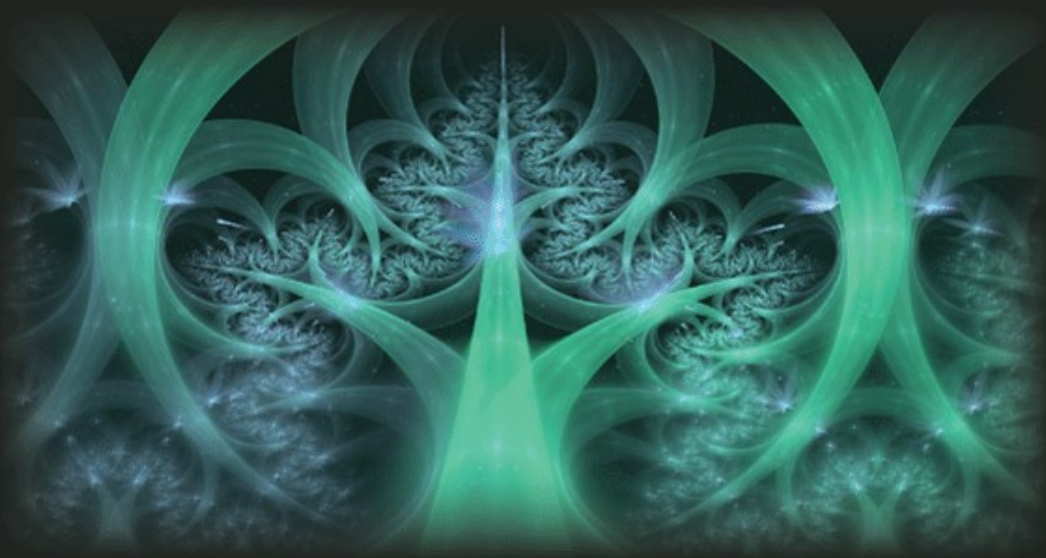
Dynamic Mathematics in Mental Experience



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Dimensions of Psychotherapy, Dimensions of Experience

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Created in the United States of America

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I: Complex numbers represent psychic object relations

David L Scharff and Hope Cooper

Derek, a shy 17-year-old, reported that for several months he had been almost unable to function. Everyday events such as an airplane flying overhead, a fire engine's siren or his mother picking him up two minutes late, brought panic. Derek's father, an accountant, had died a year earlier

from a heart attack. Derek had few school friends. His social contact consisted of playing Dungeons and Dragons weekly with older men. He said he was neither sad nor depressed and yet he presented with strikingly flat affect and an odd way of thinking that was creative yet mechanical. In his second year of treatment, Derek reported a dream:

> I was taking a Latin exam but it wasn't on Latin—it was on Dungeons and Dragons. There were 8 questions and we had to answer 3 of them. The first question was numbered 23 and the second 28. The third one didn't have a number, and after I'd finished

> it I realized I'd done the wrong question and didn't have time to go back and do the correct 3rd question. At one point I looked at my watch and it was 12:41. As I was doing the test I looked at the time at 12:52, 12:54, and 12:58. I woke up depressed because I had done the test wrong and it was something that I knew—I could have gotten it right.

Derek associated mainly to the numbers. An 8 made him think of the sign for infinity (∞), which is a sideways 8. He said that he'd always found 3 to be a difficult number, something incomplete. The numbers 23 and 28 were important in a video game he played—they had to be

divided by half in the game. He noticed that the 3 and the 8 were this time coupled with 2s. Derek said that the numbers sequencing 41/52/54/58 reminded him of a math problem that he often played in his head: somehow it ends up with 8, 4, 2, 1, 4, 2, 1 (4, 2, 1, repeat). This math problem has something to do with proving that a particular formula always works. Derek was testing it to see if he could find an integer that wouldn't work.

Derek said, 'I felt depressed because the problem was something I

knew. How could I get it wrong? I don't want to mess up. I should be good at math like my dad. He could do complicated math in his head, and he would try to teach me to do that. In physics I sometimes discover that I've done a problem wrong when I really know the answer. In physics class we're working on the principles of tension. Dealing with tension messes me up. I know I know the right answers. My father loved math and used to tell me he looked forward to helping me with physics, too, because

he was good at it in college … I don't want to be not doing physics right.'

Derek's dream provides a vivid example of the significance of numbers in the inner world and how they convey multiple meanings. It shows him using numbers to try to contain his own anxiety through mathematical skills that maintain the link to his lost father. The numbers help manage his inner tension and chaos that follow the loss of his idealized father. Perhaps the splintering of experience into chaos is

signified by the sideways 8 of infinity, a state that he feels inside as the threat of infinite confusion. He tries to bring the infinite quality of his loss and worry down to a more bearable, a more thinkable 3, but even 3 presents problems, as it feels to him so incomplete—and therefore linked to the infinity of his worries. He tries pairing 3s and 8s with 2 to make 23 and 28, but in the dream he gets everything wrong. None of his manipulations of numbers solve his inner problem. So he begins the math problem by checking the time,

something he often did during sessions, saying he does this to 'organize myself when things feel chaotic'. Numbers function to contain Derek. They become transitional objects that link him to a less threatening state of mind and to a reassuring identification with his mathematical father. His dream illustrates how numbers, particularly for some mathematically minded people, are an extraordinarily symbolic creation and a connection to reassuring relationships.

A NEW USE OF MATHEMATICS

Numbers and geometry can be used to represent mental and relational situations. In this chapter we want to see if we can make a range of complex psychological matters more susceptible to certain kinds of theoretical manipulation and understanding. We are following a tradition undertaken by Bion (1965, 1970) and Matte-Blanco (1975, 1988) to see how mental phenomena are organized like certain aspects of mathematics. Although psychoanalysis, family and group

therapy, use the numbers 1, 2, and 3, most psychological experience takes place beyond the simplified parameters of 1, 2, 3. Theory has yet to make much use of mathematics or geometry to represent, illuminate or explore complex ideas and dynamic relationships. Because numbers and mathematics contain an essence of experience that can be manipulated and juxtaposed with other symbols, they can be used to describe aspects of states of mind, reflective function, and projective identification. Numbers are currently part of psychodynamic

language as we attempt to represent the patterns of internal object relations abstracted from the specific characteristics of a particular person or introject. Closely allied with the numbers 1, 2, and 3, the concepts of 'self', 'couple' and 'oedipal triangle' are abstracted to discuss aspects of personal function and interaction. However, larger numbers rarely show up. An exception is the recent interest Bollas (see Chapter 13 in this volume) has shown in an expanded numerical dimensionality. We believe our discussion carries abstraction further

to allow easier manipulation of the patterns of individuals and group, both in external interaction and in internal psychic pattern.

While Freud did not deal directly with numbers, he did make important comments on the mathematics and dimensions of time and space. For instance:

> We approach the id with analogies: we call it chaos … It is filled with energy reaching it from the instincts, but it has no organization, produces no collective will … There is nothing in the id that could be compared with negation; and we perceive with surprise an exception to the

> philosophical theorem that space and time are necessary forms of our mental acts.
>
> (Freud 1923: 74)

Bion was preoccupied with the idea that mathematics could be of use in representing developmental and psychoanalytic ideas scientifically in order to present a more rigorous set of principles that could be followed and tested. He wrote, 'Mathematical formulation is not yet available to the psycho-analyst though there are suggestive possibilities' (Bion 1962: 51). After proposing the beginnings of

such a system, he added, ‘The scientific deductive system may be further abstracted to yield the equivalent of an algebraic calculus which would represent it’ (1962: 71).

As a first step in moving closer to these problems, we propose using complex numbers to represent internal object relations that contain the images of people in primary relationships that are internalized and split in relationship to parts of the self. Our use of numbers only begins to deal with the complexity of this situation

and of one person relating to others. Fairbairn's (1963) formulation of six basic parts of the self in dynamic flux also calls on us to invoke geometry to try to describe the complex dynamic interaction of parts of self and object in constant dynamic internal interaction. Ultimately, and far beyond the scope of this chapter, we could ask about mathematical representation of brain circuitry, and could wonder at what future point the complex algorithms of the mind might intersect with those of the brain. In the geometric arena psychoanalysis

currently uses only simple metaphors like ‘space in the mind’, ‘space for thinking’, potential or transitional space, distance and closeness, and the oedipal triangle in relationships.

A more dynamic use of geometry corresponds to the non-Euclidean geometry of fractals and fascinating patterns—called strange attractors—that emerge out of a dynamic system with apparent disorganization. Chaos theory, or theories of dynamical systems, helps understand numbers as part of systems in motion rather than

as static representations (Gleick 1987; see also Scharff and Scharff, Chapter 16 in this volume). Chaos theory studies alternations between pattern and disorder in dynamic systems characterized by continuous feedback and sensitivity to small differences in initial conditions. These are both characteristics of biological and psychological systems. Applying chaos theory lets us see that the small numbers and relatively simple geometric patterns we use in psychoanalysis to denote individuals in dyads and triads are limited

'fractals' of much larger systems—that is they are small, easily recognizable patterns embedded within the much larger and infinitely complex patterns of human interaction. This new field of fractal geometry enables us to see the importance of pattern similarity across different levels of magnitude in complex systems—for instance, the way an overly careful pattern in a minute of a patient's session is similar to the obsessional quality of his whole personality. A fractal is a representation of pattern on one order of scale (the moment of interaction in

the session) that bears similarity of pattern to other levels (the patient's personality).

To deal with these multiple dimensions, we will use what mathematicians term 'complex numbers' that exist on more than one axis. Small complex numbers stand for internal object constellations inside the mind in order to represent the multiplicity inside the individual and the way the individual is represented inside the many. We will deal first with the complexities of the multiple parts

of the self that are usually studied by object relations, and with the complexity of object relations involved in the simplified terms dyad and triad.

First a brief introduction to complex numbers. In mathematics, simple numbers fill the east-west axis from –infinity to +infinity. Complex numbers qualify the simple numbers by providing another dimension on the north-south axis that also runs from –infinity to +infinity. A complex number is mathematically written 3 +

$2i$, where 'i' originally stood mathematically for 'imaginary number'. Mathematicians no longer consider the complex number to be imaginary, so the use of 'i' is now only convention. From this perspective, simple numbers (e.g. 1 or 4) are a special case that really means $1 + 0i$, or $4 + 0i$. We have chosen to write our complex numbers differently, as 1^{+2} or 1^{-2}, and sometimes 1_{-2}, because it better fits with the idea that the complexity is inside or completely attached to the original number, representing internal object relations.

We do not mean to signify the mathematical action of squaring or multiplying the original number. We think of this notation as the equivalent of drawing a cartoon 'bubble' for speech or thoughts above a cartoon character. In our use, the superscript number represents an internal number carried in the mind as an organizing inner structure that has mental linkage to the person's representation of self. When we are representing the inner number of a group of 2, 3 or more persons, we want the superscript number (e.g. 2^{-1} or 3^{-2}) to represent

the group's shared unconscious treatment of one or more inner objects in their shared mentality.

SOME FUNDAMENTALS OF NUMBERS AS STATES OF MIND

Derek's dreams show how numbers represent states of mind and the ways in which numbers can be symbols or less developed concrete representations for mental operations and organization, for anxieties and defenses. Numbers convey bare bones of interior experience, part of the state of mind of a person or of each

participant in an interaction. More than one number would be needed to do justice to the complexity of a person's state of mind, of their potential mental states, or of two or more minds relating to each other. Here we are saying that the large number denotes the size of the group (one person, two, a group of three); the superscript denotes the mental attitude of the person or group to another single person or grouping in his or her or the group's unconsciously shared mind. (Although the notion of a group mind is a controversial idea in some

quarters, Bion (1961) and Foulkes (1965) suggest that elements of unconscious life permeate all intimately interacting groups, especially family groups. See, for instance, Hopper (2003a).)

The mathematical equations we construct have an arbitrary quality and could just as easily be written in several other forms or with other numbers because people are continually moving between differing internal equations all the time in a flux that could only be represented by a

dynamic mathematics like calculus. Here are some examples: We propose that a 1^{+1} can be used to denote a positive libidinal attachment to a single other; a 1^{-1} an aggressive link. The same applies to the inner orientation to groups of 2 or 3: a 1^{-2} denotes a person armed against the idea of an internal couple, while a 2^{-1} represents a couple that excludes a person. A 2^{-3} is a couple unconsciously armed against the idea of a group of three (for instance a couple unconsciously armed against an oedipal group), and 3^{-1} is a triad that

aggressively attacks one of its members or has trouble keeping that member in mind. In the current state of our usage, the whole configuration would then represent simply an internal number: 1^{3-1} represents a person who has an internal triad that attacks one member. This gray area—whether the large number is an external group or the group inside an individual—stems from the fact that a group can have a shared attitude that is in many respects like the mentality of a single individual, so that the notation can be used for either situation.

These notations give better *representation* of the internal links that Bion (1970) and others have discussed (Volkan 1981). By using these complex numbers more of the live dynamics of object relationships and the shifting states of mind in the inner world can be seen. For example, the self begins not just with the number 1, but also within the number 2 that stands for the dyad, the mother-baby couple; the individual selves of mother and baby contain the number 1 for each of them that must combine to produce a 2. Until the baby has

internalized an inner ‘2’, that is, experienced itself as separate from mother but linked to her, it cannot move into the experience of 3, even though the number 3 is implicitly there, all around the infant from the beginning. (See Chapter 11 in this volume for Poulton’s detailed discussion of the complexity of the numbers 1 and 2.)

Because complex numbers have a dimensional quality, they allow us to look inside internal objects to see how numbers are carried and internalized.

Thus, the mother's mind in the mother-baby dyad can be represented by parent + a child = 1^{+1} and also by 1^{-1} when the child is not only absent from her mind but the link to the child is through hatred – –H in Bion's system. Likewise with the triad: we could represent the couple with a child as 2^{+1} because the couple thinks of themselves as a dyad with the child in mind, but in another state of mind they could be represented as 3^{-1}, representing an interacting triad that, as a group, cannot keep the child in mind. In that moment, the parents have

'forgotten' or hate the child, and the child experiences herself as forgotten by them. However, the difference between hating and forgetting is a major issue, and for that reason we have considered the use of the number zero.

Even before 1, 2, or 3 is zero (0), a state of mind that the baby encounters —or at least risks encountering— because it is dependent on the mother to have a mind of its own. Although 0 is theoretically not completely achievable, nevertheless it is the state

that the self dreads from the beginning. Before birth there is a primitive encounter with zero—a relational one between mother and fetus, as the baby communicates with the mother through its movement and both may approach zero when the baby isn't moving. 'The most direct threat to the unborn child's physical survival is the danger of miscarriage' (Maiello 2001: 108).

The zero state of mind is something like psychic annihilation. Infant observation has shown the many ways

that babies hold themselves together so that they don't reach 0. This is also to say that the baby is doing relational mathematics—it knows the psychic difference between being held in the mother's mind (1^{+1}) or being hated even temporarily (1^{-1}). If the mother is suffering from depression and is unable to hold the baby in mind, the baby feels pushed towards a nothing state of mind (1^{0}). This experience is absorbed in numeric form into the baby's inner object world. The oscillation between these states of

mind can be represented by an equation:

$$1^{+1} \leftrightarrow 1^{-1} \leftrightarrow 1^{0}$$

This equation shows the mental transformations that occur in the movement between the infant's experience of feeling himself in an external relationship with mother who thinks about him, then is hatefully rejecting (carries the mental representation as -1) and then does not have him in mind and so he internalizes the experience of feeling forgotten by the mother (1^{0}). The

incorporation of a mother who is failing to contain by hating the baby—that is the mother who contains the 1^{-1} experience—may be a transient state, or may be a way station in a move by the infant to the point of experiencing himself as a 0.

SIGNS AND OPERATIONS

Numbers themselves carry primary and rudimentary meaning. Modifying complex numbers by the sign (+ or –) characterizes the libidinal attitude towards the internal object; a (+) sign is one of loving tie or affiliation—the

move towards the object; a (–) sign is one of hate or aggression—the move away from the object. *Other* mathematical operations can be used to indicate different mental operations. Division (/) is the factor that splits the wholeness of the object or its relatedness, and may tend towards splintering, fragmentation and aggregation (Hopper 2003b). The process of fragmentation can also be symbolized as $1/\infty = 1/a + 1/b + 1/c \ldots 1/\infty$, producing a sense of self that is so splintered that the person feels herself in bits, each of them equal to or

less than 1, with the most severe case being that of fragmentation into infinitely small bits—the effects of psychosis, trauma, multiplicity and of falling into pieces. 0 is a number denoting absence in the mind, but it is also a sign. In a simple way, multiplicity is an aggregate of the fragments produced by division. Multiplication (x) is the force that pushes towards merger, or an aggrandizement of self or object in slightly varying forms. For instance, the operation of multiplication that produces an aggrandized sense of the

self leads to a self that seems to be everywhere, swamping the object world. The state of grandiose multiplication of the sense of self can begin to be captured by $1 \times \infty = 1^{\infty}$ where the ∞ stands for the infinitization of experience (Matte-Blanco 1988). When we think of 0 as a sign (rather than as a number), it also has the effect of introducing an infinite quality of trauma or merger into the relationship between numbers or into the mental state. What should be clear by now is that mental operations can transform the meaning of an internal

object and its number. The change in sign from + to – can occur instantly, changing love to hate. The change from + to 0 instantly changes from love to an experience of the void. Paradoxically, the change from – to 0 also signifies the move to the void that happens at the moment a person feels forgotten by a person to whom they have a hateful link, but one that is nevertheless organizing to their sense of self. The interactions of relationships externally or unconsciously through projective identification and containment—

particularly its active element, reflective functioning—can all be thought of as ways we perform mathematical operations and change signs in the process.

Transformation of numbers overlaps with Bion's (1970) idea of the way that mutual projective identification results in containment—how the mother is able to receive from the baby its unbearable states of mind (–1 or 0) and digest them—transform them into something bearable for the infant through a projective

identification of +1. If the baby has cried for the mother and in the mother's absence the baby has moved into a –1 or 0 state of mind, the baby relies on the mother's mind to unconsciously transform –1 or 0 into +1. Then the baby also introjects the mother's capacity to transform numbers, which we can represent mathematically as giving the baby a state of mind that moves from $1^{-1} \leftrightarrow 1^{+1}$ or $1^{0} \leftrightarrow 1^{+1}$. When the baby introjects the container itself, we can represent this as $1^{-1} \rightarrow 1^{+1} \rightarrow 1^{(1+1)} =$

$2^{(+2)}$ An example describes this mental function in operation.

A small boy is in his mother's lap being read a bedtime story. His experience is of being held in his mother's mind. But then he feels angry with his mother because she tells him he must go to bed and leave Mommy and Daddy together. He tries to tear the book and then throws it. Mother yells at him, and carries him off to the bedroom. The child is now crying and feeling sad. The mother is able to process the angry experience they had

with each other and is then more able to offer the child comfort, so that the child can go to sleep.

The child began in his mother's lap with the (+) state of mind (+1, +2, and perhaps 3^{+1}), but this suddenly turned to (–) when he felt mother wanted to get rid of him (go to bed) or attacked him (go away to bed). Love changed to rejection or even hate. This was a difficult state of mind for the child to bear, because he loves and needs his loving mother, so he projects this angry, attacking, state of mind into his

mother, who enacts it by yelling at him and putting him to bed. The child is left feeling sad and abandoned (1^{-1}, 2^{-1}, 3^{-1}), approaching (0) if he fears his mother will forget him, but the mother is able to transform this back into + so that the child does not fragment (functions of [/] that would splinter the self) and can fall asleep. Both the child's capacity to project and the mother's capacity for containment through projective identification (to receive and digest the projections through reflective understanding of the child's fears) are part of how signs

change, and change again as they move back and forth between mother and child, and as they move dynamically inside both the mother's mind and the child's mind.

THE NUMBER ZERO AND NOTHING STATES OF MIND

Zero is not only a sign, but also is a number that denotes a state of mind without a sign. It signifies the idea of an emotional black hole—a number void of a sign, which makes it all the more powerful. Zero is symbolic of a state of mind that might signify

psychic death, an experience of being dropped, or a retreat from the pain of relating—a state that pulls all the other numerical possibilities into its own bottomless mental pit. The nothing state of mind is the feeling and fear that one no longer exists (Mitchell 2000). Prolonged periods of 0 can lead to a massive withdrawal, as in psychosis or autism, but we all have at least momentary experiences with 0 throughout our lives.

An observer watched 12-week-old Mary retreat into a nothing state of

mind in reaction to her mother's inability to identify with her and maintain emotional contact with two children. The mother was giving the baby a bottle. Older brother Tom approached and began sticking a pacifier in the baby's mouth. [A (-1) state of mind in each of the children.] The mother told him to stop. Tom pushed harder until the nipple of the bottle was forced out of Mary's mouth. The mother took out the pacifier and put the bottle back in Mary's mouth. Tom then hit the bottle. The mother told him to stop. He hit the baby's arm.

Mother told him to go away. Milk dribbled out of Mary's mouth (a 0 state of mind for the baby, a 1^{-1} for Tom.) Mother tried again to feed but milk continued to dribble out. Mother sat Mary on her lap, with Mary's back to mother's stomach. Mary's eyes were glassy and she stared straight ahead, not looking at anything in particular. The she begin to rock, back and forth, against mother's stomach, still staring straight ahead. This is not an autistic baby, but in that particular moment she felt unprotected and dropped from the mother's mind—so one might say she

protectively moved into an autistic or nothing state of mind, seen in the staring at nothing and rocking movement that kept her away from the pain of having been ‘forgotten’. The autistic rocking reaffirms her body as a somatic defense against feeling the pull towards 0. Ultimately, the mother was able to ‘retrieve’ baby Mary (Alvarez 1992) and they could once again be in contact, so that this state of mind did not get frozen in time—although scenes like this were repeated and probably did reinforce a 0 state of mind as one position for Mary.

FAMILY NUMBERS

We now turn to a consideration of how numbers can help us think about the family. Most of us do not grow up as an only child, the only family situation for which the number 3 might be adequate. (In the next chapter we will consider the problem of numbers greater than 3. See also Bollas, Chapter 13 in this volume.) We need a way to think about how the child's state of mind shifts in relation to the numbers in the family. For example, the birth of a sibling confronts the child with the dreaded possibility of

being pushed aside or forgotten—that is to say, towards the 0 state of mind. A sibling changes all the relational mathematics in the family. In the child's mind 3 + 1 does not only equal 4; it also equals a complex variant of 3. The 3 might be the family as it was before the birth of the second child, signifying that the child's aggression has killed off the new baby; or it could be the parents and the new baby—the new baby taking the place of the older child and pushing him out of the mother's mind. The new baby may confront this problem right from the

beginning, being –1 or 0 in the parent's or parental couple's mind. Multiplication and division may also feature in each child's attempt to find a place in the complex interactions of the family if the child feels fragmented in the interaction with family members or infused with a multiplying grandiosity of self or object.

Let us go back to the earlier observation material: Mary was born into a family in which her 2½-year-old brother, Tom, never ceded her a place. The observer (HC) who visited the

family weekly could see that Mary had to fight for space next to mother and in mother's mind. When Mary failed to attract mother's attention, she slid toward a nothing (0) state of mind, as a degradation product from the hatred of 1^{-1}, or 2^{-1}, or 3^{-1} or it could be $1^{(0 \leftrightarrow -1)}$ —meaning there is an oscillation between a sense of 0 and of –1 in her mind—depending on whether our focus is on her as an individual, a member of the dyad with mother or with her brother, or a member of a triad of all three of them, and depending on whether the experience

is being excluded from mind through hate (–) or through absence of mind (0). When we consider the addition of father, or an observer or therapist, to this family group, the math has to hold another level of complexity. From the point of view of the observer trying to hold the whole situation in her mind, the situation might alternate between two or more representations as mother and Tom oscillate between excluding and admitting Mary to their emotional group:

$$3 \leftrightarrow 3^{-1} \leftrightarrow 2^{-1} \leftrightarrow 2^{+1}$$

Another situation we can now represent is the way an internal object is itself complex. For instance, baby Mary introjects her mother's mind, which itself has complex numbers that signify its state. We might think that Mary's –1 also contains mother's history, so that the –1 should contain the complexities of mother's split internal objects. We might say Mary introjects her mother to produce a number like:

$$1^{1(-2)}$$

This signifies that Mary now contains her mother's mind or mental state that itself also contains an attack on pairing or on the possibility of forming a couple. Numbers can be used to represent Mary internalizing mother's mind as it attacks the possibility that they can be an emotional couple, the baby's processing of that attack, and the group of three participating in this phenomenon. The entire area written in superscript is an introjection of a complex experience within this family subgroup, since the father did not participate in the observation. The

observation would have been even more complex if he had been there, or even if we could represent the action of his representation in the mental states of the three who were there.

It is also possible that our notation could be done with letters with more clarity than numbers, a more algebraic form of notation. In this way each letter stands for an individual. Person A has person B in mind represented by a small b as an internal object. A^{b} represents A's positive libidinal view of B. A^{-b} is the negative, aggressive

internalization. AB^{-c} would mean the dyad of A and B attacks the link to C. If we want to signify that Mary contains her mother's mind or mental state that itself also contains an attack on pairing or on the possibility of forming a couple, we might represent this with algebraic notation where B is Mary and a is her mother's mind, b is the internal object for Mary's self. This would give the notation:

$$B^{a(-ab)}$$

This represents the way Mary has internalized her mother's hatred of the

two of them as a couple. ABC^{-c} is the family triad that unconsciously attacks the idea that its member C should play a role in the minds of the three as a group.

THE CONTRIBUTION OF MATHEMATICAL REPRESENTATIONS

It becomes obvious that the complexity even of simple situations exceeds our capacity for representation. What, then, can a system of mathematical representations contribute to our potential for understanding states of

mind and internal dynamics, since the first thing we note is that using mathematical notation tells us less about an interaction than a verbal description? The answer lies in the way that all research notation or classification simplifies complex phenomena in order to isolate the field of observation and increase understanding of small parts of complex systems. We believe that mathematical representation of mental states denotes a configuration of internal objects in relation to the self, an internal form of structure in mental

space that has a life of its own apart from the specific qualities of particular internal objects at a specific moment. Numbers or algebraic representation show something beyond the verbal description of experience in signifying a relational configuration that itself organizes the mind and that can move from one internal object participating in this configuration to another that is recruited to take part in an internal structure. These numbers have dimension like the north-south dimension of mathematical complex numbers, except that here it is an

internal dimension. Sometimes these configurations come and go, representing momentary positions of mind. But when they are traumatically introjected, they form what Bollas (1999: 113) has called 'interjects', encapsulated enduring configurations that represent more or less permanent anti-relational numbers that disrupt normal mental flow. In marking certain mental space as no-go areas, they are akin to the way a space-occupying lesion in the body is impenetrable to healthy physiological processes.

CONCLUSION

We began this chapter with Derek, whose dream used numbers to try to find a formula that would order the chaos of his loss of a mathematical father. He sought a reassuring mental pattern that could come out right when so much had gone wrong for him with his father's death.

A week later, Derek reported another dream. 'I was watching what seemed to be a real scene but it was a fight calculated by numbers—the way you play Dungeons and Dragons. The

numbers were appearing around the people and the people moved according to the numbers. The two people fighting were Andre and John from my volleyball team. They each had a sword. I woke up before the fight ended.'

Derek began to give associations. About the people in the dream, he said, 'Andre is the captain of the volleyball team. He's the best player but he can explode. He really gets angry. John just joined the team. He's quiet and

nervous. He substitutes for Andre's position.'

Then, without being asked, he talked about the numbers. 'It's like the numbers are a third person in the fight. Maybe numbers represent logic because with numbers you always get the right answer. They will always be right. I've always liked adding and multiplying better than subtracting and dividing. Adding and multiplying—you get normal answers. But with subtracting and dividing you get strange things—remainders and

negative numbers. It's not neat. Plato says there are three parts of the mind —spirit, desire, and logic. Logic keeps the other two in check. Numbers are like logic because they make things consistent.'

Derek's dream centers on a two-person contest that is presumably about two parts of him in conflict—the part that threatens to explode angrily and the quiet, nervous part. They are circled by numbers that represent a containing third person abstracted into the force of logic that might be able to

keep the conflict from doing damage to one or the other part of his internal. Here the numbers, which we have been discussing as representing internal states of mind concerning relationships, become characters of the dream, showing dynamically how Derek sees them as operating to keep his inner conflicts between warring parts of his personality in check. When he talks about liking the regularity of addition and multiplication he is speaking of the positive libidinal quality of his relationship to his objects. He dislikes the 'strange things'

that result from the negative forces of subtraction and division, the strangeness of the phenomena of loss of his father and the fragmentation of his family. We can speculate also that his numbers and the mathematical operations are representations of his relationship with the therapist to whom he entrusts this task. For Derek, the numbers are friendly, reliable inner characters that are more than abstractions. They are inner signposts to an ordering of his troubled mind.

Derek's propensity for bringing numbers to life has helped us to think about the role of mathematics in the organization of the psyche and of unconscious interaction. While he is unusual in this way, we believe he is able to tell us something about aspects of ordinary numerical organization of mind and interaction that are usually concealed by verbal logic and dream imagery. Patients with idiosyncratic styles of thinking can offer lessons in universal components of the human mind. For some mathematics is a passion: numbers speak to them and

they speak best in numbers. For others, numbers and geometry seem to be from another world. We hope that we have demonstrated that numbers are of us and in us. Often hidden, they are nevertheless fundamental parts of our organization and functioning. Learning how this is so can increase our overall understanding of the human condition.

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II: Numbers in motion, a dynamic geography of time and space

David E. Scharff and Hope Cooper

In our first chapter on numbers in psychoanalysis, we developed the supposition that numbers could be used in new ways to symbolize configurations of internal objects, links to objects, attacks on links and reparative efforts in the mind. We illustrated this through the case of an

adolescent and his dreams, and through the example of the shared mentality of a small family group with two children.

In this chapter we explore an expanded use of mathematical notation by moving into the domain of non-Euclidean geometry, Matte-Blanco's exploration of the unconscious as infinite mathematical sets, and chaos theory, also called dynamical systems theory. We believe that such examination can provide a particularly

rich conceptualization of certain highly complex family systems.

SYMMETRIZATION AND THE PROBLEM OF HOLDING LARGE NUMBERS IN MIND

We want to deal with the fact that psychoanalytic theory has not yet found a way to consider numbers greater than 3. (An exception to this is a recent essay on numbers by Bollas (1999). See also his Chapter 13 in this volume.) Since life is mostly lived in the complexity of a world characterized by large numbers, it is striking that we have no math or

geometry for families with more than one child, or for other dynamic groups. To consider the family with several children, the dynamics of life among siblings, the extended family, the social group, society, and existence in the larger world, we need a capacity to consider large numbers. Freud (1923: 333) theorized the notion of a 'family complex', implying the idea of dynamic phenomena of sibling displacement, jealousy and rivalry in family groups, and the effect on the child of such group events. We have come to think that the human mind is

not well-equipped to consider large numbers psychologically. Perhaps 6 or 7 is the largest group size for which we can ‘hold in mind’ the individuals who make up the group. If this is true, what happens at this psychological limit? How do we consider the mathematics and geometry of ourselves as part of a larger world or of the vast universe?

While parents certainly consider the family as a group, they have difficulty holding 3 or 4 or 5 children in mind as individuals. In our earlier chapter we explored the way the internal object

relationships and unconscious group relationships of each family member are better represented as a set of changeable complex numbers. This allows us to represent the ways that links to others are carried as unconscious structure, often as a fixed, single integer, like, for example, the stereotypic '3' which refers to a triangular or the oedipal situation. The problem becomes even more difficult when we turn from small numbers to family numbers greater than 4 or 5.

We propose that understanding the dynamics of large numbers relies on different methods of mental processing than for relatively small numbers. Large numbers are understood on different orders of scale. When numbers get to a certain size—say 6 or 7—our minds have difficulty wrapping around them or keeping them in focus. Instead, we begin to see them as a group, no longer keeping the discrete qualities of each individual (or integer) in mind, because our minds become dominated by an experience of the group. We perform a particular kind of

mental operation which elides thinking of each discrete person: we use small numbers to stand for the whole group. This is similar to Bion's (1961) concept that one person in a small group stands for a quality of the whole group, for instance, the group's aggression or dependency. This idea—that the idea of the group overtakes representation of the individual—has a good deal in common with Matte-Blanco's (1975, 1988) theory of bi-logic thought (the simultaneous existence of two dominant modes of human thought), which posits

contrasting symmetric and asymmetric patterns in unconscious and conscious thought (Rayner 1995). In this system, the unconscious works principally by considering classes of things or experience, by finding sameness or symmetrization, instead of the differences or asymmetries that are predominantly the province of conscious and verbal thought. Affects, especially strong affects, tend to merge experience symmetrically. Matte-Blanco's idea of symmetrization of thought—that all members of a class are thought of by qualities they have in

common rather than as individuals with discrete qualities—helps understand the mental representation of a group by one of its members. It is virtually impossible to describe a group experience while being faithful to that of its individuals. The best one can do is to alternate between descriptions of the atmosphere (symmetrization) that organizes such a group, and the focus on individuals who embody certain aspects of the group experience. Focusing on one or two individuals might be a matter of asymmetric thought that discriminates

difference, but it may function to condense symmetric thought into the idea of the one person inside or outside the group who embodies it. This operation is accomplished by the right mind, by unconscious process, but the thinking is then often returned to the left mind where it is experienced as though thoroughly logical. Stereotyping of members of an entire group is another frequent result of symmetrization carried out by people outside that group.

Another feature in Matte-Blanco's description of symmetric thought is infinitization of experience, extending it as if forever—a common feature of unconscious thinking. Infinitization is also a feature of unconscious or psychotic thought in which a thought or event is treated as if it is always or completely true (see also Stadter's discussion of time-far experience, Chapter 2 in this volume). In the process, a part is treated as equivalent to the whole. Strong affects tend to infinitize. For example, a minor setback or failure makes someone feel

the whole world is bleak and will be so forever. Experiences in large groups have a tendency to infinitize. Anger in the group may be felt by a person that everyone hates her and that the affect stretches on forever as total, permanent and unalterable.

SYMMETRIZATION, GROUPS AND PROJECTIVE IDENTIFICATION

The idea of symmetrizing aspects of group experience is also embodied in Bion's (1961) description of unconscious group leadership where one person speaks for dependency or

aggression in the group, or two people pair to speak for the capacity of the group for libidinal combination. The small numbers, individuals, pairs, triads, come to embody the larger group. We think of groups, even relatively small family groups, in a similar way: one or two individuals stand for the common qualities that characterize the group, and this symmetrization of family experience is lived out psychologically by projective identification that unconsciously actualizes the shared mental activity of housing a group trait in one member.

For example, in a family characterized by pessimism, a parent may feel a son's poor grades doom him to failure in life forever. The tendency to think in and of groups in this way becomes even more marked when we try to comprehend very large groups of hundreds or thousands. Here, we use a different mental processes, thinking of the group as a conglomerate characterized by its common qualities; or we may enter what is essentially a confusional state that we then organize by the dynamics of chaos that defensively employ limited patterns of

understanding and small number situations to simplify complex large number, multidimensional situations.

A large family by its very numbers will have to confront the difficulty of holding the numbers 3, 4, 5 and 6 in mind, and by having varying subgroups present large combinations of numbers in interaction with each other. Often, one child will contain the anxiety about individual recognition given the overall size of the family. The following example shows how a family of six engaged in this process:

An 8½-year-old girl, Kelly, came with her family who had discovered she had written notes suggesting that she and a neighborhood boy repeat some genital activity. The girl was attempting to compensate for her loneliness and sense of being left out in the family that had been accentuated by the birth of a fourth daughter in the family eight months earlier. Because the older sisters were close and Kelly felt alone, Kelly was 'given' the baby who now slept in her room. Initially pleased, Kelly soon realized that a live baby interfered with her life. There was a history of loss in the family because of two moves that left everyone feeling bereft, and there had been many months in which the father had been away on extended business assignment. When Kelly was 5, her mother had to be rushed from the house in the middle of the night with a life-threatening ruptured ovarian

> cyst. In the family interview Kelly said tearfully, 'Mommy didn't say good-bye to me.' She was voicing a deficit in mothering felt by each member of the family (including the mother) that constituted a symmetrized group level experience.

In the notational terms we described in our earlier chapter (Chapter 14), this experience could be represented as an experience for the mother as 1^{-1} or 1^{0} and in the maternal internal object that all 6 members shared as 6^{-1}. A –1 symbolizes an individual experience of being attacked or neglected, and the '0' notation represents a pull to being nothing, to the void or black hole.

However, on this occasion, the whole group was experiencing symmetrization of the (–1 ↔ 0) mentality, that is $6^{-1\leftrightarrow 0}$, an unconsciously shared group affect and mentality. This notation signifies that the family group of six shared the attack which can either be seen as beginning as an attack on the mother and on her role, or as beginning as a group experience that then condenses onto the mother. Further, this shared experience had been treated by group projective identification, and through this process, put also into Kelly as a 1^{-}

$^{1} \leftrightarrow 1^{0}$ experience on behalf of the whole group. This represents oscillation between a mentality of being hated or neglected—moving towards annihilation. Kelly and her mother take turns expressing this individually and, through symmetrization, on behalf of the group. Then, again on behalf of the group, Kelly tries in a symptomatic way to effect a transformation by manufacturing a solution through premature sexual intimacy, living out the internalized number (2^{+1}) in a fantasy image of the parents giving

each other a sense of mothering through their sexual relationship. In trying to solve her own internal problem, she is also trying to help the family group through the return projective identification of a repaired group symmetrization.

This little girl's anguish communicated her anxiety in relation to the mind's capacity to hold numbers greater than 4 or 5, an unconscious awareness of the numbers and their impact in the psyche. This example also illustrates how there is a great

deal more than the classical oedipal triangle's number 3 at play, both in larger families and in individual internal worlds. Developmentally, perhaps the main thing about moving from home to school is the emergence into a world that is numerically chaotic, needing to be recorded and processed by a different mental capacity than the smaller numbers of the home. In developmental regression, we condense our understanding to the home's small numbers (and the mind's greater capacity to think asymmetrically with

small numbers) in order to make experience affectively comprehensible. The frequent failure to comprehend these larger numbers may trigger a confusional state, one that can lead to a regression to the small number state of mind. The struggle each person undergoes to wrap the mind around large numbers has the potential to lead to an enlarged capacity to hold new dimensions in mind, but it can also lead to regression to symmetric logic that distorts the group relational experience.

NUMBERS IN MOTION AND CHAOS THEORY

Building on our earlier studies of chaos theory and our previous chapter (Chapter 14) on complex numbers, we now propose that internal numbers are constantly on the move. Everyone is constantly moving psychically between differing internal equations in a flux that could only begin to be represented by a dynamic mathematics like calculus. A number is not a fixed thing in the mind, but a state of the moment, something that is here-and-gone. Therefore, (1) self, (2) the

couple dyad, and (3) the oedipal triangle are more like constellations to be used for internal orientation than they are fixed internal numbers. A number is not so much a thing in itself as it is an address of a mental phenomenon or organization, but only for a given moment in patterns that change constantly with time. Each person is a dynamic system whose internal numbers are in flux. Numerical or algebraic notation for the flux show different frozen frames during the flux. The number is an address for a point in the flux, as is a

single frame in a movie that shows individual moments of the larger pattern that ordinarily pass by too quickly for individual recognition. States of mind and the numbers and equations that represent them are on the move. The mind's capacity to organize and re-organize new object numbers is essential for adaptation and development. How open is the internal world? Is it able to take in new experiences and 're-group', as it were, to hold new sets of numbers in different relation to one another? Because numbers are in motion, they

are part of a system that safeguards the capacity for adaptation that is inherent in chaos (Gleick 1987).

When discussing numbers in motion, we can only describe them at certain points at which we catch them, points on the excursion of dynamic systems that form complex arcs that never precisely repeat but that produce patterns we can learn to recognize. But as soon as we recognize a pattern, things change again and we see something different at another moment. Numbers seen in this way

present essential paradox: they are not so much things-in-themselves, as they are themselves patterns that organize experience for the moment. Experience—a state of mind in movement—is captured as it materializes momentarily in a number, but the number itself is in flux. That flux to another numerical constellation signifies the change in the state of mind of the kind that characterizes transformations, and change of a kind that is stopped by trauma. It is only severely, even pathologically, limited individual and relational systems that

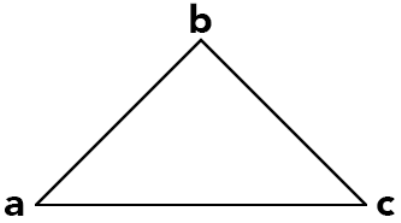
closely repeat. In health, individuals and relational groups have chaotic patterns that confer adaptive capacity to life's changing situations. People have to bear chaos, even as infants, to negotiate the vitality of relating. Part of development involves enlarging this capacity. Neither math nor language is fully adapted to the challenge of describing numbers, equations, and geometric patterns that are in movement, of taking into account the dynamic variability of living psychological systems.

This description has important implications for analytic thinking that emphasizes repetitions and re-enactments. We consider the ordinary repetitions of life—as shown in the recognizable pattern of character or the patterns of daily life—as *self-similar* repetition (characterized by the chaos theory term 'strange attractors'). These show recognizable pattern, but do not have the deadly or self-destructive *self-sameness* of those unchangeable elements we call the repetition compulsion or repeated enactments of neurotic behavior. (These are

characterized by the chaos theory term ‘limit cycle attractors’.) The *self-same* repetitions are repeated effects of mental organization of fixed internal numbers that do not have the adaptive flux of ordinary, adaptive mental life (Scharff and Scharff 1998).

Another intriguing feature of numbers is that they are essentially zero-dimensional points. They are a point, not even a line that makes full use of one dimension, lacking the two dimensions of drawings. On the other hand, the phenomena we are thinking

about are so complex that four dimensions are not enough to represent them. But mathematics can represent this problem (Matte-Blanco 1975). When a multidimensional situation has to be represented in only two or three dimensions, one must use duplication to show parts of the situation multiple times. We can illustrate this through the exercise of showing triangle 'abc'—a two-dimensional object—in one dimension.



To do so, we draw a line that represents the unfolded triangle, but we then have to repeat one of the points that represent the angles. Notice that point ‘a’ has to be shown twice to represent the unfolded triangle.

a_____b_____c_____a

The same idea of duplication applies to representing a three-dimensional object like a cube in two dimensions,

showing some lines more than once in the process. To represent the three-dimensional cube in two dimensions, each square side will be unfolded and be represented once, but some lines will appear more times, and each point is duplicated even more often (Matte-Blanco 1975). When it comes to representing four or more dimensions, these principles of duplication apply: a process or form in a higher dimension can be represented in fewer (say the two or three dimensions of a dream) by using processes of duplication to

represent the added complexity of the higher dimensions.

Now we move to a discussion of numbers in motion. Here we have to use geometry more than calculation, something that can show the motion of a point in many dimensions and over time. There are at least four dimensions of mental space as soon as time is invoked as the dimension through which three-dimensional things move. Therefore, representation will involve multiple duplication of the

kind dreams employ to show different aspects of the self over time.

Holograms can represent the idea that space and time are continuously folded into each other and that each point in space and time holds the representation of the entire universe. Negroponte (1995) described a hologram as containing all potential views of a scene which collects them into a single plane in patterns of light modulation. Constant movement is intrinsic to its pattern. Holograms give three-dimensional spatial form to non-

linear equations of dynamic systems that have the quality of similarity across orders of scale. Each part of the pattern contains the seeds of the whole pattern. Sutherland thought the hologram was an apt metaphor for representation of the self, an overarching, emergent organization in which any one part contains the potential of the whole (J. S. Scharff 1994; Scharff and Scharff, Chapter 16 in this volume; Gleick 1987). When we capture a fixed mental number or configuration, it contains the seeds of the rest of mental structure because it

is in motion and therefore relates to other points in the extremely complex pattern that is the whole of mental structure. Holograms can also be used to show structures that change over time, with alternating configurations that move and are in tension with each other; they evolve with time even while retaining pattern that contains earlier states of mind, in the way that evolving development contains condensed traces and patterns of earlier time.

TRANSFORMATION OF NUMBERS IN SPACE AND TIME

The two major organizers of thought into primary and secondary process thinking—the right- and left-brain, or right- and left-mind—process experience differently (Schore 2003a, 2003b). From Freud (1933) on, it has been understood that the quality of time is different in secondary process thought than in primary process—dream thought, creative condensation or psychosis. As we have seen, the geometry representing in three dimensions the complexity of dimensions greater than three involves multiple representations of the same

thing in the visual space, and this capacity is part of the way the right mind represents experience.

Freud wrote that there is no time in the unconscious and '…where it is possible, the dream work changes temporal relations into spatial ones and represents them as such' (1933: 26). We prefer to say that time is represented in the unconscious, but in the complex way that shows its role as a fourth dimension. When time is processed in the affective right brain, events from different times are

juxtaposed and overlap without *apparent* regard for the experience from which they are drawn having been at different periods in the person's life. The thought processes involve matching of qualities of experience, finding likenesses that span time, for instance through affect-matching. In another way, we might say that this process tells us a great deal about both the limits and the functions of time, about the likenesses the unconscious identifies that causes it to leap over time as a dimension that separates things. To put it another way,

time does exist as a crucial part of the thinking of the right mind, in the sense that it is addressed and illustrated in the limited experiential dimension available during dreaming. Time exists, but it exists as dimension differently from the way it does in left-mind's logical thought: it exists to join things across dimension, not merely to sequence them in secondary-process linear fashion. Time folds back on itself, creating the kind of fractal representation as in a hologram that has infinite internal dimension and that repeats on itself in order to create

meaning. (As discussed in Chapter 16 in this volume, fractals are patterns found in dynamic systems that are similar across different levels of scale. Fractal geometry is the study of such non-regular patterns produced by non-linear equations. See also Gleick (1987) and Scharff and Scharff (1998).) Time is an active factor and the possibility of superimposing time is precisely the point. That is to say, time is not disregarded, but seen as a multidimensional phenomenon requiring superimposition in order to be fully represented.

In the unconscious, following Freud and Matte-Blanco, the multiple dimensions of the unconscious exist simultaneously because that is the point of right-mind thought. All number representations exist simultaneously. Dream thinking superimposes these dimensions on each other. An event, a thing or a person shows up at several places in a dream to represent the multiple dimensions of experience of that event, thing or person in different situations and with differing affects in order to represent the multiple dimensions of

experience. In this way, events of differing linear time are 'purposely' superimposed in non-linear space in order to propose new arrangements and meanings.

EXAMPLES OF TRANSFORMATIONS IN SPACE AND TIME

> I (DES) dreamt of seeing my father passing at the foot of my bed silently while I was in a room where my brother slept in another bed. He was a young man, of perhaps 35. At the time of the dream, I was 38 or 39, older than the 35-year-old father I saw in the dream. In the associations, I realized that during the time of difficulty between us, he was younger than I was at the time of the dream. I had children who were older by then

> than I was in the dream. The configuration of the beds was like that of the beds in my parents' room, recalling an incident when I was 5 and had wandered into their room and stolen his cigarette lighter, which I used with my brother to start a fire while he slept, resulting in calling the fire department.

In this example, dream thought transposed at least three times in my individual life and the life of my family—my childhood at age 5, my father five years later (close to the time of my parents' separation and my difficulty with him) and myself in the present as dreamer. It also transposed space—my parents' bedroom and my

childhood bedroom that I shared with my brother, along with the bed in which I dreamt as an adult and the analytic couch on which I would certainly report the dream. In juxtaposing these elements of time and space, it became a 'dream that turns over a page' (Quinodoz 2002), because it permitted transformations in space and time. I could suddenly see that as a child I had attacked my father and my parents as a pair, and that the anger I felt coming from him was, at least in part, projective identification born out of my own youthful immaturity. The

point here is that the unconscious dream thoughts use time and space transposed in a moving hologram, using fractal geometry to create meaning, even though understanding that meaning also requires left-brain decoding.

All transformations of number occur in time and space. Numbers represent object relations patterns that move through mental space or do not have space to move or expand. The numbers acquire new patterns by repeating over time, by juxtaposing

processes of right- and left-mind, and by moving through different mental spaces. Numbers that have been constrained acquire, over time, new flexibility and the ability to exist in more than one form.

In the dream reported above, the numbers change as the images are folded, superimposed in differing time and space. The –2 of my relationship to my father, the +2 of my relationship to my mother, or the 3^{-1} of my vision of an oedipal struggle, is superimposed on a new +2 of the internal object

relationship with him, and that reconfigures the 3 with my mother, and many aspects of myself, from a 1^{-2} that had elements of intolerance for an internal couple to a 1^{+2} that is a more settled self-image. And there is also the pairing with my younger brother as a substitute +2, a factor that has been folded into the moving equation. The point here is that the transformation of numbers occurs by the folding of multiple dimensions of space and time in ways that make them interchangeable in order to create meaning.

Here is another example showing the action of time in psychotherapy. Alternating states of mind reflect the work of transformation, as can be seen moment-to-moment in a therapy session. In this example, time marks a slow transformation in the transference and the quality of object relations available to the patient. Time figures both in the details of sessions and in the larger-scale passage of time.

> A chronically depressed mother brought her 9-year-old daughter, Jenny, to therapy with me (HC). Mother said that her daughter follows her around like a shadow and cannot sleep unless she is in mother's bed.

> For the first year of therapy, Jenny carefully watches the clock and tells the therapist, usually with a deep, sad sigh, how much time is left in session. It never feels like enough. She looks at the calendar and counts how many days (the numbers taking on meaning) until her next session. After nearly two years of treatment, Jenny introduced something new near the end of sessions: she said that her stuffed animal would be calling one of the therapist's stuffed animals in the week between sessions. They will stay connected. But when there are only five minutes left Jenny becomes despondent and quiet; she asks whether there is another patient after her.

Jenny rarely experienced herself as being a +1 in her mother's mind. She needed to stay physically close to

mother to ensure that her mother did not forget her, so that she did not drop into the bottomless pit of her mother's depression. She feared becoming –1 or even '0' in her mother's psychological mathematics. Over time she began to feel held, a +1 in the therapist's mind: this transformation of numbers is expressed in the play of the stuffed animals in the space of the therapist's office, able to keep each other in mind (in mental space) as live numbers across time. The experience of '0', or –1 becoming +1, is also seen in how Jenny values her time in session, how

she wants more, and wants to know when she'll have it again. The separation at the end of the session shows how fragile this was for her, as the idea of another child who might push her out of the therapist's mind, brought her back to anxiety about –1 and 0. The numbers here are charged with meaning and affect and they are in a constant state of movement in the session and between sessions. Time and space are dimensions in the anxiety, in the change of mental state about number, and in the process of movement and transformation between

–1, 0 and +1. Jenny felt there was too little time for being held in mind or for transformation. As time passed with a steady place in the therapist's space and mind, she could experience the move from +1 to –1 with each week's separation, then form a conjunction of 1 + 1 = 2, let that go, reconfigure it so that an internal space moved from $1^{-1\leftrightarrow 0}$ to 1^{+1}, from 2^{-1} as an isolate without enough time, to 1^{+2} state of mind in interaction: $1^{+1} + 1^{+1} = 2^{+2}$. Now all of these numbers could coexist to overcome the separation of time.

ENCAPSULATED AND SATURATED NUMBERS

Numbers have versatility of form and meaning. Like all mental experience, they can be made to hold a range of qualities. In this section we briefly explore how numbers are useful in thinking about the nature of traumatic encapsulation and saturation. The unconscious juxtaposes numbers and experience across time so that numbers can move into new configurations, form new complex numbers by being combined or put into new sets. An encapsulation is

simply a constellation of numbers that cannot be in movement or in interaction with other numbers and therefore cannot be transformed or given meaning. It assumes the quality of a fixed mental object, and therefore becomes a limit-cycle attractor or even a fixed attractor—a focus of deadness and immobility in the mind (see Chapter 16 on chaos theory). Thus the number 1 as a fixed object does not allow new combinations into 2 or 3, or into a larger grouping, and even could shun becoming a complex, moving 1. There are other impediments to the

spontaneous capacity for recombination of numbers, but trauma may be the most severe.

> A middle-aged man sought therapy after the failure of his third marriage. In each case he precipitated divorce by having an affair. The man reported boyhood memories of hearing his parents argue late at night when they thought he was asleep. His father's affairs sent his mother into deep depressions. His inability to be in a couple (without enlisting a third) suggested that he may have encapsulated the number –2 to represent the warring, attacking parental couple. The encapsulation of this number was an organizing factor in his internal world and led to the pathological repetition—in this case, his parents' trauma and his traumatic experience of it.

This man kept trying to find a +2 experience, but has also carried other limit-cycle numbers: 2 ↔ –2 with his wives. He also has persistent use of 3^{-2} that attacks the possibility of +2. This number does not get transformed. It just gets repeated.

Bion's (1970) notion of saturated experience relates to the idea of encapsulation. A saturated experience ceases to have authentic meaning because it gets repeated and held on to in a way that drains its vitality. When this happens with a numbered

situation, the number may have the kind of magnetic, repeated pull (or in chaos theory terms, it functions as a basin of attraction) that this man's internal situation had—the repeated searching for a +2 situation that was saturated with –2, forming the fixed, self-same cycle that repetitively pulled his relationships towards self-destruction. When mourning occurs, the internal situation can once again become unsaturated and ready for a newly vital experience.

A 4-year-old boy would initially only allow me (HC) to communicate with

him via puppets: two on my hands and one on his. Lamb and Bear were to talk with Dog and could say anything they liked, but if they tried to address the boy directly he became violent and would attack the puppets. We might say that he only had room for three in his mind, the three puppets. After nine months of treatment, he began to allow there to be four or five of us into the room—the three puppets, the boy, and me. Dog would feed Lamb, Bear, and me a breakfast of pancakes and then the boy would talk with the four of us about the breakfast. The therapeutic space had the effect of creating more space in his mind for more complex numbers, and of course for people in new combinations of relationships.

In this example, we see the initial collapse of a capacity to number into

an encapsulation. The therapy allows expansion of mental capacity so that there is room for more numbers. It also promotes the fluid flow of numbers back and forth so that they can transform into one another given therapeutic opportunity and the dimension of the passage of time. Doing so also involves enlarging the inner space in which transformation occurs.

Movement of internal numbers creates the fractal internal geometry of mental space and the invisible

transitional geometry of interpersonal relations that is necessary for transformation and growth, and for the maintenance of normal vitality. In therapy, this occurs in the movement of the patient's or the family's static internal numbers that is brought about through the repeated passages through the mind of the therapist—that is through the matrix of transference and countertransference. The mind of the therapist has a multiplicity of number and geometry that is characterized by adaptive chaotic pattern, the ability to tolerate the projective identification of

saturated and encapsulated numbers into a more mobile space, as the therapist lets herself disorganize into creative confusion and chaos, and through tolerance of numerical rigidity alternating with confusion, to reorganize the geometry of the separate and shared internal worlds. Chaos—numbers, shapes and spaces without tangible order—alternates with order and pattern as new possibilities for number and geometric pattern emerge. The possibility of such creative transformation of numbers is the goal of our work.

CONCLUSION

Patterns of numbers and shapes express mental configurations. In the process of forming these patterns, the unconscious establishes similarity of emotional experience of object relations in numbered representations and geometric relationship and puts them next to each other in dreams or in the dream-like action of art and fantasy. The right-mind is built to make patterns in this way—to use symmetrization to create meaning. Numbers produce geometric shapes that are both a combination of points

on the plot of pattern and notations of pattern themselves, contributing to larger patterns that eventually become recognizable. These patterns do not disregard time or space. A dreamer has, in the background, a sense of the simultaneous presentation of two or more time frames, and of items from different spaces brought together to form a multidimensional juxtaposition. The right-mind does not so much disregard time to make new meaning as it juxtaposes events from different times in order to construct new multidimensional meaning about the

passage and non-passage of time in which events are similar but not exactly the same. It uses space in a similar multidimensional way, playing with space and spatial relationships to create new meaning.

Now we have a picture of moving numbers, points that make up the alternating holographs that are being constantly manufactured by the juxtaposition of right- and left-minds, of logic and affect in continual interaction, each making its own pattern. Then the dominant pattern

comes from the combination of the two, which, however, soon breaks down because it is inherently unstable, and therefore chaotic. Bion (1962) has likened this to the use of two eyes to create three-dimensional vision. Mathematically, the left, logical, linear brain does something like Euclidean geometry and simple math—squares, circles and triangle shapes, simple numbers and equations, straight-line reasoning and simple Freudian patterns. That simplification of pattern has great advantages in helping us to navigate the physical world, and to

impose understandable pattern on the emotional world where complexity exceeds our grasp. But the patterns of the right-mind are formed by non-Euclidean shapes and geometry, by complex numbers, by non-linear equations that begin with the entrainment of mother and infant's right brains in a vital pattern (Schore 2003a, 2003b) and produce the alternating confusion and pattern we see in modern psychoanalysis. With simple math and geometric thinking, we make the world more available for understanding and manipulation, but

we also rob it of its much-needed chaotic capacity for adaptation, and of much of the way its beauty reverberates across many dimensions. Having simplified it, we can put things into operation, but they have to be re-transformed into the more complex pattern in order to be given richer meaning, and this alternation between the two universes of organization goes on oscillating between the alternating holographs of discrimination and synthesis, reason and dream. To understand both modes of thinking we need both simple and complex

mathematics to plot the oscillation between order and chaos that generates meaning in our lives.

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