

This file was downloaded from BI Open Archive, the institutional repository (open access) at BI Norwegian Business School <http://brage.bibsys.no/bi>.

It contains the accepted and peer reviewed manuscript to the article cited below. It may contain minor differences from the journal's pdf version.

Steen, R. (2017). How to understand and define stress in an operational risk context. *International Journal of Business Continuity and Risk Management*, 7(4), 318-336
DOI: <http://dx.doi.org/10.1504/IJBCRM.2017.10010125>

Copyright policy of *Inderscience*, the publisher of this journal:

“Authors can use their article *for non-commercial purposes* after publication in these ways:

Posting the *Author's Original** or *Accepted Manuscript** on the author's personal webpages and/or institutional repositories and/or subject repositories without embargo, or the *Proof** upon condition that it shall not be accessible until after 6 months from Inderscience's publication date(January 3rd 2018)”

Versions of a paper defined as:

Author's Original = Author's manuscript prior to peer review

Accepted Manuscript = Accepted version of author's manuscript

Proof = Author's version of corrected accepted version

http://www.inderscience.com/info/inauthors/author_copyright.php

How to understand and define stress in an operational risk context

Riana Steen

BI Norwegian Business School

riana.steen@bi.no

Hesbygaten 5, 4014 Stavanger, Norway

Abstract

This paper aims to provide new insights on the understanding of stress and using this concept in operational risk management. We identify three main lines of definitions of stress: situations having the potential for disruption, the consequences of being exposed to various threats, and the interaction between condition and response to pressures. Based on grounded theory as a methodology and from discussion and linking stress to the concept of uncertainty, this work suggests a new definition of stress as a “two-dimensional combination of threat and coping capability associated with uncertainty.” Stress is formalised as (Th, Cc, U) , where Th represents the threat (or amount of pressure), Cc represents coping capability, and U represents uncertainty about the magnitude of the threat and existing capabilities of coping with it. The present paper introduces three interrelated strands of operational risk: sense making, decision making, and performance. Using many examples related to operational risk in banking, this study demonstrates how different components of the proposed definition of stress may influence exposure to operational risk in each of its strands.

Keywords: OR in banking, stress, coping capability, uncertainty

1. Introduction

For various reasons all of us experience stress from time to time – at home, at work, and in our social life. How stress affects our performance depends truly on the type and magnitude of the stress imposed by a given situation and our individual stress-coping mechanism. Stress in the workplace, or occupational stress, are terms often employed when stress is related to the work environment. A simple search using the keywords “work stress” on Google Scholar produces more than four million results in the form of published scientific articles and books. This reflects the considerable effort aimed at providing a better understanding of stress as a concept and the extent to which scholars have been working to develop

methods on how to cope with stress (see, for example, Selye, 1936; McGrath, 1976; Nixon, 1981; Lazarus & Folkman, 1984; Hurrell, 2011; Cooper et al., 2013; and De Berker et al., 2016).

However, despite extensive academic research on the concept of stress and its effects on performance, there is still a lack of consensus regarding its definition. In this regard, Weinberg et al. (2010) classified stress definitions into three categories: stimulus based (p. 64), response based (p. 57), and interactive process (p. 67). Related to these categories, some scholars argue that stress is located in the “work environment,” which is referred to as a stressor (e.g., Block & Block, 1980; Cooper & Marshall, 1976). Other scholars (e.g., LePine et al., 2004; Selye, 1973; Lazarus & Folkman, 1984) propose that stress is the result of an individual’s response to a stressor, i.e., some sort of threat, such as work overload or disagreement and conflict in the environment. According to Beehr (2014, p. 11) the core of an occupational stress experience is the presumed causal relationship between the characteristics of the work or workplace (stressor) and poor employee health (strain). Many researches have focused on the identification of multiple sources of stress and the way one can cope with stress (e.g., Seidel et al., 2014; Grupe & Nitschke, 2013).

Furthermore, many researches emphasize the effect of uncertainty on stressful experiences. For instance, an empirical study carried out by UCL’s Institute of Neurology confirms the strong correlation between uncertainty and stress level. UCL researchers evaluated the contribution of different forms of uncertainty to subjective and physiological stress responses and concluded: “inter-individual variability in stress relates to variability in beliefs about uncertainty” (De Berker et.al., 2016, p. 4).

Cooper (2013, p. 28 § 3) stated that the conceptual distinction between stress, strain, stressor (threat), and the adjustment process refine a generic concept of stress and could be a starting point for defining and operationalizing the empirical reference to these concepts. This is what this paper attempts to do.

This study looks closer at the concepts of stress and uncertainty. To illustrate the main arguments, we relate the effect of stress on operational risk in a financial institute. Operational risk has emerged in the financial field of risk management as “risk of loss resulting from inadequate or failed internal processes, people, and systems or from external events, includes legal risk, but excludes strategic and reputational risk.” (BIS 2006, p 144).

Two main research questions this study addresses are:

- How do we understand and define stress?
- How does stress affect exposure to operational risk?

To answer the first research question after conducting the literature review, with the issue of stress as the research topic, this paper identified three main lines of definitions of stress (refer to the review and discussion in the next sections): (i) A condition or situation having the potential for disruption; (ii) the consequences of being exposed to some sort of threat, and (iii) an interaction between the condition and the response to pressures. We discuss the relationship between these three lines of stress definitions and the concept of uncertainty. Based on the result of the analyses, this work conceptualizes stress, as:

“A two-dimensional combination of threat and coping capability, associated with uncertainty.”

In line with this stress perspective, stress can be formalised as (Th, Cc, U) , where Th represents the threat (or the amount of pressure), Cc represents coping capability, and U represents the uncertainty about the magnitude of threat and existing capabilities to cope with it. A person (or a process/system) may experience some sort of threat (e.g., overloading, fire, data virus, theft, act of terrorism, or sabotage), which might affect that person's or system's performance, employees' health, quality of performance and morale, or economic loss. Employees' responses to a threat depends on his/her coping capabilities, as well as the degree of uncertainty involved with the threat (is it real? how serious is it?), and capabilities to cope with the threat; in other words, how well we (system/ process) can cope with the threat, given our capacity.

In order to discuss in detail how stress affects exposure to operational risk, which is the second research question in this work, we focus on the causes of operational risk events. Girling (2013, p. 2) outlined four main causes of operational risk events: “(1) Inadequate or failed processes, (2) inadequate or failed people, (3) inadequate or failed systems, or (4) external events.”

The interesting question to ask is what actually constitutes these four causes of operational risk? Do they occur because the system or person does not capture the warning elements early enough, and results, for example, in a bank losing money? Do they occur when bank staff make an error because of wrong decisions? Or does operational risk occur because the system or bank staff does not function as it should (e.g., the system is broken)?

These questions lead us to introduce the three interrelated strands of operational risk: sense making, decision making, and performance in this work. This study focuses on these three strands of operational risk, uses many examples, and discusses the effect of stress on each strand. The following figure presents the main topics and areas of emphasis in this paper.

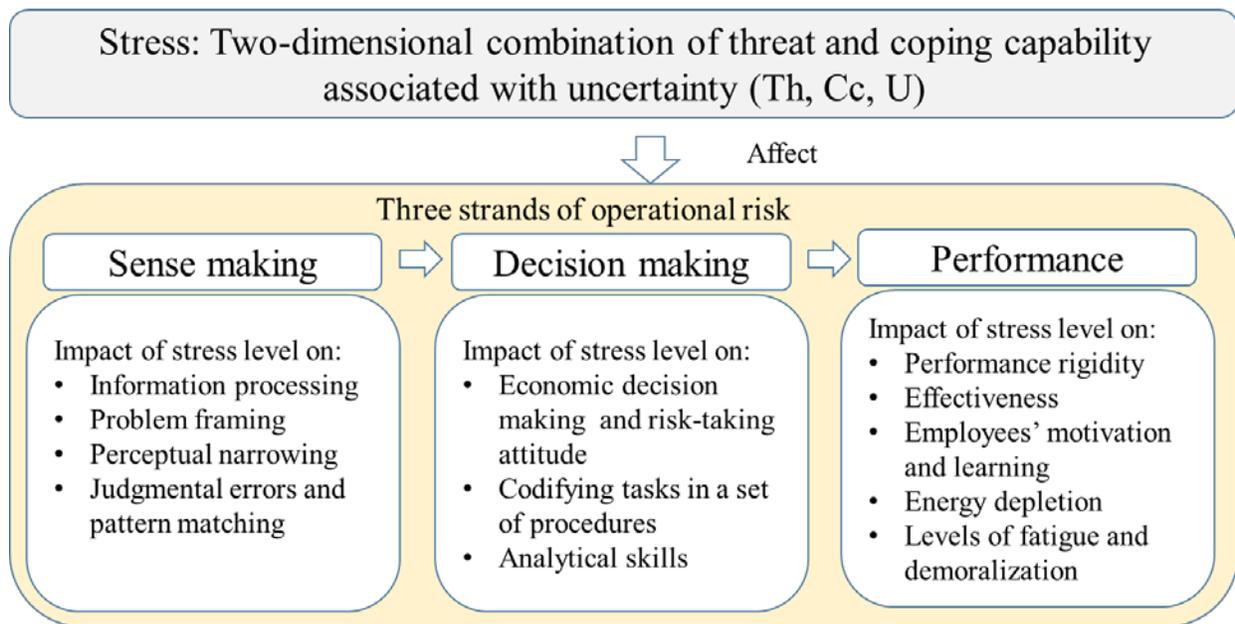


Figure 1 Stress in an operational risk context

This paper concluded that an increasing level of stress has a negative effect on the sense-making process and increases the likelihood of being exposed to operational risk. As for the decision-making process, in a stressful situation, decisions on how to act or not must often be made rapidly. Stress has an impact on risk-taking attitude; as stress increases reward seeking and risk taking (Starcke & Brand 2016), it increases the likelihood of operational risk. When it comes to the third strand, performance, this work applied the Inverted-U model, known as the Yerkes-Dodson Law. Incorporating operational risk in the Inverted-U model, this study concluded that too little stress, an unchallenging work situation in which the staff feel “bored,” as well as extremely high and overwhelming stress levels could lead to dysfunctionality and increase the possibility of being exposed to operational risk.

This work applied grounded theory as a qualitative research design, where the research strategy is based on the constitution of a set of essentials for grounded theory, stated by Birks & Mills (2015, p. 9). These essentials include initial categorization of data, analysis of theoretical sampling, constant comparative analysis using inductive and deductive logic, identifying a core category, and advanced theoretical integration.

Before proceeding with the discussion, let us review the issues fundamental for the research carried out in this paper.

2. Theoretical background

2.1 Operational risk

The Basel Committee on Banking Supervision has defined operational risk as “the risk of direct or indirect loss resulting from inadequate or failed internal processes, people and systems or from external events” (BIS, 2006). Deutsche Bank (2016, p. 17) defines operational risk as “the potential for incurring losses (including the legal component) in relation to employees, contractual specifications and documentation, technology, infrastructure failure and disasters, external influences and customer relationships.”

Operational risk arises from operational errors, which can turn into losses. According to Girling (2013, p. 2) there are four main causes of operational risk events: “(1) The person doing the activity makes an error, (2) the process that supports the activity is flawed, (3) the system that facilitated the activity is broken, or (4) an external event occurs that disrupts the activity.” Consequently, when operational risk is not addressed systematically, it can result in inconsistent performance and earnings surprises for stakeholders. Thus, operational risk exposures can have an impact on institutions’ revenues and net worth. Hence, the pricing and consequent measurement of operational risk’s capital charge has to be adequate to cover for these losses (Correa & Raju 2008, p. 59). Operational risk can be caused by a range of different internal and/or external events, as defined by the Basel Committee. The Basell II categorization of operational risk is as follows:

- **Internal fraud.** Losses due to acts of a type intended to defraud. Intentional misreporting of positions, employee theft, insider trading on an employee’s own account, tax non-compliance, and bribes and kickbacks. Other examples of internal fraud are when transactions are intentionally not reported, monetary loss due to unauthorized transactions, and intentional mismarking of positions.
- **External fraud.** Losses due to acts by a third party that are intended to defraud, misappropriating property, or circumventing the law.
- **Employment Practices and Workplace Safety.** Losses arising from acts inconsistent with employment, health, or safety laws or agreements, from the payment of personal injury claims or from diversity/discrimination events.
- **Clients, products, and business practises.** Losses arising from an unintentional or negligent failure to meet a professional obligation to specific clients, or from the nature or design of a product.
- **Damage to physical assets.** Loss or damage from natural disaster, fire, or other events.

- **Business disruption and system failures.** Losses arising from disruption of business or system failures.
- **Execution, Delivery, and Process Management.** Losses from failed transaction processing or process management, from relations with trade counterparties and vendors.

Girling (2013, p. 9) distinguishes between operational risk management and operational risk measurement. Operational risk management has a border focus area; it is about providing a holistic framework for managing operational risk and evaluating the adequacy of capital given this framework. According to BIS (2006, p 149), the operational risk management function is responsible for developing strategies to identify, assess, monitor, and control/mitigate operational risk. It is concerned with codifying firm-level policies and procedures related to operational risk management, and for the design and implementation of a risk-reporting system for operational risk.

Operational risk measurement focuses on the calculation of capital for operational risk. Many attempts have been made in the literature to develop various techniques and tools to measure operational risk, such as the basic indicator approach, advanced measurement approach, the standardised measurement approach and extreme value theory (Chavez-Demoulin et al., 2006). Assessment of operational risk requires the measurement of expected loss, based on its historical evaluation. This will require the development of an internal as well as an external database on the sources and types of operational loss exposure, in which every single operational loss event is recorded. However, the creation of such a comprehensive database is a challenging task. This work does not discuss these issues as they are beyond the scope of this paper.

2.2 Review of common perspectives on stress

The Etymology Dictionary cites the earliest use of the term “stress” in English in c. 1300, defining it as hardship, adversity, force, and pressure. In Old French, the term was derived from “estrece” and was defined as narrowness and oppression. In Latin, the term has been expressed as “districtus,” which means ‘the constraining and restraining of offenders.’ The symbolic meaning is to “put emphasis on,” an interpretation first recorded in 1896 from the notion of laying pressure on something by relying on it. The Oxford English Dictionary (2015) defines stress in two ways: as a state of mental or emotional *strain* resulting from adverse circumstances, and as something that causes a state of strain or tension. In the scientific literature, particularly in the psychological context, the term is expressed as a “non-specific response of the body to any demand for change,” Selye (2013, p. 15). Selye’s research on stress was based on laboratory experiments on animals. He discovered that a variety of stressors, such as exposure to changing temperatures and physical injury, evoked identical patterns of physiological changes (Hurrell,

2011, p. 297). McEwen (2007) defined stress as a condition of mind-body interaction, and a factor in the expression of disease that differs among individuals. George (1986, p. 532) refers to psychological stress as anxiety or fear:

“...an individual experiences in a situation that he perceives poses a severe *threat* to one or more of his values. Thus, perception of threat in the situation must occur in order for the individual to experience arousal of anxiety or fear. Threat, in other words, is not an attribute of the stimulus situation; it depends on the subject's appraisal of the implications of the situation for his values.”

Stress in the workplace, or occupational stress, is often referred to when the term stress is used in relation to the work environment. Occupational stress is defined as a multivariate process involving sources of pressure, psycho-physiological distress, lack of control, work dissatisfaction, depression, anxiety, mental health disorders, hopelessness, and suicide ideation (Iliceto et al., 2013). According to Beehr (2014, p. 11) the core of an occupational stress experience is the presumed causal relationship between characteristics of the work or workplace (stressor) and poor employee health (strain). A high level of occupational stress will influence the quality, productivity, and creativity of employees, as well as employees' health, well-being, and morale (Cohen & Williamson, 1991).

Furthermore, many researches emphasize the effect of uncertainty on stressful experiences (for a review, see Mishel, 1984; Akl, 2006). For instance, an empirical research carried out by the UCL Institute of Neurology confirms the strong correlation between uncertainty and stress levels. The institute evaluated the contribution of different forms of uncertainty to subjective and physiological stress responses and concluded “inter-individual variability in stress relates to variability in beliefs about uncertainty” (De Berker et.al., 2016, p. 4):

“...people who report higher levels of life stress behave as if they believe that the environment is more uncertain, indicating that chronic stress levels may be affected by prior exposure to environments of high uncertainty. This confirms that inter-individual variability in stress relates to variability in beliefs about uncertainty, as expected, if stress responses are tuned by exposure to uncertainty in the real world.”

Many empirical studies have aimed to identify and analyse different moderator variables associated with the stress concept. For instance, Kudielka et al.'s (2009) study demonstrates how different variables such as age and gender, endogenous and exogenous sex steroid levels, smoking, coffee, and alcohol consumption moderate the responses to acute stress. Moreover, Mossholder et al. (1982) considered the level of self-esteem as a moderator variable in experiencing stress – the lower the level of “self-esteem,”

the stronger the negative effect of stress. Tetrick and LaRocco (1987) mentioned “control” as a moderator variable in their work, in the way that understanding and having control moderates the negative effects of occupational stress. (For a review of different moderating variables, see Bowers, Weaver, & Morgan, 2013, Table 5.2, pages 178-179).

These definitions represent some common perspectives, but many others exist and the list could be lengthened. However, despite extensive academic research on the concept of stress and its effects on performance, there is still a lack of consensus regarding its definition. What is essential for this paper are the three categories of definitions, which are explained in the next section.

3. A conceptual framework for characterising stress

In this section we establish a conceptual framework for characterising stress, using the (Th,Cc,U) stress set-up as introduced in Section 1. From a review of various stress definitions in the literature, we have identified three main lines of definitions of stress:

- i. A condition or situation, having the potential for disruption/pressures (threat):
 - A set of conditions having stress in it. "Stress involves an interaction of person and the environment. Something happens out there, which presents a person with a demand, or a constraint, or an opportunity for behavior." (McGrath, 1976).
 - The negative environmental factors or stressors (e.g., work overload, role conflict/ambiguity, poor working conditions) associated with a particular job." Cooper and Marshall (1976).
 - A physical, mental, or emotional demand, which tends to disturb the homeostasis of the body (Bali, 2015).
 - A high-demand, high-threat situation that disrupts performance (Driskell et al., 2013, p. 8).
- ii. The consequences of being exposed to some sort of threat:
 - Stress is an unavoidable consequence of “modern living,” but it is an undesirable outcome (Asthana, 1985).
 - Stress occurs when one perceives he/she is confronted by harm, danger, or a challenge that may exceed his/her ability to deal with it (Chen 1999, p. 49).
 - Stress is referred to as strain and represents an outcome variable; strain is understood to be the reputed result of stressor exposure (Spector & Jex, 1998).
- iii. An interaction between the threat condition and response to pressures:

- The way people respond to work demands and pressures that are not matched to their knowledge and abilities and which challenge their ability to cope (WHO, 2017).
- The non-specific response of the body to any demand for change (Selye, 2013, p. 15)
- Stress entails a relationship between a task load and the coping capacity of an individual or collective (Boin et al., 2005, p. 29).
- An individual's psychological response to a situation in which there is something at stake for the individual and where the situation taxes or exceeds the individual's capacity or resources (LePine et al., 2004).
- A work condition interacting with worker characteristics to disrupt psychological or physiological homeostasis (Hurrell., 2011, p. 298).

Let us explain these three main lines of definition in a simple example. A person (or a system) may experience some sort of threat (*i*) e.g., overloading, fire, data virus, theft, an act of terrorism or sabotage, which may lead to some consequences (*ii*) on the person's judgement, health, quality of performance and morale (strain). Obviously, (*iii*) there is an interaction between the threat condition and how a person/system responds to the pressure.

However, the form and quality of response depends on the significance of an individual's explicit and tacit knowledge, judgment skills, experience, and abilities, by which we mean coping capabilities. Consequently, stress need not necessarily degrade performance if the task load is balanced by a high degree of coping capacity (Boin et al. 2005, p. 29). From these arguments, we identify two main dimensions of stress:

- I) The extent of the threat (Th), and
- II) Coping capabilities (Cc) in response to the threat

Based on these two dimensions, stress is then defined by the pair (Th, Cc).

Beside the threat and coping capabilities, the degree of uncertainty involved with a threat (is the threat real? how serious is it?), and the ability to cope with the threat (could I/we deal with the threat, given my/our current resources?) will affect the consequences of being exposed to some threats. In other words, the level of uncertainty has a direct effect on individual's experience of stress and the response process. Incorporating uncertainty as an influencing factor on stress in our model leads us to the following definition:

“Stress is a two-dimensional combination of threat and coping capability, associated with uncertainty.”

In line with this stress perspective, stress can be formalized as (Th, Cc, U) , where Th represents the threat (or the amount of trigger), Cc represents coping capability, and U represents the uncertainty about the magnitude of the threat and the existing ability to cope with it.

Stress, in other words, is not an attribute of the situation (*i*), nor the consequence of being exposed to some sort of threat (*ii*). Stress depends on the individual's appraisal of a situation, given current coping capabilities. The individual's appraisal of the situation is subject to “uncertainties.” Figure 1 illustrates the main features of this stress perspective.

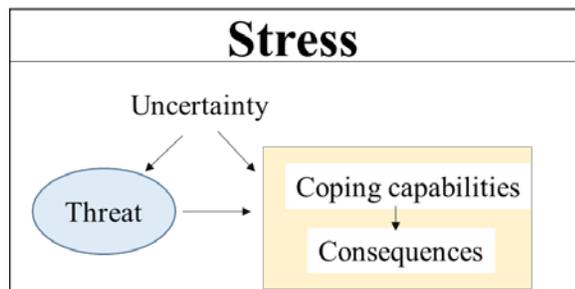


Figure 2 Formative conceptual two-dimensional stress model

As the top part of the model in Figure 1 depicts, uncertainty factors influence stress by their moderating effects. Moderation effects are generally considered as an interaction between factors or variables, where the effects of one variable depend on levels of the other variable in analysis (Fairchild & MacKinnon 2009). Uncertainty as a moderator factor in this work means it affects the strength of the relation between a predictor (threat and coping capabilities) and an outcome. The higher the level of uncertainty, the higher the level of strain.

Aven (2014) defines uncertainty as a lack of knowledge; in other words, “not knowing about something, where ‘something’ refers to the true value of a quantity or the true future consequences of an activity (p. 235).” Uncertainty is also considered a major source of psychological strain during organizational change (see Bordia et al., 2004). There are many sources of uncertainty, including the subjectivity of the analyst’s judgments and linguistic ambiguity (Zio & Aven, 2011). De Berker et al. (2016) classified uncertainty into three categories. The first category is ‘irreducible uncertainty,’ which reflects the randomness inherent in any complex environment, resulting from probabilistic relationships between predictors and outcomes. The second type of uncertainty results from imperfect knowledge of the probabilistic relationships between predictors and outcomes. The third category of uncertainty is ‘volatility uncertainty,’ which is

about the stability of the context. We refer to Aven (2014) for more in-depth discussion of the concept of uncertainty.

The components of the two-dimensional stress model, threats (Th) and coping capabilities (Cc), are illustrated in detail in Figure 2. This study adopted a simple form of “Bowtie” as a causal diagram, where threat scenarios are causes, coping capabilities are considered as barriers, and the consequences are different types of strain.

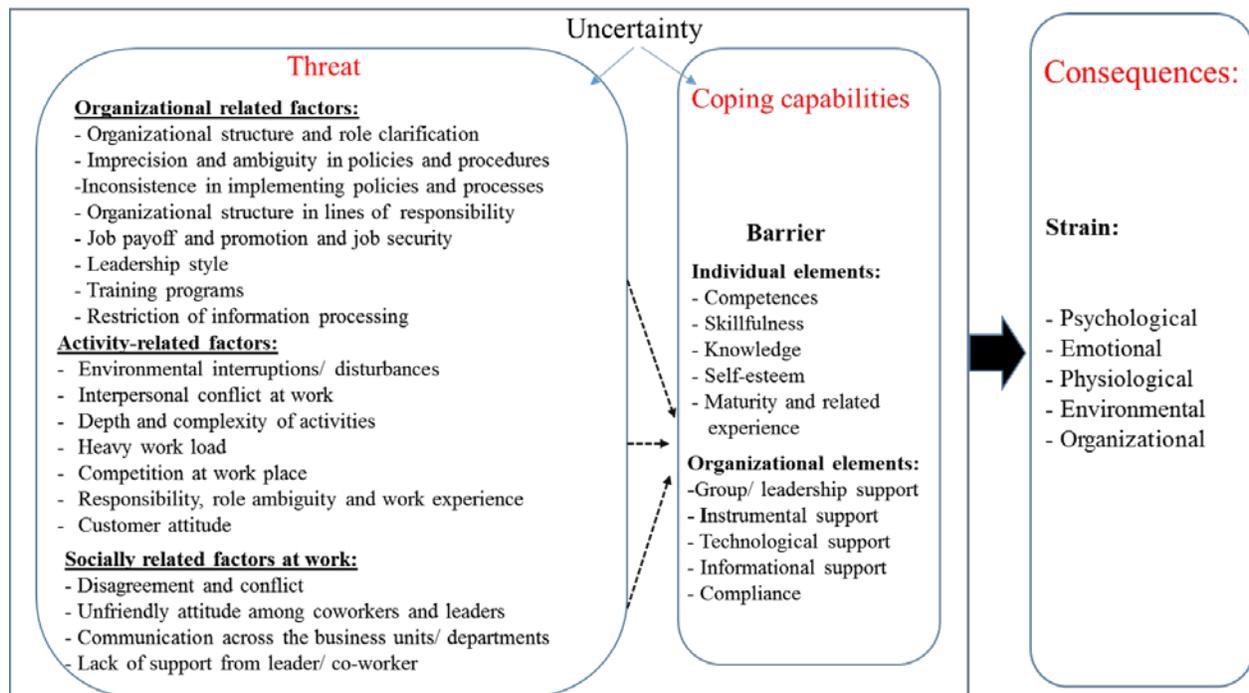


Figure 3 Causes and consequences model of (Th, Cc, U) stress perspective

Threat

In this study, threat in the suggested stress perspective falls into three categories. The first is related to organizational factors (e.g., organizational structure and role clarification, imprecision and ambiguity in policies and procedures, and inconsistent implementation of policies and processes). The second category relates to work activities (e.g., environmental interruptions/disturbances, interpersonal conflict at work, heavy work load, and role ambiguity). The third category of threat comes from socially related factors at work (e.g., disagreement, conflict, unfriendly attitudes among coworkers and leaders, and lack of support from leaders/co-workers).

Coping capabilities

This paper considers coping capabilities as barriers. Hollnagel (2004, p. 69) defined barrier as something that stops the passage of something or someone. Barrier in this work is understood as the types of means/attitudes that regulate employees'/systems responses to minimise the effect of being exposed to some sort of threat scenarios. As Figure 2 shows, these barriers are organised in two categories: individual elements (e.g., competences, self-esteem, skills, and related experience) and organizational elements (e.g., organizational culture, group/leadership support, instrumental, technological, informational support, and compliance). In the context of operational risk in a financial institution, examples of coping capability in our framework are understanding the mandate, having confidence in and respect for the institution, adherence to the bank's policies and strategies, creating an appropriate risk culture, continuous availability of employees, and the possibility of replacement (Black Sea Trade & Development, 2015).

Strain

Dictionary.com defines strain as any force or pressure tending to alter a shape and cause a fracture. Strain is understood as the reputed results of exposure to a stressor/s (Spector & Jex, 1998). Strain in this study refers to the impact of being exposed to a threat, given existing coping capabilities. As we see in Figure 2, strain can appear in different forms; for instance, psychological and emotional (e.g., poor judgment and impulsivity, sadness, anxiety, and depression, feeling guilty, restlessness, and irritability); physiological (e.g., racing heartbeat, nausea, sweaty palms, sleep problems, concentration problems, fatigue, and appetite changes); environmental (e.g., decreased interest in appearance); and organizational (e.g., reduced work efficiency or productivity, problems in communication, and social withdrawal and isolation).

However, strain varies across individuals; even similar threat scenarios can generate different levels and types of strain in different people. As an example, consider a bank staff's suspicions about possible identity theft. Two different bank staff with the same education and skills may have different levels and types of strain. One could, of course, argue that such derivation is possible when different people have different levels of coping abilities. Beside this fact, the level of uncertainty also plays an important role on the level and type of strain (see, for instance, Starcke & Brand, 2016; Akl, 2006).

4. The effect of stress on operational risk:

In this section we discuss how the main components of stress, i.e., threat, coping capabilities, and uncertainty, may have an impact on operational risk. In order to discuss in detail how stress affects operational risk we need to know what actually constitutes different types of operational risk. Does such

risk occur because the system does not capture the warning elements early enough, which causes the bank to lose money or reputation? Do such risks occur because bank staff make wrong decisions? Or does operational risk occur because the system or bank staff does not function as it should? These questions lead us to identify the three interrelated strands of operational risk: sense making, decision making, and performance (see Figure 1).

4.1 Stress and the first strand of operational risk: sense making

According to Weick et al. (2005), “sense-making primary sites where meanings materialize that inform and constrain identity and action. It involves turning circumstances into a situation that is comprehended explicitly in words and which serves as a springboard into action.” The effect of stress on sense making can be traced back to cue utilization theory, introduced by Easterbrook in 1959. This theory explains that high levels of stress (arousal) lead to a restriction of the individual’s information processing (Sharot & Phelps 2004). Findings from many empirical studies reveal that stress affects individuals’ attentional narrowness (Pargman, 2006 (p. 137); Sharot & Phelps, 2004). Driksell et al. (2013, p. 253) state that “stress may increase distraction and decrease attentional focus.”

One of the reasons for a failure to make sense of events could be due to the heavy work load (as a threat, see Figure 3) on employees. High levels of pressure on staff affect information processing, problem framing, and sense making (Boin et al., 2005, p 29). How stress affects the sense making process is explained as follows:

“The brain likes to eliminate uncertainties by suggesting a variety of shortcuts or what psychologists call “heuristics,” which do not necessarily lead to a *correct* picture of the situation. Moreover, the brain’s sense making capacities quickly deteriorate under stress. All this may lead individuals to cling to the first available (and convincing) explanation of what is happening” (Boin & Renaud 2013, p. 42).

In an operational risk context, the source of disturbance, which is some sort of threat in the proposed stress definition of this paper, may come from anywhere, ranging from seven types of operational risk (see Section 2.1). However, the cause of operational risk may originate from the inability of the individual/system to capture the warning signs of disturbances. Despite all the procedures, checklists, filters, and compliance, some situations may occur that none of these predefined risk-management tools

adequately cover. For instance, fraud, money laundering, corruption, and financing terrorism happen when employees/systems fail to observe, capture, and make sense of the elements of fraud.

An example could be related to internal fraud. According to the Association of Certified Fraud Examiners’ report to the Nations on Occupational Fraud and Abuse, the average occupational fraud scheme goes on for 18 months before being detected¹. Fraud indicates “activities such as theft, corruption, conspiracy, money laundering, bribery and extortion. It involves using deception to dishonestly make a personal gain for oneself and/or create a loss for another” (CIMA, 2009, p. 7).

An example of internal fraud is the insider trading cases in SAC Capital. Insider trading in SAC has been done by numerous employees and made possible by institutional practices and the use of illegal inside information (Nesto, 2013). For a decade, authorities investigated allegations that SAC’s great economic success was driven by unfair advantage. In 2013, SAC pleaded guilty to insider trading, and paid \$1.8 billion in fines (Childs, 2016). One could argue that this fraud could have been prevented if the regulatory process had not failed to control, prevent, deter, and detect fraud. The cause of operational risk in this case was clearly the absence of sense making, when the system didn’t capture the elements of fraud early enough and allowed it to go on for so long. Let us go back to our definition of stress and break it into its components and see how stress affected operational risk in this example (see Figure 4).

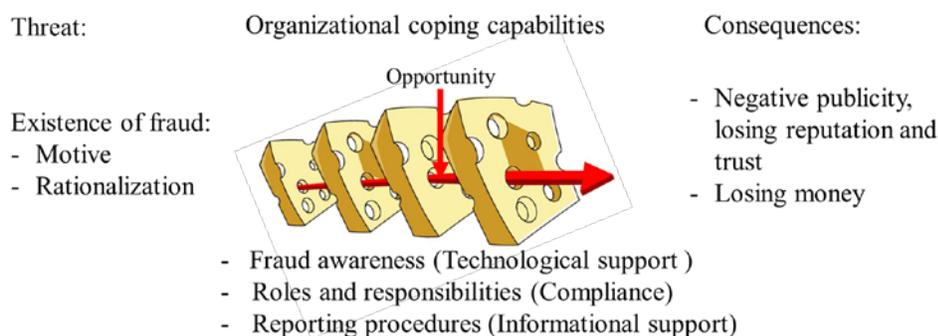


Figure 4 Two-dimensional stress definition related to the case of internal fraud in SAC

As Figure 4 illustrates, the sort of threat in our example is the existence of fraud. There are many reasons why people commit fraud. According to CIMA, fraud is likely to result from a combination of three factors: motivation, rationalization, and opportunity (CIMA, 2009, p.13). The third element of fraud in our

¹ <http://www.bankingexchange.com/risk-management/item/2280-4-internal-frauds-and-how-to-spot-them>

model, opportunity, is related to a lack of appropriate organizational coping capabilities. This could be in the form of weak reporting procedures, compliance, and internal control systems. When it comes to uncertainty, a component in our definition of stress, it highlights that there is a lack of knowledge about the threat (i.e., how strong is the staff's motive and rationalization to commit fraud) and how well will organizational coping capabilities enable a financial institution to capture and deal with fraud?

To sum up, it could be concluded that the financial institution SAC Capital experienced a high level of stress (due to the high level of threat and low level of coping capabilities), which resulted in the loss of huge sums, profits, jobs, and a great deal of trust.

4.2 Stress and the second strand of operational risk: decision making

Decision making is considered a “process by which people draw conclusions, reach evaluations, and make choices” (Highhouse et al., 2013, p. 1), and build on analytical comparisons between different courses of action (Klein, 2013, p. 50). Information processing is at the heart of decision making. Making the right decision is about choosing the right course of action. Further, our decision depends largely on how we understand a situation (sense making). However, correctly understanding what is going on does not guarantee making the right decision, particularly in a stressful situation.

In a stressful situation, course of action, which relates to the decision on how to act or not, must often be made rapidly. The essence of good decision making is maximizing the search for alternatives and evaluation procedures in light of all the relevant information that can be made available (McCauley 1998). According to Klein (2011, p. 19) “in a complex situation it is difficult to codify all the work in a set of procedures.”

Many researches suggest that stress has an impact on risk-taking attitude. Some of the ways stress does this are presented in Table I.

Table 1 The impact of stress on decision making

How does stress have an impact on risk taking attitude?	References
A high level of stress from external threats influences the concurrence- seeking tendency and may cause a failure to examine the risks of preferred choices; it may lead to a failure to reappraise initially rejected alternatives or lead to selective bias in processing information and failure to work out contingency plans.	Janis, 1982, p. 244
Time pressure has a direct effect on the magnitude of the decision threshold, insofar as increases in time pressure result in decreases in threshold size.	Busemeyer & Townsend, 1993
Risk and reward are processed differently in decision making in stressful situations.	Mather & Lighthall, 2012
Stress results in distortions in alternative generation, the assessment of available choices, and finally in the stage of making a choice from among alternatives available to the decision maker.	Gok & Atsan, 2016
Stress increases reward seeking and risk taking, depending on the decision situation and the type of stressor.	Starcke & Brand, 2016
Acute psychosocial stress affects economic decision making under risk, independent of the learning processes	Buckert et al., 2014

In the context of operational risk, there are many situations that may cause loss resulting from inadequate decision making. For instance, when a bank’s staff puts money in the wrong account or the bank does not make sufficient checks before a money transmission to a third party. Another example could be related to the fear of reputation loss. For example, a member of a bank’s staff who suspects internal fraud (a colleague fudging numbers) is less likely to report it to management if there is a possibility of misinterpretation, no group/leadership support, or the risk of losing reputation. Being afraid could be considered a sort of threat in our two-dimensional stress perspective. Stress in this case may cause a bank staff member to decide not to take further action and ignore the possible fraud.

4.3 Stress and the third strand of operational risk: performance

The Oxford Dictionary defines performance as an action or process of performing a task or function. The relationship between stress and performance has been widely researched by scholars during the past

hundred years. For instance, in one of the first researches carried out by psychologists Robert Yerkes and John Dillingham Dodson in 1908, the researchers introduced an Inverted U-model known as Yerkes-Dodson Law. This law explains that a relationship between arousal and behavioral task performance exists, and that some level of stress is necessary for optimal performance. Stress levels below or above this optimal level have an adverse effect on performance (Muse et al., 2003, p. 359).

Moreover, in 1981, Peter Nixon, a British cardiologist, modelled the relationship between stress and performance and called it “The human function curve.” Nixon’s model is divided into two zones. *First* is the positive stress zone, where an increasing level of stress will increase performance level. This zone includes an area called the Comfort Zone, which is characterized as the range of stress levels we can manage, and it empowers good performance levels. *Second* is the distress zone, where increasing levels of stress diminish productivity and performance levels. In the distress zone, increasing stress levels can be overwhelming and lead to exhaustion or ill health. Nixon used the term “breakdown” to characterize this situation. McEwen & Gianaros (2010) distinguished between different stress processes impacting performance as “good,” “tolerable,” and “toxic.” Toxic stress refers to the “faltering activation” of stress responses, which is dangerous to an employee’s health or system. This activation occurs when an individual faces severe adversity or overwhelming and other horrific experiences without any support for an extended period. As a result, a person or system collapses (Juster, 2013). In this work, we use these ideas and develop the Inverted-U model in relation to operational risk, as illustrated in Figure 5.

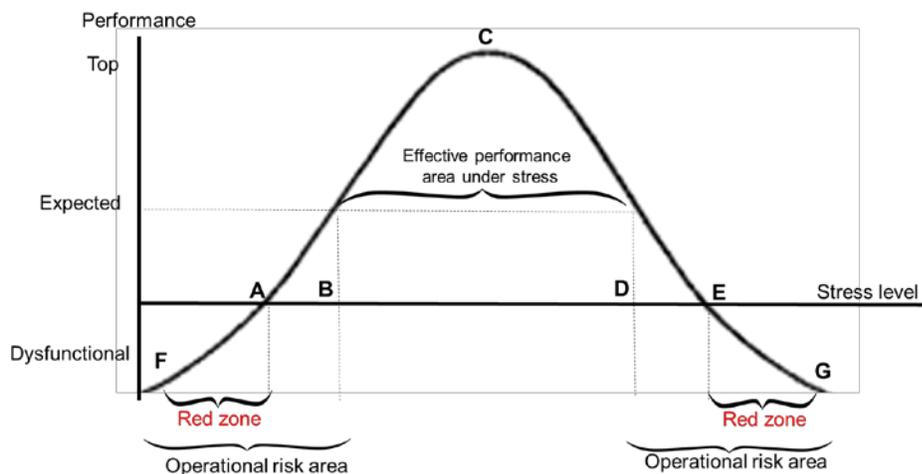


Figure 5. Performance, stress level, and operational risk

The curve in Figure 4 shows two different areas that indicate operational risk zones, where performance (quality and/or quantity) is lower than expected. Here, the F-A and E-G areas have characteristics of

dysfunctionality, labeled as “red zones of operational risk.” There might be different reasons for dysfunctionality, such as too little stress where the staff feel bored because of an unchallenging workplace environment in which there is “*too much routine*” work (F-A area). Boredom at work might arise from causes outside the person; for instance, extremely low stimulation tasks such as repetitive and/or machine-paced assembly operations, inspection tasks, and continuous control activities such as driving (Driskell et al., 2014, p. 252; Fisher, 1993). Extremely high and overwhelming stress levels, when employees feel frustration, exhaustion, and anger, could also lead to dysfunctionality (E-G area). For instance, an employee experiences a completely unmanageable and uncontrollable situation. Related to this area is what I refer to as “toxic stress,” which was mentioned earlier. Moreover, the B-D area in Figure 5 represents the effective performance level under stress. To acquire an effective performance level under demanding and threatening conditions requires the capacity to maintain one’s composure and emotional control while staying focused on tasks under stress (Driskell et al., 2014, p. 254).

In recent years many academic books and research papers have been published arguing how stress may affect performance. For instance, Driskell et al. argue that “stress may increase cognitive load and demand on capacity. Time sharing or multi-tasking can be defined as the capacity to perform concurrent tasks in a high stress environment often involving an increase in task load”

Besides task load, stress may increase social impairment, “a reduction in the tendency to assist others, increased interpersonal aggression and less cooperative behavior among team members” (Salas, Driskell, & Hughes, 2013, p. 13). Bakker et al. (2005) conducted an empirical research among employees of a large institute for higher education and found that the “job demands evoke a stress process because they lead to *energy depletion*, whereas a lack of job resources evokes a withdrawal process, because it undermines employee *motivation and learning*.”

Moreover, stress has an effect on performance rigidity. According to Driskell et al. (2008, p. 277) performance rigidity is the “tendency to approach a problem with restricted attentional focus and expectancy that there is a single solution that does not vary.” Weick (1988) stated that “people’s task and actions is consolidated with the unorganized set of environmental elements, in the way that people transform a more complex task into a simpler task in their actions and these simplifications gain significance in stress situations.”

There are many situations related to the poor performance of individuals or systems that may expose a financial institute to operational risk. An example is illustrated by Girling (2013, p. 11), where a bank’s business line offers retail customers the ability to trade bonds. One of the customers calls the broker bank

and instructs the broker to buy specific bonds, but it is mistakenly booked as a sell, instead of a buy. Many other types of employees' errors, breakdowns, or other disruptions in technology or data may be due to poor performance caused by high (or too low) stress levels.

5. Final remarks

This paper has addressed two main research questions: How do we understand and define stress? How does stress affect exposure to operational risk?

In answering the first research question, this paper addressed situations in which there were some sort of stressors (threat) that would lead to consequences (strain). As many different levels and types of coping capabilities exist to deal with threats, it is difficult to predict the consequences of alternative strategies and measures to deal with threats. The concept of stress is often used in such situations, but its meaning varies a lot. A number of stress definitions have been proposed in the literature. This work performed a review of common stress definitions and outlined a structure for categorising them. Based on this structure, the present work suggests a definition of stress linked to the uncertainty concept. Stress is defined as the "Two-dimensional combination of threat and coping capability associated with uncertainty." I believe the suggested definition of stress is robust, as it is not dependent on the stress perspective adopted, and captures the essence of the most common definitions used in the literature. The link to the concept of uncertainty provides a framework for its use in an operational risk-management context.

Regarding the second research question, this work introduced three interrelated strands of operational risk; sense making, decision making, and performance, and by using many examples, discussed how stress level influences exposure to operational risk in each of these strands.

The present article does not present strategies on how to deal with stress, but provides an in-depth analysis of important aspects of the concept of stress in an operational risk context. The aim has been to obtain new insights on the uncertainty dimension of stress to improve understanding of this concept. The scant research relating to stress and operational risk management calls for descriptive as well as normative and causal lines of research. Future work in this promising area will require interdisciplinary collaborations. Examples of research issues to be investigated could include (1) further conceptualizing stress, (2) strategy formation to deal with stress, and (3) identifying associations between stress and performance in an operational risk context.

References

- Akl, S.G. 2006. Coping with uncertainty and stress: A parallel computation approach. *International Journal of High Performance Computing and Networking*, 4(2), 85–90.
- Asthana, H. S. (1985). The concept of stress: A phenomenological approach. *Social Science International*, 1(1), 39-44.
- Aven, T. (2014). *Risk, surprises and black swans: Fundamental ideas and concepts in risk assessment and risk management*. London: Routledge.
- Bakker, A. B., Demerouti, E., & Euwema, M. C. (2005). Job resources buffer the impact of job demands on burnout. *Journal of occupational health psychology*, 10(2), 170.
- Bali, A. (2015). Psychological Factors Affecting Sports Performance. *International Journal of Physical Education, Sports and Health*, 1(6), 92-95.
- Beehr, T. A. (2014). *Psychological stress in the workplace (Psychology revivals)*. London: Routledge.
- Birks, M., & Mills, J. (2015). *Grounded theory: a practical guide*. Los Angeles: Sage.
- BIS. (2006). International Convergence of Capital Measurement and Capital Standards: A Revised Framework— Comprehensive Version. Retrieved from <http://bis.org/publ/bcbs128.pdf>.
- Black Sea Trade & Development. (2015). Bank Compliance and operational risk management. Retrieved from http://www.bstadb.org/about-us/key-documents/Operational_Risk_Management_policy.pdf.
- Block, J. H., & Block, J. (1980). The role of ego-control and ego-resiliency in the origination of behavior. In W. A. Collins (Ed.) *Development of Cognition, Affect, and Social Relations: The Minnesota Symposia on Child Psychology, Volume 13*, (p. 39-101). Hillsdale, NJ: Erlbaum.
- Boin, A., & Renaud, C. (2013). Orchestrating joint sensemaking across government levels: challenges and requirements for crisis leadership. *Journal of Leadership Studies*, 7(3), 41-46.
- Boin, A., Hart, P., Stern, E. & Sundelius, B. (2005). *The politics of crisis management: Public leadership under pressure*. Cambridge: Cambridge University Press.
- Bordia, P., Hunt, E., Paulsen, N., Tourish, D., & DiFonzo, N. (2004). Uncertainty during organizational change: Is it all about control? *European Journal of Work and Organizational Psychology*, 13(3), 345-365.
- Bowers, C. A., Weaver, J. L., & Morgan Jr, B. B. (2013). Moderating the performance effects of stressors. In E. Salas, J. E. Driskell (Eds.), *Stress and Human Performance* (p. 163-192). United Kingdom: Psychology Press
- Buckert, M., Schwieren, C., Kudielka, B. M., & Fiebach, C. J. (2014). Acute stress affects risk taking but not ambiguity aversion. *Frontiers in neuroscience*, 8, 82.
- Busemeyer, J. R., & Townsend, J. T. (1993). Decision field theory: A dynamic-cognitive approach to decision making in an uncertain environment. *Psychological review*, 100(3), 432.
- Chavez-Demoulin, V., Embrechts, P., Nešlehová, J. (2006). Quantitative models for operational risk: extremes, dependence and aggregation. *Journal of Banking & Finance*, 30(10), 2635–2658.
- Chen, C. P. (1999). Common stressors among international college students: Research and Counselling Implications. *Journal of College Counselling*, 2, 49-65.

- Childs, M. (2016, 01.Desember). SAC Capital to pay \$135m to settle insider trading suit. *Financial Times*. Retrieved from <https://www.ft.com/content/1ae4cb0e-b75f-11e6-ba85-95d1533d9a62>.
- CIMA. (2009). *Fraud risk management: a guide to good practice* (2nd edition). London: CIMA. Retrieved from http://www.cimaglobal.com/Documents/ImportedDocuments/cid_techguide_fraud_risk_management_feb09.pdf.pdf.
- Cohen, S. & Williamson, G. M. (1991). Stress and infectious disease in humans. *Psychological Bulletin*, 109(1), 5-24.
- Cooper, C. L. & Marshall, J. (1976). Occupational sources of stress: A review of the literature relating to coronary heart disease and mental ill health. *Journal of Occupational Psychology*, 49, 11-28.
- Cooper, C. L., & Marshall, J. (2013). Occupational sources of stress: A review of the literature relating to coronary heart disease and mental ill health. In C. L. Cooper (Ed.), *From Stress to Wellbeing Volume 1 The Theory and Research on Occupational Stress and Wellbeing* (p. 3-23). Basingstoke: Palgrave Macmillan.
- Correa, R., & Raju, S. (2008). *Operational risk measurement for the Indian banking sector: Alternative measures*. Mumbai: University of Mumbai (Department of Economics). Retrieved from <http://www.iibf.org.in/documents/reseach-report/Report-19.pdf>.
- De Berker, A. O., Rutledge, R. B., Mathys, C., Marshall, L. Cross, G. F., Dolan, R. J. & Bestmann, S. (2016). Computations of uncertainty mediate acute stress responses in humans. *Nature Communications*, 7. doi: 10.1038/ncomms10996.
- Deutsche Bank. (2016). Passion to Perform. FCM Specific Disclosure Document. Retrieved from <https://www.db.com/usa/docs/dbsi-fcm-specific-disclosure.pdf>.
- Driskell, J. E., Salas, E., Johnston, J. H., & Wollert, T. N. (2008). Stress exposure training: An event-based approach. In P. A. Hancock & J. L. Szalma (Eds.), *Performance under stress* (p. 271-286). Farnham: Ashgate Publishing.
- Driskell, T; Driskell, J. E. & Salas, E. (2014). Stress, Performance and Decision Making in Organizations. In S. Highhouse, R. S. Dalal, & E. Salas (Eds.), *Judgment and Decision Making at Work* (p. 251-276). New York, NY: Routledge.
- Easterbrook, J. A. (1959). The effect of emotion on cue utilization and the organization of behaviour. *Psychological Review*, 66(3), 183–201. doi:10.1037/h0047707. PMID 13658305.
- Fairchild, A. J., & MacKinnon, D. P. (2009). A General Model for Testing Mediation and Moderation Effects. *Prevention Science*, 10(2), 87–99. doi:10.1007/s11121-008-0109-6.
- Fisher, C. D. (1993). Boredom at work: a neglected concept. *Human Relations*, 46(3), 395-417.
- George, A. L. (1986). The impact of crisis-induced stress on decision-making. In F., Solomon, R. Q., Marston, & L. Thomas, (1986). *The medical implications of nuclear war* (p. 529-552). Washington: National academies press.
- Girling, P. X. 2013. *Operational Risk Management: A Complete Guide to a Successful Operational Risk Framework*. Hoboken, NJ: John Wiley & Sons.

- Gok, K. & Atsan, N. (2016). Decision-making under stress and its implications for managerial decision-making: a review of literature. *International Journal of Business and Social Research*, 6(3), 38-47.
- Grupe, D. W., & Nitschke, J. B. (2013). Uncertainty and anticipation in anxiety: an integrated neurobiological and psychological perspective. *Nature Reviews Neuroscience*, 14(7), 488-501.
- Highhouse, S., Dalal, R. S. & Salas, E. (2013). Introduction to Judgment and Decision Making. In S. Highhouse, R. S. Dalal, & E. Salas (Eds.). *Judgment and Decision Making at Work* (pp. 1-9). New York, NY: Routledge.
- Hollnagel, E. (2004). *Barriers and Accident Prevention*. Aldershot, UK: Ashgate Published Limited.
- Hurrell, J. J. J. (2011). Occupational Stress. In B. S. Levy, D. H. Wegman, S. L. Baron, R.K. Sokas (Eds.), *Occupational and Environmental Health: Recognizing and Preventing Disease and Injury* (p. 296-313). Oxford: Oxford University Press.
- Iliceto, P., Pompili, M., Spencer-Thomas, S., Ferracuti, S., Erbuto, D., Lester, D & Girardi, P. (2013). Occupational stress and psychopathology in health professionals: An explorative study with the Multiple Indicators Multiple Causes (MIMIC) model approach. *Stress*, 16(2), 143-152.
- Janis, I. L. (1982). *Groupthink: Psychological studies of policy decisions and fiascoes*. Boston: Houghton Mifflin.
- Juster, R. P. (2013). From Stressed Neurons to Resilient Neighborhoods: Discussion with Dr. Ilian Karatsoreos and Bruce S. McEwen. *Mammoth magazine* (13), 4-6.
<http://www.humanstress.ca/documents/pdf/Mammoth%20Magazine/Mammoth-no13-EN.pdf>.
- Klein, G. A. (2011). *Streetlights and shadows: Searching for the keys to adaptive decision making*. Cambridge, MA: MIT Press.
- Klein, G. A. (2013). The effect of acute stressors on decision making. In E. Salas, J. E. Driskell (Eds.), *Stress and Human Performance* (p. 49-88). United Kingdom: Psychology Press.
- Kudielka, B. M., Hellhammer, D. H., & Wüst, S. (2009). Why do we respond so differently? Reviewing determinants of human salivary cortisol responses to challenge. *Psychoneuroendocrinology*, 34(1), 2-18.
- Lazarus, R. S. & Folkman, S. (1984). *Stress, appraisal, and coping*. New York: Springer.
- LePine, J. A., LePine, M. A., & Jackson, C. L. (2004). Challenge and hindrance stress: relationships with exhaustion, motivation to learn, and learning performance. *Journal of Applied Psychology*, 89(5), 883-891.
- Mather, M. & Lighthall, N. R. (2012). Risk and Reward Are Processed Differently in Decisions Made Under Stress. *Current Directions in Psychological Science*, 21(1), 36-41.
- McCauley, C. (1998). Group dynamics in Janis's theory of groupthink: Backward and forward. *Organizational behavior and human decision processes*, 73(2-3), 142-162.
- McEwen, B. S. (2007). Physiology and neurobiology of stress and adaptation: central role of the brain. *Physiological reviews*, 87(3), 873-904.
- McEwen, B. S., & Gianaros, P. J. (2010). Central role of the brain in stress and adaptation: Links to socioeconomic status, health, and disease. *Annals of the New York Academy of Sciences*, 1186(1), 190-222.

- McGrath, J. E. (1976). Stress and behavior in organizations. In M. Dunnette (Ed.), *Handbook of Industrial Organizational Psychology* (p. 1351-1395). Chicago: Rand McNally.
- Mishel, M. H. (1984). Perceived uncertainty and stress in illness. *Research in Nursing and Health*, 7(3), 163–171.
- Mossholder, K. W., Bedeian, A. G., & Armenakis, A. A. (1982). Group Process-Work Outcome Relationships: A Note on the Moderating Impact of Self-Esteem. *Academy of Management Journal*, 25(3), 575-585.
- Muse, L. A., Harris, S. G., & Feild, H. S. (2003). Has the inverted-U theory of stress and job performance had a fair test? *Human Performance*, 16(4), 349-364.
- Nesto, M. (2013, 25. July). SAC Capital Indicted for Criminal Securities Fraud. Retrieved from <http://finance.yahoo.com/blogs/breakout/sac-capital-indicted-criminal-securities-fraud-155459600.html>
- Nixon, P.G. (1981). The human function curve - a paradigm for our times. *Activitas nervosa superior*, 3(1), 130-133.
- Pargman, D. (2006). *Managing performance stress: Models and methods*. New York, NY: Routledge Taylor & Francis.
- Salas, E., Driskell, J. E., & Hughes, S. (2013). Introduction: The Study of Stress and Human Performance. In E. Salas, J. E. Driskell (Eds.), *Stress and Human Performance* (p. 1-45). United Kingdom: Psychology Press.
- Seidel E. M, Pfabigan D. M., Hahn, A., Sladky, R., Grahl A., Paul, K., Kraus, C., Küblböck, M., Kranz, G. S., Hummer, A., Lanzenberger, R., Windischberger, C., & Lamm, C. (2014). Uncertainty during pain anticipation: The adaptive value of preparatory processes. *Human brain mapping*, 36(2), 744–755.
- Selye, H. (1936). A syndrome produced by diverse nocuous agents. *Nature*, 138(3479), 32.
- Selye, H. (1973). The Evolution of the Stress Concept: The originator of the concept traces its development from the discovery in 1936 of the alarm reaction to modern therapeutic applications of syntoxic and catatoxic hormones. *American scientist*, 61(6), 692-699.
- Selye, H. (2013). *Stress in health and disease*. Boston: Butterworth-Heinemann.
- Sharot, T., & Phelps, E. A. (2004). How arousal modulates memory: Disentangling the effects of attention and retention. *Cognitive, Affective, & Behavioral Neuroscience*, 4 (3), 294–306.
- Spector, P. E., & Jex, S. M. (1998). Development of four self-report measures of job stressors and strain: interpersonal conflict at work scale, organizational constraints scale, quantitative workload inventory, and physical symptoms inventory. *Occupational health psychology*, 3(4), 356-367.
- Starcke, K., & Brand, M. (2016). Effects of stress on decisions under uncertainty: A meta-analysis. *Psychological Bulletin*, 142(9), 909–933.
- Tetrick, L. E., & LaRocco, J. M. (1987). Understanding, prediction, and control as moderators of the relationships between perceived stress, satisfaction, and psychological well-being. *Applied psychology*, 72(4), 538-543.
- Weick, K. E. (1988). Enacted sensemaking in crisis situations. *Journal of management studies*, 25(4), 305-317.

Weick, K. E., Sutcliffe, K. M., & Obstfeld, D. (2005). Organizing and the process of sensemaking. *Organization science*, 16(4), 409-421.

Weinberg, A., Cooper, C., Sutherland, V., & Bond, F. (2010). *Organizational stress management: A strategic approach*. Basingstoke: Palgrave Macmillan.

WHO. (2017). Stress at the workplace. Retrieved from http://www.who.int/occupational_health/topics/stressatwp/en/

Yerkes, R. M., Dodson, J. D. (1908). The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurology and Psychology*, 18, 459–482. doi: 10.1002/cne.920180503.

Zio, E., & Aven, T. (2011). Uncertainties in smart grids behavior and modeling: What are the risks and vulnerabilities? How to analyze them? *Energy Policy*, 39(10), 6308–6320.