The damaged object: a ‘strange attractor’ in the dynamical system of the mind

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The damaged object: a ‘strange attractor’ in the dynamical system of the mind

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This article discusses the impact of the damaged object on the development and functioning of psychic life with particular reference to the sense of reality. The damaged object is of pivotal significance in Klein’s and Winnicott’s models of psychic development and experience in early infancy. A key dimension of the development and functioning of the sense of reality is the capacity to differentiate internal and external reality. Klein drew attention to the critical role of external reality in disconfirming or ‘disproving’ phantasies and anxieties about damaged objects in internal reality, and Winnicott emphasised the critical importance to psychic health and development of the ‘non-destruction’ of the external object. Problems can arise, however, when external reality has the effect of mirroring or confirming – instead of disconfirming – internal reality concerning the damaged object. The scientific concept of the ‘strange attractor’ from chaos theory is drawn on to characterise the way in which the damaged object can operate as a deterministic influence on psychic life and the relationship to reality in a specific constellation of internal and external realities. In this context, the relevance of chaos theory is considered as a scientific paradigm that is particularly suited to the psychoanalytic description and model of the mind. Some possible links between psychoanalysis, chaos theory and the study of narrative are explored. Detailed clinical material from two cases is discussed to elaborate these themes, and possible research applications are considered.

**Keywords:** the damaged object; relation to reality; internal and external reality; chaos theory; nonlinearity; strange attractor; iteration; recursion

But men may construe things after their fashion, Clean from the purpose of the things themselves.  
(William Shakespeare, 1599 *Julius Caesar*)

Does everything then come over again a little differently? . . . is there a pattern, a theme, recurring, like music . . . a gigantic pattern, momentarily perceptible?  
(Woolf, 1937)
Introduction

In this article I discuss the effect that the damaged object can have on the development and functioning of psychic life, with particular reference to the sense of reality, and some implications of this for clinical practice. I consider the way in which the damaged object can operate as a primary organiser of mental life and perception of external reality; the patterns of organisation and recursion in mental life that can be observed in psychoanalytic psychotherapy; and the relevance and possible application of chaos theory to the identification and scientific study of such patterns of organisation, and changes in these, over time.

The ‘damaged object’ is a key element in Klein’s conception of the inner world and internal reality. It is of pivotal significance in her model of psychic development and experience. In the paranoid-schizoid position, objects that are felt to be damaged or in pieces as a result of destructive or sadistic attacks by the infant, carried out in hatred, are experienced as a persecutory threat or danger (Klein, 1930). In contrast, in the depressive position objects that are felt to be damaged or in pieces are a source of guilt and concern, and are both a motivating force for, and subject of, the drive towards reparation (Klein, 1935, 1937). Here it is important to highlight that in her writings on this theme Klein is specifically referring to the internal object that is felt to be damaged or in pieces as a result of the infant’s destructive or sadistic attacks on the object in phantasy.

The concreteness of early phantasy in relation to the damaged object is central to my theme. Linked to this is that at an early infantile level of functioning and phantasy, emotional or psychological states may be conceived of and construed in concrete, physical or bodily terms. This concreteness was vividly illustrated by a three-year-old boy with an ASD diagnosis who came for three times weekly psychotherapy with me. At the start of therapy his language was extremely limited, and his development and functioning were in many respects those of an infant or much younger child.

Near the beginning of his first psychotherapy session Liam exclaimed anxiously, “Daddy broken!”. In subsequent sessions using the toys Liam repeatedly showed me a ‘baby’ biting his ‘daddy’. In one session he played out a crocodile biting the wheel of a train carriage after which Liam said, “The wheel’s broken”.

There is clearly a cause-and-effect association in Liam’s mind between his infantile oral aggression and the fantasy of a damaged object which is perceived in terms of being ‘broken’. There was nothing in his father’s physical condition that corresponded to this play and its associations; however, it did seem to me to be linked to father’s psychological state.

The same concreteness of phantasy related to the damaged object is illustrated in the following clinical material. In a psychotherapy session a seven-year-old girl one day unexpectedly discovered the baby doll in the therapy room had sellotape around its neck – its head had been broken from the body but had not quite entirely detached, and an attempt obviously made to stick or hold it on with sellotape.

Amy was disturbed and upset by the discovery. [In past sessions Amy had quite violently attacked the baby doll, which at the time seemed to have been the object of Amy’s murderous jealousy and rivalry towards other children whom the therapist saw in the room.] She was at first immersed in trying to fix the baby doll’s head back on. She then turned her attention to the dolls house and said the roof was ‘broken’, and she spent the rest of the session completely preoccupied with trying to stick the roof on.
The wooden dolls house was of the type with a roof consisting of two slanting removable panels. Amy was ordinarily well aware that the roof panels were removable, and she had in the past removed and replaced them in the course of her play without it being of any significance to her that the panels came off. Now, Amy was convinced the doll’s house roof was broken and in need of repair, and this appeared to the therapist to have the quality almost of a delusion. Amy remained absorbed in her desperate attempts to ‘repair’ the roof for the rest of the session.

This material illustrates the way in which a child’s relation to external reality is disturbed and distorted, in this case temporarily and in a limited sphere, because an aspect of the external world mirrors and is felt to confirm internal reality. In this instance, the damage done in phantasy to mother’s baby as a result of murderous jealousy and rivalry causes Amy to ‘construe’ the dolls house roof as broken just as the baby doll’s head is broken. This is obviously not the same as a child interpreting their parent’s state as being caused by their destructive attacks in phantasy, but what it does show is the parallel way in which something is perceived to be damaged as a result of such attacks in phantasy.

A dramatic and tragic illustration in literature of the theme of the damaged object can be found in Joseph Conrad’s novel Lord Jim. When the merchant ship on which the protagonist Jim is first mate hits something under the water during the night, Jim discovers a dent in the hull deep inside the boat and below the water line; he misconstrues this dent as a sign that the ship is catastrophically damaged and will sink, and he has a terrifying vision of all the sleeping passengers within the vessel drowning. In an existential moment of crisis he abandons ship. In this densely symbolic psychological novel, the damaged object is a recurrent and unifying theme that links a focal event around which the narrative revolves and to which it repeatedly returns, an internal damaged object which the damaged ship mirrors, and the self-experience of a ‘punctured’/damaged ego which is narcissistically identified with a catastrophically damaged object.

In this article I shall explore a specific set of circumstances in which the damaged object can exercise a perturbing and determining influence on the relationship to reality and the development of the capacity to differentiate internal and external reality. The concept of the ‘strange attractor’ from chaos theory is used to characterise the pattern of this process.

The conjunction of internal and external realities

The lines from Shakespeare quoted at the beginning of this article encapsulate a core dimension of the psychoanalytic field of inquiry: that is, the ways in which people may unconsciously ‘construe things after their fashion’ in terms of their ‘purpose’/meaning in both the internal and external world. The development of the sense of reality, and in particular the differentiation of internal and external reality, has its roots in early infancy and is a gradual, fluctuating – and never absolute – achievement. Problems in the differentiation of internal and external reality may arise for a variety of reasons. Most common in the psychoanalytic literature is the theme of confusion of internal and external reality consequent upon excessive projective identification. I shall consider another source of difficulty in the differentiation of internal and external reality, associated with the effects of the damaged object in a particular constellation of internal and external worlds.
Developmental psychology research has been instrumental in showing how from birth infants have the capacity to relate to, interact with and elicit responses from their mother and significant others, in motivated, purposeful and meaningful ways. This research demonstrates that infants have a clear perception and understanding of, and relationship to, selective aspects of external reality and the environment. The research also confirms the infant’s understanding of causation within circumscribed areas of perception and experience.

Alvarez and Furgiuele (1997), drawing in part on developmental psychology research (Bruner, 1968; Papousek and Papousek, 1975; Tompkins, 1981; Trevarthen and Hubley, 1978) as well as from psychoanalytic writing on this theme (Broucek, 1979, 1991), have discussed the link between the development of the understanding of causation and the development of a sense of agency. They argue that these co-evolve through the interactions, communications and patterns of response in the earliest mother–infant relationship. These two strands of mental and emotional development are in turn intimately bound up with the sense of self. To paraphrase: ‘I cause mother to feel and register my communications, and understand and respond to my states of mind, therefore I am’.

But what inferences of causation might the developing young infant make about the connection between him or herself and ‘the state of things in the external world’ – initially, the state of other people, and first and foremost mother or the primary attachment figure? Developmental research tells us nothing about the ways in which infants ‘may construe things after their fashion’ in relation to the cause of the emotional or psychological state or condition of people in the external world. An obvious situation where this wider question is relevant is that of mothers with post-natal depression: insofar as the baby senses and internalises ‘something wrong with mummy’, might the infant ‘construe’ itself as the cause?

Given that the breast and the mother are the primary object of identification and source of integration, the conception of a damaged breast/mummy or a breast/mummy in pieces is clearly of profound significance for the infant’s emotional and psychic development and sense of self and identity. Primitive omnipotent thinking gives rise to the belief of the type ‘I am the cause of that’ even where it is not the case. This type of belief or fantasy is easily recognisable in older children who believe – sometimes consciously, sometimes unconsciously – that they are the cause of a state, or state of affairs, for example, a mother’s physical ill health, or parental divorce; and it persists, in transient form, in everyday adult life when we mistakenly think we are the cause of someone else’s mood or state of mind.

When external reality mirrors internal reality

I speculate that an infant’s belief in itself as the cause of mother’s mental state (‘mummy broken’) can in certain circumstances be the result of the operation of a particular conjunction of internal phantasy on the one hand, and a sense of agency (= causation) in relation to the external mother on the other. The point I wish to highlight is that where external reality in some way mirrors or corresponds to internal reality, the problem may not be the infant’s omnipotence of thought in itself, but the fact that its omnipotence of thought in relation to its destructiveness is not disconfirmed by external reality in the way that both Klein and Winnicott highlight is essential to the infant’s ordinary development and mental health.
In this constellation of internal and external worlds, the interaction of internal and external reality forms a dynamic process. This touches on an often polarised debate concerning the relative importance of, and emphasis given to, internal and external reality. The understanding of confusional states and of the confusion of self and object consequent upon excessive projective identification has been a fundamental and invaluable development in psychoanalytic theory and practice (Bion, 1962; Klein, 1946; Meltzer, 1992; Rosenfeld, 1952; Segal, 1957). However, I suggest this concept needs to be clearly distinguished from what might be formulated as either a failure or collapse in the differentiation of internal and external reality as a result of the kind of constellation or conjunction of internal and external realities I am discussing. It is important clinically to keep the two concepts of excessive projective identification and mirroring of internal and external realities separate in one’s mind because of their relevance to an individual’s sense of responsibility, anxiety and guilt, and to the therapist’s ascription and interpretation of these, both implicit and explicit, conscious and unconscious.

Before exploring these ideas with reference to clinical material, I shall first give a brief selective overview of psychoanalytic theory related to the development of the sense of reality, and then discuss the relevance and application of chaos theory and the concept of the ‘strange attractor’ to the process I wish to elaborate.

Development of the sense of reality: a selective theoretical overview

And we are now confronted with the task of investigating the development of the relation of . . . mankind in general to reality, and in this way of bringing the psychological significance of the real external world into the structure of our theories.

(Freud, 1911 [1984: 36])

The ‘task of investigating the development of the relation . . . of mankind in general to reality’ has been at the heart of psychoanalytic inquiry since its beginnings. Freud writes of ‘bringing the psychological significance of the real external world into the structure of our theories’ in his classic paper ‘Formulations on the Two Principles of Mental Functioning’. In Freud’s model, it is only the failure of ‘the attempt at satisfaction by means of hallucination’ – that is, ‘the non-occurrence of the expected satisfaction’ – that gives rise to the relationship to external reality in the form of the ‘reality principle’. This occurs, Freud suggested, when ‘the psychical apparatus ha[s] to decide to form a conception of the real circumstances in the external world and to endeavour to make a real alteration in them’ (Freud, 1911).

In this classical Freudian model, external reality only comes to be apprehended as a consequence of frustration of need or wish fulfilment. It is through this process that ‘the objectifying of the outer world’ (Ferenczi, 1913) comes about. External reality is here primarily viewed in terms of something that is acted upon, in order to bring about ‘satisfaction’. Thinking is seen to have ‘developed from the presentation of ideas’, and in its more developed form is regarded as ‘an experimental kind of acting’. However, Freud goes on to suggest that thinking was originally unconscious and was ‘directed to the relations between the impressions of objects’ (my emphasis) (1911 [1984: 39]).
Ferenczi (1913) elaborated on this process of the shift to the apprehension of external reality. Ferenczi introduced the idea of ‘stages in the development of the sense of reality’. He argued that the development of the sense of external reality is a gradual process, albeit with clearly defined stages, and like Freud he stressed that it is never an absolute achievement. Ferenczi highlighted the importance of a realistic relationship to external reality, and the link between certain forms of mental illness and disturbances in the differentiation of internal and external reality.

The development of the relationship to external reality and the outer world is a central theme in Klein’s writings. Klein (1932: 11) was interested in ‘the child’s relation to reality’ from the outset. She argued that the young infant’s relation to external reality was coloured and shaped by phantasy (unconscious fantasy). She further suggested that symbolism is not only ‘the foundation of all phantasy and sublimation’ but, over and above this, that it is ‘the basis of the subject’s relation to the outside world and to reality in general’ (Klein, 1930: 221). In Klein’s view, ‘the child’s earliest reality is wholly phantastic’, but ‘[a]s the ego develops, a true relation to reality is gradually established out of this unreal reality’ (Klein, 1930: 221).

Klein (1935: 285) drew attention to the fundamental importance of the infant’s ‘good relation to its mother and to the external world’ as a protection against ‘early paranoid anxieties’. She highlighted the critical role of external reality in disconfirming internal anxieties and phantasies related to destruction or damage resulting from early destructive and sadistic attacks on the internal object. Thus she wrote:

The extent to which external reality is able to disprove anxieties and sorrow relating to the internal reality varies with each individual, but could be taken as one of the criteria for normality.

(Klein, 1940: 346)

In this context Klein (1940: 346) referred to ‘children who are so dominated by their internal world that that their anxieties cannot be disproved and counteracted’ by the positive aspects of the external world. Pursuing this line of thought, a little later in the same paper she suggests that ‘the psychic reality of the child is gradually influenced by every step in his progressive knowledge of external reality’ (1940: 347). Klein clearly regarded this disconfirmation of internal reality by external reality as critical to the development of the capacity to tolerate depressive concern and anxiety, and thus to good mental health.

The idea of variation ‘with each individual’ in the ‘extent to which external reality is able to disprove anxieties and sorrow relating to the internal reality’, allows for the possibility of both internal and external factors influencing this individual variation. With ‘children who are so dominated by their internal world that their anxieties cannot be disproved and counteracted’ by the positive aspects of external reality, it follows that where external reality in some way mirrors or corresponds to the damage and destruction that has been done in phantasy in the internal world, this can profoundly impact on or distort the ordinary development of the relation to external reality.

Winnicott (1971) discussed the significance of the non-destruction of the external object for the development of the sense of external reality in early infancy. He argued that the infant destroys the object in phantasy and that this is a necessary part in the process of ‘placing the object outside the self . . . out in the world’ (Winnicott, 1971: 107). (For Winnicott, this is a pre-requisite for the development of the capacity to
In this context, ‘finding externality . . . depends on the [external] object’s capacity to survive’ (Winnicott, 1971). Winnicott highlighted the role of the external mother in this developmental process:

> It is an important part of what a mother does, to be the first person to take the baby through this first version of the many that will be encountered, of attack that is survived. (Winnicott, 1971: 108–9)

He drew attention to the ‘variations . . . that arise out of the differences in experiences of . . . new born babies according to whether they are or are not carried through this very difficult phase’ (Winnicott, 1971: 109). In this context, Winnicott considered the implications of ‘the object’s failure to survive’. Of particular relevance is Winnicott’s idea of ‘the object’s liability not to survive, which also means to suffer change in quality, in attitude’ (my emphasis) (1971: 109). It follows that the quality of the external mother’s state of mind (e.g. depression) may be construed by the infant as a consequence of its destructive attacks in phantasy.

Rey (1994: 229) considered the nature of the relationship to reality in individuals who are dominated by the need to keep alive and repair damaged objects; these individuals aim ‘to bring about the reparation of certain objects without which the subject’s self cannot function normally and happily’. Rey (1994: 247) observed: ‘In a “normal” person there is a kind of equilibrium between the inner world of inner objects and the external world of external objects.’ He suggested that the task of borderline and psychotic patients – for whom the relationship to reality is severely disturbed – is ‘to manage to keep their damaged good objects alive in the hope of putting them right’ (Rey, 1994: 237). One might add that where in infancy the external world of external objects in a significant way mirrors the damage in the internal world of inner objects so that they are not easily differentiated in the mind of the infant, this normal ‘equilibrium’ between inner and external worlds cannot be established or maintained, and the normal relationship to external reality is liable to distortion.

The field of autism has been a rich source of psychoanalytic understanding regarding the theme of the damaged object and its relation to the development of the sense of reality. Tustin (1972) discovered the type of ‘black hole’ psychotic depression in some autistic children which is linked to the phantasy of a breast with the nipple broken off; here the phantasy of a damaged object as a result of destructive rage can lead to the most extreme consequences in the form of autistic withdrawal and isolation from people and the external world. Tustin (1972, 1990) also discussed the problems arising from the phantasy of acquiring qualities by literally ‘taking’ them from parental figures, leading to the belief that the parents have been damaged. Haag (1985, 2000) describes the phantasy in some children with autism of mother and baby as two halves of the same body leading to the experience of bodily separateness being equated with damage to object and self. For both writers, the phantasy of the damaged object is associated with catastrophic anxieties, resulting in the relationship to external reality becoming severely distorted, disturbed or compromised.

Rhode (2004: 17) has discussed catastrophic primitive phantasies of destruction in some autistic children where the ‘child . . . confuses his mother’s state of mind with what his own mouth has done’ in infancy. Elsewhere Rhode (1999: 90) describes a shared feature in three children on the autistic spectrum, all of whom had a seriously
disturbed relation to external reality: all three children ‘were acutely sensitive to other people’s moods, and to the possibility that they might be responsible for causing damage’. Rhode (2005) also considers the situation where such anxieties and phantasies of destruction are linked to the infant’s experience of damaged or dead objects in the mind of the mother (the object’s damaged internal objects). Here it is the shadow of the object’s (damaged) object falling on the ego (Barrows, 1999, cited by Rhode) that can lead to disturbance in the relation to external reality. Rhode draws on Winnicott’s (1967) concept of the ‘mirror role of the mother’ to make the point that

the baby derives its fundamental sense of existence and goodness from what it sees reflected in its mother’s face . . . we are what we see. If the mother’s preoccupations [or damaged internal objects] intrude excessively for too much of the time, then these are what the baby will see . . .[as a reflection of itself].

This can lead to the catastrophic internal situation of the baby feeling itself to be both the cause of, and identified with, these damaged objects in the mother’s mind. The damaged object can thus at times have a primary determining influence on the mental life of the individual, and can act as a primary organiser of mental life. It is the scientific study of patterns and mechanisms of determining influence that I shall discuss next, before illustrating these with clinical material.

Chaos theory: a paradigm shift

. . . methods developed for linear systems give the wrong answer when applied to nonlinear questions (Smith, 2007: 115)

Rustin (2001) has compellingly argued for the relevance of chaos theory, and complexity theory which evolved out of it, to the psychoanalytic study of the mind. Rustin cites a number of psychoanalytic writers who have applied ideas from chaos theory to psychoanalytic theory and practice, including Moran (1991), Quinodoz (1997) and Miller (1999). Moran draws on concepts from chaos theory to elaborate a model of the ‘fluidic nature of the mind’; Quinodoz applies chaos theory as a way of thinking about psychic ‘transition states’; and Miller discusses the ways in which the mind can be thought of as demonstrating properties of chaos and complexity, as defined within their scientific study.

Classical science

Gleick (1987) suggested that chaos theory constitutes a new scientific paradigm. He argued that chaos theory is a new form of scientific understanding and explanation of the relationship between certain kinds of phenomena: this ‘new science’ involves the identification of hitherto unrecognised complex patterns of cause and effect that are not predictable or explicable by the classical model of science.

The classical model of science is both ‘mechanistic’ and ‘reductionist’ (Gell-Mann, 1994; Lewin, 1993): that is, it defines and describes processes in the natural or physical world in terms of ‘mechanisms’; and it is based on the premise that ‘reducing’ a system to its constituent parts and analysing these tells you everything there is to know about the whole, because there is a determinate connection between the properties and relationships of the parts and of the whole. This reductionism is fundamental to ‘modern’ science. Pirsig (1974) – who
was originally a biochemist and became interested in the philosophy of science – provides an insightful history and critique of this tradition and its roots in the evolution of classical Greek philosophy.

In its study of the physical and natural world, a fundamental assumption and principle of this classical model of science is that causation and relationships between different states of whatever is being observed are linear: this means that the classical scientific laws of the physical world and of nature define regular, predictable and proportionate relationships between phenomena. Lorenz (1993: 209) defines a ‘linear system’ as one ‘in which alterations in an initial state will result in proportional alterations in any subsequent state’ (original bold, my italics).

This model of science and the relationships it describes are ‘deterministic’, meaning that a state of a system at any given point in time completely determines and defines a subsequent or later state, in ways that can be calculated and predicted following prescribed methods (however complicated). Or, as Lorenz (1993: 207) puts it, a ‘deterministic system’ is one ‘in which later states evolve from earlier ones according to a fixed law’ (original bold). The classical model of science and Newtonian physics is entirely suited to the study of ‘closed systems’ in which the dynamics and interactions between elements in the natural world are invariant. In this classical model, causation and scientific theories or proofs of causation are regarded as constant and holding true independent of time.

The classical model of science evolved out of the discovery and study of regular, linear patterns and chains of causation in the natural world. Understandably ‘science’ came to be synonymous with the linear phenomena and laws of nature that it discovered and the methods it used to study these. In the philosophy of science this is well recognised. The physicist Jones (1982) has referred to this as the ‘stacked deck’ of classical scientific knowledge and methodology.

**Dynamical systems and changes of state over time**

Chaos theory represents a ‘paradigm shift’ (Kuhn, 1962) in the concept of causation and the nature of the relationship between ‘causes’ and effects’, and in scientific understanding and explanation of these. Chaos theory has its origins in the physical sciences and the study of changes of state over time. It emerged in particular from scientific research into the phenomena of motion, turbulence and perturbation, in fields such as meteorology, fluid dynamics and population biology. Of special interest to scientists studying these phenomena are changes of state and the behaviour of entities on the boundary between states (e.g. between liquid and gas, or more abstractly between equilibrium and disequilibrium).

Common to these areas of scientific study are attempts to identify and understand the properties of what are called ‘dynamical systems’: these are systems composed of a number of elements that dynamically interact with each other in complex ways which lead to ‘emergent’ properties and forms of organisation or ‘self-organisation’. The study of such systems involves the analysis of states of a system over time, and the identification of types of patterns of change of state over time.

The scientific mode of representation of a system’s changes of state over time involves plotting its trajectory in ‘phase space’; phase space, also known as ‘state space’, is a mathematically derived graphic or pictorial, often multi-dimensional and complex representation of all the possible states of a dynamical system in time. In phase space a given point in the visual representation of the ‘orbit’ or trajectory of a
system over time contains all the information about the system at that particular point in time. It is possible to use a mathematical technique of converting a multi-dimensional representation of the states of a system over time into a two-dimensional representation, drawing on a method developed by the mathematician and philosopher Poincaré. Visual representations of a dynamical system’s changes of state over time can reveal significant and defining patterns of change of state which cannot be seen or identified from statistical systems of analysis (Smith, 2007).

In chaos theory, chaos is not understood in its everyday sense of ‘random’ but is applied to certain dynamical systems. In classical science, the study of dynamical systems led to the identification of three categories of regular, linear patterns of change of state over time: ‘fixed state’ (constant), ‘periodic’ (cyclical) or ‘torus’ which combines features of the two. The abstract representations of these patterns are called attractors, because they describe the state to which a system is ‘attracted’ or drawn over time. The scientific discovery of ‘chaos’ identified a new category of patterns of change of state – that is, nonlinear patterns – that did not conform to these three known linear categories and could not be explained and, crucially, could not even be observed by classical science. Chaotic systems demonstrate patterns of change of state over time that contain some features of regularity combined with features of irregularity, in ways that make the behaviour or changes in states of the system over time either partially or entirely unpredictable. The science of chaos is thus concerned with systems that are neither wholly random, nor wholly deterministic in the classical science sense.

**Sensitive dependence on initial conditions**

A defining characteristic of the scientific concept of chaotic systems is that of ‘sensitive dependence on initial conditions’: this refers to the nature of the relationship between the initial conditions of a system and later states of the system. More specifically, it refers to the phenomenon whereby a small difference or change in the initial conditions of a system leads to a large, disproportionate (i.e. ‘nonlinear’) and unpredictable difference or change in the state of the system at a later point in time. Lorenz (1993) has argued that ‘sensitive dependence on initial conditions’ is – with a technical qualification in its definition – synonymous with chaos in its scientific sense.

Dynamical systems, which have properties of chaos in its scientific sense, and in which there is sensitive dependence on initial conditions, consist of patterns of changes of state that: (a) are impossible to replicate or reproduce in identical detail under experimental conditions; (b) do not provide linear, regular, determinate and predictable measures of cause and effect or outcome; (c) are non-periodic, that is, they never return to or repeat the identical state or set of conditions; (d) nevertheless demonstrate recursive patterns of complexity and variation over time that have identifiable characteristics and can be shown to be the deterministic – though not predictable – product of a limited number of factors or ‘dimensions’.

There is a striking correspondence between the simple and at the same time complex, scientifically revolutionary and profoundly illuminating scientific concept of ‘sensitive dependence on initial conditions’ from chaos theory, and the psychoanalytic model of psychic development and functioning. Here I am thinking of the primary importance of the ‘initial conditions’ of the infant’s environment, personality and experience (starting *in utero*; Piontelli, 1992), the ways in which these interact, and the ways in which ‘micro’ perturbations in initial conditions after
birth can lead to exponential and disproportionate effects on later conditions. I shall consider this further, in relation to clinical material, with reference to another key concept within chaos theory – the ‘strange attractor’.

**Strange attractors**

In the physical and applied sciences, an ‘attractor’ is a point, a state or a pattern of organisation towards which a dynamical system is drawn or ‘attracted’ over time. An often quoted simple example from physics is a swinging pendulum which, if it is not driven by a mechanism, will eventually come to a state of rest: the position of the pendulum at the state of rest is described as an ‘attractor’ because it is the point to which the pendulum in such circumstances will be drawn. An attractor functions as an organising force, acting like a ‘gravitational pull’, which has a determining influence on the shape or pattern of a system or of phenomena.

In classical mechanistic science models, attractors describe and define predictable, linear relationships and causes between phenomena. It is this mechanistic reductionist classical model of science which, for example, underpins the scientific methodology and findings of attachment theory: for instance, in relation to the implicit premise that attachment categories of mothers determine and predict attachment categories and patterns in their infants in regular, predictable, linear ways. Here, the mother’s attachment category could be thought of as a conventional type of ‘attractor’. Another example is the assumption or belief that early attachment patterns, and disturbances in attachment relationships, determine and predict later psychopathology in linear chains of causation, which it will be possible to reveal once methods to identify these have been sufficiently refined. In such instances, exceptions, irregularities or inconsistencies in statistical or experimental results are considered to be either extraneous ‘noise’ obscuring true underlying linear patterns of cause and effect, or the result of imperfect methods of measurement and inquiry which are assumed to need further refinement. In chaos theory, by contrast, a ‘strange attractor’ (Ruelle and Takens, 1971) has a complex, nonlinear and either partially or totally unpredictable but nevertheless deterministic influence on the shape or pattern of phenomena that have some features of regularity combined with features that can appear to be irregular, chaotic or random.

**Fractals and ‘self-similarity’**

The scientific discovery of strange attractors converged with the mathematical study of patterns of irregularity and nonlinear dynamics as a result of the work of the mathematician Benoit Mandelbrot. Mandelbrot (1982) applied mathematics to the investigation and measurement of irregularity in shapes, structures or patterns in the natural world, for example, the shape of a coastline or of the edges of clouds; the pattern and structure of bifurcation of branches in trees, or of air tubes in the lungs; or the longitudinal statistics of floods of a river. These are complex shapes and patterns in nature characterised by ‘regular irregularity’ (Gleick, 1987). One discovery that emerged from Mandelbrot’s mathematical explorations was that many irregular but nevertheless patterned shapes or structures in the natural world have a dimension which is not a whole number (a phenomenon which was known within the study of sets in mathematics, but which had not been formulated conceptually or applied in relation to the natural world). Mandelbrot coined the
term ‘fractal’ to refer to these patterned yet irregular shapes and structures that have a fractional dimension. As Gleick (1987: 98) put it, ‘Fractal dimension becomes a way of measuring qualities that otherwise have no clear definition: the degree of roughness or brokenness or irregularity . . .’

Linked to this finding was Mandelbrot’s discovery in nature of repeated or recursive patterns at different scales of measurement. Mandelbrot found that if one ‘zoomed in’ on a particular part of such irregular shapes or structures in the natural world, one discovered the same pattern and degree of irregularity on a smaller scale, seemingly infinitely ‘embedded’ or ‘nested’ within the larger scale shape or pattern. This came to be known as ‘self-similarity’ or ‘scale-invariance’. (Mandelbrot had previously discovered such patterns of self-similarity, which demonstrated non-standard statistical distribution, in statistical data from fields as diverse as commodity prices and market movements in economics, electrical transmission noise and the distribution of large and small cities.) The relevance of this to chaos theory emerged when scientists in different fields recognised that these properties of fractal dimension and self-similarity are defining features of strange attractors.

Discussion

Although chaos theory emerged in the 1960s, the implications and applications of chaos theory both in the natural and applied sciences are still very much in the process of being discovered and elaborated. Chaos theory does not in any sense replace classical mechanistic reductionist science, rather it identifies a distinct category of deterministic nonlinear phenomena and of cause and effect in the physical and natural worlds that cannot be revealed or measured by classical science.

Writers on chaos theory (Gleick, 1987; Lewin, 1993; Lorenz, 1993; Williams, 1997; Gribbin, 2004; Smith, 2007) invariably make the point that chaos in its scientific sense is ubiquitous and that – contrary to classical science’s Newtonian assumption of a ‘clockwork universe’ – it now seems likely that most phenomena in the physical and natural world are in fact chaotic in the scientific sense. Research in the past two decades in human biology and physiology applying chaos theory techniques of analysis has revealed that patterns of heart functioning, oscillatory diseases, epilepsy and brain functioning all demonstrate properties of chaos as defined scientifically. As Rustin (2001) has argued, the notion of a scientific paradigm that studies nonlinear changes in organisations or states of a system over time, and patterns of turbulence and perturbation, is of self-evident interest and relevance to a psychoanalytic model and description of the mind and its functioning from infancy onwards.

In the clinical material of the two cases that follow – as in the life histories of the two children themselves – the theme of a damaged object is present from the start, recursively reappears at different ‘scales’ and is reiterated over time, and seems to have a deterministic though not linear influence on what evolves.

Clinical material

Case discussion A: the damaged baby and the damaging baby

In the following case, the whole Green family (I have changed the names) were seen for the initial assessment phase, after which there was an extended period of work with parents and the referred child together. An assessment for individual
Psychotherapy was carried out after over a year’s work with parents and Isaac, who was seven years old at the time of the psychotherapy assessment, and this led to ongoing once weekly individual psychotherapy for the child. In the initial assessment meeting with the family, it became apparent from the start that damage was an immediate and recurrent preoccupation of Isaac’s parents and of Isaac, and a central theme in their lives.

Isaac’s parents spoke about his early history. Isaac was the first child of his parents. The pregnancy had been straightforward with no complications. However, Isaac was born two weeks early by a difficult, protracted and extremely painful (for mother and undoubtedly also for baby) forceps delivery. Isaac's head was severely squashed and bruised by the forceps delivery. His parents were concerned at the time about possible physical and psychological long-term effects. They were told by medical staff that the bruising would have no permanent physical effect, that Isaac would have no memory of the experience, and that it would have no lasting impact. It was clear to me that Isaac’s birth and his condition after birth were a profound trauma for his parents which had never been processed, and that while they recognised this when I named it, before I did so they had not thought of it in this way or recognised it as such.

Mother and father spoke movingly of the first few weeks after the birth, when they were unable for medical reasons to hold or cuddle their baby, except to feed him. Although they did not themselves appear to have had any thoughts about depression in mother after Isaac’s birth, from what they said and the way they spoke about these first few months I was left wondering about mother’s emotional state at that time. I strongly suspected mother may have been at the very least in an extremely fragile state if not actually depressed without anyone realising or recognising it at that time.

Mother returned to full-time work when Isaac was four months old. From my understanding this was not because of financial need. Isaac was then cared for full-time during the day by a child minder who looked after another baby at the same time. Isaac’s mother became pregnant when he was two-and-a-half years old, and Isaac started full-time nursery at the age of three. There were complications in the delivery of Isaac’s younger twin brothers and serious concerns about their condition, which resulted in them being placed straightaway in a special care baby unit after birth. Mother did not see her newborn twin babies for the next 24 hours and wasn’t allowed to touch them for two days.

Mother subsequently developed post-natal depression. Since then she had been on anti-depressants for several years – with one unsuccessful attempt to come off them – and father expressed his worry about mother’s emotional and mental state and his fear of her having a breakdown, though he did not use this word. I wondered whether the traumatic birth of the twins and concerns about their condition echoed and revived the unprocessed trauma of their experience with Isaac, and tipped mother ‘over the edge’.

In our meetings with Isaac’s parents, they spoke about Isaac as if there was ‘something wrong’ with him that needed ‘fixing’. This persisted throughout our contact with them, giving the impression of a sense of something ‘irreparable’. In the initial assessment they reported that Isaac often broke things at home but not deliberately, and from their descriptions it did sound as if this was more like clumsiness or possibly carelessness rather than active, wilful or unconscious destructiveness. This was in contrast to their description of other times when Isaac
might break something in a fit of anger and more intentionally. In a later session with Isaac and his parents:

Isaac got out the horse from the toy box, immediately noticed that its tail was missing and briefly wondered where it might be and searched in the toy box for it – he seemed perhaps faintly troubled by the missing tail. Then he took out the hippo and commented on that not having a tail either. Father told us that Isaac is concerned to fix things, and that he was very bothered by a recent catastrophic event – associated with the field in which Isaac’s father is involved in his work – in which a number of people had died. Isaac seemed to have been troubled that his father wasn’t able to fix things when this event had occurred.

The theme of damage appeared at the very start of Isaac’s first individual psychotherapy assessment session:

1st Individual assessment session

From the beginning of the session there was a restless and very agitated quality to his manner of speech. He seemed unreachable and it felt impossible to make a connection with him.

This very agitated and restless quality was also reflected in what Isaac did: he first got out a box with a game that consisted of a plastic head with balls that are meant to be ‘posted’ into it . . . He quickly became immersed in investigating the head: there were arms on the sides and one came off and Isaac immediately said, “I’ve broken it” [in fact he hadn’t – the arms are designed to come off – though I did not say this to him] and he then said, ‘I break things and then I can’t mend them.’ This had the feeling of a statement about a deep-seated sense of self and of his experience.

[Later] he stood all the animals together and began joining together and laying out pieces of the train track, starting with the two halves of the bridge. He made a track that enclosed all the animals he’d put out . . . He made a long train with all the train carriages, and pushed it round the track a few times. He then disconnected the two halves of the bridge as the train reached it and said the bridge was ‘broken’; the train engine then went rampaging around inside the track, violently crashing into and knocking over all the animals. He explained when I asked that the engine was doing this ‘because it was angry because it couldn’t carry on’ [over the bridge]. When I made a link with how angry he might sometimes feel when he wants to ‘carry on’ something but can’t, this seemed to strike a chord and Isaac agreed.

This theme of damage continued in the subsequent individual psychotherapy assessment sessions:

2nd Individual assessment session

Isaac stood all the smallest animals in a group – in a circle, facing in – referring to them as ‘babies’, and he then did the same thing with the grown-up animals. Next he laid out the train track in a complete circuit around them, saying it was to ‘protect’ them. He took out a large dinosaur and made repeated fierce and threatening noises in the direction of the babies, moving the dinosaur a little in their direction, and he confirmed that the dinosaur wanted to get the babies and to eat them. He then made the lion and some of the other jungle animals fight off the dinosaur and lock it away in the small baby dolls house – Isaac said it was dead but a little later it then came back and was alive again; this sequence was repeated, but this time Isaac made the lion repeatedly hit the dinosaur and he said the lion killed the dinosaur’s spirit.

[A little later] he got out all the cars and laid them in a continuous line on the railway track – he called these ‘safety’ cars; however, the cars went wild – like the train engine the previous week – and knocked over all the animals; this time Isaac couldn’t say why
or what was happening. I was struck by the contrast between this session and the previous one, in terms of the feeling of the session and how it proceeded, despite Isaac in many respects doing similar things in both sessions. This session never really acquired the more settled, focused and calm quality of the previous one – Isaac’s play seemed less coherent, more fragmented and there was more moving from one thing to the next.

Isaac now got the cat and mouse and made the cat chase the mouse wildly: the track got completely broken up and all the animals, which he had stood up again, were knocked over once more. Isaac played out this scene of destruction in a very immersed and excited way. The feeling of Isaac’s play was increasingly agitated and I was aware of it having an intensely agitation and disorganising impact on my mind, to the point of it becoming extremely difficult for me to think – I felt as if all my thoughts had been broken up. I had a growing inner feeling of turmoil and chaos, and at one point I made a conscious and very active effort – it took all my concentration and determination – to try to calm this escalating inner turmoil (I didn’t say anything to Isaac about this): at this precise point there was a notable decrease in Isaac’s agitation. I commented on how this session felt different from last time, and how everything kept getting knocked over and broken up again and again this time. After I said this, the quality of Isaac’s play changed, and he then spent some time standing all the animals up and putting the track together again to its original shape – this felt like order and calm being restored.

Note that my determined (and on this occasion successful) effort to process my overwhelming and escalating inner turmoil and disorganisation of thought appeared to lead to an immediate reduction in Isaac’s agitation and destructiveness; and that what I said to him after this led to a positive shift in his state of mind. It might have been tempting to have tried to interpret or comment directly on Isaac’s destructiveness, and I could easily have unwittingly done this without having sufficiently processed and overcome the intensely agitated and ‘broken up’ state of mind that Isaac’s play had evoked in me. Had this happened, I believe my state of mind would have been communicated in my interpretation, however much I was aware of this state of mind in myself. If I had managed to formulate an interpretation about Isaac’s destructiveness, I believe what Isaac would unconsciously have taken in would have been my accompanying inner feeling of ‘broken up thought’, and that this would have been experienced by Isaac unconsciously as confirmation of the damage he causes to his object – in this case to someone else’s mind and thinking. I suspect it would also have been unconsciously experienced by Isaac as a disturbing experience of damage being got rid of and pushed back into him.

3rd Individual assessment session

Isaac took out the baby leopard and laid it carefully right in front of the mother leopard’s mouth and carefully placed the end of the baby leopard’s tail inside the mother’s mouth. When I commented that he had done this, Isaac said it was “So that it won’t be separated.”

I took up this theme of not wanting to be separated and linked it to him seeing me on his own, and I asked how he feels when he is separated from his mother. Isaac said he’s ‘sad’ and that he doesn’t like it. In the middle of this bit of conversation about not wanting to be separated from his mother Isaac suddenly said, “I hate my mother”: this verbal ‘outburst’ felt as if it just popped out as part of a stream of thoughts – it did not form part of the sentence he was in the middle of or follow (consciously) from what he had actually been saying, and he did not elaborate but instead continued with what he had been speaking about. I picked up on what he’d said, and when I asked about him feeling this he said it ‘happens all the time’.

Isaac had by then finished standing up all the animals. While we were talking he had joined engines and carriages together on the track to make one long train, and now he
said, “There’s a storm” and, unhooking the two halves of the railway track bridge that are joined in the middle, he moved them apart and said, “They’re separated.” He pushed the engine at the front of the train right up to the edge of where the bridge was divided in two, and said “The train can’t go over.”

He pushed the two halves of the bridge together so that the links were touching but not actually linked together, and said the bridge was ‘fixed’; when I commented on the two sections of bridge not being properly joined, and wondered whether the train would be able to get across, he said the bridge was ‘fixed enough’ for the train to get across. I queried this but he ignored me. He began slowly edging the train across the not-properly-joined-up-middle of the bridge, then suddenly he made the train wildly smash into the bridge and break up the track. Isaac excitedly broke up the track completely and said, “It’s demolished.” He began moving all the animals – which had got knocked over and scattered as the track was smashed up – to the space underneath a nearby chair, carefully standing and lining them all up and saying that they ‘will have to stay there until their home [i.e. the track] is fixed’.

I said the animals’ home getting ‘demolished’ and needing to be rebuilt reminded me of what his parents had said [in a meeting all together before the individual assessment sessions] about the building works at their home and that he was getting a new bedroom – he was having to sleep in a different room until the work on his new bedroom was finished; Isaac replied with feeling that his old room is ‘demolished’ and that they are putting stairs where his room had been. He said he doesn’t want to move and had wanted to stay in his old room. I suggested that he doesn’t like changes and Isaac agreed – I thought this really struck a chord for him. I spoke here about the baby Isaac who might have wanted to stay in his mummy’s tummy and not ‘move’ or come out – Isaac spontaneously replied with feeling, “That was my home.” I linked this to his dislike of being separated from his mother and being away from her. Around here Isaac made a comment that he ‘hates’ school, and I commented on school being another experience of being separated and away from mother and father too; I talked about how a part of him hates being separated from his mother, and that he sometimes hates his mother for the two of them being separated.

In a subsequent session in his therapy, Isaac told me that he had ‘demolished’ the previous house that the family had lived in when he was very young before his twin brothers were born, and that this was the reason they had moved.

It is of course possible to think about this material in many different ways, but one of the things it seems to me to illustrate is a child’s equation of, and confusion at a phantasy level between, the experience of separateness/separation, a connection or link that is damaged, and damage that is the result of the destructive rage of the child (the ‘storm’).

The theme of damage crystallised in the transference in a first session after a holiday break, a little over a year into treatment, when Isaac was eight years old. Isaac had for some time been using the large square foam cushions in the room to build structures, which kept collapsing.

**First session after a holiday**

At the end of the first session after the holiday, I was struck by the way in which Isaac cleaned and tidied the therapy room with uncharacteristic assiduousness and thoroughness which he had never shown before in the therapy (or at home), though in the session he had been no more messy or untidy than usual. I commented to Isaac that he seemed to be taking much more care than usual to clean up and tidy away today. Isaac replied that he had changed. I asked how he had changed, and in response Isaac asked if I had seen a story in the newspaper about a mother of three children who had killed herself. I commented on how awful this was, and then asked why he thought the mother had killed herself; Isaac replied that he thought it might be because she couldn’t
cope with her three kids. I pointed out that his mother is a mother of three children also, and I suggested he might sometimes worry that he and his brothers were too much for her to cope with. This clearly struck a chord, and Isaac confirmed he did worry about this. I said he might sometimes worry that he causes his mother to feel like the mother in the newspaper story – again Isaac agreed. I then interpreted that he was wanting to make sure today that he didn’t leave me anything to do at the end, and that I thought he might have a similar worry here that he was ‘too much’ for me to cope with and caused me to feel like the mother in the newspaper story, and this was the reason for his extra careful cleaning up and tidying away. Isaac said I was right. I linked this anxiety of his with the holiday, and suggested that he might have a thought at the back of his mind that the holiday was because I couldn’t cope with him and needed time away from him.

In this session I thought Isaac showed an implicit awareness of his mother’s depression, and a catastrophic anxiety about being the cause of her state of mind. Two sessions later Isaac played with a baby tiger figure that he had brought with from home:

Two sessions later

Isaac made the baby tiger bounce excitedly around inside the dolls house, referring to it as ‘he’ and ‘him’. He said the family are frightened of the tiger because they are worried he might ‘damage’ something … Then the family moved out of the house because of their worry … I took up how the tiger made the family feel … Isaac then constructed two towers beside each other, using the dolls house furniture, one taller than the other (they were suggestive to me of two figures), which stood where he had put down the family figures in front of the dolls house; they kept collapsing and he referred to them as ‘wobbly’. I linked these collapsing towers to his previous repeated building of structures with the large square foam cushions which also kept collapsing. I suggested that what he’d made now were like two figures, like a mum and dad, for instance. When I said this Isaac placed a male figure on the taller ‘tower’ and it fell apart and collapsed. He repeated this several times, rebuilding the towers.

[Later] Isaac built a construction with the foam cushions: it consisted of two levels, each with two ‘legs’ and a horizontal section, the overall shape suggesting a body and legs (I did not say this to Isaac).

Isaac got down on the floor and came through the ‘legs’ and emerged out of the front, then patted and climbed on top of the structure, which immediately collapsed. He repeated this several times, trying to rebuild the structure so it wouldn’t collapse and fall down. I linked this to the idea of someone who ‘falls apart’ and him being ‘too much’ for someone, and to his recent thoughts about a mother who couldn’t cope with her children … He was pleased when eventually he built a structure that held up under his patting and leaning on it … At the end of the session when I said there were 5 more minutes, Isaac suddenly violently smashed the structure down.

Discussion

This material shows the concrete experience and representation of a fragile internal object that is easily ‘damaged’ and collapses ‘in pieces’. It also shows the association and possible confusion between a baby’s liveliness on the one hand (the tiger bouncing round the house), and aggression on the other hand (violently smashing down the structure in response to separation at the end of the session), as a cause of the object’s destruction and ‘falling apart’. Over the course of the term, Isaac’s preoccupation with being the cause of a damaged and collapsed object/container was elaborated in his play. He repeatedly built enclosed structures with the foam cushions, with himself inside, and every time he emerged the structure collapsed;
similarly, he built tunnels with himself inside, and again each time he tried to emerge the tunnel fell apart and collapsed, much to Isaac’s frustration. This material evolved during the term into drawings of the Titanic and a preoccupation with the catastrophe of its sinking due to the damaged hull and weaknesses in its construction. Isaac had a spontaneous association to the hull of the Titanic breaking in two being ‘like a husband and wife breaking up’ (my emphasis); what emerged was his anxiety about being the cause of arguments between his parents which he feared might lead to their splitting up (in reality, there was nothing to indicate or suggest this being likely). Here we see an initial anxiety about a damaged and fragile maternal object seguing into anxiety about a damaged parental couple: the phantasy of damage seems to be carried over from the dyadic to the triadic situation or from one level of psychic life to another.

Speculatively, I believe there is a link between the circumstances and experience of Isaac’s birth for parents and Isaac, his parents’ anxieties after his birth about a damaged baby, mother’s likely fragile emotional state during the first two years of Isaac’s life, and parents’ sense of ‘something wrong’ with Isaac that needed ‘fixing’ and of something ‘irreparable’ in Isaac, on the one hand; and on the other hand Isaac’s sense of himself as someone who ‘break[s] things and can’t mend them’, his characteristic and pervasive preoccupation in therapy with flimsy or collapsing structures and with causing them to collapse, and his anxiety about being the cause of mother’s depression. The psychic leitmotif running through all these is the damaged object. It is as if in nonlinear fashion the initial condition of anxiety about damage (to Isaac after his birth) exponentially grows in dimension and influence in the minds and inner worlds of Isaac and his parents until it becomes a deterministic nonlinear organiser of mental life. In other words, as if the damaged object acts as a strange attractor.

**Case discussion B: the dead baby and the destroyer baby**

The second case I want to discuss to illustrate the idea of the damaged object functioning as a strange attractor concerns a child of four, whom I shall call Jason, who was seen for three times weekly intensive psychotherapy. In my discussion of this I am substantively and extensively drawing on and quoting from a trainee’s detailed unpublished case history. Jason was described by his therapist as ‘a passionate and yet sensitive little boy, who is extraordinarily in touch with his internal reality’ and who ‘has difficulty overcoming the strength of his destructiveness’.

Jason was the second born child of a young mother, Ms A, whose first baby had been stillborn late in the pregnancy. Ms A had unintentionally become pregnant very soon after the loss of the first baby. It appears that during this second pregnancy Ms A was depressed and highly anxious. Jason was born by emergency caesarean section after a prolonged but unsuccessful labour. Jason’s mother and father separated in the first year of his life. For the next few years there was just mother and Jason at home. During this time they spent long periods in the home with little contact with the outside world, and Ms A was referred on several occasions to adult psychiatric services for depression.

Describing the first individual psychotherapy assessment session, the therapist wrote that Jason ‘was so anxious and confused that he was unable to organise himself: his thoughts, feelings or actions. Consequently, chaos quickly
ensued . . . The degree of confusion was such that I was unable to write detailed
notes.’ Discussing the assessment as a whole, the therapist described how: ‘At the
end of each session I felt full to bursting from the intensity of his presence and his
projections, my mind in a complete whirl.’ At the same time she ‘was also touched by
his warmth, despite his plight’. She commented that, ‘Jason’s presentation at the
clinic and his mother’s description of him at home were consistent with descriptions
disorganised attachment.’

A key feature of the essential framework that enabled Jason’s psychotherapy to
take place was a reliable ‘strong supportive structure within which analytic work
could proceed’, involving arrangements that required close inter-agency collabora-
tion. The therapist wrote that ‘a central feature of Jason’s psychotherapy [was]. . . the
need to create and maintain a firm setting with clear boundaries in which he
[could]. . . bring all aspects of himself and his chaotic internal world’. The vicissitudes
of this essential external supportive structure for the therapy played an important
role in what unfolded within the therapy, and in the interplay between the child’s
internal and external worlds.

Jason’s destructiveness was unsurprisingly a central and recurrent theme in the
therapy. The therapist described a phase in the first year of the therapy when Jason
began to be able to play in a slightly more settled way. This involved play at the sand
tray with the funnel, bucket and their sand contents:

On . . . occasions, when he joined the bucket and funnel together to create a breast and
nipple shape, he ripped them apart thereby breaking the connection between them. Each
time he discovered that wet sand did not go through the funnel, he panicked and was

was convinced the funnel was broken. He frequently asked with urgency and mounting
frustration, “What’s wrong?” before he exploded, unable to contain himself . . .

(my emphasis)

The therapist goes on to state: ‘The external circumstances of his family only
seemed to confirm his fears and phantasies’ (my emphasis).

On one occasion in his therapy Jason spoke about a film he had seen, which had
involved a unicorn family. There was a ‘great wave’ which ‘flooded their land’, and
Jason seemed amazed that this beautiful family had survived. This material seemed
to reflect Jason’s anxiety that ‘his waves of destructive hate have destroyed all beauty
and goodness’, but as the therapist noted it hinted also at his sense of wonder at the
idea that his destructiveness does not have such catastrophic effects.

There followed a number of serious impingements on the supporting structure of
the therapy which the therapist was powerless to influence or protect Jason from. At
this stage in her account the therapist noted that the more she deteriorated in Jason’s
mind into a damaged, inadequate, and in particular a powerless and unprotective
figure, the more he turned to powerful omnipotent (and I would add destructive)
defences.

There was a two-month period of the therapy during which the regularity of the
sessions was interrupted due to strikes, fuel shortages and other external world
reasons. This period of interruption to the regularity of the sessions followed (but
was causally unconnected with) mother starting a new relationship, and it was clear
that Jason felt his position was dangerously precarious, both at home and in his
therapy. The therapist reported that ‘the re-establishment of regular sessions
provided improved containment for Jason’.
In a session after this period of repeated interruptions to the therapy, and approaching the subsequent holiday break, Jason was desperately trying to construct a ‘cage’ to constrain a scissors/bird character that was making biting attacks on the other animals. The cage construction that Jason made kept collapsing, and Jason was completely furious with the therapist – here the therapist wrote that ‘the whole atmosphere [was] one of imminent explosion’. Jason then played out a scene with the toys in which there is a flood that destroys everything and kills all the animals. In a session a few days later, Jason inspected each of the animals, finding imagined injuries: he worried about the mummy cow’s leg and said, “It’s broken inside.”

The therapist went on to report that critically, after the subsequent holiday, the ‘containing structure that had supported Jason’s therapy sessions unravelled’. There was a further period of irregular attendance. Three key figures who had provided stability for Jason and his mother were not available: the social worker went on long-term sick leave, the social work assistant ‘was preoccupied with additional responsibilities’, and the volunteer driver who brought Jason to his sessions retired. Jason and his mother had known the driver for several years, he ‘had become a positive [parental] figure to them’, and the therapist described him as having been ‘integral to the stability and continuity of their attendance at the clinic’. Writing about these circumstances, the therapist commented: ‘With hindsight, I don’t think I fully appreciated the combined effect of these losses on Jason at this stage in his psychotherapy.’

I would add that Jason was faced with a double catastrophe. First, the damage which he feels he has caused to his internal objects; second, the damage he feels he has caused in his internal world, instead of being disconfirmed by external reality, is in turn felt to be confirmed by the external world through the collapse of the external containing structure. The therapist formulates this collapse in terms of the effect of the ‘losses’ on Jason; however, while I agree that this is one dimension, I believe a different but equally important dimension is Jason’s possible unconscious belief and guilt that his destructive attacks are responsible for the breakdown of the external structure. For Jason there is now the added problem of a collapse of the differentiation of internal and external worlds, because the state of an essential feature of his external world – the supporting structure for the therapy, and the ‘frame’ of regular three times weekly sessions – cannot be differentiated in his mind from the damaged state of his internal objects.

If the anxiety and guilt about the effects of his destructiveness on the external world are not also recognised and addressed explicitly by the therapist – that is, they are not interpreted and linked to how Jason ‘construes’ himself and his destructive attacks as the cause of the breakdown of the supporting structure and frame of his therapy – they remain unacknowledged and cannot be thought about or worked through (the ‘unthought known’ [Bollas, 1987]). Paradoxically, acknowledging and interpreting Jason’s anxieties about the effects of his destructiveness in the external world in the here and now would give him the opportunity to restore or recover the differentiation of internal and external worlds. I think this might in turn help him to differentiate between what he is responsible for (his destructive attacks in his internal world) and what he is not responsible for (the breakdown of a key component of the external world, here the external supporting structure); and this might make it more possible for Jason
to accept responsibility for the former. (This is of course not to be confused with giving reassurance.) If the loss of differentiation in Jason’s mind between internal and externals worlds is not held in mind by the therapist, Jason is left feeling it is ‘all his fault’ and that he is responsible for the state of both – for ‘everything’.

In one particular session in the ensuing period of therapy, Jason repeatedly and relentlessly attacked the therapist and his own art work from previous sessions:

... after I had actively prevented him from destroying his previous work ... he settled to build a house with a roof, which [he said] “stopped a storm from getting inside”. Nevertheless, it teetered on the edge of collapse and although he repeatedly added extra supports, it remained extremely precarious. He roared with frustration, “It’s all your fault!”

It is possible to think of Jason’s accusation that it is all the therapist’s fault as merely a straightforward denial of his own unbearable sense of responsibility and guilt for his destructiveness; however, while this may be partly true, another interpretation is that it is a communication about a feeling of being blamed and held responsible for everything – both what is and is not his fault. I believe that failure to acknowledge and interpret the child’s unconscious guilt and sense of responsibility for things in the external world in the here and now which in reality he is not responsible for, may be taken unconsciously by the child as implicit confirmation that the therapist believes he is responsible for them – because external reality is not felt by the child to be differentiated from internal reality in the therapist’s mind.

Following the material quoted above, the therapist describes how she addressed the external realities facing Jason in relation to the breakdown of the structure around his therapy. Here the therapist named the external realities facing Jason, but the therapist did not consider these as something Jason might unconsciously feel guilty about being the cause of which needs interpreting (personal communication). In contrast, the therapist was aware of Jason’s ‘fear that his destructiveness is responsible for the failings of his internal objects’. One state of affairs (in Jason’s internal world) is understood as a subject of guilt and internal sense of responsibility, and Jason’s feelings about this are held in mind by the therapist (even if not interpreted); another state of affairs (‘the external realities facing him’) is not understood or recognised as a subject of guilt and internal sense of responsibility, and Jason’s possible feelings about this therefore have no place in the therapist’s mind. I believe this is an important distinction. If external circumstances are merely acknowledged or named and the child’s unconscious phantasies and feelings about being the cause of them are not recognised and interpreted, the child is left on their own with these feelings, as if they did not exist.

Finally, the therapist reiterates: ‘a central difficulty had been the way in which his past and present external realities mirrored and reinforced his internal reality and phantasies’ (my emphasis). The therapist clearly understood the way in which the child’s past and present external realities fail to disconfirm his internal reality: in the past this was in relation to the dead baby and to mother’s state of depression. However, if the child’s anxiety and guilt about being the cause of external realities in the here and now in therapy are not also recognised and held in mind by the therapist, then the therapist speaks to the child as if the only problem is anxiety and...
guilt about internal reality, and fails to address what amounts to the tragic double catastrophe of the child’s psychic life.

**Psychoanalysis and chaos theory: iteration, recursion and narrative**

... the primal processes of introjection and projection lead to constant changes in the ego’s relation to its objects, with fluctuations between internal and external, good and bad ones, according to the infant’s phantasies and emotions as well as under the impact of his actual experiences. The complexity of these fluctuations engendered by the perpetual activity of the two instincts underlies the development of the ego in relation to the external world as well as the building up of the internal world.

(Klein, 1958: 239)

In the above quotation, Klein captured a fundamental characteristic of mental life and experience *as it is lived and evolves over time* in terms of its ‘constant changes’, ‘fluctuations’, ‘perpetual activity’ and ‘complexity’. This *temporal* dimension is a defining feature of mental life, and is integral to the psychoanalytic study and model of the mind. Psychoanalysis has contributed to the observation, description, elaboration and explanation of this core characteristic of mental life through the discovery and delineation of internal objects, unconscious fantasies and processes (including transference and countertransference), and psychic organisations. What chaos theory offers is a complementary scientific empirical methodology for studying this *nonlinear* temporal aspect of mental life: that is, it offers the possibility of identifying nonlinear patterns of changes of state over time.

The primary data of the psychoanalytic study of the mind is the ‘first-order history … of the analytic dialogue’ (Schafer, 1981: 49). In psychoanalytic child psychotherapy the conventional ‘standardised’ form of this primary psychoanalytic data is process recording – the observational, sequential, detailed, fine grain micro-description of speech, behaviour, feeling, action and interaction *as they unfold over time*. One could think of the ‘basic unit’ of this data as a process recording of a single clinical session, but the total data may cover a single session or else a series of sessions over the course of a week, a month, a term or an entire treatment (e.g. Klein, 1961). This means that the data which are studied is by definition a form of *narrative*. (This kind of observational descriptive process recording narrative is to be distinguished from the autobiographical or self-analytical activity of ‘[c]onstructing narratives’ or stories about ourselves, which Bernstein (1990: 55–6) terms ‘narrative self-reflection’, in which ‘we rehearse past events’ that we regard as significant in our ‘life-history’.)

In this final section, I shall consider some possible links between psychoanalysis, chaos theory and the study of narrative, with particular reference to literary narrative. In the two case histories discussed, the damaged object is a prominent and recurrent theme that constitutes a *leitmotif* in the therapies, as in the inner and outer lives, of the two children. The damaged object seems to operate as a primary (though not exclusive) organiser of mental life for these children, and to have a deterministic influence on ‘the development of the ego in relation to the external world’. The presence of a theme that constitutes a leitmotif in a child’s (or adult’s) psychotherapy is a common phenomenon that will be familiar to any psychotherapist.
Are there patterns in the recurrence of such leitmotifs, and in the ‘constant changes’, ‘fluctuations’ and ‘complexity’ of mental life over time, that have properties of nonlinearity and chaos in its scientific sense? This question is one that has been increasingly addressed in the psychoanalytic literature in the past two decades. Levin (2000) refers to the way in which

... each patient ‘shows a consistent signature in their pattern of being. One could argue that this signature is fractal-like in that it reappears at various levels of “magnification” in the patient’s behaviour and thinking (Galatzer-Levy, 1997).

(Levin, 2000: 93)

Levin (2000: 91) suggests that ‘chaos theory is robust in its ability to mathematically describe developmental patterns, such as the growth of trees, snowflakes, brains or mind’. The application or extension of chaos theory to fields outside mathematics and the natural sciences – such as psychology – is a matter of dispute amongst some scientists, and Gell-Mann (1994) bemoaned what he regarded as the misuse or corruption of the concept of chaos by literary or popular culture. Nevertheless, there has been a gradual proliferation of studies in the psychological field applying chaos theory to the understanding of mental life, some using increasingly complex and sophisticated systems of data analysis deriving from nonlinear dynamical systems theory and chaos theory. These techniques of data analysis have the ability to identify ‘visible relationships’ in nonlinear systems to which ‘statistical analysis is blind’ (Smith, 2007).

Concepts such as iteration and recursion might provide ways of linking chaos theory with ideas such as ‘leitmotif’ and ‘signature’ referred to above. In mathematics, iteration refers to the repeated application of an equation or calculation (e.g. an algorithm), where the output of one step of the process becomes the input for the next; in computer science, it refers to the repeated application of a set of instructions, again each application acting on the output of the previous one. Recursion refers to a repeated process or operation that acts upon itself, or in a more general sense to the process of repeating objects in a self-similar way. These concepts may offer tools for the formal study of nonlinear variations of a recurrent theme or repeated dynamic in the clinical data from a psychotherapy case, in a way that does justice to the temporal characteristic of mental life highlighted by Klein.

In addition to articles in journals, two systematic attempts to apply chaos theory to the mind and to the process of psychotherapy – both, interestingly, from the United States – are Butz’s (1997) Chaos and Complexity: Implications for Psychological Theory and Practice and Marks-Tarlow’s (2008) Psyche’s Veil: Psychotherapy, Fractals and Complexity. Butz (1997: 2), a clinical psychologist and university academic, suggests that ‘Chaos and complexity theories represent the cutting edge of modern science,’ and he applies the concept of nonlinearity to notions of psychological growth and development, psychopathology, personality, the self and change. Marks-Tarlow (2008: 3), a practising psychotherapist in the United States and a Research Associate at the Institute of Fractal Research in Kassel, Germany, similarly argues that ‘Nonlinear dynamics represents the science of change.’ She makes links between chaos and complexity theory, neuroscience research, psychological and psychoanalytic models of the mind, development and change, and ‘coupled dynamics’ where two or more dynamical systems (e.g. two minds) ‘share the same underlying attractors’ (Marks-Tarlow, 2008: 58).
Within the field of literary studies, and more specifically in relation to the formal study of literary narrative, a number of writers would seem relevant. Rimmon-Kenan (1983: 16), in her analysis of narrative fiction, refers to the ways in which in literary narratives ‘events combine to create micro-sequences which in turn combine to create macro-sequences’ (original italics). Citing the semiotologist Bremond (1966), Rimmon-Kenan (1983: 23) discusses the concept of ‘embedding’, where ‘one sequence is inserted into another as a specification or detailing of one of its functions’, in effect articulating the property of recursion in narrative. Interestingly, she also discusses Bremond’s study of ‘bifurcation’ in literary narratives, as well as his idea of movements in narratives towards either ‘equilibrium’ or ‘disequilibrium’; bifurcation is an important concept in chaos theory related to phase-changes in the state of a dynamical system and to stages in the movement of a system towards chaos.

More recently, Parker (2007) has applied chaos theory to the study of narrative form in the novels of four novelists. In her introductory chapter ‘Chaos Theory and the Dynamics of Narrative’, Parker (2007: 27) elaborates the notion of ‘chaotic narratives’ and suggests that ‘Chaos theory ... enables us to reevaluate iterative sequences in texts’. She explores in particular the idea of strange attractors in narrative texts, and proposes that ‘[i]n the narrative text, the attracting point comprises motifs’ (2007: 28). Parker finds in the texts she analyses the property of ‘similarity across scale ... whereby structural similarities occur at both global and local levels’, and she links this with the ‘scaling ... often noted in fractal forms’ (2007: 39). In her discussion of Sterne’s Tristram Shandy, Parker (2007: 38) shows the way in which ‘the text serves as an implicit demonstration of the fact that linear causality inadequately models the complex workings of the mind’.

Donald Spence, a psychoanalyst with an interest in links between psychoanalysis and narrative, has written about recursion in narrative and its relevance to mental life and clinical experience. In his article ‘Narrative Recursion’ (1987:188–9), Spence argues that ‘the recursive structure lies at the heart of much of our experience in ‘real life’ and at the heart of many significant clinical phenomena’. Spence discusses the connections between ‘repetition’, ‘pattern’, ‘theme and variations’, and the property of recursion. He suggests that in a ‘recursive narrative’, while ‘our first impression may be one of random change’, there is an ‘underlying principle which provides the repetitive pattern’, and this pattern is ‘strictly determined’ (1987: 190). Fascinatingly, Spence formulates the concept of the ‘recursive operator’ which can ‘completely determine the shape of the data’ (original italics) (Spence, 1987). Here, ‘the extent of transformation is defined by the underlying recursive operator’ (my italics). Spence makes no reference to chaos theory and gives no indication of being aware of the concept of the ‘strange attractor’, but his concept of the ‘recursive operator’ seems remarkably close to that of the ‘strange attractor’, including the way in which a strange attractor fully determines the possible trajectory (i.e. ‘extent of transformation’) of a dynamical system in state space.

Spence elucidates the ‘reasons why recursive narratives have a particular relevance to clinical observations’ (1987: 190). First, he points to the way in which ‘a recursive operator can generate a complex universe of data points’. Second, he makes the link between an ‘underlying recursive operator’ and ‘an unconscious phantasy or early memory’ (1987: 191). Third, he draws attention to the ‘resemblance between recursion and clinical repetition – in particular, repetition in the transference’ (Spence, 1987): the ‘variations on a ... theme’ that are observed in
the transference are, Spence argues, ‘not casual or quixotic but, quite the contrary, tightly controlled and overdetermined’ (Spence, 1987). Spence considers different types of recursion in the clinical setting, such as when ‘language becomes action [in the transference] and content becomes form’ (1987: 194); and he suggests that ‘[t]he transition from language to action is a special property of clinical recursion and one reason why the underlying operator . . . is often hard to identify’ (1987: 195).

Spence illustrates the action of a recursive operator in the clinical setting through a discussion of the role of interpretation in shaping the pattern of clinical data over time. Discussing the question of methodological validity in psychoanalytic interpretation, he argues that

the recursive operator and the opportunity for repeated confirmations is significantly more convincing than the more usual procedure of using the patient’s associations to validate an interpretation.

Spence (1987: 201)

Last, he speculates that

Future investigations of recursive narratives may well reveal typical time patterns which can be used to further support the assumption of an underlying recursive operator. (my emphasis)

Spence (1987: 202)

This brings me to the final question of the possible research applications of chaos theory and the study of deterministic nonlinear (chaotic) time patterns in relation to clinical material.

**Research applications**

... many—possibly most—actions that last over time are nonlinear

(Williams, 1997: 10)

... when working with the wrong model, we may ask the wrong question

(Smith, 2007: 157)

Smith (2007: 159) states that ‘our best models of the world are nonlinear’, that ‘chaos has changed the goal posts’ in science and that ‘[t]he study of chaos has provided new tools’ (2007: 160). How might chaos theory and these ‘new tools’ be used in research within the field of child psychotherapy? While conventional time series techniques and statistical methods of analysis have been used in research in child psychoanalysis or psychoanalytic child psychotherapy (e.g. Moran and Fonagy, 1987; Philips, 2009; Schneider et al., 2009), as far as I am aware nonlinear models and the ‘new tools’ derived from chaos and dynamical systems theory have not so far been employed. The lesson from chaos theory seems to be that statistical analysis and conventional time series techniques, while unquestionably useful in studying linear correlations and relationships, are unable to observe or identify nonlinear deterministic patterns, structures or chains of cause and effect. This means the assumption based on statistical analysis of linear patterns that ‘[i]f . . . two processes are uncorrelated, it is unlikely that they are causally connected’ (Moran
and Fonagy, 1987 [2009: 88]) proves to be incorrect in relation to nonlinear or chaotic processes.

Marks-Tarlow (personal communication) has suggested that methods of data analysis deriving from dynamical systems theory, chaos theory and complexity theory are particularly well suited to capture the temporal aspects of clinical experience, and more specifically the nonlinear recurrent themes and underlying ‘relational attractors’ that arise over time in the clinical setting. All of these are based on the use of complex and sophisticated mathematical approaches. Tschacher et al. (1998) used the concept of state space for an empirical study of order and pattern formation in psychotherapy. Dynamical systems theory has given rise to the development and use of state space grids (Lewis et al., 1999). A state space grid ‘incorporates time as a dimension of analysis’ (Hollenstein, 2007: 384), and involves the representation in two-dimensional grid form of high dimensional dynamical systems. In the field of developmental psychology, Lewis et al. (1999) used state space grids to study early infant socio-emotional development, and Hollenstein (2007) has reviewed the use of state space grids, and the associated concepts of attractors and phase transitions, in a number of other studies that analyse the process of infant and child development across time.

Another system of data analysis suited to nonlinear systems is recurrence plotting (Eckmann et al., 1987; Marwan, 2003; Marwan et al., 2007): this is an advanced system of nonlinear data analysis and involves a method of plotting ‘all the times when the phase space trajectory of the dynamical system visits roughly the same area in the phase space’ (www.recurrence-plot.tk). Cross recurrence plotting shows ‘all those times at which a state in one dynamical system occurs simultaneously in a second dynamical system’, and joint recurrence plotting shows ‘all those times at which a recurrence in one dynamical system occurs simultaneously with a recurrence in a second dynamical system’ (www.recurrence-plot.tk).

A more recently developed technique is orbital decomposition (Pincus, 2001; Pincus, in press). This is a complex mathematical method particularly suited to analysing patterns of change of state of a nonlinear system over time, by studying and coding recurrent patterns and variations in ‘strings’ of categorical data in a time series. Pincus and colleagues (Pincus, 2001; Pincus and Guastello, 2005; Pincus and Perez, 2006; Pincus et al., 2008) have applied this method of data analysis to the study of family and group dynamics, and more recently orbital decomposition has been used in other fields including a study of the physician–patient relationship with patients with uncontrolled diabetes (Katerndahl and Parchman, 2010), and also in a study of violence in human societies over time (Spohn, 2008).

These techniques of data analysis of nonlinear patterns and dynamics clearly require an in-depth knowledge of dynamical systems and chaos theory combined with specialist mathematical skills and knowledge. The application of chaos theory and use of such nonlinear data analysis techniques within the field of child psychotherapy research would require collaborative research projects that would bring together child psychotherapy clinicians and academics with the necessary knowledge and skills. This would obviously be a considerable practical challenge.

On another level, there is the question of how and whether such theories, approaches and techniques might be of relevance or use to the discipline of child psychotherapy and within child psychotherapy research. I think this is an open question, and my aim has been to raise this question and hopefully to have inspired an interest in others to explore this further. I believe the two case studies I have
discussed illustrate the common phenomenon of a *leitmotif* in, and primary organiser of, the clinical material and transference dynamics of sessions, and that the presence of these in a child’s therapy (and life) is a familiar phenomenon to clinicians. The patterns of recurrence of such leitmotifs would appear to go hand in hand with Spence’s (1987: 188–9) suggestion, quoted earlier, that ‘the recursive structure lies at the heart of much of our experience in ‘real life’ and at the heart of many significant clinical phenomena’. Schneider et al. (2009: 76) refer to the difficulty in research studies of identifying and capturing in data analysis ‘the mosaic of therapeutic patterns’ and the ‘myriad dynamics and nuances within sessions’. Authors who have employed techniques of data analysis deriving from dynamical systems theory and chaos theory have invariably concluded that the findings of their studies could not have been reached through conventional systems of data analysis. Within the field of child psychotherapy the case for a pluralistic research culture (Desmarais, 2007) and need for complementary research techniques (Carlberg, 2009; Philips, 2009; Schneider et al., 2009) have increasingly been highlighted. Chaos theory and the techniques of data analysis of nonlinear patterns and dynamics might provide new ways of endorsing existing knowledge within the field of psychoanalytic child psychotherapy; or they might conceivably reveal unexpected patterns, generate new hypotheses or introduce new questions.

**Summary**

In this article I have discussed the impact of the damaged object on the development and functioning of psychic life with particular reference to the sense of reality. I have highlighted the importance of the role of external reality in disconfirming phantasies of damage and destruction in the internal world, as emphasised in the theories of Klein and Winnicott. I have elucidated the problem that can arise in psychic functioning and development in a particular constellation of internal and external worlds, where the external world fails to disconfirm, and instead mirrors, phantasies of damage in the internal world, leading to a failure or collapse of the differentiation of internal and external worlds. I have argued that this is different from the confusion or conflation of internal and external worlds which is a consequence of excessive projective identification, and that in the clinical setting it is important for the therapist to distinguish between these and to keep this distinction in mind.

I have illustrated these themes with two in-depth case studies in which the damaged object seemed to be a primary organiser of mental life of the two children, and of the clinical material and transference dynamics. In both cases a central preoccupation for the child seemed to be that of damage, and in both children a core unconscious anxiety seemed to be the damaging effect of their destructiveness on their objects. Interestingly, both children used the same symbol for their destructive rage and the damage it causes in phantasy – namely, a ‘storm’. For Isaac and Jason, the external world failed to disconfirm their primitive phantasies of damaging their object, and instead an aspect or aspects of their external world (past and present) were felt to mirror or confirm these phantasies.

I have drawn on the scientific concept of the ‘strange attractor’ from chaos theory to characterise the way in which the damaged object can operate as a deterministic influence on psychic life and the relationship to reality when such a constellation of internal and external worlds occurs. I have discussed the relevance of chaos theory as a scientific paradigm concerned with nonlinear dynamics, patterns and relationships
of cause and effect; and I have argued, following Rustin (2001), that chaos theory is particularly suited to the psychoanalytic description and model of the mind, and to the study of the temporal dimension of psychic life. I have explored some possible links between psychoanalysis, chaos theory and the literary study of narrative. Finally, I have considered the possible application and use of chaos theory, and of dynamical systems theory techniques of data analysis suited to nonlinear processes and dynamics, within the field of child psychotherapy research.

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References


