

Fractals of Stress Experience at Air Traffic Controllers

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Abstract

Introduction: *The present study is rooted in the desire of finding suitable solutions for the aggravating forms of stress. Beyond the harsh reality of powerful stress factors, there is our desire for recovery and adequate use of personal resources. This is not a simple task at all, and in order to do this we should first identify our personal resources.*

Objectives: *The objectives of the study were to study the interaction between the personality factors and the fractals of occupational stress among air traffic controllers and the Optimization of stress adjustment mechanisms among air traffic controllers and the development of the premises necessary for adopting a lifestyle based on an efficient coping.*

Methods: *The instruments used are: the Perceived Stress Scale, the Freiburg Personality Inventory, the Holmes Scale, and the Coping Scale. The subjects have been asked to answer individually to the samples that have been applied, with no time limit. For each group of subjects, the sample application has been performed inside the institution in which they usually worked. The sample consisted of 90 individuals, all air traffic controllers, with a mean age of $m=38.2$. It is important to point out that the study refers only to en-route air traffic controllers and due to the low number of women working in this domain, the gender variable has not been taken into consideration. Furthermore, the study compares the results obtained for the air traffic controllers working in Arad and those working in other regions of Romania.*

Results: *Results have shown that the prolonged presence of stressful factors in the case of the groups subjected to study, has led to negative effects for all five categories that have been taken into consideration: influence on personality, cognitive effects, influence on health, influence on behaviour and physiological effects.*

Conclusions: *By identifying the dimension of our reaction to stress, some of our adequate possibilities to react and some of our personal resources, we can take a step forward towards participating with more openness and enthusiasm in the interventions that occur in the case of critical incidents.*

Keywords: *stress, fractals, personal resources, critical incidents*

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I. Introduction

Stress, like any other element that is subjected to a fractal analysis, has to satisfy the requirements of a fractal dimension such as (according to Gavriluță, 2003):

- Its components have the same structure or form as the whole, but at a different scale;
- Its form is extremely irregular, fragmented, irrespective of the examination scale (it is neither a point nor a line, but a reality similar to a mathematical „dust” - a reality that can be the reality of our own lives, for example);
- It contains distinctive elements, which are extremely varied and cover a very wide range (the reality of human life usually covers the space of the broad individual reality).

However, irrespective of their applications, the fractals are characterized by the same self-similarity or dilated symmetry feature, which makes any part of a fractal increased randomly to look like the original fractal.

The stress model, which I propose in the present study, has its roots in the simplest acceptance of fractals, known as fractional parts. Due to the fact that stress can be viewed as both cause and effect, it cannot be enlisted on a „continuum” that might have the two notions at its extremities. However, it represents an entity, which reproduces itself endlessly on various levels and degrees, being either a cause or an effect, according to an inter-changeability that depends on an inner reality within which their juxtaposition is made. A possible representation of stress as a fractal dimension should meet all the conditions of such a dimension:

- The first feature would be the internal homothety or self-similarity - according to this statement, each hypostasis of stress contains the whole in itself (for example daily stress has various sources, which are perceived by the body in a certain way, which can be partially dysfunctional or not, with the body trying to find a solution or not; this regularity can be applied to any stress type, irrespective of its intensity and its length in time);
- The fractality of stress allows the revealing of a fine and ample detailed structure (here, we can insert the mechanism responsible for generating stress);
- The stress hypostases are created according to its intensity on different levels;
- The stress creates a reality, which exists irrespective of the nature of our perception;
- The reality of stress is, in any single moment, a reality

built up from „stress dust”, namely through the overlapping of various types, which exist in our life at that specific moment; it does not have a linear, continuous, irreversible flow, but it evolves ceaselessly, sometimes having a more obvious presence, other times a more attenuate one, sometimes positive, sometimes negative, but always present (according to Maier, 2011).

Stress is a way to engage the entire organism, even though we might not be aware of this aspect from the very beginning. Our relationship with stress is mediated by several factors such as: sanogenesis factors, vulnerability to stress and coping skills. Throughout our lives we discover these mediators and we learn how to use them adequately. However, in certain situations, our ability to react and our coping methods are affected to such an extent, that they might end up being dysfunctional; these are the situation in which stress reveals its most severe forms such as: burn-out, the Karoshi syndrome or the Post Traumatic Stress Disorder.

Stress is a dimension of our daily life and most of it is caused by our work, the so-called occupational stress. To learn how to cope with stress ultimately represents a necessary condition for a healthy life. When the level of stress in our lives increases or when our mechanisms cannot cope with it any more, fatigue, burn-out or the Karoshi syndrome make their presence felt. The Karoshi syndrome is a relatively recent form of stress, connected to the problems that people have to face at their workplace. The expression comes from the Japanese language and it might be translated as „death from overwork”. The first Karoshi syndrome case was recorded in Japan in 1969. The Japanese Ministry of Labour has been publishing annual statistics on deaths caused by the Karoshi syndrome since 1987. Although the Japanese officials claimed that only 80 people died because of the syndrome between 1987 and 1989, a separate investigating committee reached the conclusion that in a single year (1990) more than 10.000 people had died because of the syndrome.

It has also been pointed out that the effects of the syndrome are felt by the affected person even after interrupting the anxiety causing occupation (the effects of overwork can appear even at a six-month distance from starting a normal working routine). Currently, the Japanese officials recognize the existence of this syndrome and starting from 2001 several laws have been adopted in order to diminish its effects and find suitable solutions for employees.

The most obvious stress sources are the traumatic events or, to be more precise, the critical incidents, which represent an event or a waterfall of highly stressful events, which deconstruct the mechanism employed in stress coping. „We say that Post Traumatic Stress Disorder is a normal response to an abnormal event, because the condition is completely understandable and predictable.” (Schiraldi, 2009, p. 3).

The Post Traumatic Stress Disorder is more commonly met among war veterans, but it can also appear in the case of natural and man-caused catastrophes or highly stressful events, either individual or collective. The services that are necessary during the acute phase include, among others: interventions during situations of crisis, psychological education and social support to help the affected people cope with the psychical stress caused by exposure to calamity.

The Post Traumatic Stress can be: primary - when the affected people are directly exposed to the traumatic event and secondary - when the concerned people were not directly exposed to the traumatic event, but they can express themselves through extreme compassion, co-transfer and traumatising by proxy (these stress expressions might occur in those who try to help the victims, such as the members of rescuing teams or the reporters who send live transmissions).

The top three risk factors that are involved in the occurrence of secondary stress disorders are:

- Exposure to images or to multiple accountings coming from the victims involved in the traumatic experience;
- The empathic stability of the people exposed;
- The unclear emotional aspects, which are affectively or symbolically linked to the sufferance that the individual witnesses.

The more uncontrollable an event is, the more stressful it becomes for those involved (according to Atkinson, 2002). Every day, in almost all domains, people have to face situations that imply various degrees of risk. Joffe (2003) made the distinction between two theories that tried to explain risk: the cognitive theories on risk perception and the social representation theories. The majority of the research and studies conducted in this domain have focused on cognitive processes, which occur when people actually face a risk, namely the perception of risk and the errors (biases) that an individual makes when he/she takes a decision that implies a certain degree of risk. When they are asked to take into consideration their chances to face a risky situation, most people have the unrealistic tendency to imagine a future with few unhappy events and they are convinced that events as

such are unlikely to happen to them but to others (according to Joffe, 2003). This phenomenon is also known as the „illusion of invulnerability”, which might appear in both individual decision making conditions and group conditions as a factor of group thinking. This is also one of the characteristics of the air traffic controllers who live under the impression that a critical incident cannot happen to them. This outlook results from the fact that people compare themselves with others who are exposed to the same stressful or even more stressful situations, in order to maintain a lower sense of personal risk, but, at the same time, they overestimate their own abilities that they might need in order to successfully handle a situation that implies risk and over-emotional charging.

The traumatic situations are those in which it is not possible to have a proper subjective reaction. Those are the situations which, for surviving reasons, urgently require a proper and fast action, but which unfortunately do not allow such a reaction. The analysis of traumatic situations must take into consideration not only the situational traumatic factors, but also their objective cooperation within the central traumatic situation, which is formed of the engagement of objective data and subjective assignment of meaning on the background of personal life events. The central situational traumatic theme refers to the central subjective meaning the traumatic situation has for the affected individual. It is conditioned by the personality elements and by the previous personal traumatic experiences, which have generated various defence mechanisms specific to a certain individual.

The trauma scheme is formed within this intricacy of objective situational factors and personal interpretation of the situation. The individual's receiver-effector scheme has the purpose to create within a certain situation, the fragile balance between the individual and his/her surrounding environment. The traumatic scheme is the expression of losing this balance, due to a traumatic situation. It is defined through a breakdown of the subject's common functions, which help him/her assimilate the suitable factors in the environment and get a defence or cope with the problematic situations. The traumatic scheme stores the memory of the event, the peri-traumatic experience, but also the subject's image in a helpless position, defenceless against an extremely threatening situation. Under the pressure of the peri-traumatic experience, the subject loses the functions that are commonly employed in the successful processing of both perception and experience, meaning that the individual fails to determine the situational circle

between the subject and its environment. In the case of a traumatic experience, the interaction between the receiver and the effector sphere is still valid, but it is highly hindered and affected for a long period of time. In the majority of cases, there are three different ways to deal with the post traumatic reaction:

- a) the solving or completion tendency of the traumatic reaction - meaning that the individual's personality has managed to bring the traumatic experience to a certain harmony with both his/her inner self and the surrounding world; we no longer have to deal with the tendency to designate culpabilities in an unrealistic manner or to wait for the return of the trauma; memory losses and defence mechanisms belong to the past; people can cope with the array of stimuli that remind them of the traumatic event or with the disposition states, which are connected to the trauma and which can be recognised in their meanings; the people who have successfully elaborated the traumatic experience can talk with a suitable affective state (for example rebellion) about their experiences and are capable of giving a minute account of it.
- b) the early interruption of the elaboration process - these people no longer display the traumatic symptoms for a period of time, but in the background they are still preoccupied by their traumatic experience; they display memory losses and they react to the array of stimuli connected with the trauma by displaying fear and an intensive behaviour of avoidance. An increased tendency towards somatization is also characteristic; among the redundant factors, one can include the tendency towards negation and repression, towards a positive and unrealistic view upon the world, as well as pronounced dissociating tendencies.
- c) the chronic perpetuation of the traumatic reaction (it can be observed especially in the case of extreme trauma) and it corresponds to the traumatic process (Pantelie, 2008, p. 2).

One of the primary methods used in the study of critical incidents is called „the method of critical incidents” and it was inspired from F. Galton's (1885) and Gordon's (1947) studies, which were based on the collection and analysis of various anecdotic cases, which might be encountered in certain activities. In 1941, this idea was adopted by people working in the aviation domain (especially by those who were in charge with the psychological aspects of this field) and a system for analysing the errors occurred during specific activities was developed; thus, this analysis received the name of „critical incidents method”. Flanagan managed to link his name to this method or to

be more precise, to its development. He actually formulated the method as such. „By a critical incident, one might understand any observable human action, which is complete enough to allow the performance of inferences and predictions referring to a certain activity” (Pitariu, 2003, p. 73).

According to Pitariu (2003), an incident can be catalogued as critical if it meets the following criteria:

- the observed human activity should be distinct, isolated, constituting a particular case;
- the defined situation should allow the study of both causes and effects, allowing the understanding of everything that is important for the concerned activity;
- the situation must be reported in a clear manner;
- the reported incidents must represent extreme behavioural cases, either positive or negative.

The reactions, which each person has to the stress inducted by a critical incident, must be understood as merely an echo or an effect of the actions of various events that overcome the individual's ability to cope with the event, overlapped on the premorbid psychological characteristics both in terms of the individual's resistance and the structure of the reaction (different people might have a different reaction to the same event). Another important factor in this case is the general somatic-psychic state, when stressors come into action (fatigue or even overworking, convalescence after a disease etc.). The individual does not have an immediate perception on his inner state and in order to know it, he engages in inferences starting from their behaviour. The self-perception reasoning allows a reinterpretation of the observed effects for a better self-knowledge (according to Moscovici, 1998).

In his study on recovery and development after experiencing various traumatic events, Carver considers that development (physical or psychological) reflects itself through a reduced reaction to further stress factors, more rapid recovery or an operation occurring on ascending levels. The psychological development can be reflected through: development at the level of abilities, trust or sense of security in interpersonal relationships. The psychological development does not depend on experiencing a trauma, but such events may cause it. Specialists in the domain often ask themselves why certain people progress while other involute when they are subjected to the same event, why so many different or even opposite reactions, why some of these reactions can be

framed within the normality sphere while others border on hazard? A possible answer might state that the differences concerning trust perpetuate and intensify themselves. This idea suggests that there are certain variables that play a very important role in the process of recuperation and development. These variables include:

- personality variables such as optimism;
- contextual variables such as social support;
- situational variables such as adaptation reactions caused by an obverse event (according to Maier, 2011).

Objectives:

1. The study of the interaction between the personality factors and the fractals of occupational stress among air traffic controllers.
2. Optimization of stress adjustment mechanisms among air traffic controllers and the development of the premises necessary for adopting a lifestyle based on an efficient coping.

II. Methods

In accordance with the objectives stated above, the instruments used in the present study are: the Perceived Stress Scale, the Freiburg Personality Inventory, the Holmes Scale, and the Coping Scale.

The subjects have been asked to answer individually to the samples that have been applied, with no time limit. For each group of subjects, the sample application has been performed inside the institution in which they usually worked.

The sample consisted of 90 individuals, all air traffic controllers, with a mean age of $m=38.2$. It is important to point out that the study refers only to en-route air traffic controllers and due to the low number of women working in this domain, the gender variable has not been taken into consideration. Furthermore, the study compares the results obtained for the air traffic controllers working in Arad and those working in other regions of Romania. Their distribution is: in Arad a total number of 30 people (out of which 2 were women) and across the country 60 people (out of which 7 were women).

III. Results

The results for the first hypothesis are:

For the personality scale, one cannot observe significant differences between the two categories subjected to the research.

In the case of the stress perception variable ($t=-7.876$ at $p<0.001$) - it has been found that air traffic controllers unfolding their activity in Arad have the

tendency to present significant lower levels of stress perception. A possible explanation might have its roots in the perception of the controlled airspace, namely that air traffic controllers working in Arad know that their airspace has a higher degree of difficulty in comparison with others across the country and their annual results point out that they manage to overcome their situation and problems successfully. The study did not identify any differences, due to personality factors or to the intensity of stressful experiences. Thus, it would be interesting to investigate the source of the difference, which might reside in factors that do not depend on the individuals, but, as previously assumed, depend on the context of the activity itself and on the organizational culture.

The comparison made between the two groups, by taking into consideration the coping styles, pointed out the existence of important differences such as:

(1) the tendency of air traffic controllers working in Arad to obtain significantly higher scores in active coping ($t=2.835$, at $p<0,05$), planning ($t=3.853$, at $p<0.001$), elimination of competing activities ($t=4.802$, at $p<0,001$), restraint from action ($t=2.802$, at $p<0.001$), social instrumental support ($t=4.379$, at $p<0.001$), acceptance ($t=3.430$, at $p<0.05$), behavioural and mental passivity ($t=2.566$ at $p<0.05$);

(2) the air traffic controllers across the country got significantly higher scores when it came to the following aspects: orientation towards religious aspects ($t=3.600$, at $p<0.001$), emotional discharge ($t=2.672$, at $p<0.05$) and use of alcohol and legal drugs ($t=2.929$, at $p<0.001$). Overall, one can observe the tendency of air traffic controller working in Arad to be more oriented towards active coping styles, but not exclusively (mental and behavioural passivity), while among air traffic controllers across the country there is a powerful orientation towards passive styles. Having this observation as a starting point, a possible solution for air traffic controllers working in other regions of our country, would be to turn their attention towards more active coping methods.

By taking into consideration the differences registered after the comparison between the two groups, on the basis of the Holmes and Rahe scale, it was possible to observe that there weren't any significant differences. However, the attention is drawn by the high value of the obtained score, namely $m=241.33 - 261.26$, which encloses air traffic controllers within the category of „middle life crisis“. This means that, for 50% of them, there is a high possibility to get ill during the next year. This scale has

been chosen because certain events in the life of air traffic controllers have a repetitive cycle, namely annual training courses, leaving the country for attending training seminars, periods of time when their normal working routine is changed from working in shifts to working eight hours a day, when they are at the simulator and then returning to the working routine based on shifts. One of the shortcomings of the present study is that it had been carried out before all air traffic controllers working across the country were relocated in Bucharest. It would have been useful to study the stress of relocation and its effects upon air traffic controllers, their families, their health and efficiency of their work etc.

Regarding the correlation between the investigated fractals of stress, the following have been observed:

- the air traffic controllers that perceive higher levels of stress have the tendency not to be oriented towards the following coping styles:

- active coping ($r = -.605$ at $p < 0.001$), planning ($r = -.656$ at $p < 0.001$), the seeking of social instrumental support ($r = -.437$ at $p < 0.001$), positive reinterpretation ($r = -.489$ at $p < 0.001$), while those who present lower levels of stress perception are oriented towards denial ($r = .387$ at $p < 0.001$), mental passivity ($r = .407$ at $p < 0.001$), behavioural passivity ($r = .510$ at $p < 0.001$),

- the air traffic controllers that display an increased psychosomatic reaction have the tendency not to be oriented towards the following coping styles:

- elimination of competing activities ($r = -.541$ at $p < 0.001$), instrumental social support ($r = -.448$ at $p < 0.05$) and positive reinterpretation ($r = -.362$ at $p < 0.05$),

- the air traffic controllers that display an increased nervousness, aggressiveness, low control of impulses have the tendency not to be oriented towards the following coping styles:

- positive reinterpretation ($r = -.482$ at $p < 0.001$),

- the air traffic controllers that display a low self-esteem and a general mood dominated by depression have the tendency not to be oriented towards the following coping styles:

- planning ($r = -.482$ at $p < 0.001$) and elimination of competing activities ($r = -.487$ at $p < 0.001$),

- the air traffic controllers that display an increased general emotional instability have the tendency not to be oriented towards the following coping styles:

- elimination of competing activities ($r = -.569$ at $p < 0.001$) and social instrumental support ($r = -.488$ at $p < 0.001$);

- the Holmes scores do not correlate with the FPI scales.

The results for the second hypothesis are:

After the interview, it was possible to observe an important number of malfunctions that have occurred among air traffic controllers over the last few years. The occurrence of these malfunctions might be associated with stress.

Starting from the idea that a good health might lead to a better adjustment between the individual and his/her environment and the absence of an adequate stress management can lead to a deterioration of health condition, I made a table displaying the malfunctions of the body registered among air traffic controllers in the past five years.

The categories, according to which the stress effects were grouped, were in accordance with the ones used by Derencio, 1992, p. 39.

Table no. 1. Effects of stress

Types of influence	Recorded effects	Number of cases
Influence on personality	- aggressiveness	14
	- irritability	25
	- nervousness	12
Cognitive Effects	- the inability to make proper decisions	5
	- amnesia	9
	- hypersensitivity towards criticism	10
Influence on health	- migraines	4
	- sleep disorders	19
	- sexual malfunctions	2
Influence on behaviour	- alcohol addiction	17
	- excessive smoking	19
	- impulsive behaviour	15
	- anorexia	1
Physiological effects	- hypercholesterolemia	11
	- hyperbilirubinemia	1
	- high blood pressure	3
	- obesity	16
	- digestive problems	5

In conclusion, the prolonged presence of stressful factors in the case of the groups subjected to study, has led to negative effects for all five categories that have been taken into consideration. However, the most relevant are those on personality and behaviour. The persistence in time of these negative effects might lead to negative outcomes of the working activity performance. Following the results, a specialised intervention at a group level has been proposed. Due to the type of activity involved, shift working, disposition to take part in interventions (almost absent), types of chosen predominant coping, namely active coping,

the strategic coaching has been proposed as the suitable intervention.

In the initial phase, the specialists gather as many data as possible about the people taking part in the coaching session, through tests, interview guides, but also through group discussions. Once the data are collected, they are shown to the group. Then, the data interpretation follows - this is the planning and consolidation stage. The development plan and its implementation are established based on this stage. The coaching activity has the aim to form individual abilities. The process begins with establishing

objectives, choosing the strategy necessary to reach them, establishing a time span to reach the objectives, accessing the individual resources, venting emotions, setting up a strategy for success and its replication in various life contexts.

IV. Conclusions

Starting from the application of some useful evidence in order to identify the fractals of stress, a useful intervention has been proposed, in order to make the chosen coping mechanism more efficient, as well as to decrease the level of the subjective stress perception. By identifying the dimension of our reaction to stress, some of our adequate possibilities to react and some of our personal resources, we can take a step forward towards participating with more openness and enthusiasm in the interventions that occur in the case of critical incidents. Thus, the work group can turn into a support group in case such events occur in the air

traffic controllers' life.

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