*" (see Sections 6 and 7) Schrödinger says that eating is more important for us as a supply of the negentropy (while a maximum of entropy "means death"), than as a supply of energy. The concept of entropy applied to a finite *structure*, that Schrödinger uses in [2] without any foundation (and we have just a little advance in that), can be reduced, however, to the concept of order or simplicity, see Appendix 1 and [3-5] (especially [4]) and references there.

Based on the "digestion analogy", we assume, -- as our constructive point for the intellectual/psychological side, which leads to concrete recommendations, -- that the reason for the organized hooliganism is the spreading by the radio, TV, Internet, etc. of information that the defined hooligans *cannot normally treat* in their mind, and thus the entropy (disorder) of the mind is increased. We thus assume that the "days of violence" [6] are a protesting response to the improper feeding. One remembers BBC reports of the type "*The police stood helpless not knowing from where and why all this comes to it*". The "days of violence" were not understood, and we would like to really explain them, noting that many facts around the hypothesis of "faulty informational feeding" appear to be coherent.

Since our assumption is that the societal dissatisfaction of those who participate "the days of violence" is of an *intellectual nature*, the social welfare problems that usually are seen as crucial, are assumed to be of a secondary importance. In our opinion, such problems mainly are a "trigger" for the protest accumulated because of more serious causes. Unfortunately, WEB search on "hooliganism" leads only to the "soccer (football) hooliganism", which, in the logical view that we develop, is a minor problem. That is, the "days of violence" that are a really deep problem, are absolutely not explained, which does not reflect honor on the numerous social and psychology journals.

Before formulating the target of the project in Section 3, we make in the next section the point regarding the use of entropy in [2] more concrete, which is necessary because Schrödinger actually speaks about some undefined *structural entropy*, using terms appropriate for the (usual) statistical entropy.

Appendix 1 recalls the meanings of thermodynamic and statistical entropies in simple terms, and also supports some arguments of Section 2 regarding "structural entropy".

Appendix 2 mentions some (both theoretical and experimental) works from the field of academic brain studies, which may be interesting to a strong student.

Appendix 3 considers the problem of hooliganism *per se*, as a social and psychological phenomenon, and in a much wider scope than that needed for understanding the formal target of the project. Since the importance of hooliganism is obvious in any frame, this appendix can be ignored at the first reading.

## **2. From the physiological outlook of [1] to the problem of hooliganism**

Speaking about human physiology, Schrödinger says that the main role of our feeding is in *decreasing our entropy, and not in receiving energy*. This is, at first, very unexpected, because we cannot live without an energy supply, and because significant changes in entropy of a system usually occur together with some processes consuming/releasing significant energy. However, Schrödinger is focused on *life* and not on any complete description of the physical processes occurring in/to some bodies.

Making the argument of [2] more feasible, we interpret (see [3,4] for more details) the "decrease of entropy" after eating as not something ("negentropy") directly present in food, but as a *possibility* for us to decrease the entropy  $S(t)$  of the body's molecularly system, which was *increased* after the body received the new molecules that have to be included in the body's structures.

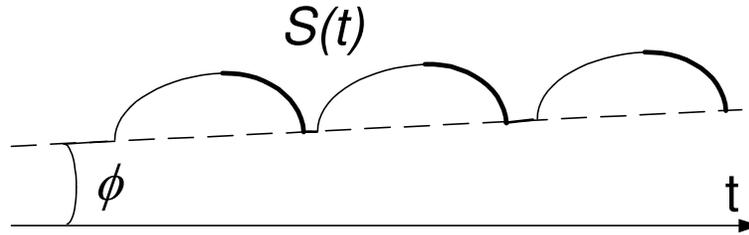


Fig. 1. This is life in terms of  $dS/dt < 0$ . ( $\phi \ll 1$ ) The intervals of the bold lines show that the body successfully absorbs the new molecules within its structures, which obviously is the essence of life, and, at the same time, since the positions of the new molecules obviously become *ordered* (fixed) with this absorption, the entropy is decreased. This is the actual sense of Schrödinger's thesis defining the essence of life as receiving neg-entropy.

The right part of Fig. 2 shows the situation when the body is not able to decrease the entropy; thus, though the supply of the new molecules still occurs, death is inevitable.

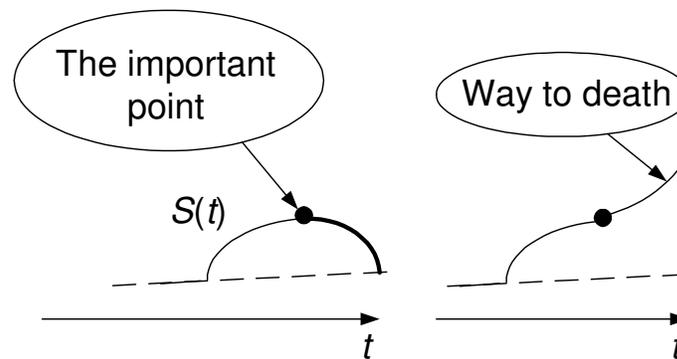


Fig. 2: The right figure is the bad case; the body fails to decrease the entropy. The structures of the living body cannot grow, and the body cannot perform the maintenance of the structures. Both life and death are simply seen in terms of negentropy. Of course, in the intellect's case, "death" means the appearance of psychological and behavioral abnormalities.

As was said, we accept that the situation re our *information feeding* is basically similar; that is, we must be "fed" by information that is well treatable ("digestible") by us. In more physical terms, the *treatment* of information in our mind/brain must, from time to time, decrease the activated area of the brain and thus the entropy of the logical scheme. In the intellect's sense, "death", illustrated by Fig. 2, means the appearance of behavioral abnormalities, and the increasing entropy of the logical system (mind, thinking) can lead, as was argued, to violent actions aimed to simplify the psychological situation.

It is important to notice that the problematic slogans were calling for *violence* and not for hooliganism. No "days of hooliganism" were announced. That is, *violence per se* simplifies the intellectual atmosphere, and thus is "needed". The defined (of *this* type) "hooligans" are *not* proud of any effective hooligan actions. They are alarmed by their *internal* psychological problem, -- the necessity to *simplify* the psychological situation imposed by the informational complexity of their mind, of They see before their eyes their families which they will not be able to support without the simplification provided by the violence.

Without doubt, the society has to well understand the reasons for the "days of violence", even if only because of the legal side associated with the definition of hooliganism as crime, and associated punishments.

The distinction between the notions of violence and hooliganism will be absolutely clear after reading Appendix 2: violence stops development/activity of the right hemisphere of the brain; hooliganism is expressed in actions developing the left hemisphere. The union of the two is natural if the right hemisphere is overdeveloped with respect to the left hemisphere.

Definitely, the days of violence are not an expression of the simple usual hooliganism.

### 3. The target of the project

Since today the electrical activity of the brain and such responses as anger can be measured [7-9], the project's target is to check the state of the brain activity of different humans when they are receiving the "typical" information from radio or TV, or Internet, and, as the final target, to develop the relevant recommendations for the editors of the news, etc.. The experimental checking can be done in regular laboratory conditions, or when the person under investigation is sitting against the driving-training fixture, because this too is the common reality.

There are some degrees of freedom left for the student's initiative, but in any case, one must detect *whether or not the human receives the information as some suspicious gossip causing him to worry or be angry, or he treats the information in his mind by normal quiet thinking*. Obtaining statistical data of the brain activity, which would distinguish between the two possibilities, would be very important.

Some information about the concept of entropy is found in Appendix 1 and in [4]. This information shows a student who likes theory that he can develop here a deeper research approach. In particular, finding (in entropy units) the threshold criteria for the difficulties in treatment of the information would be interesting. However, no such research in depth is necessary for the formulated target of experimental checking of the brain activity, and the project as such can be relevant also for an average student.

### 4. Conclusions

Our very decisive position is that the society must abandon its ambitious pride in its intellectual ability, -- an euphoria that cultivates the narcissism of intellectuals, growing in the modern world like a rolling snow ball. We have to speak not only about the things that, in principle, increase the entropy of our mind (or of the very methods of the logical operations), but also about the things that can help one to decrease the complexity.

Society must start to observe and learn *what* this euphoria and this intensive propaganda of intellectualism, means to the majority of people, and to learn how to speak with people in general. See also recommendations in [12].

The proposed project helps us to study the basic limitations of our mind, defined by Nature, and will be never changed, just as the limitations of our physiological-digestion system will be never changed. Of course, for both, there are some statistical distributions observed over the whole society, but the basic parameters of these distributions are prescribed by Nature.

### **Appendix 1: On the concept of entropy**

The usual thermodynamic entropy, is defined (originally only for reversible processes) as

$$S = \int \frac{dQ}{T} , \quad (\text{A1})$$

where  $Q$  is the received heat, and  $T$  is temperature. The integration is over the volume of a system composed of some distinguishable subsystems (parts having different temperature), or over the track of the system undergoing a work-cycle.

Boltzmann's equation (with his constant  $k$ , and  $P$  as the probability of the distribution of the particles involved)

$$S = k \ln P \quad (\text{A2})$$

explains the statistical sense of  $S$ . Indeed, the small  $dQ$  appearing in

$$dS = \frac{dQ}{T}$$

means a small addition of some *disorder* to that of the system,

$$dQ = \alpha \cdot d(\text{disorder}) ;$$

however,  $T$  is also associated with the system's disorder, thus

$$T = \beta \cdot (\text{disorder}) ,$$

with some constants  $\alpha$  and  $\beta$ , and for  $dS$  considered as some measure of the *relative change in the total disorder*, we have

$$dS = \frac{dQ}{T} = a \frac{d(\text{disorder})}{\text{disorder}}$$

with  $a = \alpha / \beta$ . From the latter formula, entropy as a function of "*disorder*" is given as

$$S = a \ln(b \cdot \text{disorder}) \quad (\text{A2a})$$

where constant  $b$  is due to the integration. That is,  $a = k$ .

For final adjusting (A2a) to (A2) it remains to formulate "disorder" in terms of probabilities, which should also give the value of  $b$ . This is usually done by speaking about the probabilities of *certain states that might be described and realized*.

The problem we meet (and this is the severe problem in [2]) is that we have to associate entropy with the complexity of the *macroscopic* structures that interest us here. This is not simple; however, just the usual approach of seeing probabilities in terms of realizations of certain states, gives hope for the development of a reasonable application of the concept of entropy to the characterization of structures. Then, (A2) can be related also to macroscopic models required for the description of living, botanic or zoological, objects.

Thus, in order to follow the line of [2], one can replace, as in [4], the concept of "probability" by the concept of "possibility", considering, for instance, the different, equally good, possibilities of connecting parallel branches of a 1-port, which can be the matter of arbitrary choice during the work of the designer/technician. In such approach, the basic scales' distinction compared to the statistical situation just means that the processes need not be as quick as the molecular movements in a thermodynamic system, and not with so many non-controllable degrees of freedom, but the probability sense is kept.

Remark: For a formal definition of "structural entropy" one can consider the graph or matrix theories, starting from simple models. Information theory, associating entropy with signals, should also be helpful here (e.g. [10]), because signals and systems are inseparable by their physical definition; we do not need one without the other. One also notes that in solid state physics, many structures are studied by wave scattering, etc.. However, in making such a formalization, the physical essence of the things can be easily hidden behind numerous description details. Intuitive use of entropy or "disorder" can be allowed here, especially in view of [2], where such use is demonstrated.

Keeping the connection with statistical entropy via Boltzman' formula, we can easily observe that the thermodynamic entropy obtains maximum at the thermodynamic equilibrium. Indeed, if we see  $x$  as a parameter that at the equilibrium obtains the value  $x_0$ , then, using

$$S_0 \equiv \max\{S(x)\} = S(x_0) , \quad (\text{A3})$$

assuming that for  $x \approx x_0$

$$S(x) \approx S_0 - \mu(x - x_0)^2 , \quad \mu > 0 ,$$

(the usual parabolic maximum), and substituting this expression for  $S(x)$  into (A2), one obtains that

$$P(x) = e^{S_0/k} e^{-(\mu/k)(x-x_0)^2} ,$$

i.e. a Gaussian distribution, and the same for a set of several describing parameters  $\{x_i\}$ .

Since the behavior of the live body near the maximum of the entropy relates more to death than to life, we thus see that Gaussian distributions, and thus, probably, *any statistical* distribution is not helpful for the description of life. In view of

monotonicity of the logarithmic function, it is even directly seen from (A2) that any probability distribution with a maximum includes the point where the statistical entropy possesses its maximum, which, in terms of [2], means death.

We have to be limited by these brief completions to Section 2.

## **Appendix 2: The brain activity**

In [11] the development of the right brain hemisphere, stronger than development of the left hemisphere (this is named in [4] *the "R+ problem"*) is seen as a *reason for violence*, because violence obviously stops the deep intellectual activity (such as scientific creativity) associated just with the right hemisphere, while associated aggressive actions can help in the development of the left hemisphere responsible for the simple feeling of time and distance, counting, etc..

It is not easy to directly biologically observe and measure the unbalance in the development of the hemispheres. It can be assumed, however, that one feels in some way, the difference in the electrical activity of the hemispheres, and this unequal distribution of potentials becomes one's problem. Actually, we speak here about some electrical interaction between the hemispheres.

Since it is known that the frontal part of brain (related to both hemispheres) is responsible for human communication, the empirical investigation of [8], revealing that some magnetic excitation of the front of the left hemisphere, influencing then the right hemisphere, cause *angry faces* of the patients (who did not know the purpose of the experiment), is very interesting.

It is not clear a priori whether the overdevelopment of the right hemisphere causes its stronger electrical activeness, or weaker (as if there is some saturation) one, as compared with electrical activity of the left hemispheres. In any case, the influence of some *asymmetry in the brain activity* on aggressiveness seems to be undoubted, especially in view of the pioneering investigation [9], involving, in particular, empirical studies of aggressive prisoners.

The mentioned academic researches can be completed, however, by the simple experiments that we suggest from our "phenomenological" point of view that directly touches psychology and sociology of the everyday reality. The connection between the very different approaches should be given by some system-theory approach using constructive modeling, which could allow a formal introduction of the complexity (entropy) argument. In particular, it would be interesting to find a phenomenological argument explaining whether the informational overdevelopment of a hemisphere leads to its relatively stronger or weaker electrical activity.

As it stays now, works [8,9] (see also the references there) and the present "phenomenological" outlook touch the problems of human spiritual health and behavior from very distant edges. Maybe, starting from the suggested simple project, a student will find his own path in this field, combining biology, sociology, and psychology, -- the topics that all may be touched by modern electronics!

### **Appendix 3: On the way of modern society and on the real frames of hooliganism**

#### ***A.3.1. Intellect and democracy: a paradox***

Let us note, additionally to the considerations in the main text, that the founders of the theory of democracy, Plato and Aristotle, saw democracy as a societal state *opposite to dictatorship*, but suggested to distinguish between the roles of people of different intellects, assuming that the more intellectual group has to be more influential in the borders of the democratic structure. Even though the currently accepted humanistic democratic principles formally do not make any distinction between humans as re their social rights, -- that is, we seemingly have progressed compared to the position of the ancient philosophers, -- as the matter of fact the powerful information means promote influence of the more intellectual group, which is stronger than that what Plato and Aristotle could imagine.

Originally wishing to come to social justice in the sense of the usual food supply, democracy freedom and technical progress have led us to a severe problem with the intellectual feeding of the society. When the powerful information technique is involved, the *positively oriented* [4,11] intellect's targets can become a dangerous tool, and the intellectualism and the "advanced" democracy appear to be in paradoxical relation.

The present situation is that radio, TV and Internet create the same strong informational stream for all of us. Though one can choose a channel or site he likes more, -- **the intellectualism is the single society ideal given for everybody**. This does not give respect to simple people, does not make them confident, and this is the source of the protest which is expressed in hooliganism of different kinds, including the "days of violence", and as we even argue in [11], it even can be already seen in the "classical" WWII fascism.

#### ***A.3.2. The opinion of Dostoyevsky and the mind of a simple man***

It is written in the novel *The House of the Dead* by the outstanding Russian thinker Feodor Dostoyevsky, that a simple man and an "intellectual" *will never be friendly*. Since Dostoyevsky's interests always were psychological, and not sociological, this insistence actually is the observation of the *different way of thinking* in the different groups. Indeed, it is clear that for a simple man it is first of all very important to be *well concentrated*, i.e. clear minded, since he can have dangerous work. He also must be well concentrated when driving car whose repair is very expensive for him, and he must have a clear mind for communication with his wife, child and mother, which is his (almost) whole intellectual life.

A simple man does not perceive life philosophically, and the members of his family do not see him humoristically as it often is in the family of a professor who can earn enough money, even if he is a funny "spread" person. That modern society becomes less and less religious makes the influence of these life-game rules/factors sharper. Damage to one's clear mind, which can be caused by a too complicated intellectual (informational) feeding, can be a catastrophe for a simple man whose seriousness must be much more firm and stable than that of an intellectual. *It is clear that the information flow being received should not be a burden for the simple man*. Hardly, any relevant authority is concerned with that.

### A.3.3. *The making simple mind complex is a killing of life*

Speaking about mind, we have to observe that simple structures (logical systems) *better* represent life than complicated structures that it is more difficult to grow up (breed) or maintain in the sense of the periodic decrease of entropy, i.e. in terms of Fig.1.

This means that by making simple minds more complicated, society kills life. In other words, the making of intellectualism into the main society ideal is, at a large scale, a type of suicide for humanity. Intellectualism is allowed to be a *personal* ideal for a properly gifted person, a matter of one's free choice.

However paradoxical it is, for one who has devoted his life to research work, the present opinion is that just the ambitious wish of humanity to demonstrate (to itself!) its thinking power, is the cause of the troubles that directly lead to hooliganism in its different forms. In fact, this paradox is not so surprising, because it is not difficult to understand that the "intellectual/informational feeding" of people with the information that they cannot well digest – *is hooliganism in itself*. That is, the hooligan physical actions just reflect some initial, *initiating* hooliganism found in the scornful attitude to simple people of the society's means of information. (Note that, this very regretful conclusion inevitably follows here from the position of [2].)

Intuitively, simple people understand this perfectly, and the "hooligan" reactions of the "days of violence" are the first signs of their protest which will be enhanced as time passes, if the incorrectly oriented (focused) policy of the means of public information is not be changed. According to [11] this is already observed in the cruelty of the Holocaust.

### A.3.4. *Do not create "classes" of people!*

History teaches us that creation of *classes of people* is dangerous, e.g. the creation, due to the industrialization process, of the class of factory workers led Marx and Engels to the slogan "*Proletarians of all countries, be united!*". (This was, first fo all, an observation of the physical possibility to use an accumulated power.) Similarly, the "intellectualization" policy of the means of information can (will) cause the simple people of the world be united, in some, common for them philosophical frame, against intellectuals, and the known troubles that Jews have had will come to *all* intellectuals because they will *all* be seen as *different*.

It is interesting to notice at this point, that the often-met hate of the "different" can be directly understood in terms of the preservation of life, as discussed in the previous item. A contact with the "different" can lead to the acquisition by one of some of the "different" properties that are not natural for one. From that moment, in order to remain "alive", i.e. in order to preserve his features, one has to preserve the acquired property, but it is difficult and not natural for him. In some psychologically always-present sense, the "different" always appears as a sick person from whom one can get a dangerous disease.

By the way, the Rwanda holocaust made by Hutu against Tutu, also had, in its foundation, the simple fact that these two groups living in the same country, were clearly *different in their education and social positions*. Tutu were in a better (an aristocratic) position, and Hutu decided to prove that they are better than Tutu, using that an alive seems to be better than a dead. Thus, our position can be supported not

only by the days of violence and the Holocaust of WWII. However, there are other terrible, more recent, observations.

### A.3.5 *This is anti-intellectualism*

Quite recently, a participant of NDES 2012 told me that today in small Russia towns Jews cannot walk at night, because they are killed, -- and, he added impressively, -- people with glasses are also killed as they are accepted as Jews (!). It is clear that people with glasses are *not* accepted as Jews, but both Jews and people with glasses are accepted as intellectuals (Jews because of their famous prophets and numerous scientists). This anti-Semitism is a part of *anti-Intellectualism* of the same basic nature as the propaganda preceding the "days of violence", saying that this world needs violence (as simplifying the psychological situation, we argue). It seems that educating people in the sense of the present point of view would be quite timely, which has caused us to introduce the present Appendix.

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