A (Cybernetic) Musing: The Boundaries of Distinction? The Distinction of Boundaries?

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In Australia, the men of the Aboriginal peoples go on walkabout. They take time out (often many months) to walk through the landscape—their landscape—to maintain and repopulate it with the stories that tell of the land, its formation, and of the relation of the land, the spirits and the animals, plants and sky, re-entering dreamtime, the time of creation. Each people has its own territory and each family has its own songlines, as they are sometimes called (Chatwin, 1987). Walking them maintains both the land and the people—and the relationship between the two. It's an ecological act, an act of mutual sustenance and well-being.

It is indeed an amazing experience to be taken by an Aboriginal man through his landscape, although it is far beyond my imagining to share even the tiniest part of his understanding and his cosmology. I make, as always, my own image.

I have come to believe it is hard to overestimate the importance of lines, in the way we live in our worlds. A metaphor I like is of bicycle wheels, which leave traces that are lines. In this image, we have a circular system, creating the trace of its interaction with its environment—a line. We see in lines: Although we look around us, we look in focussed cones relatively so thin that they may be thought of as lines. We distinguish one thing from another through lines that contain and exclude—boundaries. Looking back at my work I find a constant interest in lines and what they do, as boundaries, edges, distinctions, as having qualities of their own, when placed together, when closed and when crossing. That most thoughtful and intelligent of artists, Paul Klee (1953), explained that drawing was "talking a line for a walk."

These lines of our lives, which begin when we're born and end as we die, are, to us, without beginning or end. A colleague endlessly draws cones to explain his world, but I draw lines—lines in lines and so on; they seem to be my minimalist conceptual archetype. I have the feeling that if I could draw less than a line, I would. But I haven't found the way. So I find that lines, and their drawing, are of enormous importance.

I like to think of the lines that the Aboriginals walk as particular and explicit examples of the lines that we all walk (and which we can also be understood to inhabit, as we draw them), generating traces in and from our lives in two ways.

First, they divide space, creating within the one space two spaces, one on either side of the line (on occasion, a contained space, made by connecting the ends of the line together). The line distinguishes two spaces. We cross over the line, treating it as a boundary, an edge demarcating two distinct sides.

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Second, they have a presence of their own: They have quality. In the built form of a line, such as a road, that quality can include being habitable. We live in lines: Insofar as we leave a line as the trace of our living, we live in lines we draw (Glanville, 2000). And we often give these lines built form, providing permanence and presence (like a road). Lines are inhabitable, and, as we both draw them, and make them into spaces, they are themselves.[2]

In my last column, I explored aspects of this way of looking at and through lines, in particular, the way that this could lead to an understanding of architecture. I wrote about the architecture of the Maya as explicitly concerned with this sort of understanding. I mentioned George Spencer Brown's logic of distinctions, presented in his seminal book, *Laws of Form* (Spencer Brown, 1969).

I came to the notion of distinction (in Spencer Brown's sense), boundaries and edges (what Vincent Turner, 1986, came to call the liminal) through this interest in lines.[3] Hence, my fascination with certain contradictions that, I believe, appear in Spencer Brown's formulation, which I relate to this understanding of lines and of crossing or living in them. I have on occasion suggested that I would write about these contradictions. I do so now, knowing that I share this column with probably the world's leading authority on laws of form, [So you're saying he's an expert on the book as opposed to the concepts and expansions thereon? If you mean both, then lower case is the right form because that covers both concepts within the text and elaborations on those concepts. If you mean only the text, you might say: "world's leading authority on Spencer Brown's seminal text" The point is that if you want to use upper case it must be clear that you are referring to the text; this is ambiguous.] and that this short piece is a little island in the sea of Kauffman. And I remember Robin Robertson's (1999) outstanding beginner's Spencer Brown.

Let me start with a short overview.

George Spencer Brown published his *Laws of Form* in 1969 in the UK and in 1972 in the US. In fact, the 1969 edition was not the first: It was the first public edition. Spencer Brown published, privately, an imprint of his own in 1967 (the Introduction is specifically dated 1967).

Working for British Rail, Spencer Brown developed a logic for moving trains across tracks by setting the points (switches, in American), as he tells us in *Laws of Form*. In reference to this work, he cites the contribution of his twin brother, D. J. Spencer Brown. Gordon Pask, who knew Spencer Brown well (they both lived in Richmond-on-Thames on the outskirts of London) insisted they were the same person in different moods.

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2. A literary example: in *The Third Policeman*, the great Irish writer, Flan O'Brien (1967) attributes the assertion that there was no landscape before there were paths to his mad, fictional savant, de Selby. According to de Selby, then, it is the paths that make the landscape. In other words, it is our passage (and the trace that leaves in the form of a path: for instance. sheep runnels) that creates landscape—a very constructivist view!
3. My first publication on boundaries, what they contain, and their intersection and overlap, was in a student analysis of the edges of a town. In this, I already and independently explored—albeit naively—many of the insights that Spencer Brown develops in *Laws of Form* (Glanville, Hambury, & Woolston, 1967).

The *Laws of Form* was, at the time, considered a book of outstanding importance in the circles of those who made second-order cybernetics. It was published (publicly) and promoted through the efforts of Stafford Beer, who also reviewed the book in *Nature* (Beer, 1969).[4]

Spencer Brown's command "Draw a distinction" came close to becoming a mantra. It had an impact, in the form of what were renamed *boundary logics* by their authors, in AI and computing.[5] The book was admired, by cyberneticians, for what was taken to be its radical logic, a logic of becoming, of action (a logic that was not simply binary) as well as for its terse clarity. It was a sort of poem. Robertson points out that it attempted to provide both an algebra and an arithmetic, a way of working that had disappeared in modern logic and mathematics. And it has provided a constant source of magic, regeneration and play for many, primary amongst them (in my opinion) Lou Kauffman. According to Wikipedia, Spencer Brown is still (1 April, 2011) alive: see http://en.wikipedia.org/wiki/G._Spencer-Brown. There is an interesting compilation and commentary by Randall Whitaker at http://www.enolagaia.com/GSB.html which specifically links Spencer Brown to the work of Maturana and Varela on autopoiesis.

Presuppositions 1

At the heart of this column, then, is one work: George Spencer Brown's (1969) *Laws of Form*, which I consider a treatise on the line. For a long time,[6] I have been concerned with how to understand both the line and its relation to the notion of distinction that Spencer Brown introduced, and with certain contradictions that I believe appear in the way I understand Spencer Brown's formulation. Before I go into the detail of my arguments, I think it may help to list the difficulties I see, and to sketch my resolution of these difficulties.

In the central act of *Laws of Form*, Spencer Brown commands we draw a distinction that cleaves a space into an inside and outside. The mark of this distinction indicates its value.

The problems I struggle with are:

1. The space assumed
2. The implicit agent
3. The distinction between mark and value

I have come to the conclusion that a distinction cannot cleave a space, and that its value should not be distinct from its mark, that is, a distinction distinguishes (is) itself

4. Heinz von Foerster also reviewed it, in the *Whole Earth Catalogue* (Foerster,1972), which was published by Stewart Brand who, later, funded the publication of Foerster's massive "Cybernetics of Cybernetics" class book (Foerster, 1974).
5. E.g., William Bricken and Eric Gullichsen's work. See Bricken's recent review (2006).
6. My first publication concerned with some of these problems is Glanville (1979).

(Glanville, 1979). This resolves what I will argue are the chicken and egg problems of Spencer Brown's assumed piece of paper (space) upon which marks may be made (the unmarked cross), the problem of infinite regress that results from distinguishing the mark from what is contained inside the distinction, that is, what Spencer Brown calls the value[7] and the distinction from the distinguished of the distinguisher,[8] the mark and value of which are distinguished (according to Spencer Brown) in the drawing of the distinction. Thus, the distinction of my self as my own mark / value unity should appear to be both the primary and the ultimate distinction.

The contradictions I raise arise out of the presuppositions Spencer Brown makes. We all make presuppositions whatever we do. But in a work as stripped back and with such fundamental aims as Spencer Brown's, presuppositions are crucially important, even if they are often almost invisible.

You do not need to be a mathematician (or even a logician) to raise the points I do. I am most certainly not arguing with the logic Spencer Brown develops.

Presuppositions 2

Spencer Brown starts the *Laws of Form* with "A Note on the Mathematical Approach," beginning thus:

> The theme of this book is that a universe comes into being when a space is severed or taken apart. The skin of a living organism cuts off an outside from an inside. So does the circumference of a circle in a plane. By tracing the way we represent such a severance, we can begin to reconstruct, with an accuracy and coverage that appear almost uncanny, the basic forms underlying linguistic, mathematical, physical, and biological science, and can begin to see how the familiar laws of our own experience follow inexorably from the original act of severance. The act is itself already remembered, even if unconsciously, as our first attempt to distinguish different things in a world where, in the first place, the boundaries can be drawn anywhere we please. At this stage the universe cannot be distinguished from how we act upon it, and the world may seem like shifting sand beneath our feet. (Spencer Brown, 1969, p. v)

I include the whole paragraph because it exemplifies Spencer Brown's thinking. But my primary interest lies in the first sentence: that a universe comes into being when a space is severed or taken apart.

At the start of the main text, Spencer Brown writes

> 1
> THE FORM
> We take as given the idea of distinction and the idea of indication, and that we cannot make an indication without drawing a distinction. We take, therefore, the form of distinction for the form.
>
> Definition
> Distinction is perfect continence.

7. which Varela and I showed to generate formal re-entry in intenso and extenso (Glanville & Varela, 1980)
8. for, to whom else does Spencer Brown address his dictum "Draw a distinction"?

That is to say, a distinction is drawn by arranging a boundary with separate sides so that a point on one side cannot reach the other side without crossing the boundary. For example, in a plane space a circle draws a distinction.
Once a distinction is drawn, the spaces, states, or contents on each side of the boundary, being distinct, can be indicated.
There can be no distinction without motive, and there can be no motive unless contents are seen to differ in value.
If a content is of value, a name can be taken to indicate this value.
Thus the calling of the name can be identified with the value of the content.

Axiom 1. The law of calling
The value of a call made again is the value of the call.
That is to say, if a name is called and then is called again, the value indicated by the two calls taken together is the value indicated by one of them.
That is to say, for any name, to recall is to call.
Equally, if the content is of value, a motive or an intention or instruction to cross the boundary into the content can be taken to indicate this value.
Thus, also, the crossing of the boundary can be identified with the value of the content.

Axiom 2. The law of crossing
The value of a crossing made again is not the value of the crossing.
That is to say, if it is intended to cross a boundary and then it is intended to cross it again, the value indicated by the two intentions taken together is the value indicated by none of them.
That is to say, for any boundary, to recross is not to cross. (Spencer Brown, 1969, pp. 1-2)

This is the whole of chapter 1, and I quote it in full because it reports the key moves. But my examination rests, primarily, in the first part, up to Axiom 1. The text presents the basis of Spencer Brown's extraordinarily powerful and distilled thesis. As he says (again in "A Note on the Mathematical Approach"):

> Unlike more superficial forms of expertise, mathematics is a way of saying less and less about more and more. A mathematical text is thus not an end in itself, but a key to a world beyond the compass of ordinary description. (Spencer Brown, 1969, p. v)

And, again, I point to the first sentence, where Spencer Brown confirms his aim to produce the powerful and distilled. I include the second in homage to Lou Kauffman, who, it seems to me, treats us to his mathematical peregrinations within exactly this understanding.

Presuppositions 3

As I wrote above, there are, I believe—in the way that Spencer Brown sets up his argument—three assumptions he chooses not to fully recognise. These matter, because they both limit the universality and provide challenges, problems to be resolved.

To recapitulate, the three are:

1. The space assumed

2. The implicit agent
3. The distinction between mark and value

Let us look at these three, in the sequence in which they become apparent in Spencer Brown's text.

The Space Assumed

Spencer Brown states that a universe comes into being when a space is severed. As he says, "in a plane space a circle draws a distinction." That Spencer Brown assumes the space in which the distinction is drawn is clear in this quote from the start of chapter 2:

> **Construction**
> Draw a distinction.
>
> **Content**
> Call it the first distinction.
> Call the space in which it is drawn the space severed or cloven by the distinction.
> Call the parts of the space shaped by the severance or cleft the sides of the distinction or, alternatively, the spaces, states, or contents distinguished by the distinction. (Spencer Brown, 1969, p. 3)

Here, the critical concept lies in the way Spencer Brown refers to the space in which the (first) distinction is drawn, which, in my reading, implies this space already exists prior to the distinction universe coming into being, brought about by drawing the first distinction.

But, to come into being, the space itself (in which the first distinction is to be drawn) must be brought about by drawing distinction. So, for Spencer Brown's first distinction to be drawn, cleaving a space, there has to be a distinction already draw (bringing into being the space Spencer Brown asserts the first distinction cleaves), drawn before the first distinction. This is clearly impossible, and leads to an infinite regress of distinctions drawn to create the space in which the previous distinction can distinguish! Thus, the argument presupposes as a condition for its action (i.e., space) precisely that which is the outcome of that action (i.e., space). The act of origin requires that it is already in effect before the originating act. This is a paradox.

In other words, what first distinguished this first space within which (on which) distinctions can be drawn, so that (as Spencer Brown puts it) "a distinction is drawn by arranging a boundary with separate sides so that a point on one side cannot reach the other side without crossing the boundary" (Spencer Brown, 1969, p. 1)

The Implicit Agent

For all that there is a style of writing and presentation that omits agency popular particularly in mathematics and science, Spencer Brown clearly recognises the importance of the agent. Chapter 2 of *Laws of Form* begins with what must be the most famous line in the book, a line also used by Heinz von Foerster as the abstract /

motto/prologue to his paper "On Constructing a Reality": "Draw a distinction" (Spencer Brown, 1969, p. 3).

To whom is this command, written as an imperative, addressed? An implicit agent, a draughtsman, is being addressed. The agent must, at least in temporally conventional accounts, exist before the exhortation can be made, and before the act of drawing a distinction can be executed. How does this agent come into being? In a universe made of (consequent upon) drawing a distinction, the agent needs also to be distinguished in order that (s)he may draw a distinction. Yet the agent—an inhabitant of this universe—depends, for his/her existence, on a distinction being drawn. The problem is the same as the problem of the space. The agent must be assumed in order that the agent can be brought into existence (distinguished). For the first distinction to be drawn, the agent that draws the distinction must already be distinguished. This is a paradox.

The Distinction Between Mark and Value

Spencer Brown specifies that the boundary is two sided: he specifies an inside and an outside (which Robertson (1999), using the convention Spencer Brown introduces in chapter 11 (and the notes to chapter 2), shows by drawing a circle on a plane, to mark a distinction).[9] And he writes of the value indicated as distinct from the mark (of the distinction).

Then, once again, a similar problem arises: if we need a distinction to differentiate, what differentiates the mark of the distinction from its value? Surely, in Spencer Brown's universe, another distinction! Hence, to distinguish the mark of distinction from its value needs another distinction to be drawn *between* the two—that is, between the edge and the inside (the problem of edges). This continues ad infinitum. If mark and value are to be distinguished, there will be a chain of distinctions drawn, for every distinction between mark and value requires another distinction (also needing to have its mark and value distinguished by drawing another distinction) to be drawn. This is an infinite regress.

Some resolutions

There are ways out of these problems that derive from what appear to be Spencer Brown's presuppositions—ways that are closely connected—as are the problems themselves.

The Implicit Agent

Since this is a (second order) cybernetic journal, let us start with the problem of the implicit agent. The problem is that the agent is needed not only to draw the distinctions that bring others into being, but in order to draw its own distinction (to

9. Lou Kauffman often uses circles in his columns. And, as per the quotes above, Spencer Brown also, on occasion depicts a distinction with a circle.

distinguish itself) so that it can draw other distinctions. How can it exist to act, when its existence depends on the action having taken place?

One way of dealing with this, at least for the agent itself, is to change vocabulary. If distinction drawing brings both actor and action into being, together, in the drawing of a distinction, there is no problem of precedence. The problem can be understood as arising from the way we separate action and actor and require the actor to exist in order that the action takes place. The agent does not stand apart from the action: The action brings the actor into existence as the actor brings the action into being: There is a becoming.

This is the key move in my cybernetic doctorate (Glanville, 1975).[10] In that work, I argue that (in this case, in a universe of knowing) when I say, for instance:

"I know this."

I imply that the I of the sentence actually knows itself, for this is the entry requirement for a universe of knowing. Thus, the sentence should be rewritten:

"I know I know this."[11]

This strange move brings the implied agent into existence within and through the mechanism of the action, that is, both are brought into existence together. It also leads to the creation of time, when I insist that I cannot be both my own subject and my own object at one and the same time, betokening a switch in roles, from subject to object and back again.

When I invented this structural device, and its formulation as the opening move in my attempt to design a structure that allowed us to construct our own worlds in such a way that, while accepting we all understand and experience differently, we can act as though we understand and experience the same things, I was scarcely aware of more of the content of Spencer Brown's *Laws of Form* than the command "Draw a distinction." In devising a way out of my problem of the generation of subject (the self) I stumbled upon both a time generator, as Spencer Brown does in *Laws of Form*, and a way of resolving what I see as the problem of his implicit agent.

The Space Assumed

Now that we have an agent, we come to the other precondition that Spencer Brown seems not to have dealt with: the required space in which distinctions are drawn, which also allows Spencer Brown to call into being inside and outside, through the cleaving of a space.

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10. For some time, the editor has invited me to write about this cybernetic PhD in this journal. I have every intention of doing so, relatively soon.
11. There is another step that I insist on which is not, however relevant here—the symmetry of mutualism, that this also knows this. Thus: "I know I know this knows this." I should point out I am arguing a form, not animism or anthropomorphism!

One way we can deal with this is to talk of a distinction that does not cleave a space. In Spencer Brown's account, the space is divided into that which is inside and that which is outside the (mark of) the distinction because that mark creates a cleavage in the space in which it is drawn. Spencer Brown depicts this with a circle.

But there is an alternative to the circle: the Möbius strip. Unlike the circle, which has two sides and thus inside and outside, the Möbius strip has only one side: that is, it does not cleave a space into an in- and out-side. In fact, the Möbius strip does nothing to space, and in that sense does not need space at all. What it distinguishes is itself.

I would like to extend two points from this understanding.

First, when I say the Möbius strip distinguishes itself, I am giving a form to the implication that *I know I* which I discussed in the previous section. Although in my Ph.D. I chose another way of talking about these strange structures, which I called "Objects," they can also be depicted as Möbius strips. (However, the way I chose to represent them has turned out to be more powerful, at least to my way of thinking.)

Second, when viewed from above, the position of the outside observer looking down on "an objective reality"—that is, the ideal of the scientific observer which is the position Spencer Brown takes—what is observed is a type of space in which both circle and Möbius strip might exist: the space projected by the observer, that is at the heart of the argument in Abbott's (1884) *Flatland*.

In this observer space, we can imagine that it is almost impossible to see the difference between a circle and a Möbius strip: imagine that instead of a strip of paper, they were both made of thin thread! I will return to this distinction in a moment.

The Distinction Between Mark and Value

The suggestion that we think of the form of a distinction as being a Möbius strip, rather than a circle, also resolves our third presupposition problem. If the value is not inside, in a space cleaved by the mark of a distinction, where could it be? If, rather than the space cleaving circle we use a Möbius strip, there is no space inside, so there is only one place the value can be: on the mark. In fact, *on* may not be the right preposition. It is (the same as) the mark. The mark is the value, the value is the mark. If this is the case, there is no longer any problem distinguishing the mark from the value, no longer the problem of an infinite regress of distinctions, for the mark and the value are indistinguishable: they are the same. In this case, we think of distinctions as self-drawing. Thus, each distinction draws itself, it is its own agent, acts for, by and of itself: Each distinguishes itself.

We have a universe of the Ouroboros![12]

12. The ancient symbol of the Ouroboros has been used as a depiction of the circular form of second order cybernetic systems, especially in the "in-house" covers of Heinz von Foerster's papers.

This twisting pair of dragon-serpents eating each other's tails, designed by Pille Bunnell [?], is one of several Ouroboros type logos used by the American Society for Cybernetics over the past 20 or so years.

Summary

By replacing the image of the circle with the image of the Möbius strip, we resolve the presuppositional difficulties that I raised, although, in doing so, we may have lost some of the benefits we gain from the *Laws of Form*, for in most respects Spencer Brown's distinctions work exactly because a space is cleaved and there is an inside and an outside. Interestingly, however, Spencer Brown described a re-entrant form in chapter 11 of *Laws of Form*. Lou Kauffman has speculated on what he calls a very subversive form for the distinction: a Klein bottle (Kauffman, 1996). As the reader will know, a Klein bottle is an interpretation, in a three dimensional world, of the two dimensional world's Möbius strip.

There are advantages to both circle and Möbius strip as images for the distinction. They include the possibility of enrichment in understanding (when we understand the distinction as taking the form of a circle), which we might equate with the constant redrawing of the mark of the distinction, which could give us the sort of stability through recursion Foerster captured in his eigenforms (Foerster, 1977). This arises from crossing the distinction. But, equally (when we consider the distinction as through the image of a Möbius strip), we avoid this constant redrawing of the distinction by allowing that the distinction draws itself. In doing so, it does not cleave

a space. Thus it gains no value. This is the distinction as we live in it, the self, as seen by the self. Here we have boundaries,[13] lines, crossings, spatial experiences, and thick walls, as I discussed in my last column. And when we take on the *Flatland* metaphor, we find that the two, the distinction understood through a circular image, or image of a Möbius strip, are difficult to tell apart. In a follow up column I shall consider what it would mean for these two to be complements (to use a metaphor familiar from physics).

The circle is about crossing the distinction, that is, it is about boundaries and edges. The Möbius strip is about where we are, inhabiting the edge, being in and yet in-between, calling a name.[14]

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13. One group of people who pursued Spencer Brown's work developed what they liked to call boundary logics (used in computing) as their re-telling of *Laws of Form* (Bricken, 2006).
14. It is sometimes said that the commentary composed by one of the work of another says more about the one than the other. I shall not be surprised if readers believe what I have written about *Laws of Form* says more about me that Spencer Brown, even if that has not been my intention.