

PRACTITIONERS' BROAD VIEW

THE FIELD OF EVENTS IN RISK ANALYSIS

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Abstract:

This paper aims to bring to the attention of theorists and practitioners in the field of risk analysis an alternative way of considering events and the field of events. By developing a matrix with two times four characteristics of events and assigning a value in the range 1-12, we will present the defining elements of events, we will indicate the difficulty of estimating the probability level depending on the type of events, and we will suggest ways of approaching the analytical task.

Keywords: *field of events, analytical task, estimating, probability.*

Argument

This article was originally a small part of the course *Risk analysis: a practical perspective*, written and taught a decade ago together with a valuable collaborator at “Mihai Viteazul” National Intelligence Academy¹, and never published until now. The starting premise is still valid and is based on the observation that risk analysis – in intelligence and not only – almost always focuses directly and exclusively on the evaluation of the event, in the probability versus impact matrix and very rarely, if at all, it focuses on the prioritized understanding of the type of event that is the subject of the analysis. Therefore, at that time, I felt the need, more as a practitioner than as a theorist, to develop a separate chapter that would draw attention to the topic. Subsequently, practice has proven and it has also proven to me (doing analysis and coordinating impressive teams of analysts) that the

¹ C. Bizadea, V. Andrei, *Risk analysis: a practical perspective*, “Mihai Viteazul” National Intelligence Academy, Bucharest, 2015, pp. 54-57.

reason is on the one hand, the urgency that demands analysts' immediate immersion in the task. On the other hand, it is the absence in intelligence analysis of relevant event field theory² and practice.

Ten years later, with the agreement of the co-author of the original material, I believe it is the time and place we brought this topic back to the attention of trainers and practitioners by updating the source material. At the same time, please receive it as an invitation for justified criticism and welcome additions to this still incipient endeavor. This is all the more so because between then and now a radical change has occurred in the approach to intelligence analysis in general, and risk analysis in particular: *the automation of analysis processes*

Terminological boundaries

As a whole, probability can only be associated with a risk in close connection with an event and in relation to a temporal horizon. Simply put, in the absence of the event, the risk does not exist and the probability cannot be approximated without the time frame.

The formal definition of an event is: "a segment of time at a given location that is conceived by an observer to have a beginning and an end" (Zacks et.al., 2007, p. 273). The taxonomic framing of events is difficult, because they can be short (seconds) or long (geological periods), goal-directed or undirected, generated by an animate (human, animal, technology) or non-animate (natural phenomena) "agent". Also, segmentation of events in time can sometimes be almost impossible, in the sense of separating the end of one event from the beginning of another. In spite of these shortcomings, or precisely because of them, there is a symbiotic association of events – or more precisely of the field of events – with probability estimation.

In a proper definition, the field of events is the totality of events that may occur in relation to the individualized subject of the risk analysis and includes certain events, possible events – within the scope of the risk analysis –, and impossible events.

² This term has nothing to do with event field theory in physics.

The events field includes:

- **compatible events**, i.e. two or more events that can occur simultaneously (*event 1/* fall in production, *event 2/* reduction in investment, *event 3/* fall in the number of employees and increase in unemployment, *event 4/* fall in population income $\Rightarrow$ fall in GDP = economic recession);

- **incompatible events**, i.e. events that cannot take place simultaneously, as a rule the realization of one event makes the other event impossible (*event 1 – certain/* Ukraine's nuclear arsenal is to be renounced under the agreement of 05.12.1994, *event 2 – impossible/* Ukraine's use of nuclear weapons);

- **repeatable events**, i.e. events that will have the same characteristics, given similar conditions. This characteristic allows assessments based on sampling and extrapolation (*event 1/* coming of spring in 2014 $\Rightarrow$ decrease in natural gas consumption, *event 2/* coming of spring in 2015 $\Rightarrow$ decrease in natural gas consumption);

- **unrepeatable events**, i.e. rare events that occur under conditions difficult to assess, observe, and control (Chavas, 2004, p. 14). This category includes the highly unlikely events (theoretically possible, but without a recognizable historical referential and with a difficult to intuit pattern of manifestation), known in analytical culture as Nassim Taleb's "black swans". As a rule, they are in fact a chain of compatible events, in which the initial event (in the following example, the magnitude of the earthquake and the size of the seismic wave) or the subsequent sequence (*event 1/* 9.0 Richter earthquake near the island of Honshu, *event 2/* automatic shutdown of Fukushima reactors, *event 3/* emergency diesel generators start up, *event 4/* 15 meter seismic wave overcomes the 10-m-flood barriers of the plant, *event 5/* generators are flooded and power supply is shut down, *event 6/* unpowered reactors overheat and explode);

- **dependent events**, i.e. those events whose occurrence depends on the occurrence of another event (*event 1/* Islamic radicalization, *event 2/* integration into an Islamic terrorist organization, *event 3/* suicide terrorist attack);

- **independent events**, whose realization does not depend on the realization of another event (*e.g. event 1/* rotation of the Moon around the Earth);

- **events with obvious links**, where relationships, causes, effects, and temporal chaining are easy to identify (e.g. *event 1/* heavy rains, *event 2/* increased river flow, *event 3/* floods);

- **events with non-obvious links**, i.e. those events which are difficult to estimate, seemingly independent of each other in space, time or space and time, but which influence each other in a relationship of partial or total dependence (*event 1/* widespread introduction of electricity, *event 2/* increase in soap opera audiences, *event 3/* decrease in birth rates and demographic pressure³).

For example, the fall in the birth rate (and thus in the risk of demographic pressure) in South America has also been made possible by the introduction of electricity and the widespread adoption of television, which promotes – for purely commercial reasons – new cultural models for family patterns. In National Geographic's article *Brazil's Renaissance* Cynthia Gorney (September 2011) points to the impact of “*novelas*” (soap operas) on the Brazilian reproductive model, as soap operas promote a small-lineage family model strictly for commercial reasons – it is much easier and more cost-effective to write soap operas about small families.

The field of events and the reality of analysis and risk analysts

The above example has been included in extenso because the problem of non-obvious links between events is the most difficult to overcome in the process of probability estimation. The ability to identify interdependencies and isolate significant events is often limited not by the quality of the analyst or the risk analyzer (implicitly the automated data processing systems), but by the sheer volume of connections that can be made, as the search for new and new evidence only exponentially increases the time segment and spatial frame of the risk analysis (to return to the definition at the beginning of the article). For this reason, the most valuable risk analysis systems, automated or not, and the best analysts are those who possess the ability to limit interdependencies and connections strictly to the relevant ones, so that the assessment is not blocked by the dimension of relationships (in the sociological paradigm of everything has to do with everything).

³ The very fact that it is difficult to intuit the connection between the three events validates the assumption that they fall into the family of events with non-obvious links.

This is all the more relevant today, when big data and AI analytic support systems can draw an enormous landscape of relationships, limited only by data size and processing capacity. Thus, an important caveat to keep in mind and issued publicly long before big data and AI became a reality is that “with the passage of time, the controversy between evaluation based on past observation and subjective degrees of belief has taken on a deeper significance. The mathematically driven machinery of modern risk management carries within it the seeds of a dehumanizing and self-destructive technology” (Bernstein, 2014, p. 19).

What Bernstein envisioned a decade ago has now become the reality of risk analytics and analysts. The use of AI in intelligence analysis has to take into account inherent limitations, at the current stage of development, in terms of contextual understanding (AI limitations: What artificial intelligence can't do), biases inherent in the data on which systems are trained (The limitation of AI: understanding the boundaries of machine learning), and, in some cases, the transparency of reasoning (a problem overcome, at least in part, by the new XAI – explainable AI). All this does not relativize but, on the contrary, reaffirms the importance of understanding the type of events in order to increase the accuracy of probability analysis.

The table below has been developed as a summarization exercise to indicate – on a progressive scale from 1 to 12 – the difficulty of estimating the probability of events with multiple characteristics:

Table 1: The difficulty of estimating probability (Source: Bizadea & Andrei, 2015)

EVENTS	repeatable	compatible	dependent	with obvious links	unrepeatable	incompatible	independent	with non-obvious links
repeatable		1	2	3		5	6	7
compatible	1		3	4	5		7	8
dependent	2	3		5	6	7		9
with obvious links	3	4	5		7	8		
unrepeatable		5	6	7		9	10	11
incompatible	5		7	8	9		11	12
independent	6	7			10	11		
with non-obvious links	7	8	9		11	12		

Relatively easy. The first category includes events in the 1-4 range, i.e. repeatable and compatible, compatible and dependent, with obvious and repeatable links, with obvious and compatible links, repeatable and dependent. Historical evidence, sampling and extrapolation exercises, linkage mapping processes, and identification of the time organization of events are sufficient to address them. A small number of analysts – and a simple system for automating and highlighting the links between relevant indicators –, within a reasonable time frame and using a limited inventory of methods, can usually estimate the demonstrable probability of such events. Obviously, the accuracy depends on the skill of the information, analysts, and automated data analysis systems.

Average. The second category includes events in the 5-8 range: with obvious and dependent, compatible and unrepeatable, independent and repeatable, independent and compatible, with non-obvious and repeatable, with non-obvious and compatible, incompatible and dependent, incompatible with obvious links, etc. Probability estimation is both demonstrable and questionable and, in such situations, involves simulation exercises, creativity stimulation processes, alternative approaches. The number of analysts required increases with the level of complexity, the assessment usually requiring more time to validate or substantiate working hypotheses, and the alternative, often combined or competing use of methods. Support of big data systems is essential for accuracy and speed of analysis.

Difficult. In the last category the events in the 9-12 range are placed, namely incomparable and unrepeatable, unrepeatable and independent, unrepeatable with non-obvious links, incompatible and independent, incompatible with non-obvious links, dependent and with non-obvious links. The decision on the probability value is predominantly questionable and highly speculative, theoretically extremely close to uncertainty (risk that cannot be measured). In terms of resources, more is not better in this case, as simply increasing the volume of analysts or the methodological and technological inventory does not necessarily guarantee better performance. Without estimating and speculating on the contribution of GenAI in such situations, certainly

the use of such systems more quickly generates alternative analytical insights that need to be considered if only to invalidate various scenarios. On this level, there is often no demonstrable answer but only an inspiration – a feeling of the risk analyst, which should not be trivialized but operationalized.

In the case of an event field in the 9-12 range, the recommendation is to assess the appropriateness of delaying either the probability assessment or the risk response decision, given that “not acting may be the wisest action. The more uncertain the outcome, the more valuable the delay in acting” (Bernstein, 2014, p. 27).

Conclusion

The situations presented are complicated by multiplying with the time element, characterized by two coordinates: short-duration vs long-duration events, respectively recent vs distant events. A simple axiom could be that the longer the time span of the event and the interval since its occurrence, the more the complexity of the risk probability estimate multiplies, in the sense that “time transforms risk, and the nature of risk is shaped by the time horizon: the future is the playing field” (Bernstein, 2014, p. 27).

The good news is that the analysis of events is sometimes simplified by the presence of the correlation phenomenon, which makes it possible to establish the interdependence between two events. Either way, the risk analysis is at best incomplete and at worst flawed without a priori consideration of the type of event itself and the field of events.

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