THE STUDY OF THE TOLERABILITY OF THE ECOSPHERE IN CELLULAR AUTOMATON MODELS

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Az elmúlt 5 -10 év kutatásai bebizonyították, hogy a környezeti rendszer (ökoszféra) sejtautomata felfogásban történő vizsgálata gyümölcsözőnek igérkezik.

E kutatási irány legfontosabb jellemzői a következőkben foglalhatók össze:
A sejtautomata modell ma az egyik leghatékonyabb operatív kutatási eszköz, amellyel a komplex rendszerek kisérletileg tanulmányozhatók. A kisérletezés eszköze a számítógép, az orvosi kutatásban alkalmazott in vitro módszerrel analóg „in silico” technika.
A sejtautomata modell számot tud adni az emergenciáról amit a magyarban talán az angol „emergence” után a „rendszer-létesülés” kifejezéssel lehet visszaadni.
A sejtautomata modell számot tud adni az önszerveződésről, amely a környezeti rendszerek elidegeníthetetlen attribútuma.
A környezeti rendszerek tanulmányozására Clarke által kifejlesztett SLEUTH elnevezésű sejtautomata-modell feltárta azokat a hatáselemeket és kockázati tényezőket amelyek tekintetbevétele a gyakorlati alkalmazásokat is lehetővé teszik.

Introduction

The researches in the past five to ten years have proved that the study of the environmental system (ecosphere) in a cellular automaton approach seems to be fruitful. The major characteristics of this research branch can be summarized as follows:

- A cellular automaton model is nowadays one of the most effective operational research tools, by which complex systems can be experimentally studied. The tool of experiment is the computer, the technique is “*in silico*”, analogous to the method *in vitro,* used in medical researches.
- The cellular automaton model can render account of *emergence (*in Hungarian literally: creation of a system).
- The cellular automaton model can render account of *self-organization*, which is an inherent attribute of environmental systems.
- The cellular automaton model named SLEUTH, developed by *Clarke* to study environemntal systems, revealed the effect elements and risk factors, the consideration of which facilitate the practical applications.

This study intends to further develop the SORS model, previously elaborated for the ecosphere [Bukovics 2006a] in relation to the study of tolerability, i. e. we intend to render account of tolerability in a cellular autamaton model named SORS.

Precedence

The acronym SORS refers to “Self-Organizing Raiding System”.
The basic idea is:

(1) Every operation’s (including strategic games played against nature) weakest point is usually the unorganized state.

(2) To avoid unorganized state and to restore organized state selforganizing systems are the most suitable means.
(3) Artificial selforganizing systems, selfreproducing automata are known as cellular automata – networks of automata.
(4) Cellular automata have also been used in practice on the present level of development of information technology.

In the present study we assume that a risk system is given with an *explicatum*.
This means the following:
From a formal aspect, under a **KR** risk system we understand a system of Boolean algebraic equations with n members,

$$E_i = C(E_{i_1}, \ldots, E_{i_{m_i}}) \quad i = 1, \ldots, n$$

where
E indicates arbitrary but fix elements of a Boolean algebra of m order, to which the following is true:
$m_i = 1, \ldots, n$ and $i_1, \ldots, i_{mi} > i$ (1)
C means the conjunction or disjunction of m_i number of Boolean variables.
$\mathbf{E}_i$ elements are called the vents of a **KR** risk system, and we say that the logical type of $\mathbf{E}_i$ is "A" ("AND") or "V (OR, "Vel")", depending on wether function **C()** means conjunction or disjunction.
The elements on the right hand side of the equation system are the *explicants* of the element on the left hand side. The elements on the left hand side of the equation system are the *explicatums* of the element on the right hand side. The events, which are exclusively present on the right hand side are called *prime events*, the rest are called *complex* events. The above equation system, together with its restrictions is called *risk explicatum.*

The central notions of SORS (which are not defined with a strict theoretical apparatus, but only colloquially described (in a narrative intuitive way) are as follows:

(1) *Site* and *scene*. Site as the most basic notion of SORS is what sustainabilty can be referred to, to which the model of sustainability (normative and not descriptive) is intended to be used. Site is where events happen, where processes go on, from which some are to be sustained, some are to be changed (including the logically possible *termination*). We intend to elaborate and apply the paradigm of sustainability to sites, where the ongoing changes are typically chaotic, quasi deterministic and unique. In SORS, site is the interpretation of scene, i. e. scene is the abstratction of site. In other words, scene is the *explicatum* [1] of site. *Site* may be the entire surface of our Earth, or it can be a well-describable geographical unit: London, New Orleans, Madrid, a jungle, a flood- or earthquake-stricken settlement, a part of a forrest becoming inflammable due to aridity, an area infected by viruses, an agricultural unit populated by a weed-killer resisting weed-relative of a transgenic weed-killer resisting rape, an area of an airport waiting hall suspicious for narcotics smugglers etc., etc. The success of application on all the above depends on how well the applier of SORS can correlate scene to site (more precisely: some given features of site in SORS

[1] L. [Bukovics-Molnár]

to the feautures or requirements relating to scene.) Scene is what a cellular space (cellular automaton) represents in SORS theory.
The parts of scene are cells (as the elements of cellular space), in SORS, theory parts of site correlate them. Such parts can be demonstrated typically as a block of flats in a city, a pollution source with measurable emission, a piece of land with soil pollution, etc., etc.

(2) *Cellular space, transitional function*[2]: A scheduled system, connected according to a homogenous network of identical, finite, deterministic automata – cells – , in which every cell's next scheduled state only depends on the last scheduled state of its own and its neighbors. The kind of dependence is specified by the (local) transitional function.[3]

(3) *Cell state:* In the SORS model, it is a number between 0 and 15, indicating the cell's *threat degree* (of the part of site, forming the cell's interpretation).

(4) *Threat degree:* In the SORS model, the threat degree of a cell (a part of site correlated to the cell) is defined by the kind of interval of the management cost and time demand of the *cell's prime event* (specified by preliminary agreement).

(5) *Prime event:* A common undesired event is assigned to every cell, the management (prevention of or the response to) of which is the goal. This undesired event is called prime event and is correlated to and interpreted for every cell (more precisely: to every part of site correlated to every cell). To manage a prime event we use the methods of logical risk analysis[4].

(6) *Logical risk management*: It deals with the so-called nonprobabilistic risk. The unique and unrepeatable events' – disasters are, naturally, like these – risk cannot be described by the method of probability calculus. Since we are intending to approach sustainability using disaster theory methods, we cannot avoid using logical risk analysis.

The expression "non-probabilistic risk" can hardly be found in the Hungarian specialized literature in its literal translation (at least according to the Internet). One of the possible synonyms could be "deterministic risk", "logical risk (?)". The intuitive content of its meaning could be perhaps defined that we can speak of non-probabilistic risk if uncertainty prevails in case of events, phenomena, happening, whose *probability cannot be interpreted*. "Cannot be interpreted" *does not mean* that, for us (due to the lack of our knowledge or information), *the probability in question is not known*, but it means that the assumption that the event *has* probability leads to a logical self-contradiction.

The fact that an event can be risky even if it does not have probability (i. e. the numerical probability cannot be interpreted), might seem surprising at first glance, but 9/11 2001 (the day of the New York terrorist attacks) made not only the basic issues of security and freedom necessary to be reviewed, but also the theoretical bases of risk analysis and disaster management, emphasizing the imperative necessity to use logical risk analysis.

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[2] L. [Fáy]
[3] This intuitive expression is a quote from [Fáy]'s study. The exact mathematical definition, by far exceeding the latter, can be found in [Riguet]'s study. In the present study, it will not be needed to such an extent, although it is indispensible in forming SORS and in its computerized implementation.
[4] The method of logical risk analysis is characterized by the fact that we omit all that refers to probability from probabilistic risk analysis (in other words from the fault-tree method) .

Figure 1 below shows a part of a cellular space representing a system (site), i. e. a part of the site desired to be modelled (in the format of a scrollable chart).

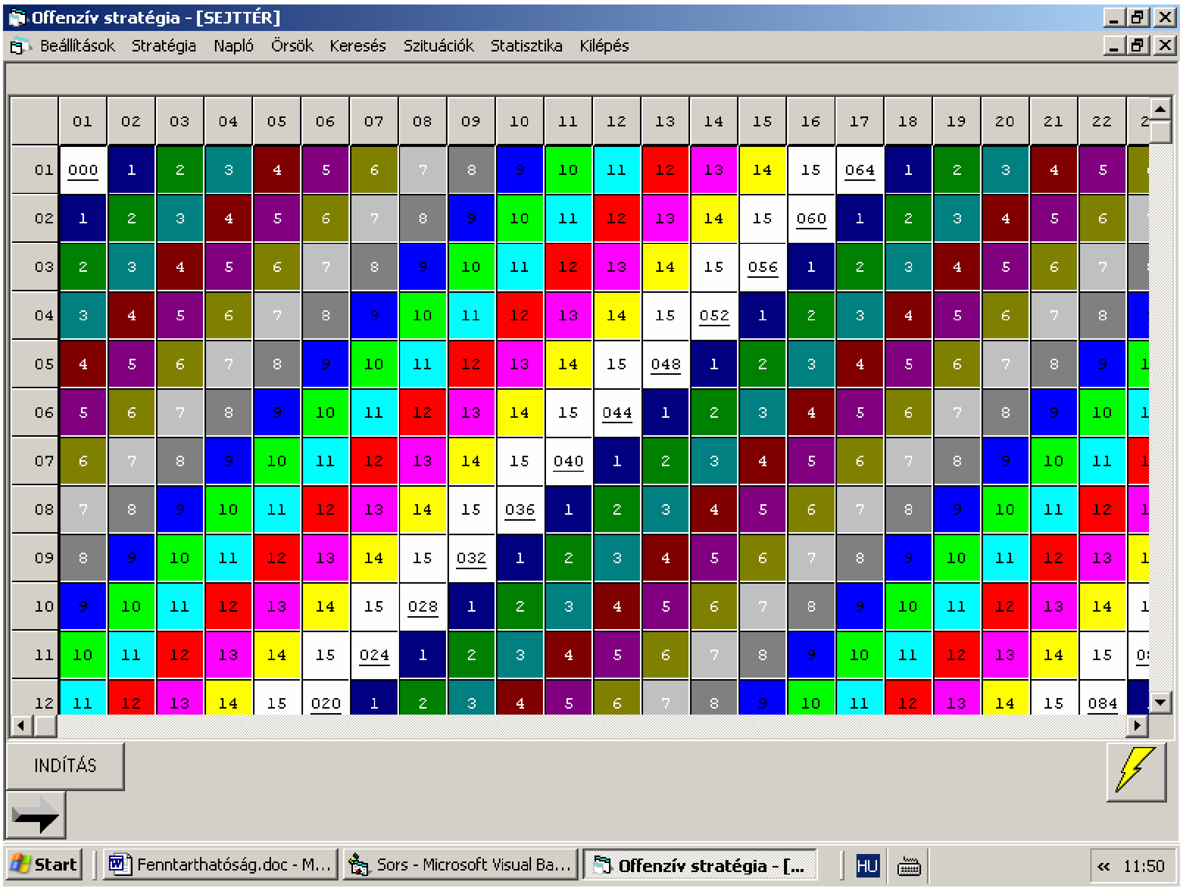

Figure 1
The basic status of cellular space

The intuitive content of tolerability

Conventional context

To grasp the intuitive content of *the notion of tolerance* to be introduced in relation to the ecosphere, discussed and interpreted in the SORS model, one has to take into account the context, in which the *colloquial* meaning of the following notions is fixed and seem to be acquired consensual acceptance in the European Union [Sagris]. This context is characterized by the following key notions:

Vulnerability: The degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Climate Variability: Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all temporal and spatial scales beyond that of individual weather events.

Exposure: The nature and degree to which a system is exposed to significant climatic variations.

Sensitivity: Sensitivity is the degree to which a system is affected, either adversely or beneficially, by climate-related stimuli. The effect may be direct (e.g., a change in crop yield in response to a change in the mean, range, or variability of temperature) or indirect (e.g., damages caused by an increase in the frequency of coastal flooding due to sea level rise).

Adaptive Capacity: The ability of a system to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences.

Risk: The probability of harmful consequences, or expected losses (deaths, injuries, property, livelihoods, economic activity disrupted or environment damaged) resulting from interactions between natural or human-induced hazards and vulnerable conditions.
Conventionally risk is expressed by the notation Risk = Hazards x Vulnerability.
Some disciplines also include the concept of exposure to refer particularly to the physical aspects of vulnerability.

Hazard: A potentially damaging physical event, phenomenon or human activity that may cause the loss of life or injury, property damage, social and economic disruption or environmental degradation.

Hazards can be single, sequential or combined in their origin and effects. Each hazard is characterized by its location, intensity, frequency and probability.

Vulnerability: The conditions determined by physical, social, economic and environmental factors or processes, which increase the susceptibility of a community to the impact of hazards.

Exposure: Physical aspects of vulnerability.

We intend to insert the intuitive notion of tolerability into this context, into the inherent approach, in relation to climatic extremities.
We emphasize that the above glossary does not replace, in any way, the exact definition; it merely serves for setting down the intuitive content.
As far as *tolerance* itself is concerned, which we intend to introduce as the explicatum of "tolerability", one should be prudent when defining its content. Namely, the danger persists that the *formal* notion of *tolerance*, introduced by us, will be criticized based on its *verbal* meaning; it may become the subject of misunderstandings or even misinterpretations.

Roget's notion classification

To grasp the intuitive content of tolerance we start off Roget's Thesaurus [Roget]. In Roget's notion classification "toleration" has six different meaning domains. These and their contexts are as follows:

- "Benevolence" 906
- "Calmness" 826
- "Feeling" 821
- "Laxity" 738
- "Lenity" 740
- "Permission" 760

All these belong to the class of *affection between people.*
However, the subject of our study is the *tolerability against undesired climate change*. In the Hungaruian language the following words reflect it better: *"stand"*, *"tolerate", "survive", "resistent"*. In English the expression "climate change tolerance" suits the best. However, to our knowledge, at present it has no scientific definition.
Thus, the notion of tolerability should be approached with an abstraction and defined in a transferred sense.

Tolerability as a way of conduct

In the present study, the intuitive notion of tolerability is interpreted in the following way: Tolerability characterizes the *way of conduct* as a risk system responds to undesired effects with its state chenges.

Common language presents numerous signs of appearance of tolerability and in many cases facilitates quite a wide range of word usage. Their study can explore several *enthymemes*, which can enhance the establishment of an exact tolerance notion. If we try to express them in general terms (which can be correlated both to human beings and objects), it might seem obvious that in some cases such tolerance notions "hide", in which an undesired *event does not leave a trace in the memory*, in other cases it does. Let's call the first way of conduct, for our own use, "*pack-horse patience",* opposed to *"taurine patience"*. A person with pack-horse patience "does not even pick up" the offense (i. e. the undesired event). This shows that he (presumably) *does not remeber* the offense, *the undesired event does not leave a trace in his memory*. Of course, on the level of simple observation one cannot exclude the possibility that the offense does leave a trace, but only for a short time. We prefer this hypothesis. The relation "to leave a trace in the memory" can be interpreted as a change of state in the SORS model, and indepedent from an obscure and sloppy psiychological reminiscence. A person with taurine patience formed a way of conduct and reached a state, in which he was in the *offensive* againts an undesired effect. If we assume that a "transitional function" works in a human being, which (in the spirit of psychophysical parallelism) describes this process as an action (more precisely a reaction) is created from an offense (i. e. from the event of perceiving an undesired event), we come closer by a step to the basic assumption of the SORS model. In the SORS model, one can well demonstrate the two basically different reactions of the effect (on some cells): in some (well defined) environmental states (i. e. in case of change of state) *there is a reaction* (i. e. the cell's state changes), in other cases *there is none*. According to this, there is a meaning of the fact that a cell "tolerates" certain environmental effects, but does not tolerate others. In this respect, tolerability is related to regulation theory problem. How a cell reacts to an environmental effect (state) can be discussed without any problem in the SORS model with the conditions for transitional functions. However, the task is not only to interpret an operative tolerability for certain cells, but besides this that we interpret tolerability on the *entirety* of the risk system. It is not the local tolerability, i. e. the one that belongs to *individuals* (human beings, villages, towns, countries, continents) that needs to be developed but the global tolerability of the Earth as a risk system. The logical relationship of the local, individual tolerabilities with the global tolerability is the actual topic of our study.

The introduction of the notion of *offensive state* in the SORS model, more precisely in relation to the cell belonging to it is problematic. It does seem reasonable either that it would sensible to to compensate the undesired ebvents of climatice extremities with a kind of offensive conduct. The game against nature – in our interpretation – cannot be offensive. In other words, in the SORS model it is not the taurine patence way of conduct that needs to be implemented (honestly, at present we do not see any technical possibility to do so).

At this moment – on a purely formal basis – the question arises: whether the defensive state (conduct, strategy) seems to be more expedient and easier implementable in the SORS model. For this, it has to be taken into account that defense as the opposite of offensive has two subcases: one of them is *active*, the other is *passive* defense. The latter is well-known in the everyday language as passive resistence and the different forms of strikes. The notion of *passive defense* is by far more technical, and is an everyday practise of disaster management and warfare. It is a

question whether the explication of this way of conduct and its imbedding into the SORS model (lacking other possibilities) is necessary or whether a *third form* exists, which cannot be classified under the notion of either defense/protection or offensive. We think yes, and it is *adaptation*.
Human beings can mostly be affected by two undesired effects. One of them is illness, the other is *accident*.
We protect ourselves entirely differently against illnesses and accidents.
A kind of a tolerance notion can be originated from both and it necessitates two kinds of simulations of offensive in the SORS model. In the SORS program, it is represented by the menu points Offensive and Defense.

Tolerability as a rehabilitation and failure avoidance ability

Adaptation – according to many – is the only possibility of climate policy.[5] A form of adaptation especially interesting to us is *mimesis*[6], which can be observed everywhere in nature. Mimesis – as camouflage – is a generally known and used procedure in warfare, however, it is not used in disaster management, as far as we know, (if only we do not reckon disaster management against terrorism among them). At the same time, in the SORS model, more precisely in the range of notions of risk system strategies – theoretically and in strongly transferred sense – it is the knowledge of a strategy closely related to it. This was introduced in the study as *Shannon's strategy* [Bukovics 2006c]. Shannon's strategy is not about whether we make a state of a risk system *undetectable* for an attacker, since in relation to climatic extremities the "attacker" is nature itself, and in this relation, in the SORS model, "noticing" does not seem to be interpretable. However, it is possible to interpret and ensure *inpredominatability* or *terminatability of predominance* of an offensive. This possibility is *syncathegorematic* in the sense that only the notions of "*inpredominatability of an offensive" and "terminatability of the predominance of an offensive"* can (should) be interpreted, but the notion "offensive" separately cannot/should not.[7]
The basic idea of Shannon's strategy is as follows. There are events which only occur if several events simultaneously occur at the same time. These are called *conjunctive* events in risk theory and everyday practice brings millions and millions of examples each day. It is enough only to mention the example of fire. One of the necessary conditions of the breakout of fire is to have inflammable material on site. Another condition is the presence of oxygen. When extinguishing fire we do not terminate its *cause* (not just because the notion of *cause* is a problematic *transdisciplinary* notion, which is affected in all the disciplines starting from physics, chemistry, aerodynamics, electrodynamics through to criminology and law), but the *condition of its predominance,* e. g. by terminating the presence of oxygen. The protection/defense of several risk systems can be ensured according to this principle and Shannon's strategy is built on its theoretical elaboration. The study [Bukovics 2006c], in this respect, serves with abundant details.
To intuitively perceive tolerability as a *rehabilitation ability* the indisputable fact also belongs there: an individual's tolerability (and here, in theory, it is absolutely the same whether we talk

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[5] Compare: [Bukovics 2006b]
[6] The word mimesis is used in the sense as ethology (borrowed from history of arts) uses it, i. e.: "The similarity of the integument to the environment, its coloring is patchy or striped, its patterns or other peculiar drawings, which helps stay unnoticed". Compare e. g.:
http://www.nyme.hu/fileadmin/dokumentumok/emk/vadgazdalkodas/vadaszati_okologia/allatokologia_kezirat.pdf
[7] It is similar to: "we are not inferior to any nation" expression is of full meaning without allocating any meaning to the expression "abject nation".

about a homeless person or the ecosphere), essentially depends on two factors: *its own skills* (makings, possibilities) and *connections*. The former factor belongs to the conventional research area of occupational psychology. The other factor is in relation with a relatively new research area, network theory. There are risk systems where the key to questions originating in risk are to be mostly searched in network relations. These can be called *network centric risk systems*. Pre-eminently, all environmental systems (and models) belong here, the ecosphere itself, and so the SORS mode, too, but *critical infrastructures*[8] and *network centric warfare*[9] can also be reckoned here. The reason we chose the cellular automaton model as an interpretation basis is because it promises to become one of the most effcicient operational network centric systems.

Risk theory notion of tolerability

Theoretical approach

The intuitive definition of tolerability is insufficient to serve as a starting point in an exact, therefore formalized theory. The notion of tolerability itself "as such" would be unnecessary and unproductive in logical risk theory.[10] In relation to which, in logical risk theory, one can attain valid ascertainments (provable based on verifiable and explicit axioms), it is rather a much more contextual (syncathegorematic) relative notion, and it is the notion of the next relation (colloquially, sounding undoubtedly and intolerably weird, though by far much more productive)
"to successfully practice the tolerabiliy against environmental state changes".
In this formulation it is implicitely included that we talk about a well-defined *environmental system*. Well, in our study the environmental system, to which we attach the above – in brief – "tolerate"-relation, is the interpretation of the already mentioned SORS model. We intend to give the definition of the *terminus technicus* named "*tolerate"* in its notional system. The "tolerate" relation is therefore the *explicatum*[11] of tolerability.
In order to do so we will need the *accurate formulation of "undesired change of the state of the environment".*

Practical approach

The advantage of the previous theoretical approach is that it operates with set theory notions and so the ascertainments that can be made on tolerance will benefit from one of the mostly developed branches of mathematics.
But then its disadvantage is that the undesired change of state does not exhaust the practical cases, in which it does not occur in an evolutive way (i. e. including the previous states). In practice, cases intuitively and justifiably regarded as undesired also occur, when the undesired states are supplemented, during the process, not only by new and new ones, but some states passivates. This wavering process goes on in the SORS model, in most cases. At the same time, according to experience, if the initial "threat degree" of the cellular space is not too high, sooner or later the system will bring the situation under control and it can passivate all cells with a

[8] Here, before all, one should mention [Lewis]' excellent work.
[9] Compare: [Szabó]
[10] In logical risk theory, a risk system is given with its *explicatum,* i. e. essentially with the equations defining the fault-tree free of probability relations. In detail see: [Profes]
[11] The explicatum and the explication is detailed in the [Profes] study.

realistically dangerous state. This danger-removing process is typically not evolutive; many times it is accompanied by checks, sometimes by reversals, but ends with success. Nevertheless, tolerability, as a rehabilitation ability, is characterized by states by which the state is able to reach a danger-free state, which does not have be identical with the initial state at all. These considerations justify to give another characteristic of tolerability, which characterizes tolerability with the number of phases, which is necessary for the full passivation of a given undesired system state.

Interpretation of tolerance

The definition of tolerance is completely technical here. It may only be interpreted in the way its explicatum and the risk system given by the *Franklin frame*, and the notional apparatus of the SORS model allows it. In order to use it, it must be interpreted. Interpretation means that we show to what extent this notion gives account (based on the given risk theory) of the extradisciplinary expectations, which motivated the explication of the notion of tolerability. It also belongs to the intertpretation that we show what *cannot be expected* from this notion, and which expectations may be misleading, misguiding or dangerous. The intuitive colloquial content of tolerability is naturally by far much richer than its formal exact equivalent. Therefore, the same connotations cannot be expected from the latter, which are attached to former. The central element of the notion of tolerance interpreted in the SORS model is the notion of state and the degree of liveliness cannot be expected from it, which common language may allow itself. There is no possibility in the model to interpret declarations like "XY is in a worse mood today than yesterday". There is neither an interpretable mark to directly indicate the state itself. The depiction of the state does not make it possible to decide, based on the direct approach, which of the two states contains the other in the sense as it was introduced in connection with the undesired change of state. Therefore, in order to judge the state-order itself special IT services are needed. This means that the relationship between states and the depiction of a states demand entirely different tools, especially the depiction of the *change* of state. To illustrate the changes of state of the SORS in a synoptic way we regard Franklin's space as suitable. The way how the system tolerates the external effects (i. e. originating randomly) we illustrate in Franklin's space.

Franklin's space

Franklin's space is one of the possibilities to illustrate the predominance of tolerability.
Franklin's space is a two-dimensional Cartesian orthogarphic coordinate system, whose abscissa is composed by **K** *(cost axis)*, its ordinate is **I** *(time axis)*. The system's state at a ceratin *t* time (t = 0, 1, 2, . . .) is illustrated in Franklin's space by point **P**(t), whose abscissa is the so-called *"global cost demand"*, necessary for establishing a state at time k(t) (t > 0), its ordinate is the *global time demand* i(t). Both k(t) and i(t) are integers and are measured in an optional but fixed unit. The selection of this unit (e. g. euro), in this theoretical phase, is absolutely indifferent, it cannot be defined like in the case of t > 0, therefore we assume that it means an optional but fixed value. Relating to the initial t = 0 time, k(t) and i(t) are naturally Franklin coordinates. Threfore, sometimes it seems expedient to indicate the point representing the state as **P**(k(t), i(i)), being more detailed, name it generally as the *work point* (of SORS). We assume that every prime change of state (i. e. the activation and passivation of every prime event) has its well-defined cost and time demand, although their values can be unknown in a given case.

If the values of the Franklin's coordinates k(0) and i(0), belonging to the initial (t = 0) time, are given, and for every t > 0 time the system's (global) state is known, the *global cost and time demand of* every system state at t > 0 time can be unambiguously defined (though sometimes significant IT resources might be needed). This circumstance means the theoretical basis of the definition of tolerability in the SORS model. Due to its central significance this principle was named *Franklin determinism*. Its detailed analysis will be given in the next item.

Tolerability as strategic problem

In the SORS model, a common *risk explicatum* (fault-tree) is assigned to every cell. This makes the uniform *local* management of the state change possible. However, it is practically desirable that each cell have several risk explicatums. Although, mathematically every fault-tree's every branch is fault-tree again. Thus, several fault-trees can always be contracted into a single equivalent fault-tree. Fault-trees of too large size are unmanageable from an IT aspect and the reasons are not only due to technical barriers, but the so-called *combinatorical explosion*, in other words: "NP problems". [Cormen e. a.]
In this respect we intended to implement the *heterogenous allocation* of the risk explicatum in the SORS model. This is the goal of assigning different fault-trees to different cells. By this, we intend to model that it is not always expedient to "plant" a "land-slide" prime event fault-tree to a e. g. mountainous landscape (cell), etc.
The use of the menu point "Heterogenous allocation" of the SORS program makes it possible to assign designated fault-trees to a cell.

The presentation and the components of SORS **can be found at www.katasztrofavedelem.hu.**

Summary

In the practice of disaster management the notion of tolerability is gaining more and more ground in relation to the problem of climatic extremities. In the study, we deal with the explication of this intuitive notion. This means that we determine tolerability and the various notions of connotations in a system defined by formal mathematical and logical tools. We also pay attention to the fact that the expectations attached to this sphere of notion also receive adequate representation.
The formal system is the SORS model (or the SORS system) elaborated earlier and its enhanced version. In this study, after demonstrating the major features of the SORS system, as a preparation of the explication of tolerability, we define the formal mathematical notion of the explicatum of the risk system, which is substantively built on the notion of a special class of the Boolean algebraic equation systems. The notion of the explicatum of the risk system confers to the explicatum of the (strongly intuitive and weakly formalized) notion of a traditional fault-tree in Carnap's interpretation of the word.
Afterwards, the intuitive content of tolerability is analyzed. In order to do so, we start off from the notions making up the context of tolerability, recommended by the European Union (in some cases, with optional etymology).
We present the classification of the classical Roget's notion. From this, one can determine that during the scientific examination of climatic extremities, with respect to expectations seeming necessary and suiting the disciplinary requirements, the classical notional foundation also ignores the principle of correspondence accepted in partial disciplines and linguistical interpretations as an unwritten law.

It can be ascertained that between the EU's and Roget's interpretation there is no adequate correlation, since while the former is environment-oriented, the latter is invidual-human related. Nevertheless, the former should be built on the latter, since the latter are the products of direct human perceptums and observations. This correlation discrepancy is harmful because it makes the formal disciplinary notion of tolerability and the interpretation of the ascertainments relating thereto more difficult. By this, sometimes it can and does make the state of crisis communication impossible, having close relevance with it.

We explored three aspects of tolerability, whose explication we judged inevitably important. These are: tolerability as a way of conduct, as rehabilitation ability and as a failure avoidance skill.

Finally, we pointed out the relationship between the modification of the transitional function used in cellular space and creating attractors, with special regard to future research possibilities and perspectives.

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