

## **Nonlinear Impacts of a Complex Dynamics as the Physiologically Adequate Method of Weakening of the Crowd Phenomenon and Restoration of Critical Thinking in Stress Situations**

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**Received:** March 14, 2017; **Published:** April 12, 2017

### **Abstract**

It is known that in the crowd phenomenon, the individual consciousness disappears, and the person loses self-appraisal and ability to think critically. Besides, the possibility of manipulating the person's consciousness and provoking him to antisocial behavior and illegal actions increases. The fans' reaction in the stadium or street battles of the fans are examples of how the public turns into the acting crowd of an aggressive type, easily directed by random instigators. Also, there is a high danger that panic may be provoked. The brain is highly susceptible to the rhythm of external signals and can synchronize rhythms of its activity with the rhythm of the environmental cues. We are developing a hypothesis about the critical importance of the experience of nonlinear sensory stimulation received by the person during life for the maintaining a healthy structure and dynamics of brain activity. It is substantiated that the use of intermittent impacts with nonlinear dynamics of parameters of stimuli, the improvement of physiological functions and human behavior will occur due to the restoration of the complexity of the neural networks and timing of their activity in the brain. Technologies of nonlinear impacts on human brain can provide the optimal complexity of the brain activity restoring the ability of the person to think critically destroying the internal ties of the crowd. We analyze designs of technical means that could provide the low-intensive, physiologically adequate stimulation of the brain by non-periodic stimuli of complex dynamics in the mob, and in stress and crisis situations.

**Keywords:** *Brain Stimulation; Nonlinear Impacts; Critical Thinking; Crowd Phenomenon; Stress Situations*

### **Introduction**

The danger of the crowd is that the deindividuation of the person occurs in it, the person is less able to assess the situation critically, and the self-concept is violated. In the crowd, the possibility of manipulating the individual's consciousness and provoking him to antisocial behavior and illegal actions increases. The behavior of the fans in the stadium or the street battles of the fans are examples of how the public turns into an expressive and then - into the acting crowd of an aggressive type, easily directed by random instigators [1]. In the mob conditions, a sense of fear caused by different factors provokes panic. Any information (hearing) about a real or false danger or the use of the so-called non-lethal weapons by the police, including laser or infrasound can serve as the triggers.

An effective way to disperse the crowd may be to reorient the attention of its constituent people. Internal ties that unite the crowd can breakdown in situations where new incentives create other strong emotions, for example, under the influence of the instinct of self-preservation or fear. However, this, in turn, can provoke such a dangerous phenomenon as panic.

Local governments in different countries use different methods of crowd control to keep it safe or to disperse crowds and prevent people from engaging in riots and looting [2]. There are publications evidenced that sometimes methods are used to do this, attributable

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**Citation:** Zueva Marina Vladimirovna. "Nonlinear Impacts of a Complex Dynamics as the Physiologically Adequate Method of Weakening of the Crowd Phenomenon and Restoration of Critical Thinking in Stress Situations". *EC Neurology* 5.5 (2017): 197-200.

to the so-called “non-lethal weapons” [3,4]. The ultrasound effects can provide significant effects but were found to be harmful to human health care [5].

Panic can completely block the ability of people to assess the situation adequately, and the actions of people in the crowd become defensive-chaotic. On the other hand, panic often leads to the crush, injuries, and loss of life. To disorganize a peaceful crowd, the methods that provoke fear and panic, are the ethically inadmissible [6].

Therefore, it is relevant the development of physiologically adequate technologies that being safe for a person allow weakening internal links in the crowd, controlling the condition of the man and return to him the individual self-awareness and critical thinking, reducing the danger of panic. It is important that these methods being useful for solving problems at the same time meet ethical requirements and observe high standards of safety for human health.

### **The Opinion**

It is well documented that our brain is highly susceptible to the rhythm of external signals, and can synchronize the waves of neuronal activity and patterns of human behavior with the rhythm of the forced stimulus [7]. This property is used in the treatment of certain pathological conditions using stimulation therapies [8-12]. In the recent review of interdisciplinary research, possible mechanisms of modulation cortical functions by transcranial alternating current stimulation (tACS) and random noise stimulation (tRNS) have been discussed [11]. The authors concluded that these methods might have the prospects in the therapy of neurological and psychiatric disorders malfunctioning brain oscillations.

On the other hand, it was shown that the psychological aspects of the perception of sensory stimuli, in particular, the emotional component (positive and negative emotions) influence the behavior of a person and his perception of the timing of events and the temporal characteristics of external stimuli. In the processing of time information, that is, the assessment of frequency, speed, duration of stimuli and events, many brain structures are involved. A recent study [13] established socio-temporal mental and neural mechanisms of the brain that determined the chronology of assessing the social significance of stimuli by the observer. On the other hand, it linked the formation of perception of the temporal characteristics of the stimulus (duration, frequency, speed) with its social significance. A. Schirmer and her colleagues argue that rhythm facilitates our interpersonal interactions. In particular, the musical rhythm affects not only how we move, but, and what we say and think. Rhythm promotes the interaction of people by synchronizing brain waves and increasing the effectiveness of perception of what the other person is doing at a particular moment in time. When people move in a synchronized rhythm, they are more likely to perceive the world in synchrony, which facilitates their ability to interact.

Note, however, that neuronal structures are highly susceptible to the imposed rhythm, allowing them, on the one hand, to be mobile and rapidly reacting to changes in the environment, but on the contrary, make them vulnerable to the effects of factors having the excessive force or duration. The temporal structure of the rhythms is of particular importance, from on which even the sign of the effect may depend.

We are developing a hypothesis about the critical importance of the experience of nonlinear (non-periodic) sensory stimulation received by the person during life for the maintaining a healthy structure and dynamics of brain activity [14]. It is substantiated that the use of intermittent impacts with nonlinear dynamics of fluctuation of parameters of stimuli, the improvement of physiological functions and human behavior will occur due to the restoration of the complexity of the neural networks and timing of their activity in the brain.

Today it is well established that a distinctive feature of the physiological processes of a healthy organism including the activity of the brain is their fractal (deterministic-chaotic) dynamics. Fluctuations in the parameters of physiological functions are invariant in time. If in the norm, the variations of the physiological parameters represent the deterministic-chaotic process, then they became deterministic or stochastic in pathological conditions [15,16]. Typical signs of violation of fractal dynamics are the weakening of long-range correlations and the appearance of highly periodic system behavior or completely uncorrelated fluctuations in physiological parameters (white noise).

Nonlinear stimulation (light, sound or combined) can contribute to an efficient recovery of brain function. Recent studies have shown that the rhythm of movement can be altered by synchronizing gait dynamics with the temporal structure of external signals directly during stimulation.

We substantiate the prospectiveness of the development of technologies of the effects of nonlinear stimuli of complex dynamics in the aim the dissociation of the crowd and the release of individual consciousness and self-control among spectators of mass events and sports fans. Today it is known that a normally functioning brain operates in the state of the so-called "self-organized criticality," in which the system spontaneously self-organizes to be ready to act at a critical point between order and randomness [17,18]. The restoration of complex nonlinear dynamics seems to be able to contribute to the return of the criticality and self-awareness of the people. Different variants of peripheral devices in nonlinear stimulation technologies are possible. We believe that the possibilities of using visual stimulation should be studied primarily, since the light stimuli, seem to be the most promising incentives allowing to influence all brain structures [19].

They can include generators of highly correlated nonlinear sound and light noises of a complex dynamics, which, given their low intensity, will create an unobtrusive background that will not interfere with watching competitions no harm the health and psyche of the fans. The fractal light flickering can be combined with musical compositions that are believed to possess fractal properties, and, with color-music. The temporal structure of fluctuations in diffuse illumination of sports arenas of various designs can be programmed. On the other hand, one can note that the crowd has a high ability to the imagination, and pictures that amaze the imagination of the crowd are always straightforward and clear. Taking into account these psychological observations, one can assume that a mob that thinks in images should be receptive only to images. This property can be used in the presentation of bright moving (geometric and dynamical) fractal stimuli, attracting the attention of people who can periodically be projected on advertising or information screens installed in stadiums and streets of the city.

On the streets, it is possible to use outdoor fixed advertising displays of various designs as well as mobile screens that are operatively moved to the place of congestion of aggressive mob. Rollers with moving fractal stimuli can temporarily interrupt the current information commonly displayed on these screens, helping to optimize the brain activity, shifting it closer to statistical properties of the healthy natural dynamics and promoting the critical behavior of people.

The application of nonlinear impacts on human brain can favorably affect self-organized criticality and functional complexity of the brain improving cognitive performance and human behavior. Such the technologies can also provide relaxation and rehabilitation after physically and psychologically severe types of labor and be critical for long-term productive activity under extreme conditions.

### Conclusion

We believe that the technologies of nonlinear impacts on human brain can help providing the optimal complexity of the brain activity, thereby restoring the ability of the person to think critically and consciously act, destroying the internal ties of the crowd. Visual and audiovisual impacts of complex dynamics should also provide a potential to make decisions and operate under stress and crisis situations.

### Conflict of Interest

The author declares that there is no conflict of interest regarding the publication of this paper.

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**Volume 5 Issue 5 April 2017**

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