Translation

Comprehending Conceptual Structure in Risk Through Phenomenology

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Risk, Concept, Generalization, Phenomenology, Structure

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Abstract

Although there have been many studies on the concept of risk in previous research, there is no widely accepted concept or definition of risk. Since risk is a concept and does not exist in nature, its essential nature cannot be pursued in ways that are generally considered scientific. This has implications for risk management and risk engineering. To solve this problem, we attempt to abstract the structure that makes people feel a particular way, which is common when people feel that there is some risk in a way that does not specify the field or type of risk, through phenomenology and non-conventional science based on it. The structure of risk from the perspective of the perceiver can be summarized as (1) having a future story that the perceiver does not want to be influenced by surroundings and (2) holding a personal belief, doxa, or conjecture that an incident may affect the progress of that story and prevent it from going forward as expected. Having a future story is the premise for the existence of risk, while holding a person belief about the story's progress is the essential nature of what we generally call risk. This new perspective could trigger a paradigm shift in risk-related academia and practices, such as risk management and risk communication.

1. Introduction

Currently, although there are standard guidelines for organizational management regarding risk (JIS, 2019), there is no widely accepted concept or definition of risk (e.g., Matsushita, 2018; Kinoshita, 2016).

Generalized considerations of risk include approaches from sociology, such as the proposal to position risk as the possibility of future damage by an entity that is highly controllable by that entity (summarized from Luman, 2014), the consideration of risk in contrast to a fluctuating world situation (Giddens, 2004), and Beck's proposal (1998) regarding the concept of a "risk society." However, these sociological approaches to risk mainly focus on how risk exists in society and the definition of risk has not been sufficiently examined.

In response, this study demonstrates the essence of the problem, discusses the means to solve it, and proposes a generally acceptable hypothesis regarding the concept and definition of risk, what risk is, which is generalized according to the policy of the solution.

The Guideline for Risk Management (JIS, 2019) advises that the first step to do is to discover the risks for the risk management activity. However, this step is fraught with difficulties (Maeda, 2010). One reason for this is that the definition of risk has not yet been clarified. It is logically impossible to distinguish and indicate unidentified objects, risks, from the chaos. Therefore, risk management practices actually implemented (e.g., Niki, 2009) cannot escape the yoke of arbitrariness.

The absence of a definition of the concept of risk is also a problem in risk communication, which is the practice of sharing and discussing knowledge about risk while seeking the best direction for reaching a consensus on problem-solving (summarized from Kinoshita, 2016). No matter how much information about risk, which is understood differently by different people, is exchanged, it is difficult to reach consensus, consilience, or a problem-solving agreement that integrates all the concepts and understandings of risk; the result is often a list of discrete issues.

These situations indicate that risk-related practice in the world is still in the realm of art, that is, skill or technique, based on intuition and experience, and that in academia, systematic knowledge of the risk concept itself that is applicable to any given situation (i.e., science of risk) has not yet been established.

One reason why current risk studies (Society for Risk Analysis Japan, 2019) and risk engineering (University of Tsukuba, 2022) remain in the realm of item-by-item research, such as considering the treatment of specific accidents in a particular field or studying mathematical tools to handle ambiguity, is that the concept of risk itself has not yet been established as a system of knowledge, i.e., a science.

This study aims to address the above situation regarding risk using the phenomenological approach, to systematize the general theory of risk, and to provide an entry point for thinking scientifically about the concept expressed as "risk."

2. Problems Inherent in Risk Identification

According to the International Standard for Safety (ISO, 2014), risk is defined as the combination of the probability of the occurrence of harm and the degree of that harm. In actuarial

science, risk is defined as the product of the occurrence probability of a target accident and its impact, specifically, the degree of harm assessed, that is, the expected value of the impact. In industrial safety and insurance practices, risk is evaluated from the following two perspectives: the probability of an incident(1) and magnitude of its impact. In risk studies, these two perspectives are considered basic principles or, in a sense, absolute rules.

However, several issues remain to be discussed in each of these perspectives when considering risk, as outlined in the following subsections.

2.1 Issues Inherent in Occurrence Probability

The occurrence probability in the international standard of risk and actuarial science makes sense under the assumption of universality of target systems, that is, the invariance of the statistical properties (i.e., ergodicity). In other words, it is implicitly assumed that the nature of the dice does not change.

When considering incidents, such as simple accidents that physically occur in the real world, the invariance of the statistical properties of the system can be assumed to a considerable degree and can also be assumed a substantial number of populations. Therefore, the occurrence probability can ordinarily be scientifically identified from a frequentist perspective. Insurance against accidents, disasters, illnesses, and so on can become a product under this assumption and within the size of the population for which the statistics are meaningful.

Meanwhile, in fields involving human arbitrariness, such as crime and rumors, which are influenced by human behavior and social trends, the universality of the system or the invariance of statistical properties cannot be necessarily assumed. In the cases where the universality of the system cannot be assumed, such as dice with a soft clay die whose shape changes every time it is thrown and whose number of sides is not even fixed, even if the probabilities are calculated based on past results, they do not necessarily predict the future. In such cases, it is difficult to describe the future with probability.

In addition, if an event has never occurred in the past, or if an event cannot be identified as a target, i.e., if E in probability $P(E)$ cannot be identified, then probability cannot be derived from past performance, nor can risk be considered on that basis.

There is a hidden structure of time related to the past and the future behind the concept of risk. The essence of the past is static information about things that have already appeared, that is, memories (i.e., knowledge), records, and, in addition, traces of events. The essence of the future, on the other hand, is imaginary stories from now on, as it relates to a person, that the person has arbitrarily made up in the person's mind based on the past (see Subsection 6.4). The structure in time is somehow forgotten when considering risk. Considering risk is basically thinking about upcoming incidents (i.e., the future) based on information so far, that is, the given knowledge about previous incidents that have already occurred (i.e., the past). Therefore, when considering risk, we need to be very careful about the given information, which is often a priori knowledge or premises(2) that we are not aware of, and which we often introduce arbitrarily and implicitly.

2.2 Issues Inherent in Impact

In the international standards and in the field

of insurance, another component of risk is the impact of an incident, that is, the reduction in value it causes. This is often assessed on a monetary scale and expressed as the amount of loss. This means that the reduction in value has become an object of arbitrary evaluation based on the sense of value of the parties involved, similar to a merchandise price determined by an agreement at the time of purchase/sale (Amari, 2018).

To examine the reduction in value, it is necessary to understand what value is (Amari, 2021a). However, many discussions on risk (e.g., Japan Risk Research Society, 2019) have not considered this issue, and many studies that quantify risk or consider it in a mathematical model have treated the value affected by risk and the magnitude of the harm (i.e., the reduction in value) as given variables. Simply put, they have not touched on what value is, i.e., axiology.

Because value is neither objective nor natural, the value of the same object can often differ for different people and situations. Therefore, it is difficult to determine what value is by using methods that are generally considered scientific. We consider that this may be a remote cause of the current situation in which the main focus of risk consideration is on the probability of an incident occurring, rather than on the degree of impact or the reduction in value objectively assessed by some scientific measure.

In summary, in many actual cases, the reduction in value is almost completely neglected when considering risk.

3. Clues to Pursue the Nature of Risk and the Structure of the Risk Concept

Risk is a concept that cannot exist in an uninhabited world and is not something that exists in the natural world. The systematic way of thinking that seeks the essence of such an object is philosophy. In this study, we consider risk scientifically in an abstract form, without specifying any field or object, with the help of philosophy. The reason for this is easy to understand based on Takeda's (2020, p. 169) following statements:

- At the philosophical table, a "question to be explored" is presented, such as "What is the world?" This "what is" question means "to explain the essence of a thing in terms that everyone can understand."
- A philosopher tries to show this "essence" by setting some key words or principles.
- The principle of philosophy is to seek what words best explain the "essence of things," not to show what is the truth.

For risk, which is a concept understood differently by different people, we cannot pursue natural scientific facts or truth. What we can pursue is the best explanation in words that everyone can understand or a common understanding with universality. Therefore, this study draws on philosophy[3] to explore the general nature of risk.

In this study, we consider the nature of risk in an abstract form, without specifying the field, using phenomenology, which is a philosophy of cognition, and a scientific approach based on phenomenology, which we call "phenomenological science" in this paper (see Subsection 5.2). Simply put, this scientific approach to risk is an attempt to find a reasonable structure, sufficient for common understanding, that makes people feel that there is a risk, regardless of the field or type of risk. In addition, this study attempts to develop a hypothesis that best explains the

structure in risk.

Ultimately, we aim to broaden the understanding of risk to take it out of the realm of art and skill, to make risk an object of science or academia, and to provide guidance for engineering risk from a generalized perspective. In practical terms, we intend to create a foothold to provide a basis for systemizing risk-related work, such as risk management and communication, beyond intuition and experience.

4. Why Systematizing Risk in a General View is Difficult

Today, we are caught up in the idea that we perceive the world outside ourselves through visual, auditory, and other sensory perceptions. This seems so obvious and natural that we are rarely aware of it. The idea that there is an object that is perceived in the world around us, and that our consciousness, or the perceiving subject, the subjectivity understands it as objective (i.e., Descartes' dualism), has been the basis for the progress of science and technology in the modern era. Today's society is basically built on this idea, or natural attitude.

The perceptions of physical existence and related events do not vary significantly from person to person, given the same conditions. Therefore, generality is not lost when a theory is devised based on a person's perception and understanding, and an academic system is developed by amplifying the theory. This is the foundation of natural science. Today's science and technology are also based on this premise.

Meanwhile, dualism results in a major issue regarding cognition, specifically, can the subject of cognition or human consciousness correctly grasp an object? The senses or perceptions of the person as the subject of cognition, subjectivity, are "different for each person" when "entities without physical nature" such as concepts, senses, and values are the object of cognition (Takeda, 2020, p.79). Therefore, it is not easy to generalize one person's knowledge or perception and to make it acceptable to everyone, or "science," when the object of cognition is an entity that does not have a concrete form in the natural world, namely a conceptual object.

Risk consideration involves thinking about an incident that has not yet occurred. This object has no substance because it has not yet occurred. Therefore, the perception of risk differs for each person, making it difficult to deal with risk in the manner of current science, which is based on dualism. This means that the nature of risk cannot be understood just by relying on the dualistic thinking system on which modern society is based. It seems that many of the current risk studies (e.g., Society for Risk Analysis Japan, 2019) fall into this trap to a greater or lesser extent.

5. Ways to Understand the Risk Concept[4]

5.1 The Thinking Framework of Phenomenology

In contrast to Descartes' dualism, there is a way of thinking, or the philosophy of cognition, that does not presuppose the outside world. This is the phenomenology developed and systematized by Husserl.

Consciousness, the subject of perception, is confined in the physical body and cannot go beyond it. Therefore, consciousness cannot know objectivity in the true sense, or the reality that must exist in the outside world.

Meanwhile, information from the perception of the outside world through the eyes, ears, and

other sense organs, as well as from memories and unconscious knowledge, is brought to the consciousness imprisoned in the physical body, and then appears(5) there as immanence. Phenomenology considers this immanence or appearance in consciousness, called a phenomenon, as the main actor of our cognition. On this basis, it adopts the phenomenological attitude that the immanence, i.e., what is felt by our consciousness, causes our consciousness – the subject of cognition – to have the belief that the object in the outside world is definitely like this, namely transcendence (Takeda, 2020, p.72). Moreover, without considering everything in the outside world (i.e., phenomenological reduction), phenomenology focuses only on the immanence, the appearance as a phenomenon of "it" in consciousness, i.e., the feeling that "it is it," namely, the qualia of "it." Next, it tries to discover from the immanence an identity (i.e., an isomorphic structure) that makes us feel a certain way and positions the found identity as the essence of "it." The above sequential procedures give us the nature of "it," the target, and are called essential insight in phenomenology.

In dualism, it is necessary to presuppose an objective existence to be recognized in the outside world. Therefore, if the perception of a supposedly objective existence as an object differs for each person, the following question emerges: Based on whose perception should we understand its existence? Consequently, we cannot determine the understanding about the object as the result.

Phenomenology, on the other hand, takes the feeling that appears in consciousness as the main actor and pursues what causes that feeling (i.e., the feeling that "it is it") in consciousness. In phenomenology, it is sufficient to pursue only the isomorphic structure that evokes that feeling in our consciousness. It is not necessary to assume an objective existence in the outside world. Phenomenology does not pursue objective facts but identifies the structure that brings our conviction about "it," or that "feeling," regardless of whether or not "it" exists in the outside world. This isomorphic structure, or identity, is the essence of an object found phenomenologically.

5.2 Science Not Premised on the Existence of Objectivity

To scientifically examine the nature of risk, which is a concept and has no substance in the outside world, this study positions structuralist scientific theory (Ikeda, 1998; 2006) and structural constructivism (Saijo, 2013; 2005, Kirita, 2009), which are based on phenomenology, a way of thinking about cognition that does not presuppose the existence of an object in the outside world, as phenomenological science and uses them as tools for examination.

According to the structuralist scientific theory, science is the activity of finding identities or isomorphic structures in multiple phenomena, or immanence, that appear in the consciousness of several perceivers or of one perceiver at different times, and of expressing or encoding them in some expressive way. Expressions here can take various forms, such as qualitative natural language expressing a feeling, such as "red," numerical values, illustrations or diagrams, such as a table or graph, or mathematical formulas or symbols, e.g., $\boldsymbol{f}=m\cdot d^2\boldsymbol{r}/dt^2$, $2H_2+O_2\rightarrow 2H_2O$, ♂♀, etc.

Structural constructivism, an extension of structuralist science, has been proposed to scientifically treat conceptual objects that are largely related to human arbitrariness, especially in the humanities and sociology, and that are

understood in different ways by different people. Structural constructivism asserts an "interest correlation" (Saijo, 2013; 2005), whereby things as phenomena appear in consciousness and are understood by the consciousness in a way that is correlated with the interest of the perceiver or the party. This means that in order to find identity in multiple objects, the party must pay attention to the objects so that they – the phenomena of the objects – appear in consciousness. Furthermore, this interest has the nature of "opportunity correlation" (Kirita, 2009), in which the state or strength of interest changes depending on an opportunity as a trigger provided to the party. These two correlations work particularly well in understanding the concept of risk, i.e. in achieving a common understanding of risk with conviction (see subsection 6.4).

Incidentally, phenomenology, which does not take the position that there is objectivity, proposes the concept of intersubjectivity instead of objectivity. It is the conviction that others must feel and understand similarly to how I feel and understand.

According to structuralist science, the requirement for establishing intersubjectivity is isomorphism in the process of deriving identity from phenomena. In this study, we understand and postulate this requirement as narrativity, or contextuality in thinking, in the process leading to appearance in consciousness. Structural constructivism further formalizes this requirement for intersubjectivity in structuralist science and asserts that disclosure of conditions of examination is a requirement to establish intersubjectivity, that is, to ensure scientificity in a broad sense.

When deriving a hypothesis about the concept of risk in this study, we conduct condition disclosure that shows the flow of thinking as a narrative with context, that is, a scenario. We do this to ensure the intersubjectivity that is phenomenological-scientifically necessary to be science.

In the case of reasonable, convincing understanding through appropriate essential insight in the phenomenological framework, in which strong intersubjectivity is broadly established, the understanding or the result through the insight is sometimes taken for granted, not as a scientific result. The reason that one sometimes thinks so is because the closer to the essence the stated is, the higher the intensity of the understanding and the more natural, or self-evident, it seems (Saijo, 2017). The sense of a matter of course or self-evidentiality of things seen with the naked eye is an effect of the strong intersubjectivity of visual images, phenomena that appear in our consciousness. The strong intersubjectivity, or the sense of taking-for-granted (i.e., the transcendence), of the "appeared images in consciousness from one's own eyes," is due in large part to the "narrative" of the process that brings the appearance in consciousness, that is, the process leading up to the appearance has sufficient contextuality and is not contradictory, comprehensibility is strong, and there is little room for doubt.

An example of contextuality here is the continuous change of visual images that appear in consciousness, flows of experience, in correlation with motor sensations, i.e., "kinesthesis," such as moving the position of the eyes, while maintaining a "consistent temporal relationship," narrativity (Takeda, 2020, p. 103).

6. Conceptual Structure in Risk Through Phenomenology

6.1 Structural Model of Risk Identification and Risk Management

Figure 1 shows a schematic of the isomorphic structure.

The sentence in Subsection 2.1, "Considering risk is basically thinking about upcoming incidents (i.e., the future) based on information so far, that is, the given knowledge about previous incidents that have already occurred (i.e., the past)." is a model in natural language that expresses or encodes the identity, specifically, the isomorphic structure, that is common to the activities that we call risk identification and management, regardless of the domain or risk type.

Understanding that there is a particular risk, that is, risk identification, is the construction of a model of incidents from given information about past incidents, events 1 through N, that have already occurred, basic knowledge, and numerous assumptions. This is tantamount to creating a system of identities about incidents that have occurred so far. In other words, risk identification is positioned as the science of incidents that have already occurred. In addition, risk management refers to the engineering or technique that attempts to predict and control incidents, event X, that may occur in the future, which have not yet occurred and are therefore intangible, based on the incident model in risk identification or knowledge of the identity of past incidents, and further assumptions, some of which are arbitrary.

In this section, the main part of this study, we attempt to apply the framework of phenomenological science to the concept of risk, starting from the schematic structure shown in Figure 1, and to find the identity, or isomorphic structure that latently exists in the concept. Thus, we attempt to apply the methodology of the essential insight to the concept of risk. In this way, the goal in the title of this study, "Comprehending Conceptual Structure in Risk Through Phenomenology," can be achieved.

In summary, when people perceive a risk, we attempt to find out why they feel that way, that is, the isomorphic structure common to all cases in which the term risk is used, and to express it, i.e., to code it, using some expression or model.

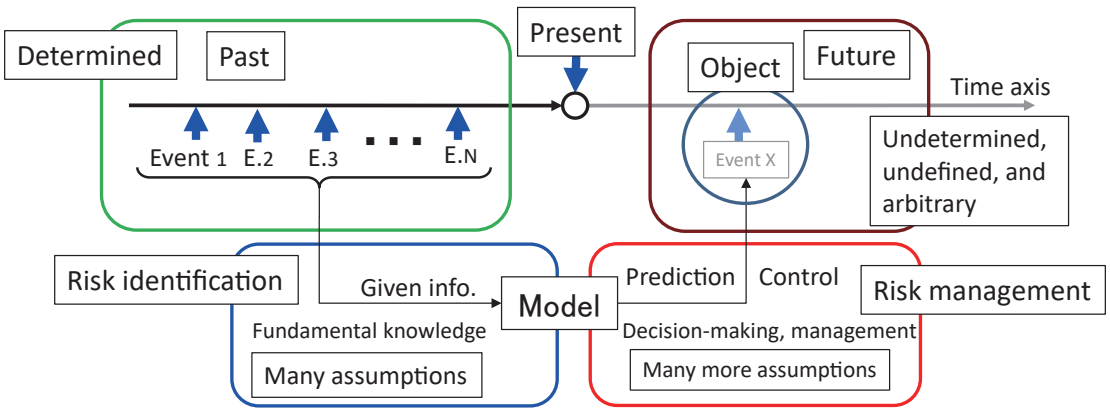

Figure 1: Structure of "Risk Identification" and "Risk Management"

6.2 Contradictions in the Common Understanding of Risk

As can be understood from a few expressions in the Encyclopedia of Risk Research (Society for Risk Analysis Japan, 2019), such as "familiar risks hidden in everyday life" (p. 24) and "various risks existing in the world" (p. 26), the common understanding of risk is based on conventional science, which implicitly assumes that subjectivity and objectivity coincide. In other words, people are dominated by the subject-object composition, i.e., dualism, and think that the objectively existing object, risk, is perceived by the cognizing subject, i.e., consciousness, subjectivity.

However, as some of the structural reasons suggested in Section 4, the common understanding of risk, that is, the common thinking and natural attitude based on the dualism that "there is an initial existence of risk, and the result of the perception, such as cognition, awareness, and discovery, of it is risk" (e.g., Nakayachi, 2012; JIS, 2019) is not necessarily appropriate. Examples are given below.

Shortly after the Kumamoto earthquake in Japan in April 2016, false information began circulating on social media that a lion had escaped from a zoo, along with a fake photo of a lion walking in the city (Kawano, 2020). This disinformation led to people's false knowledge or belief that there was a lion in town. This false knowledge from the disinformation reminded people of the possibility of being attacked by the lion; in other words, the thought that the incident could happen – that there was a risk – made people uneasy. Although the lion's escape did not actually happen and the story was a hoax, this incident shows a case in which knowledge based on disinformation became the basis for creating a risk[6] that should not have existed from a dualistic perspective.

Another example involves a long period of wet weather, which is an incident for sun-dried food producers. Here, the possibility of such an event, a period of wet weather, is a risk to them. However, the same wet weather event would be desired by farmers suffering from drought, and thus, is not a case of risk.

These cases cannot be rationally explained by the natural way of thinking (i.e., the natural attitude based on dualism) that first there is an entity called risk, and then people perceive it in the same way no matter when or who they are. That is, the common scientific perspective contradicts the above examples.

6.3 Knowledge: Premises for Understanding the Existence of Risk

We can only consider risk within the scope of our own knowledge of a target event or incident. This knowledge (i.e., the model in Figure 1), which is about similar incidents that have already occurred or may occur, is formed based on information provided through experience, hearsay, records, and teachings.

One example is the risk of Cascadia earthquakes, which have recently been found to occur every few hundred years along the northwest coast of North America. The details of the earthquakes were revealed by records of the 1700 tsunami in Japanese archives (Satake, 2003; Tsuji, 1998; Atwater, 2015) and communicated to people; thereafter, the risk was recognized as real for the first time.

Here, individual knowledge is the premise on which an individual identifies risk. Knowledge is a means of human understanding, and like risk, it is also a concept that does not exist as a physical substance in nature. Therefore, the understanding

of the concept called knowledge depends on the individual and differs from person to person. Accordingly, it is necessary to phenomenologically reaffirm the understanding of what individual knowledge is and to share a reasonable agreement on knowledge with intersubjectivity in order to advance the consideration of risk, that is, its nature, absence/presence, and how it exists.

From a phenomenological perspective, the essence of an individual's knowledge, that is, the isomorphic structure common to all cases in which a person says, "I have knowledge of it" or "I know it," is that the person has "doxa," a personal belief about it, the target object, which is constituted by the information about the object that the person has received so far. Because this study is based on phenomenology and does not adopt the idea of objectivity, it takes the position that all of an individual's knowledge is their own beliefs, doxa, which have been constructed in their consciousness as a result of the information provided to them.

For example, the concept of trust, which is a type of knowledge and closely related to risk, is also an understanding, that is, a belief about the person or organization that is constructed in consciousness through the information, often repeatedly conveyed from multiple sources. That is, the knowledge called trust that the target person or organization has responded faithfully and will continue to do so in the future has been constituted with information conveyed to the perceiver assuming that the nature of the person or organization is unchanging.

6.4 How is Risk Constituted?

To summarize first, risk is a perceiver's belief, or knowledge, about an event that may happen in the future and that it could become an incident that affects the upcoming story that the party arbitrarily imagines. In addition, the upcoming story often has some purpose[7]. Figure 2 illustrates the process through which this belief emerges in consciousness as a risk. Here, incidents refer to events that affect the story.

Risk emerges first as a perceiver's knowledge that consists of (1) firsthand information brought to the perceiver's consciousness as perceptions from situations in the past and immediate past; (2) secondhand information drawn from a priori knowledge, that is, beliefs, which are constituted based on information brought to the perceiver from others in the past or by some learning; and (3) information from assumptions arbitrarily made by the perceiver. Then, if some (4) triggering information is provided to the perceiver, this knowledge changes into (5) personal belief, or constitutive immanence, that a similar event could happen as an incident that affects the future story, in which "I" am involved. This personal belief, (5), which is also knowledge of the perceiver, is the true nature of the entity called risk.

Consider the following example. Suppose that people have prior knowledge, an understanding, that consists of information from (1') the realization that abnormal temperatures are frequent, (2') learning about climate change, and (3') the assumption that the same trend will continue. In this situation, if (4') information about the occurrence of Event T, such as super typhoons and poor catches of marine products for example, is conveyed to the people and stimulates their emotions, (5') the belief will appear in their consciousness that if the climate trend continues, disasters, Incident F, caused by global warming, may occur around them, and the

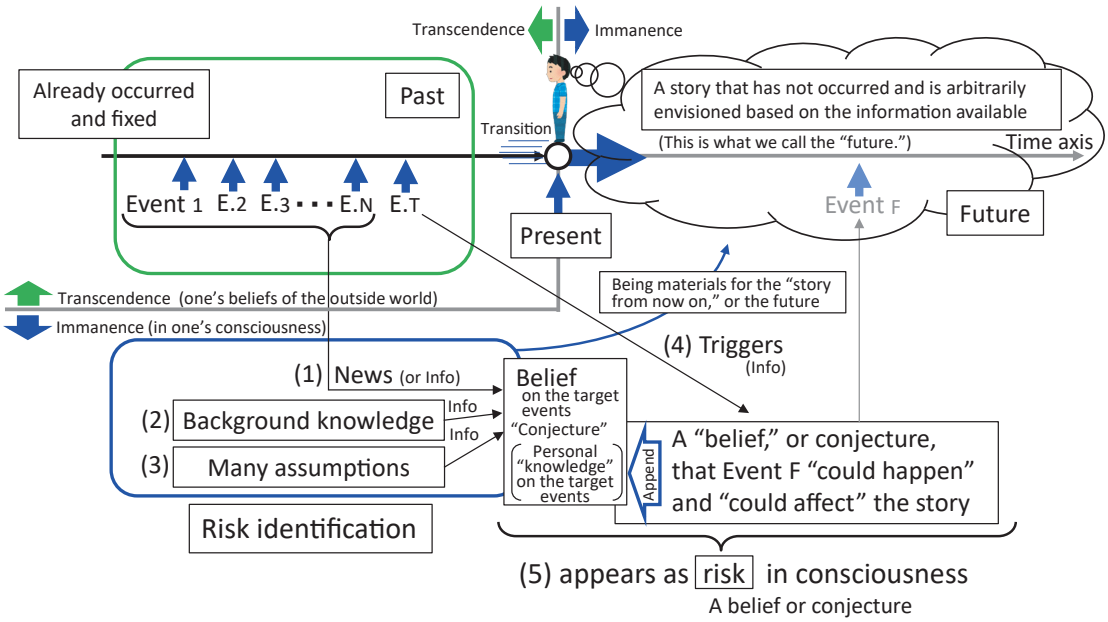

Figure 2: Structure of "Risk Appearance" in Consciousness

disasters may negatively affect the future of the people concerned, including themselves and their descendants. This belief in consciousness, (5'), is a risk called the global warming risk.

Since the nature of knowledge is beliefs about an object that consist of information about the object, risk, which is a belief about an incident that has not yet occurred, formed from information (1) to (4), is also personal knowledge in its nature. Therefore, the risk has no objective substance in the natural world. It goes without saying, but it is easy to forget, that once a risk appears in the world with some substance and is perceived as affecting the story one has conceived, it has already become a past incident that has already happened and is no longer an entity called a risk.

If we were to dualistically state where and how risk with such attributes exists, it would appear in each of our consciousnesses and exist as something we have come to understand as existing.

Similar to knowledge, risk is a phenomenon, i.e., an immanence that appears in the consciousness of a party or an individual as a belief. Because of the interest correlation of a phenomenon, advocated by the structural constructivism introduced in Subsection 5.2, risk, as one of the phenomena, appears in a manner that correlates with a party's interest. In addition, from the opportunity correlation of interest, this interest also appears in consciousness as a phenomenon through the trigger in which some information is brought to the party as an opportunity.

This interest appears in the consciousness of the parties concerned because they have a story in peaceful normal times in the future. This peaceful future story, which is a source of the interest, is also arbitrarily drawn in the consciousness of the parties concerned by information based on the aforementioned points

(1) to (3), brought to their consciousness. In addition, some opportunity to induce the interest is involved in the drawing of the future story. In this sense, the interest correlation of phenomena and the opportunity correlation of interest in structural constructivism have much to do with how risk exists.

A key element in the process of constituting risk with this structure is a vehicle called the present that moves along the time axis from the past to the future at the same speed as the passage of time. We are forced to ride this vehicle facing backward; thus, we see only the past. All events in the world, events 1 to N, are always migrating from the future to the past on the time axis at the same speed of the time transition and are constantly appearing as if they were real – that is, as transcendence – before the eyes of our consciousness. We, or more precisely our consciousness, can only see or intuit the landscape of the ever-changing past, to which new past events are constantly being added. Some of this past landscape or the previous story remains in the form of static information, that is, memories, understood knowledge, records, and traces of events that have already occurred. This static information is the nature of what we call the past. It is sometimes called history.

Meanwhile, the landscape of the future, no matter how immediate, is a story from now on as a prediction that each of us has made in our consciousness based on information about past events. We live in anticipation of the future, which we can never see directly, based on the past, which we can see, that is, intuitively feel and know. In other words, we always accept given information, that is, (1) information about various past events on the time axis, which is constantly updated as time passes, (2) information brought to consciousness from personal knowledge or beliefs related to the object event, which is formed through past learning, and (3) information from many arbitrary assumptions. Then, based on the given information, (1) to (3), we live imagining the events from now on that will happen in the future, that is, the future story in which we are involved, and sometimes worry about the future events, event F, that might happen and change the future story as an incident, even though they are essentially knowledge, or beliefs in our consciousness. These beliefs in consciousness, i.e., knowledge, are the essential nature of risk.

Furthermore, based on beliefs, or the knowledge of past events that are an appearance in consciousness, people arbitrarily make many more assumptions to predict the future events, event F (i.e., possible incidents that have not yet occurred), and try to control the predicted future events so that they do not affect the future story. This is the essential structure of an activity known as risk management.

6.5 The Process by which Risk is Constituted

In this subsection, we examine the process by which risk (i.e., the belief that an incident may affect the future story that we have arbitrarily conceived) emerges.

For risk to appear in the consciousness of a perceiver, an individual, whether they are aware of it or not, there must be a future story in which they are involved, and often in which they appear directly. The scenario of this story is arbitrarily based on the information (1) to (3) brought to their consciousness. Only then do they become interested in future incidents, event F, that may occur in the future and could influence the course of events in the story. Considering the interest

correlation of structural constructivism, if the party concerned does not have an interest, that is, a future story to which they are related, then it does not matter to them what kind of event may occur in the outside world, or even if this event actually occurs, it does not evoke an incident, event F, in the future that constitutes a risk.

Consider, for example, an earthquake on the moon. On the one hand, such an earthquake generally does not appear as an incident, event F, in a person's consciousness because there are very few people who currently have a story on the lunar surface in the future, but on the other hand, if there are some parties, such as astronomers who have a story there that they want to progress smoothly, such as lunar exploration, an earthquake on the lunar surface would appear in their consciousness as an incident that constitutes a risk.

As shown in the example of the risk due to the false information about the lion's escape (Subsection 6.2), this future incident, event F, is also an appearance in consciousness, that is, an immanence, based on the information (1) to (4), brought to consciousness. Therefore, the future incident, event F, is not something in the world outside with objectivity.

Risk first appears as an individual's knowledge, that is, a personal belief about the target event, made from the information (1) to (3) brought to consciousness. However, this stage is a state in which the information is understood by the intelligence in the form of the model (illustrated in Figure 1) of the event as an understanding; in other words, there is knowledge about the possible event. This is the precursor stage before risk becomes literal risk. At this stage, the model represents literal knowledge, which is often not perceived as a risk and is rarely referred to as such. An example of this is the state of having knowledge of a disease.

For the risk to decisively appear as a literal risk to consciousness, some (4) triggering information, such as a friend having contracted the disease, needs to be provided to the above precursor state. This triggering information induces interest in the future course of the story, which leads[8] to a belief – that is, appearance in consciousness – that this future event, event F, could happen and become an incident and affect the future course of the story. This is (5) risk emergence, in which risk emerges from the precursor state and appears in the individual's consciousness.

Note that although the information and its sources, (1) to (4), are considered separately here for simplicity in understanding the risk-constituting process, in actual cases the information, (1) to (4), is often complicatedly mixed and not clearly perceived independently.

In general, the trigger, (4), for risk to appear in consciousness as risk comes in the form of narrative information that some event, event T, has occurred. Information that the object event, event T, has resulted in harm to a familiar, or perceived so, person, (i.e., the identifiable victim and iconic victim cases) (Nakayachi, 2009, 2021) could become the trigger, (4) because of its strength in narrativity. In addition, information about an event with a significant impact, subjectively perceived, can also be this trigger, (4) in many cases because of its contextual nature or its narrative strength.

As the former example regarding information of harm to a victim familiar to people, it has been pointed out that information about the death of a nationally well-known comedian in Japan from COVID-19 stimulated people's sensibilities or emotions about risk more than the results of a

mathematical epidemiological simulation of the disease, effectively changing their behavior (Nakayachi, 2021).

Examples of the latter type of high-impact information include major accidents at nuclear power plants or airplanes, frequent occurrences of super typhoons, and news of the emergence of infectious diseases with high mortality rates, such as Ebola hemorrhagic fever.

Neither the upcoming scenario in the future story in this structure nor risk as a belief about future incidents – that is, events that can or are perceived as likely to affect the story – are static. Given that all events continue to be incorporated into the tense of the indeterminate future to the determinate past as time passes, (1) information about events that have occurred is constantly changing. In addition, knowledge changes with the information through risk communication in a broad sense, such as learning from others' experiences and opinions and from hearsay that continues to come from the surroundings. Accordingly, (2) information from knowledge related to past events also continues to change its form with some contingency. Furthermore, (3) information from assumptions that a party posits is not fixed. This is because the assumptions are always made arbitrarily under the influence of the party's interests because they are phenomena with the interest correlation. Thus, the information, which is the basis of risk in consciousness, comes from a variety of sources and also changes over time with some arbitrariness of the person receiving it. Consequently, the risks in our consciousness are always complex and fluid. The shape of risk in our consciousness varies for each person, depending on the information that comes from different sources and also changes with time and circumstances. Given the above process by which risk is constituted as an immanence in our consciousness, it is inevitable that each person's understanding of risk will differ at any given time.

6.6 The Tense of Risk and the Nature of the Future

Another reason that everyone's understanding of risk is different is that risk is always in the future.

The axis of time from the past to the present always ends at the present. Beyond that endpoint, there is only the idea that things should go on like this from now on. In other words, an extension beyond the present does not exist in reality. Nevertheless, for a long time, we have arbitrarily extended the time axis that ends at the present, selfishly called the extended part that does not really exist the future, and treated it as if it has existed[9].

What we call the future is conjecture as a premonition, that is, a belief in each of our consciousnesses, and it never exists as a given. The essential nature of the future is the belief about the story from now on to which we are related, that is, the models/scenarios inherent in our consciousness that each of us has arbitrarily created in our minds. The belief as a premonition, or an upcoming story in ordinary times in peace, is arbitrarily plotted by a party based on the information brought to the party from (1) various events from the past to the present, (2) the knowledge the party has, and (3) many assumptions arbitrarily posited by the party.

When the information that something bad, event T, has happened in the past or just recently is brought to our consciousness, it will (4) trigger a (5) feeling that a similar event, event F, might happen as an incident in the future and could

disturb the future story, that is, the scenario of the future in ordinary times that we have first arbitrarily plotted and assumed. This feeling is the true nature of what we call risk.

In addition, with the appearance of the risk, which is a possible incident in the future, another story, generally an undesirable future, different from the first in ordinary times, also appears in our consciousness as a conjecture.

The nature of the future is a belief as a story to come; that is, a model/scenario from now to hereafter to which we are related, arbitrarily created or constituted in each of our consciousness as an immanence. Moreover, the verb tense in the concept of risk is this future that does not exist in reality. These two are the structural reasons, in addition to those mentioned in the previous section, why people understand risk differently.

6.7 Essential Nature of Risk: Summary of the Discussion

This subsection summarizes the discussions so far. Regardless of the field or type of risk, any entity that we call a risk appears in the consciousness of the parties involved as a feeling or conjecture about possible incidents that may affect their imagined story of their related future. At that time, different kinds of information brought into consciousness affect the appearance of risk in consciousness.

This is the essence in the concept of risk, which is phenomenologically derived, or the identity common to all cases in which we say, "there is a risk." The aforementioned sentences are the linguistic models, i.e. descriptions of risk in natural language. In addition, Figure 2 expresses a schematic diagram of identity in risk, that is, the isomorphic structure common to every appearance of risk in consciousness, derived through the framework of phenomenology and phenomenological science.

Risk is not something that objectively exists in the outside world, but a phenomenon or qualia as an immanence that appears in the party's consciousness in correlation with their desire (i.e., interest) to keep the future story in which they are involved progressing smoothly. This appearance of risk as immanence is often accompanied by the individual's feeling, often called worry[(10)], that something bad may happen and interfere with the future story that they want to continue smoothly.

This structure is less related to the physical form (i.e., the type or scale) of incidents that may affect the story and the intentions/actions of the party trying to reduce risk. Even if an event is scientifically and rationally concluded to have a low probability of its occurrence and/or almost no impact, if there is a feeling (sometimes a delusion), an appearance in the party's consciousness that the event may become an incident and affect the future story in which the party is involved, then it becomes a risk, even if it is objectively considered irrational.

For example, as has been widely reported in the Japanese media in the past and is well known there, if people feel that beef may cause bovine spongiform encephalopathy (BSE), also known as mad cow disease, despite sufficient countermeasures against beef, or if they feel that some seafood may develop radiation damage despite confirmation that it is not contaminated with radioactivity, these feelings become rumor risks and often change people's behavior.

A related specific example is the case of the postponement of the planned relocation of a food market in Tokyo to a site where soil contamination

had been observed (Sakamaki, 2009). Despite the measures taken to deal with the soil contamination, the postponement was executed with a statement from the head of the local government, "The site was safe, but there was no peace of mind." Although some have pointed out that this view of the municipal head is neither scientific nor rational, we consider that there is the sense of risk proposed in this study at its root.

Assuming that risk is an appearance in the consciousness of the perceiver or the party as immanence, we can understand that the possibility of an event and the situation caused by the event, both external to the party, cannot play a leading role in risk. This is because everything becomes a matter of appearance or immanence in the consciousness of the party as far as risk is concerned. From a phenomenological point of view, if the feeling or qualia of risk appears in the party's consciousness, then it is a risk. However, if this feeling does not appear, it cannot be considered a risk(11).

Incidentally, the word "concern" (especially for the bad) is a good word (i.e., an appropriate, concise natural language model) in our everyday vocabulary to appropriately describe the sensibility structure of risk that we have been discussing so far.

The model of risk, the definition of risk discussed and hypothesized in this study, is a structure that makes people feel that there is a risk. This model is common to all cases in which people perceive existence of a risk, regardless of the field or type of it. We believe that the risk model considered in this study represents or codes the latent identity, the isomorphic structure in all that we call risk, regardless of its diversity and arbitrariness.

7. Reconsidering "Risk Communication"

Many social issues in Japan, such as the BSE scare in the early 2000s, the overreaction to the handling of personal information triggered by the Personal Information Protection Law enacted in 2003, and the suspension of the recommendation for the HPV vaccine against cervical cancer in 2013, are related to the social risks generated by information conveyed in the mass media or the news press in Japan.

As discussed in Section 6, risk is a belief and an immanence in consciousness and is perceived differently by each person because it has the attribute of personal knowledge. In addition, it also follows the structure of the concern. Therefore, if we try to understand risk in the usual way of thinking, which assumes a subjective-objective composition whereby subjectivity coincides with objectivity, we must consider exceptional treatments, such as the so-called bias in risk perception. This makes it difficult to share and consider risk perceptions – risk communication – among a number of people who are not necessarily in the same position and who do not always have the same opinions.

Reconsidering risk as an appearance in consciousness or an immanence under the immanence-transcendence composition in phenomenology must bring about a major change to the current methodology of risk communication (Kinoshita, 2016; Lundgren, 2013).

It is an important consideration in the practice of risk sharing (i.e., risk communication) that risk is a party's belief constituted in consciousness by the information brought to the party, has the attribute of knowledge individually possessed by the party, i.e., the party's understanding, and also has the structure of sensibility in the form of concern at the

same time. This is because a belief that appears in our consciousness, made from some news brought to us through communication (i.e., information), is what we call "risk," which simultaneously has the attribute of personal knowledge (i.e., doxa: conjecture) as understanding and the structure of concern as personal sensibility.

If we assume that risk has attributes of personal knowledge due to the information brought to us, and also has a structure of concern that we have at the same time, then the current ways of bringing information to us, or risk communication in a broad sense (e.g., the current media's reporting attitude, which is unconsciously based on dualism), must necessarily change.

When we perceive a risk, we should have definitely received some information through some way (i.e., risk communication in the broad sense) prior to the perception of the risk. It is not risk communication to first suppose the risk and then communicate information about it. In reality, the provision of information or risk communication comes first, and as a result, what appears to the individual consciousness as the party's belief or conjecture is the risk (see Subsection 6.3).

What can be communicated is information that makes the risk present in consciousness or change in its state, and never the risk itself. Discussions on risk communication will henceforth require this Copernican paradigm shift.

Based on the hypothesis of this study, risk communication means engaging with risk as a belief or a conjecture that has attributes of both knowledge and structure of concern, by bringing information to people's consciousness. From this view of risk, the mass media are more than mere informants who merely convey information about objectively existing risks to the masses from the standpoint of a non-party, in a third-party manner. As far as risk is concerned, the mass media are directly responsible for creating or changing the risk present in people's consciousness through the dissemination of information.

In previous studies using the phenomenological framework, we have discussed that service and peace of mind (Amari, 2021a, 2021b) both appear in consciousness (i.e., immanence) and do not exist in the outside world. The same thinking can be applied directly to the case of risk. Nowadays, when the term "risk" abounds, the press must henceforth pay attention to the following points in news reporting. That is, risk is not a risk of being, but a risk of becoming, and risk is what appears in people's consciousness as a result of the information they receive through the mass media. In summary, it is necessary for the news press to reconsider risk communication to the general public from the new perspective.

8. Conclusion

Since the concept of the "risk society" was proposed by Beck (1986), the term "risk" has gained recognition and is now almost an everyday term. It is probably no coincidence that the spread of the term "risk" in the world has kept pace with the popularization of the internet. This is because the vast amount of real-time information available through the internet about other people's experiences and events elsewhere has dramatically increased the size and frequency of updates to the models of future events that people hold in their consciousness as beliefs and has also significantly affected the risk that people perceive as their subjective feelings.

Some may feel that the hypotheses about risk proposed in this study are a matter of course, self-

evident, obvious, and not based on science, as mentioned in Subsection 5.2. In response to this doubt, this study has provided a train of thought (i.e., logical flow) to ensure scientificity in the broad sense, as stated by structural constructivism. If many people agree that something is reasonable under the condition that the train of thought is shown, then it means that thought experiments under the same conditions have been repeated by many people, and they have arrived at the same conclusion. Therefore, we believe that it is reasonable to think that this conclusion is scientifically based.

Takeda states that (2020, p. 170) "In philosophy, one's own experience is the central material, and the philosopher tries to gain insight into the nature of things by reflecting on it. Science begins with this insight or hypothesis and tests the hypothesis by working on nature through observation, experimentation, and measurement." In this study, we have conducted the first half of this process, from insights into the nature of risk to the formulation of the hypothesis about the risk. Verification of this hypothesis requires future research(12).

We believe that the hypotheses proposed in this study could be a step toward envisioning a new, different picture of risk-related science, engineering, and practices such as risk management and risk communication. We expect that this study will provide a new view for the systematization of a "general theory of risk" for academia and a springboard for the consideration of a new form of risk in the field of risk-related practice in industry.

Notes

(1) When considering safety and insurance practices, events such as hazards and accidents are often concrete and have a clear causal relationship to their effects. In contrast, "events when considering risk," such as rumors, are often vague and do not have a clear causal relationship to their effects. In this study, we use the term "incident" to denote a factor that disturbs operations in some way (Amari, 2018, 2020) and use it to describe a broader range of events, including people's behavior and social trends, not limited to simple accidents or malfunctions that are easy to identify specifically.

(2) Special attention should be paid to numerical information, such as probabilities, because it is often introduced alone and its premises tend to be easily forgotten.

(3) In the author's prior studies on service and peace of mind (Amari, 2021a, 2021b), for the same reason, Takeda's summary and the outline of phenomenological scientific theory shown in Subsection 5.2 are also introduced, and their discussions are developed with the help of philosophy.

(4) The ways of thinking introduced in Section 5 are outlined with examples in the papers on services and peace of mind (Amari, 2021a, 2021b).

(5) This is expressed as "phenomena in consciousness." Phenomena in phenomenology, a discipline of philosophy, refers to the appearance of images that appear in consciousness, not physical events as is commonly used.

(6) When the certainty of the lion's escape is unknown, it is more natural and reasonable to understand that there is a risk, and it is unnatural to assume that there is no risk.

(7) In previous research on the concept of security (Amari, 2018, 2020), the story in which the objective is clear is called an "operation" and is considered an essential entity that we need to protect when considering security.

(8) The interest correlation of a phenomenon and the

opportunity correlation of an interest in structural constructivism contribute to this process.

(9) One reason for our illusion that the future exists as a given is that we are surrounded by fictional representations, such as people coming from the future to the present, in manga, movies, and other media.

(10) When one's involvement in the story is great, such as when it concerns one's own future, the sense of risk that appears in one's consciousness is often expressed (i.e., coded) as worry, anxiety, or fear.

(11) The idea that the appearance of a risk in the consciousness of the parties involved determines whether it is a risk or not may seem strange to those who deal with risks in actual business. The main reason for this strangeness is the habit of modern people to think about things based on the implicit assumption of the outside world – that is, objectivity – without being aware of it. However, as mentioned in Section 4, it is not necessarily appropriate to think about risk based on a dualism that assumes its existence in the outside world.

(12) Future issues include validating the applicability of the hypotheses proposed in this study to each of the risk theories that have been proven useful in practice, such as equipment failure and public health theories.

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