Non-Suicidal Self-Injury:
A Systemic Perspective.

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Overview:
Human behaviour is complex, variable and multi-faceted. As a result, describing and predicting human behaviour continues to fascinate and perplex those in the social sciences. Due to its enigmatic and dimensional nature, some theorists have argued that human behaviour can best be understood by taking a systemic perspective; taking into account a multitude of interlinked factors that produce a particular behaviour could be influential to our understanding. The primary focus of the present essay is to discuss how systems related approaches can be applied to non-suicidal self-injury (NSSI). Part one of this essay will provide an overview of systems theory with a specific focus on non-linear dynamic systems and catastrophe theory. Following this, NSSI will be introduced. Part two will discuss how systems related concepts and NSSI can be integrated with one another; NSSI will be discussed in relation to catastrophe theory and the environmental model. Finally, part three will introduce two interventions for NSSI, Multisystemic Therapy (MST) and Dialectical Behaviour Therapy (DBT), which are grounded in a systemic framework. Limitations in the current literature will be discussed, as will avenues for future research.

Part One: An Introduction

1.1 Systems Theory: Nonlinear Dynamic Systems:
Nonlinear dynamic systems (NDS) theory is one branch of general systems theory, an interdisciplinary meta-theory containing a myriad of rules, constructs and propositions that can be applied to all types of systems (Gustello, Koopmans & Pincus, 2009). ‘Dynamics’ refers to the way in which a system changes; from a mathematical perspective these changes occur in either a linear or a non-linear manner. Linear equations are additive, with forces increasing linearly with parameters. For example, taking the description outlined by Lanza (2000), if we have an event, Y, that is caused by event X, and the relationship between X and Y is linear, what we mean to say is that any change in X, however large or small, will have a proportional effect on Y. Linear equations work well for a number of problems in the physical sciences. For instance, they can be utilised when predicting planetary orbits, or when trying to understand the effects of wind resistance or gravity on an object’s trajectory (Barton, 1994). Although linear equations are useful when describing smooth flow patterns within a system, living systems, such as humans, do not operate in quite such a fashion; an alternative systems approach is needed to describe these.
Living systems require non-linear descriptions; initial changes in measurement do not remain constant, but grow and decay non-linearly with time. Referring once again to Lanza’s (2000) description, if there is a non-linear relationship between X and Y, a small change in X could produce a dramatic change in Y. Alternatively, a dramatic change in X may have only a minimal impact on Y. As prediction of non-linear systems trajectories are difficult, these systems can at first glance appear stochastic (completely random), yet they do in fact have well-ordered, underlying mechanisms.

A variety of researches have demonstrated that NDS can be applied to human behaviour. In particular, research has suggested that NDS has useful applications that can enhance our understanding of clinical phenomena (Barton, 1994), including post-traumatic stress disorder (Glover, 1992), multiple personality disorder (Putnam, 1988), schizophrenia (Schmid, 1991), the development of mental states in infancy (Wolf, 1987) and psychiatric disorders in general (Sabelli & Carlsson-Sabelli, 1989; Guidano, 1991). More recently, a variety of aspects pertaining to NDS have been applied to non-suicidal self-injury (NSSI) (Selby, Anestis & Joiner, 2007; Armey & Crowther, 2008; Washburn, Richards, Styer, Gebhardt, Juzwin, Yourek & Aldridge, 2012). In particular, NSSI has been described by catastrophe theory, and has also been explained by the environmental model, a systems-related approach describing human behaviour. Such applications will be explored in part two of this essay. The remainder of part one will introduce NSSI and catastrophe theory.

1.2a) Catastrophe Theory:
There are few phenomena in the world that act in an orderly manner. Rather, many processes involve sudden transformations and unpredictable divergences (Stewart & Peregoy, 1983). Applications to such phenomena can be made with catastrophe theory. As devised by Rene Thorn (1972) and popularized by Zeeman (1976), catastrophe theory is a special branch within the broader domain of NDS theory. It is used to identify and describe the positioning and outcomes of bifurcation points within a system. Bifurcation denotes a pattern of instability within a system. The term is used to conceptualise situations in which small alterations in a system lead to abrupt and dramatic changes from one type of behaviour to another. Within a system, gradual increases or decreases to a particular factor lead the system further away from its steady state until a threshold point is reached. It is at this point that a bifurcation (two or more steady states) becomes available to the system. According to Guastello et al (2009), bifurcations can be subtle, explosive or catastrophic. As such, they are central to catastrophe theory.
Zeeman (1976) outlined that there exists seven elementary catastrophes, known as the: fold catastrophe, cusp catastrophe, swallowtail catastrophe, butterfly catastrophe, hyperbolic umbilic catastrophe, and the parabolic umbilic catastrophe. The cusp is the most frequently applied model (Cobb, 1981); it will be to this model that this essay will refer when discussing catastrophe theory.

1.2b) The Cusp Catastrophe Model:
This three-dimensional model describes two stable states of behaviour (see figure 1). Two control parameters (asymmetry and bifurcation) control the changes between the two states. The bifurcation parameter controls the size of the change that takes place, whilst the asymmetry parameter governs the system’s proximity to this sudden, discontinuous change. When levels of bifurcation are low, changes are smooth, but at high levels they are potentially discontinuous, although this depends on the levels of asymmetry; when bifurcation is high but levels of asymmetry are low, changes are relatively small. At high values of asymmetry, changes are, once again, small. If however values of asymmetry sit somewhere in the middle, changes are relatively large. With regard to the bifurcation set, the point at which these two modes of behaviour meet is called the cusp. This is the threshold point at which more than one behaviour becomes available to the individual. At this point, dramatic alterations in behaviour may occur, with the behavioural trajectory crossing over the inaccessible region, thereby jumping from one state to another (it is said to make a ‘catastrophic jump’). The shaded area in figure 1 depicts the region of inaccessibility. This region represents the intermediate levels between two behavioural states that, according to the model, are theoretically impossible.

![Diagram of the Cusp Catastrophe Model](image-url)

Figure 1: Diagram of the Cusp Catastrophe Model, taken from Gustello, Koopmans and Pincus (2009).
As previously mentioned, catastrophe theory has been applied to a variety of phenomena. Zeeman (1976) for instance, made several applications using the cusp catastrophe model, including applications to rapid mood changes, prison disturbances and anorexia nervosa. Cusp catastrophe modelling has also been implemented in relation to anxiety and sports performance (Hardy, 1996), anxiety in visual perception (Stuchlikova, Kindlman & Mann, 1996), child abuse (Tutzauer, 1984), cognitive development (Van Der Maas & Molenaar, 1992) and decision framing (Svyantek, Deshon & Silver, 1991). With such a breadth of research pertaining to the usefulness of catastrophe theory in explaining human behaviour, it seems only fitting that the model should be applied to non-suicidal self-injury.

1.3 What is Non-Suicidal Self Injury?

With regard to self-injurious behaviour, there is a lack of agreement or consistency concerning the most appropriate definition to use. Terms used have included: deliberate self-harm (DSH); non-suicidal self-injury (NSSI); self-mutilation; self-abuse, and parasuicide. One reason behind these classificatory disagreements relates to differing perceptions of the intention behind the behaviour; there is a question concerning the presence or absence of suicidal intent. Miller and Smith (2008) note that although it is sometimes evident that an act of self-injury was without suicidal intent, self-injury often occurs with swiftly changing intent; behaviour may start as suicidal but evolve into a non-suicidal act, and vice versa. The blurred boundary between suicidal and non-suicidal self-injury makes it difficult to define or categorise self-injurious behaviours. Despite definitional inconsistencies in the literature, for the purposes of this essay, self-injury will be referred to as NSSI, a definition conceptualising the behaviour as, ‘the deliberate, self-inflicted damage of body tissue inducing bleeding, bruising and other forms of pain’ (Nock & Favazza, 2009).

Currently, NSSI is not viewed as a ‘mental health disorder’ in its own right. Rather, it is most commonly perceived to be symptomatic of, and therefore treated alongside, Borderline Personality Disorder (BPD) (Linehan, 1993) and other psychiatric disorders, including anxiety and depression (Miller & Smith, 2008). Consequently, research and treatments that focus specifically on NSSI are scarce. Further still, most research examining the efficacy of interventions for self-injurious behaviour tend to merge suicidal and non-suicidal behaviours together, thus distorting the conclusions that can be inferred.

Notwithstanding this, some research has indicated that a greater understanding for NSSI may be gained if a systems based approach is taken. For example, it has been argued
that NSSI is a behaviour that acts non-linearly and as such, it can be investigated and modelled using catastrophe theory (Armey & Crowther, 2008). Furthermore, according to the environmental model, NSSI can be depicted as a behaviour that arises from within a family system (Sutyemoto, 1998), in turn indicating that therapies focusing on family systems, such as multi-systemic therapy may have a positive impact on the behaviour. Other interventions that draw on systems theory, such as Dialectical Behaviour Therapy (DBT), may also be useful in reducing NSSI (Backer, Miller, & van den Bosch, 2009; Klein, 2011; James, Winmill, Anderson & Alfoadari, 2011). These systems-related applications are discussed in parts two and three.

**Part Two: Systems Theory Meets Non-Suicidal Self-Injury**

2.1 Catastrophe Theory and NSSI:
In order for a particular behaviour to be considered within the context of catastrophe theory, Zeeman (1976) outlined that it must exhibit five qualities: bimodality, inaccessibility, divergence, hysteresis, and abrupt transmissions. Armey and Crowther (2008) outlined how NSSI can be viewed as possessing all of these qualities. For instance, bimodality is the binary presence or absence of a particular behaviour. NSSI is bimodal in that, although there are differences in the rates at which individuals self-injure, they either engage in NSSI or they do not. Inaccessibility is very much entwined with bimodality; within the cusp catastrophe model, intermediate levels between two behavioural states are theoretically impossible. With regard to NSSI, the individual is either in a behavioural state whereby they are engaging in self-injury or they are in a behavioural state where they are not. Divergence is the possibility for seemingly minor perturbations in the initial state of a system to have an impact that creates a large difference in the system’s final state. For instance, small changes to predictor variables of NSSI may lead to dramatic alterations in the behaviour. Hysteresis refers to the idea that variables that are considered responsible for the occurrence of a particular behaviour may not be responsible for the return to a state in which an individual is not engaging in that behaviour. In other words, the presence or absence of factors that cause NSSI are not necessarily responsible for the return to a state whereby NSSI does not occur. Finally, NSSI can be seen to make abrupt transitions – the shift from the absence to the presence of the behaviour.

Research exploring NSSI has tended to use traditional statistical procedures that assume linearity. However, it has been argued that human behaviours are complex, and as
such may be poorly represented by linear models (Ehlers & Stein, 1995). Armey and Crowther (2008) investigated NSSI in relation to both linear and non-linear cusp catastrophe models. By examining predictor variables of NSSI (aversive self-awareness and dissociation), they found that the cusp catastrophe model accounted for 66% of the variance compared to only 10% accounted for by linear models. These findings indicate that the cusp catastrophe model holds superiority over traditional procedures when investigating NSSI predictor variables.

Despite these promising findings, Armey and Crowther (2008) note several limitations relating to their investigation, including examination of a narrow age-range of participants, use of a sample lacking in ethnic diversity, and retrospective data collection. Replication of the study would strengthen the conclusion that statistical techniques drawing on cusp catastrophe modelling are useful for the analysis of NSSI.

It has been suggested that the appeal of catastrophe theory stems from the impressive accomplishments it has seemingly achieved in modelling discontinuous phenomena. However, others argue that such claims are unsubstantiated; Zahler and Sussman (1977) outline a myriad of reasons discrediting catastrophe theory applications. They suggest that conclusions that have been drawn are greatly exaggerated and have been based on incorrect mathematics and unreasonable assumptions. Furthermore, they argue that catastrophe theorists combine concepts that are inaccessible to those who are not professional mathematicians. This leaves individuals able to grasp an intuitive understanding of the model, yet unable to understand or criticise the flawed mechanisms and equations that underlie it. Zahler and Sussman (1977) conclude by stating that there remains a possibility that catastrophe theory may produce solid applications in the future, but that until proponents of the theory succeed in substantiating their claims, an air of scepticism must be maintained.

Despite the shortcomings of catastrophe theory’s application to NSSI, the behaviour has been described by alternative approaches that also have a systems related foundation. One particular approach that may have explanatory power for NSSI is the environmental model.

2.2 The Environmental Model and NSSI:
Grounded in both behavioural and systemic theory, the environmental model is based on the concept that behaviours occur as a result of an individual’s interaction with their environment and the systems contained within it (Sutyemoto, 1998). Behaviours may be reinforced and maintained by the continuation of such interactions. Further reinforcement occurs when the individual comes to perceive the behaviour as reinforcing within itself. Characterised in this
way, the continuation of the behaviour in question can be viewed as serving both the individual who engages in the behaviour and the environmental system.

With regard to NSSI, Sutyemoto (1998) outlines how the environmental model addresses factors that could initiate and maintain the behaviour. For example, where the system is say, the family, self-injury may begin as an emotional response to a systemic familial dysfunction. For the system as a whole, this behaviour may act to deflect attention away from the core problem, leaving it in a state of equilibrium, albeit relative and short-lived. Feelings of relief experienced as a result of the self-injury may in turn create an internal reinforcement for the behaviour, thereby increasing the likelihood that the same pattern of behaviour will be repeated, particularly when similar environmental cues are evoked. Although the system is often the family, research examples illustrating what may constitute an environmental system have included hospital wards (Podovoll, 1969; McKerracher & Watson 1968; Ballmger 1971), youth custody centres (Cullen, 1985) and prisons (Cookson, 1977). It has been proposed that the self-injurious behaviour in these settings may be engendered due to both external tensions such as environmental restriction and inactivity, and internal tensions caused by the absence of normal outlets due to confinement (Burrows, 1992).

**Part Three: Interventions, a systemic perspective**

As previously mentioned, few treatments have been designed and evaluated specifically for NSSI. However, in light of systems related research, some interventions have been highlighted as potentially useful in reducing NSSI. In particular, explanations of NSSI pertaining to the environmental model have led to the suggestion that multisystemic therapy may be an effective treatment.

3.1a) *What is Multisystemic Therapy?*

Originally developed as a strategy for reducing anti-social behaviours in youth (Washburn et al, 2012), multisystemic therapy (MST) has been adapted and applied to those with a variety of emotional and behavioural needs (Hengeler, 1999) including those who engage in NSSI (Huey, Henggeler, Rowland, Halliday-Boykins, Cunningham, Pickrel & Edwards, 2004). MST is an intensive family-based intervention program that takes a systems-oriented approach. It aims to address the multiple environmental systems that are thought to have contributed to the initiation and maintenance of an individual’s maladaptive behaviour. Such
systems include the home environment, schools, the neighbourhood and peer relations. Using evidence based treatment, MST adheres to nine major principles (Hengeler, 1999):

1) Find the ‘fit’ – identify the individual’s problems and how they fit into their entire context.

2) Focus on the positives within the established systems - use strategies already known to the family so as to identify and build on protective factors.

3) Promote responsible behaviour and decrease irresponsible behaviour amongst family members.

4) Take an action-oriented approach to prevent specific and current issues.

5) Target sequences of behaviour within or between systems; these sequences are key to the maintenance of the behaviour.

6) Develop interventions that are appropriate to the youth’s age and developmental needs.

7) Implementation of strategies must be continuous.

8) Regular evaluations of progress must be made.

9) Interventions must be generalizable; they must be designed so that they can be implemented in the long-term, long after official treatment has been terminated.

3.1b) The efficacy of Multisystemic Therapy in treating NSSI:

After presenting to an emergency department, one hundred and fifty-six adolescents were randomly allocated to receive either MST or inpatient treatment as usual (Huey et al, 2004). Using a variety of self-report measures from both children and their caregivers, it was found that those in the MST condition showed a greater reduction in acts of self-injury over a 1-year follow up. However, Miller and Smith (2008) note a crucial limitation of the study in that 44% of those in the MST sample also received inpatient care during the treatment period. It is thus difficult to discern whether the improvement observed was due to receiving MST or to the engagement in more than one treatment type. Additionally, the authors themselves note a methodological limitation regarding the temporal variation and overlap between measures. For instance, one measure that caregivers were asked to complete was the Child Behaviour Checklist (CBCL; Achenbach, 1991) in which their reports were based on the past six months. In contrast, a measure completed by the adolescents known as the Youth Risk Behaviour Survey (YRBS; Kolbe, Kann & Collins, 1993), was based on events concerning the past 12 months. It is therefore possible that the ratings provided by participants were
based on differing time perspectives, potentially limiting the reliability of the study’s findings.

However, similar results were obtained by Schoenwald, Hengeler and Rowland (2000) who compared the efficacy of MST to emergency psychiatric hospitalisation in relation to self-harmful behaviour. 113 adolescents took part and were randomly allocated to either the MST condition or the hospitalisation condition. Post-treatment, MST was found to have a greater preventative effect regarding self-injurious behaviour and the number of days spent in hospital as a result of self-injury was significantly lower for those in the MST condition.

Despite these positive findings, research regarding MST and NSSI is limited. Furthermore, like much research in the area, both Huey et al (2004) and Schoenwald et al (2000) merge suicidal and non-suicidal self-injury into one category. Additionally, both studies compare MST to hospitalisation only; the efficacy of MST compared to other treatment types was not evaluated. Although findings such as these may be promising to the development of systems based interventions to treat NSSI, further exploration is required before convincing conclusions can be drawn.

Further systems related therapies have been identified as useful in the treatment for NSSI. For instance, one particular strand of Cognitive Behavioural Therapy (CBT), termed Dialectical Behaviour Therapy (DBT), has shown promise in treating NSSI. It has been argued that DBT is heavily grounded in systems theory (Miller & Smith, 2008).

3.2a) What is Dialectical Behaviour Therapy?

Originally developed as a treatment for those with Borderline Personality Disorder (BPD), DBT has since been applied to other behavioural disorders, including substance dependence, binge eating, and depression (Dimeff & Lineham, 2001). Importantly, DBT has been evidenced as an effective treatment for NSSI (Backer et al, 2009; Fleischhaker et al, 2011; James, Taylor, Winmill & Alfoadari, 2008; James et al, 2011). DBT targets destructive behaviours that can be attributed to dysfunctions in the emotion-regulation system; emotional dysregulation occurs as a result of the interactions between a biologically emotional individual and an environment that does not adequately accommodate for their vulnerability (Linehan, 1993). Miller and Smith (2008) state that DBT treatment strategies are grounded in a dialectical philosophy that, ‘views reality as an interrelated system with opposing internal forces in a state of continuous change’, suggesting the importance of focusing on a multitude of factors that may be contributing to the NSSI. Through group and individual therapy, DBT
combines a variety of techniques, including skills training, problem solving, cognitive modification strategies, and exposure and response prevention (Muehlenkamp, 2006; Washburn et al, 2012). The overall aim is to help individuals replace maladaptive problem-solving methods with more effective problem solving behaviours. DBT can be viewed as an intervention targeting the systems that initiate and maintain the behaviour. Considering once again the environmental model, group sessions in DBT help to alleviate factors within the system as a whole (e.g., familial dysfunction) that lead to NSSI. Meanwhile, individual sessions teach the individual to adopt alternative coping strategies, in turn reducing their need to engage in NSSI as a form of internal reinforcement.

3.2b) The efficacy of DBT in treating NSSI:

The efficacy of DBT has been observed in studies utilising the therapy for adolescents with BPD symptoms (such as NSSI). For example, after investigating across a sample of 44 participants, Shearin and Linehan (1994) reported that DBT was a more effective treatment compared to treatment as usual (hospitalisation) in reducing the number of self-harm acts. DBT also showed superiority in reducing the severity of the injuries. James et al (2008; 2011) analysed improvements in NSSI for participants who had received DBT. All participants had a history of engaging in severe and persistent NSSI for 6 months or more. After 2-6 months of weekly DBT, participant showed significant post-treatment improvements in NSSI. These improvements were maintained at an 8 month follow up. Additionally, Elwood, Contois, Holdcraft and Simpson (2002) found that after participants from a community mental health clinic had received DBT, all participants showed reduced NSSI up to a year later. Unfortunately, the study did not include a comparison group with which to compare the efficacy of the DBT, and as such the usefulness of the treatment cannot be validated.

Although the quantity of research regarding DBT and NSSI far outweighs that offered by MST research, such evidence is still limited. This limitation, like much existing research in the area, is grounded in the fact that NSSI and suicidal behaviours are grouped together, and that NSSI is often investigated only in relation to other psychiatric disorders. As with MST, the evidence for DBT’s usefulness in reducing NSSI is promising, but further exploration is required.

Ideally, future research could consider addressing treatment outcomes specifically in relation to NSSI. From an empirical point of view however, studying NSSI in isolation is a difficult task. Not only is NSSI currently perceived as symptomatic of other underlying psychiatric disorders, the co-occurrence of NSSI and other mental health issues is high
As a result, it may be difficult to identify whether a treatment has reduced NSSI directly, or whether the treatment has been beneficial to an underlying disorder which in turn led to the reduction. Further still, as previously mentioned, the boundary between suicidal and non-suicidal self-injury is blurred, meaning it is difficult to reliably identify the intention behind the act. Unfortunately, although assessment of a particular treatment’s effect on NSSI alone could prove insightful, the task itself is evidently impractical. Nevertheless, continued investigation into the efficacy of systems-based interventions relating to NSSI may prove invaluable.

A Final Word:
The primary focus of the present essay was to discuss how systems related approaches can be applied to NSSI. This was achieved in a number of ways. Firstly, NSSI was discussed as a behaviour that acts non-linearly and could therefore be examined using catastrophe theory. Secondly, NSSI was viewed in light of the environmental model. Following this, two systems related interventions – MST and DBT – were described and evaluated regarding their usefulness in reducing NSSI. Overall, it has been outlined that viewing NSSI from a systemic perspective is, to some extent, beneficial and potentially useful as a basis for intervention strategies. However, caution is warranted before one can draw convincing conclusions as limitations, such as mathematical inaccuracies in catastrophe modelling and definitional discrepancies in NSSI research, must be borne in mind when using such systems related approaches.

References:


