

## **Structures and Mechanisms, The Chaos Theory and Organizational Change**

**Ofer Erez**

**ROTeM - Center for Practical Professional Training**

**Anna Cristal-Lilov**

**ROTeM - Center for Practical Professional Training  
Clalit Health Services**

**Anat Ben Salmon**

**ROTeM - Center for Practical Professional Training**

*A conceptualisation of personal epistemology was constructed drawing from the 'structures and mechanisms' of the Critical Realist theoretization and concepts of the chaos theory. Individuals can be viewed as an open system, within another open system of their environment, in which minute changes or fluctuations in the opening conditions, can cause unpredictable outcomes. Viewing organisations such as a University as open structures, the process of installing innovative knowledge into the academy was then examined in chaos theory terms. Open systems exist in a state of perpetual disequilibrium, being subject to constant fluctuations and autocatalysis, yet maintain stability. Since Universities strive to maintain stability by perpetuating traditional epistemologies and knowledge, introducing innovative knowledge is a challenge. A small team of researcher-practitioners conducted successive actions, intending to introduce a new epistemology and method, challenging the status quo. The University's self-renewing dynamic, tried to suppress these fluctuations. The professional obligations of the practitioner-researchers motivate them to persist, until their actions will overcome the system's ability to suppress them, and 'second-order change' will occur.*

*Keywords: personal epistemology, 'structures and mechanisms', critical realism, chaos theory, open system, perpetual disequilibrium, innovative knowledge, challenging the status-quo, university, practitioner-researcher, second-order change.*

According to the premises of Critical Realism, the structures and mechanisms of social phenomena determine its functioning, as well as the way in which we perceive and experience it. In my understanding, the structure of a phenomenon is the data which we perceive in a momentary still picture of a scene involving it. The mechanism is the way the phenomenon evolves over time and the data which we perceive while observing it's dynamic activity, as if watching a movie. When we observe the attributes of a situation in our empirical dimension, we attempt to connect them to the structure and mechanism of a phenomenon which we are familiar with. For example, when we enter a room and see party decorations and a birthday cake on the table, hear lively music playing and are greeted by a person giving us a drink, we understand that the structure and mechanism of the situation is a birthday party. Certain conditions must exist for us to

define the situation as a birthday party. The presence of certain objects which are usually present at birthday parties (comprising structure) is insufficient to define the situation as a birthday party. Party music, the presence of the person celebrating the birthday and guests behaving accordingly (mechanism) are also necessary in order to define the situation as a birthday party. Otherwise we may have arrived before or after the party was over. This aligns with Fletcher (2017), who stated that CR attempts to identify the contextual conditions which are necessary for a certain causal mechanism to occur and to result in the empirical patterns observed (Fletcher, 2017).

In other situations there could be more than one explanation for the scene which our senses perceive or in other words more than one alternative 'structure and mechanism' could determine what we observe. When we enter a scene we instinctively try to understand the circumstances before we proceed. It is important that we understand the structures and mechanisms that determine the phenomenon in order to know how to act. In order for us to conduct a decision making process for our choice of action, we require a more accurate understanding of the circumstances than our personal interpretation. For example, if I leave my house in the morning, and am confronted with a scene of people in the street with masks on their faces, it is necessary for me to reveal the reason for this unusual phenomenon, in order to know how I should act myself. There are two possible structures and mechanisms/explanations for the people's behaviour. Either they may be being precautionary on their own account, or the Ministry of Health may have instructed citizens to wear masks due to an increase in the prevalence of a dangerous contagious disease and the necessity to prevent the spread of the disease in the population. If the latter is the case, evidence of this structure and mechanism will be apparent in other domains such as the media. Therefore, in order to clarify or refute my hypothesis, my initial action will be to turn on the radio or check the T.V. news or on the internet. If I read or hear about such recommendations being taken by the Health Ministry, my next action will be to take precautions in accordance with them. If I do not hear such Health Ministry recommendations, I conclude that there are alternative structures and mechanisms determining the behaviour of the people with masks, and there is no need for me to be carried away by my anxiety.

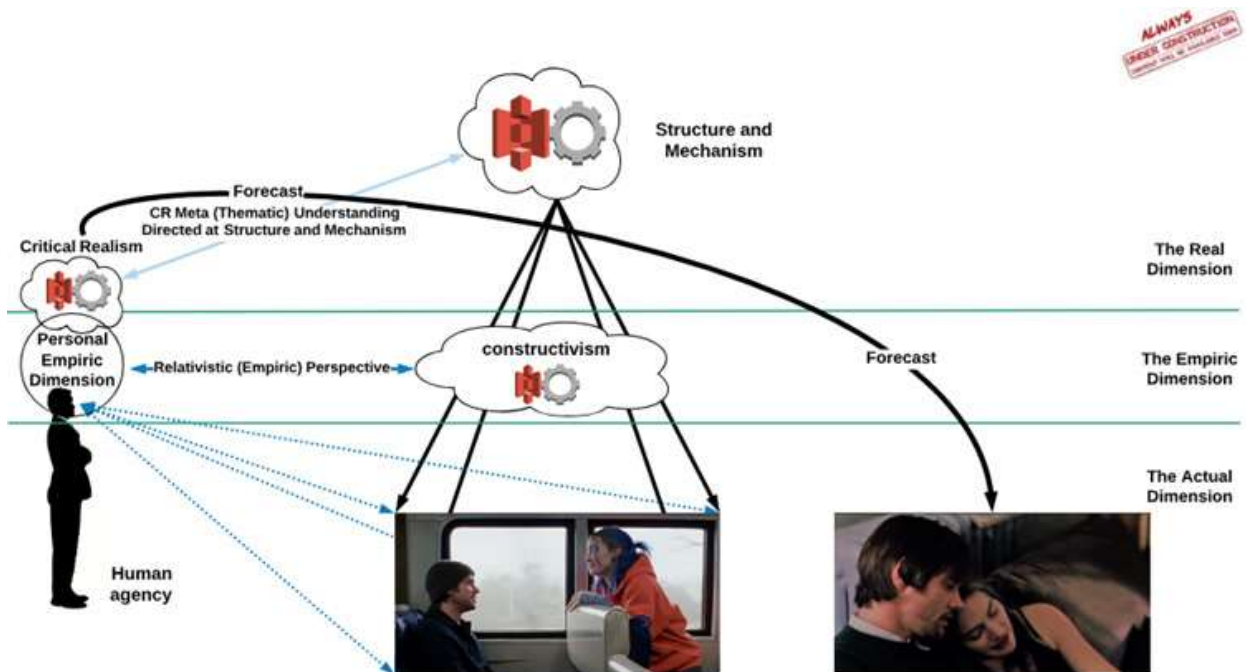
In my model of personal epistemology, a person's behaviour in a certain situation reflects his current understanding and interpretation of the data which his senses perceive (in his empirical dimension), regarding the circumstances (in the actual dimension) and the best way to achieve his intentions in light of the circumstances. Introspecting into my thought processes, I propose that when we enter a familiar situation where we are well acquainted with the attributes that characterise the situation, and what we currently observe aligns with our expectations, we behave intuitively. Eg. When we enter the office in the morning where we have been employed for a period of time, we will intuitively know how to act. However, introspection has led me to understand that a more complex process occurs in my mind when I enter an unfamiliar situation. This is an internal cognitive process which has a number of quick stages. The first stage of this process is to identify the anomalous or peculiar attributes which characterise the phenomenon which I am now observing. These are characteristics of the situations which differ from what I expected to observe based on my current knowledge. Then through retroduction, I search my memory for representations with thematic similarity to what my senses are now perceiving. I recall the sequence of events that followed my previous encounter with the phenomenon in question and consider possible alternative reasons for the appearance of the phenomenon. Through abduction, I eliminate unreasonable explanations, and am eventually drawn to two more reasonable, competing explanations for the attributes of the situation which I am observing. The choice of my initial action is intended to clarify which of these is the more accurate explanation for the situation. This involves identifying a reference point, a doxastic junction, at which conducting an activity and observing the outcome of the action will either confirm or refute my understanding. If my understanding is refuted, by a process of elimination, the second explanation must be more accurate. My next actions will be in accordance with the new understanding I reached and will express my goals for the situation. Nevertheless, my new understanding is still the best possible current understanding and is fallible. It is essential for me to be aware of this and pay attention to all further incoming information which may not align with the current understanding and should cause us to update our knowledge. Thirty years of experience in the practice of psychotherapy, which involves observing my patients behaviour and attending to their narrative, has provided me with the opportunity to investigate my

understanding of the DMP which precedes their actions or statements. These understandings have frequently been confirmed by the subsequent events, leading me to believe that a similar thought process which follows our entry into an unfamiliar situation and proceeds our choice of action, occurs in most people. This process will vary from person to person depending on their previous life experience, but the basic methodology is similar for all of us.

Derived from all of this, a person's behaviour, like all social phenomena has a structure and mechanism. In my model of personal epistemology, I propose that it is impossible to differentiate and separate structure from mechanism in the individual and his behaviour, because they are interrelated and overlapping. Therefore when considering human behaviour, I replace the term 'structure and mechanism' with the term 'Organising-Guiding Principle' (OGP), which refers to a dynamic process which is derived from our understandings and interpretations and directed towards a goal. From my experience as a psychotherapist, when we observe another person's behaviour, in our empirical dimension we can only perceive certain attributes of this OGP. It is usually necessary for us to observe a number of his actions or hear a few statements in order to conceptualise a hypothesis regarding the OGP of his behaviour.

**CRITICAL REALISM**

**FIGURE 1  
FORECASTING THE FUTURE BEHAVIOUR OF OTHERS,  
HAVING IDENTIFIED THEIR OGP**



For example in the picture in the above diagram, when a newly acquainted couple who are attracted to each other interact, all their behaviours will reflect their goal to advance their acquaintance with the other. The attributes of their behaviour in the actual dimension will be evident to all observers whose senses perceive their behaviour in their empirical dimension, and if they are familiar with such circumstances, they might conceptualise it as flirting behaviour. The observer, thinking that he has understood the OGP of their behaviour, will be able to forecast their future behaviour. It appears to the observer that the woman is attracted to the man, she has turned around on her seat and is chatting to him in order to advance her acquaintance with him. Therefore the observer hypothesizes that romantic attraction is the OGP which

determines this observed phenomenon. If the observer's hypothesis is accurate, in the next scene of the movie, he will see the man and woman in an activity which resembles a closer and more intimate acquaintance.

In my understanding, in order to survive and progress in life, it is necessary for us to reveal the structures and mechanisms of the phenomena which we encounter and become acquainted with them. This process is essential in order to facilitate our understanding of the circumstances, their significance for us, to identify our role in them and in order to know how to act accordingly. In addition, it is necessary for us to hypothesise regarding the OGP of the people we interact with, in order to become acquainted with their goals, and to achieve our own goals in light of theirs and the circumstances.

From my professional experience in the therapy setting, I listen to the patient's narrative and pay attention to all aspects of his behaviour which accompany his narrative, such as the tone of his speech, body language and the choice of the issues which he chooses to raise with me. In my approach to therapy I observe the aspects of his behaviour which I perceive in my empirical dimension and strive to conceptualise the OGP which determines his behaviour. My goal is to understand the dynamic process which I observe by revealing the life experiences from which the behaviour was derived and the goal towards which it is directed, while taking into consideration that the way the patient interprets his experiences depends upon his goals. Frequently, the patients declared intentions differ from his real intentions which he may not be consciously aware of. Once the patient becomes aware of his own real intentions, his decision-making process for choosing his actions becomes easier for him and this contributes to the process of personal change.

In my model, the OGP is directed towards an ultimate personal goal. Adler, Ansbacher, and Ansbacher (1956) proposed the Fictional Final Goal meaning that the individual strives towards a future-oriented ideal goal of significance, superiority, success or completion (Adler, Ansbacher, and Ansbacher, 1956). In my practical experience, every individual has what I call a Main Motivator (MM) which is the goal towards which all his actions are directed. I prefer the term Main Motivator rather than Fictional Final Goal because I prefer a term that relates to an achievable goal which we can strive towards through realistic activities. The way the individual perceives the circumstances of situations and his position in them is related to his MM. All his decision-making processes for his choice of action are determined by what will advance him most towards his MM. This MM is unique for each individual, can change over time and part of the therapy process is to constantly monitor my conceptualisation of the patient's MM.

I propose that the OGP of an individual's behaviour in each situation which he encounters, is directed by its advancement towards his Main Motivator (MM). The OGP determines his behaviour in the actual dimension, and how others perceive his behaviour in the empirical dimension. This aligns with Davidson's 'Actions, Reasons and Causes', (1963), where he proposes that an individual explains his actions, by referring to reasons related to intentions or motives, which comprise a form of causal explanation. This proposition of causal explanation was opposed to the accepted view that an event should be explained by a physical rule or regularity. My notion of the individual's OGP, aligns with Davidson (1963) who stated that providing rational explanation involved showing how the action was coherent to some wider pattern of behaviour. I understand this to mean explanation by reference to the personal reasons of the individual, independent of explanation by causes like a physical rule with generalised regularity (Davidson, 1963). In my model of personal epistemology, in order to understand the causality of another person's actions, we observe the aspects of his behaviour to which we are exposed in our empirical dimension, and can try to identify an OGP which is directed towards his MM. This is related to the idea of 'Theory of Mind' which Goldman (2012) defined as the cognitive capacity to explain behaviour through attributing it to mental states of the self and others. This will be discussed further below. In my approach to practice, I try to identify the intentions of the individual in each situation, through my hypothesis regarding the OGP of his behaviour. Since the patient's goal in each situation is intended to advance him towards his MM, this process will eventually enable the revealing of his personal MM. I propose that in order to understand how the OGP directs human behaviour towards the individual's Main Motivator, we need to progress beyond the linear order of Newtonian Physics and the aspiration that a psychological theory could be scientific and suffice to provide linear logical prediction of human behaviour. How much energy does the therapist need to invest,

through which method and towards which direction, in order to achieve the specific desired result?! In the twentieth century, Newtonian physics is still used to understand physical phenomena at surface value and thematically similar logic is present in the understandings of human behaviour in cognitive and behavioural theories. I believe that a better understanding of the unique reasoning behind an individual's behaviour can be achieved by capitalising on the concepts and claims of the chaos theory.

### Chaos Theory

Goldberger, Rigney and West (1990) discussed the Chaos theory in systems with nonlinear dynamics, which respond disproportionately to stimuli. They referred to examples of such systems in phenomena such as epidemics, the kinetics of certain chemical reactions and the changes in the weather. In certain circumstances, these nonlinear systems appear to behave erratically, or chaotically. However, according to Goldberger, Rigney and West (1990), unlike the dictionary definition of chaos as complete disorganization or randomness, chaotic systems possess nonlinear dynamics which are considered to be deterministic (Goldberger, Rigney and West, 1990). I consider human behaviour in terms of the chaos theory, and accordingly, each individual can be described in terms of an open dynamic system. This might provide us with an explanation for our inability to use linear logic like Newton's rules of physics, in order to understand and predict human behaviour which is apparently non-linear by nature. I incorporate this explanation in my model of personal epistemology and propose that it can assist psychotherapists in their work.

Goldberger, Rigney and West (1990) stated that nonlinear chaos refers to randomness which is constrained by a certain type of geometry, known as fractal. They referred to Benoit B. Mandelbrot of the IBM T. J. Watson Research Center, who first conceived the notion of the fractal, and described it as a geometric structure of varying size and orientation with similar shape (Mandelbrot, 1983 in Goldberger, Rigney and West, 1990). In nature, fractals are likely to remain, following instances of chaotic processes which shaped an environment such as the coast, the atmosphere, or a geologic fault. A well-known example of a fractal is the fern leaf. When examined under a microscope one can discern the same shape, smaller in size within the structure of the branches of the leaf. At a higher magnification, one observes the same geometric shape again, at a smaller level. Although at some level of the branching of the leaf, the pattern stops, idealized fractals have infinite detail.

In human behaviour, the fractal is a set of behaviours which are organised in order to advance the person towards his ultimate goal or his MM. The nature of the behavioural fractal is determined by the OGP which directs the person's behaviour in each specific situation, in accordance with his understanding of the circumstances, his interpretation of them and his desire to fulfil his goal in the situation. These behavioural fractals can be observed repeatedly, in various situations in the person's life, with perhaps only slight variations, because they are determined by an OGP which is to advance the individual towards his MM. Therefore, as psychotherapists, careful observation of our patient, and attention to his narrative describing occurrences in his life, may facilitate our conceptualisation of a 'Main Motivator' to which all his behaviour is directed. In my practice, when I have achieved a hypothesis regarding the patients OGP and MM, I probe by presenting him with hypothetical circumstances which plausibly could occur in his life. I tell the patient how I think he would behave in such a situation based on my current hypothesis of his OGP and MM, and achieve a spontaneous doxastic reaction from him of either rejection or acceptance of my statement. The latter will be mixed with the surprise of the patient that I could know how he would behave in a situation, without him discussing it with me previously. From my experience, such an intervention strengthens the therapeutic alliance and the trust of the patient in the therapist, as a figure who can understand him and support a process of personal change.

$$Behaviour \sum_{Circumstance}^{one} \Rightarrow \lim_{OGP \Rightarrow MM} \quad (1)$$

The sum of an individual's behaviours in all situations, expresses the way he understands the circumstances and reflects the way he influences the circumstances in a manner which advances his goals. This reveals the OGP of his behaviour and the MM towards which it is directed.

Goldberger, Rigney and West (1990) explained another term integral to chaotic systems which is the 'attractor'. The simplest kind of attractor is the fixed point, which all the trajectories in the system converge towards. An example of which is a pendulum, whose movement is slightly restricted, and always develops into a single state. The next most complicated attractor is the limit cycle, in which the trajectories follow a regular path or a regular periodic state. An example of this is an ideal, frictionless pendulum cycle. The last type of attractors described by Goldberger, Rigney and West (1990) is simply called "strange." These are systems that are neither static nor periodic. In the presence of a strange attractor, two trajectories that began under almost identical conditions, will diverge over the short term and become very different over the long term, and will never converge to the same position. The strange attractor is characteristic of chaotic systems (Goldberger, Rigney and West, 1990). In that sense, a person's MM functions as a 'strange attractor' and all his behaviours are organised and motivated by his attraction to this ultimate goal, whether he is aware of this connection or not. Two different individuals may have a similar MM, but the behaviour they adopt in order to achieve this ultimate goal will usually differ and be unique, and will appear 'strange' to the other. This includes the therapist who is responsible for revealing the 'strange' OGP and the individual MM of the patient.

According to Brown, Witschey and Liebovitch (2005) in chaotic systems, processes that start at essentially the same point, can diverge exponentially in different directions. According to Lorenz (1972), minute changes or fluctuations in the opening conditions of complex dynamic systems can cause large unexpected differences in the outcomes that actually occur, compared to those forecasted by the model. This explains how the OGP of the behaviour of two people with similar MM's, will differ. This is because their life experiences, the way they interpret them and reach understandings, differ from person to person. Lorenz (1972) termed this notion 'the butterfly effect', referring to the possibility that a tiny force, such as the beating of a butterfly's wings can have a dramatically disproportionate, nonlinear effect. Brown, Witschey and Liebovitch (2005) stated that the practical implication of this is that systems which contain the same processes and elements, can produce radically different patterns when there are minor differences in the starting conditions. A possible practical example I can bring for this from my field is when a slightly different attitude of a parent towards identical twins, can lead to the development of very different personalities in each twin. Brown, Witschey and Liebovitch (2005) stated that another implication of the understandings of chaos is illustrated by the physical example of the compound pendulum, which is made up of at least two parts and two hinges. In this relatively simple system, the motion of the tip of the pendulum behaves unpredictably, because even a minor disturbance induces a gradual change in the pattern of motion until it overwhelms the underlying pattern (Brown, Witschey and Liebovitch, 2005). Therefore, this chaotic behaviour apparently defies prediction and queries the accepted philosophy of science whose goal is to discover predictive laws. Lorenz (1972) showed that even in the simplest deterministic systems, and in fields where all the laws governing the functioning of their systems are known, it is impossible to predict long term developments. In order to do so, it is necessary to know the precise starting conditions, which is impossible (Lorenz, 1972). In my view, this is even more true in humans, each of whom comprises an open system, within another open system of the environment in which they grew up and live. Even genetically identical twins will develop different personalities and behave differently due to infinite variations of individual experiences and environmental conditions, even if they grow up in the same home.

Nevertheless, Brown, Witschey and Liebovitch (2005) referred to the work of Brown, 1995a, 1995b; McGlade, 1995, McGlade and Van Der Leeuw, 1997; and Nicolas and Prigogine, (1989) and stated that the chaos theory has been applied in the social sciences in the systems of fields such as politics and economics (Brown, 1995a, 1995b; McGlade, 1995, McGlade and Van Der Leeuw, 1997; Nicolas and Prigogine, 1989, pp. 238-242 all in Brown, Witschey and Liebovitch, 2005). Sungaila (1990) noted that the chaos theory relates to many, if not most, structures at all levels of the physical, social and cultural reality. These are open systems with dissipative structures that exist in a state of perpetual disequilibrium and are subject to a constant process of autocatalysis or positive feedback. Nevertheless, these systems manage to maintain

stability in space and over time. Sungaila (1990) stated that the new science of chaos is particularly concerned with the notion of order through fluctuation and extrapolated these understandings into a social system of educational administration (Sungaila, 1990). Installing innovative knowledge into the academy is always a challenge because the system strives to maintain stability over time by perpetuating their traditional epistemologies and their desire to maintain their hegemony over current knowledge. Introducing a new epistemology is an even greater challenge, because such an activity might threaten the stability and very existence of the academic institution.

Sungaila (1990) also suggested that a social organisation such as an educational system is a dissipative structure with a self-organising dynamic, which is able to adopt a new regime, through what she terms a "second-order" change. This dynamic process occurs through fluctuation (caused by the movement of butterfly wings) which eventually brings 'order out of chaos'. She noted that frequently societies attempt to drastically change the educational regime, but argued that a qualitative change in the system will never be achieved by large-scale administrative reform. Sungaila (1990) referred to Miller (1988) who suggested that leadership is more complex, profound, and challenging than a style, trait or talent or a combination of them, and goes beyond effective management behaviour (Miller, 1988 in Sungaila, 1990). When extrapolated to the field of educational leadership, Sungaila (1990) stated that the butterfly effect is the creative input of the single individual who conducts a very small but courageous initial step which challenges the status quo. This intervention can lead to a huge change in the system which is known as 'second-order change'. According to Sungaila (1990), a small starting step must be smaller than appears necessary, because no finite perturbation can be expected to alter the system from one regime to another in a single act. After this small starting step, a process that occurs through a nucleation mechanism, assisted by autocatalysis follows. Reactions within the system produce more of the same result, suggesting that the process should start with a minor change, in order to establish minimal success and allow each small success to induce further success. Sungaila (1990) stated that the vision of the process comprises the vector which directs these growing fluctuations in the system. However, there is a risk that these self-reinforcing fluctuations will be suppressed by the dissipative structure's own self-renewing dynamic. According to Sungaila (1990), when the creative leader makes a small and courageous action which challenges the status quo, "the growing waves" this produces, eventually cannot be contained and suppressed by the system. Therefore, it is necessary for the leader to either destroy or at least modify the cultural, political and material support which uphold the dynamics of the current system. According to Sungaila (1990), as the self-renewing dynamic is weakened, its power to contain the ever-increasing fluctuations is reduced. In this way, the system is able to organise itself at a new level of functioning. The leader acts symbolically and politically to weaken the system's self-renewing dynamic, and at the same time, persistently emphasises the values of the new regime, and in doing so the system is revitalised (Sungaila, 1990).

We can understand my experience of doctoral research of practice, in light of Sungaila's (1990) understanding of chaos theory. The butterfly effect is being created by my input as researcher-practitioner working in a small team with Anat and Anna, and conducted a very small initial step which challenged the status quo of the academic institution. I could not expect to alter the system from one regime to another in a single act, because as expected, a process likened to autocatalysis followed, which was expressed in the institution's motivation to maintain the existing epistemic and methodologic conditions. My vision as a practitioner-researcher regarding the contribution of the knowledge produced by our collaborative effort to our fields of practice, (which still requires the recognition of the knowledge by the academic community), comprises the vector which directs successive actions intended to achieve the goal of altering the system. These repetitive actions cause growing fluctuations in the system. In accordance with Sungaila's model, as expected the University's dissipative structure which has its own self-renewing dynamic, is trying to suppress these fluctuations. Acting to uphold the institution's epistemic conditions, the staff are persistently impeding the progress of our research. Motivated by our professional obligations as practitioner-researchers, we will persist with our actions which inevitably challenge the status quo. According to Sungaila (1990), as the self-renewing dynamic is weakened, its power to contain the ever-increasing fluctuations is reduced. Eventually the "growing waves" which the actions of the researcher-practitioner creates will reach a threshold height beyond the system's ability to cannot suppress them. Persistent and

repetitive activities by us as practitioner-researchers are necessary in order to challenge the hegemony of the academic staff over knowledge and academic freedom and eventually lead to ‘second-order change’ in the system. We understand that it is the practitioner-researcher’s obligation to suggest an alternative that can replace or at least modify the cultural, political and material supports which uphold the current dynamics of the system. The practitioner-researchers goal is evolution and development and therefore they act in order to direct the system towards a new MM. In second order change, a new equilibrium will be achieved when the self-renewal forces are modified and directed towards adaptation of the system. This means organising itself at a new level of functioning, directed towards the new MM. If the self-renewing forces remain directed towards their previous MM, they support the dissipativity of the system and may eventually lead to its destruction. While the University is still directing it’s forces towards the previous maladaptive MM, Anat, Anna and I are acting symbolically and politically to weaken the University regime’s self-renewing dynamic, while persistently emphasizing the values of the new regime, suggesting new epistemology, methodology and method which is intended to revitalise the system (Sungaila, 1990).

## REFERENCES

- Adler, A., Ansbacher, H.L., & Ansbacher, R.R. (1956). The fictional final goal. *The Individual Psychology of Alfred Adler*, pp. 94-96.
- Brown, C. (1995a). Chaos and Catastrophe Theory. *Quantitative Applications in the Social Sciences* (No. 107) Sage Publications, Newberry Park (CA).
- Brown, C. (1995b). *Serpents in the Sand: Essays on the Nonlinear Nature of Politics and Human*.
- Brown, C.T., Witschey, W.R., & Liebovitch, L.S. (2005). The Broken Past: Fractals in archaeology. *Journal of Archaeological Method and Theory*, 12(1), 37-78.
- Davidson, D. (1963). Actions, reasons, and causes. *The Journal of Philosophy*, 60(23), 685-700.
- Fletcher, A.J. (2017). Applying critical realism in qualitative research: methodology meets method. *International Journal of Social Research Methodology*, 20(2), 181-194.
- Goldberger, A.L., Rigney, D.R., & West, B.J. (1990). Chaos and fractals in human physiology. *Scientific American*, 262(2), 42-49.
- Lorenz, E. (1972). Predictability: Does the flap of a butterfly's wing in Brazil set off a tornado in Texas? (p.181).
- McGlade, J. (1995). Archaeology and the Ecodynamics of Human Modified Landscapes. *Antiquity*, 69, 113–132.
- McGlade, J., & Van Der Leeuw, S.E. (1997). Introduction: Archaeology and non-linear dynamics: new approaches to long-term change. In van der Leeuw, S. E., and McGlade, J. (eds.) *Time, Process, and Structured Transformation in Archaeology*. *One World Archaeology* (Volume 26, pp. 1–31). Routledge, London.
- Miller, J.A. (1986). *Conferencias Caraqueñas*. Recorrido de Lacan.
- Nicolas, G., & Prigogine, I. (1989). *Exploring Complexity: An Introduction*. W. H. Freeman and Company, New York.
- Sungaila, H. (1990). The new science of chaos: Making a new science of leadership? *Journal of Educational Administration*, 28(2).