

LAWS OF FORM

**ALPHABETUM III
2019**



LAWS OF FORM

GEORGE SPENCER-BROWN

In collaboration with the Liverpool University
and the Laws of Form 50th Anniversary Conference.

Alphabetum III

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The *Yin and Yang* of G. Spencer Brown's *Laws of Form*

R. John Williams

I. Changing Consciousness

One evening in the fall of 1969, along the picturesque cliffs of Big Sur, California, media gadfly and *Whole Earth Catalog* editor, Stewart Brand, approached the neuro-physiologist and dolphin researcher, John C. Lilly, with a copy of a strange little book called *Laws of Form*. They had spent the weekend attending panels, meditating, and dropping acid at a recently established center named Esalen — one of several burgeoning hotspots of what had come to be known as the 'human potential movement'. Brand needed somebody to review the book, but thus far had had difficulty finding anyone who would dare take on the project. Brand didn't claim to really understand the book, but he did sense that it was more than a mere exercise in logic. Indeed, as he puzzled over its pages, it seemed to have some kind of occult power — a key, perhaps, for unlocking the doors of perception and entering the incandescent realms that he and so many others were seeking at Esalen and other centers for new age spirituality.

For the previous issue of *The Whole Earth Catalog*, Brand had asked solar-energy guru and eco-warrior Steve Baer to review it, but what Baer turned in was less than helpful (even as it confirmed Brand's intuition that the book offered something special). 'Jesus Christ,' Baer wrote, 'I'm not ready to review this book. Who the hell is? It merely starts over, remakes logic and mathematics from a different beginning, from the Tao's beginning of the prime distinction. It's too simple to grasp.' Brand went ahead and listed the book with Baer's non-review, on page 10, just above the *Tao Teh Ching (Dao De Jing)*, but he knew he needed something more.¹

What Brand wanted from Lilly was something substantive and clarifying, something that could help make sense of the book for his readers. Lilly, no doubt, seemed like a logical choice. He had already made a name for himself in neurophysiology, and, over the last decade, had ventured far beyond the realms of established science. He had gone from sticking electrodes in the brains of monkeys and dolphins and recording their brainwaves to immersing himself in sensory isolation tanks, taking LSD, hearing voices in the deep — even, he thought, the voices of alien Beings who transmitted messages to him during these trips. He had become convinced that if we could physically remove ourselves from the constant stream of sensory input that makes up our every waking experience, our minds could begin to engage in a form of self-exploration that would eventually render legible the 'programs' and 'metaprograms' that make up the states

¹ Steve Baer, 'Laws of Form', *Whole Earth Catalog* ed. by Stewart Brand (Menlo Park, CA: Portola Institute, 1969), page 10. For more on Baer's eco-friendly architectural innovations at the time Brand asked him to review the book, see Mike Davies, 'Exploring, Rehearsing, Delivering', in *Innovation in Architecture* ed. by Alan J. Brookes and Dominique Poole (London: Spon Press, 2004). Page 22 — 23.

of consciousness dictating our realities. Only by 'being here now' in the sensory deprivation tank, he thought, could we enter those transcendent realms outside of time. In short, he had been trained in logic and science, and was more than willing to test their limits. Perhaps he would review the book?

Lilly sensed immediately that it was an important text. He was excited by its extravagant claims — not only that it offered a novel mode of engaging Boolean algebra, but also got at something more primitive and grand. As the book announces in its opening pages:

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.²

The coming into being of the universe? Linguistics? Math? The physical and biological sciences? These were no small potatoes. The book was also sprinkled with puzzling epigraphs from the *Dao De Jing* (including a string of Chi-

² G. Spencer Brown, *Laws of Form* (London: George Allen and Unwin, LTD, 1969), p. v. It is worth mentioning that it is sometimes hard to know how to cite Spencer-Brown's name ('G' or 'George'? 'Spencer-Brown' [hyphen] or 'Spencer Brown' [no hyphen]), mainly because he himself altered how he wrote his name (and would change it entirely when it suited him, going by 'James', 'David', 'Maxwell', and others). Also adding to the confusion, the book itself went through several printings, with prefaces and appendixes being added in each. In this article, I will simply cite the relevant edition and spelling to the historical period I am referencing.

nese characters, offered without translation) and oblique references to psychoanalysis, archetypes, relativity, and analytical philosophy. Years later, in a pop historical account of the new age scene surrounding the book, journalist George Goodman remembered taking a copy of *Laws of Form* to some of his mathematician friends at the Institute for Advanced Study in Princeton. It was a 'nice exercise in Boolean algebra,' they responded, 'but what was all this about changing consciousness?'³

Changing consciousness. That was important in 1969 — a kind of key phrase for the flourishing new culture of spiritual seekers, many of whom were turning to forms of Eastern religiosity and mysticism, and John Lilly was right there at the forefront of it all. When he read the book that weekend at Esalen, however, like Steve Baer, he balked. 'I don't think I can write the review,' he confessed, 'and in fact, I know only one person in the United States, possibly in the world, capable of reviewing this book.'

That one person, he thought, was Heinz von Foerster, an Austrian American scientist with expertise in cybernetics and, at the time, head of the Biological Computer Laboratory at the University of Illinois at Urbana-Champaign. 'This book, *Laws of Form*, has everybody spinning,' Brand wrote to Von Foerster, 'Like, John Lilly has bought and given away 6 copies and keeps getting knocked into trance by material in the book. Our problem is that nobody will review it. Will you?' (Fig. 1, page 10).

When Von Foerster received his copy in the mail, he vaguely recognized the author's name 'G. Spencer Brown'. His friend Gordon Pask had sometimes referred to a 'crazy friend' of his by that name who lived nearby in

3 Adam Smith (George Goodman), *Powers of Mind* (New York: Ballantine, 1975). Page 297.

Richmond Surrey. Opening the book, he was immediately transfixed, even astonished, staying up long into the night reading it. His wife asked him, the next morning, if he'd stumbled onto a new book of jokes, saying, 'I heard you laughing all night'.

'No,' he replied, it was this book's 'funny logical somersaults,' leaving him 'totally enchanted and delighted'.⁴

What Brand wanted for his review, as he clarified in a follow-up message to Von Foerster, was an answer to the question, 'How is the book *useful*?' What, in other words, did the book *do*? Brand had plenty of people telling him it was a 'brilliant' and 'consciousness-raising' book, but what were the nuts-and-bolts of its arcane maneuvers? Von Foerster was comfortable moving among both technocrats and counterculturalists, and thus well-positioned for the task. He had extensive expertise in computation and cybernetics, was happy to go on hippie trips and Buddhist riffs, even if he was never a hardcore spiritualist or seeker of the paranormal (at least not to the degree that the crowd at Esalen was at the time). When his glowing review appeared in the next issue of the *Whole Earth Catalog*, the book's cosmological ambitions were front and center.⁵ The first line of his review, for instance, announces, with breathless exclamation: 'The laws of form have finally been written!' The 'ancient and primary mystery' that has haunted philosophy has now been 'resolved!' (Fig. 2, page 12).

4 Heinz von Foerster and Monika Silvia Broecker, *Part of the World: Fractals of Ethics — A Drama in Three Acts* (Urbana-Champaign, IL: Department of Electrical and Computer Engineering, University of Illinois at Urbana-Champaign, 2010). Page 269.

5 Heinz von Foerster review of *Laws of Form*, in *The Last Whole Earth Catalog*, ed. by Stewart Brand (Menlo Park, CA: Portola Institute, 1971). Page 12.

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MESSAGE

TO Dr.
Heinz Von Foerster

University of Illinois
Urbana, Illinois

DATE
27 Feb 70

This book, *Laws of Form*, has everybody spinning. Like John Lilly has bought and given away 6 copies and keeps getting knocked into trance by material in the book. Our problem is that nobody will review it.

Will you?

Stewart
Stewart Brand

IP OK, deadline
about Apr 1.

OK
HVF

REPLY

DATE 3/4/70

I will. Wonderful.

How many words? As many as

May I use the 4 simple tables

diagrams on pages 102 and is wor

103? Of course.

The book
a full page
we'll do it.

How is the book used
is the main question I have.

Cheers

Cheers

Stewart

Heinz Von Foerster

SIGNED

Fig. 1: Messages exchanged between Stewart Brand (Whole Earth Truck Store and Catalog, Santa Cruz, CA) and Dr. Heinz von Foerster (Biological Computer Lab), Feb. 25, 1970 - March 4, 1970; Heinz von Foerster Papers, University Archives, University of Illinois at Urbana-Champaign, Box 47, Series No. 11/6/26.

The review still puzzled many readers, most of whom were not familiar with the book's mathematical questions, let alone its ambitious answers. Von Foerster had laid out the book's basic claims, but did not offer any of the more helpful examples of notational self-reference that scholars of Spencer Brown's work would eventually develop to illustrate these ideas. Years later, for instance, the mathematician and early admirer of *Laws of Form*, Louis H. Kauffman (in an extremely clarifying expansion on the book's operations) put John H. Conway's 'look and say sequence' into conversation with Spencer Brown's system of notation.⁸ As Kauffman shows, take the following number sequence:

1
1 1
2 1
1 2 1 1
1 1 1 2 2 1
3 1 2 2 1 1
1 3 1 1 2 2 2 1

What would the next line be in this sequence of numbers? How to describe the relation among them? In this set, to think in terms of secondary mathematical operations (searching for patterns of addition, subtraction, multiplication, and so on), is to miss the trick. If, however,

⁸ For a description of Conway's 'look and say sequence', see Siobhan Roberts, *Genius at Play: The Curious Mind of John Horton Conway* (New York: Bloomsbury, 2015), page 76 — 77; and Louis H. Kauffman, 'Eigenform', delivered as the 'Heinz von Foerster Lecture on Cybernetics' in Vienna (November 2006), page. 22 — 23, published online at <https://www.univie.ac.at/constructivism/pub/hvf/papers/kauffman05eigenform.pdf>; for an earlier exploration of some of these ideas, see Louis H. Kauffman, 'Self-Reference and Recursive Forms', *Journal of Social and Biological Structures* 10 (1987). Page 53 — 72.

you read the numbers out loud, the organizing principle becomes suddenly legible:

one, one one, two ones, one two, one one ...

Each line of digits, in other words, *describes* the digits in the line above it — referencing elsewhere and performing its own place within the set at the same time. It's a 'recursive' system, such that each digit both refers and is referred to, generating a potentially endless sequence of self-reference. The genius of Spencer Brown's book, in this sense, was to have established the basic conditions for an expression to be able to 're-enter its own space' (and thus account for — by performing *within* its own space — the seemingly insoluble problems of paradoxical phrases like 'This sentence is not true'). Scale things up, throw in a 'memory function', and what begins in the book as a simple 'cross' \sqcap , eventually becomes, in Chapter 11, a symbolic notation that more than affirms the felicity of the book's proximity to the *Dao De Jing* as reviewed in Brand's *Whole Earth Catalog*:

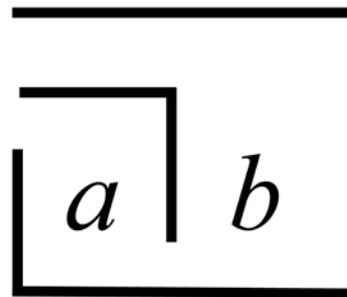


Fig. 3: Notation for expression of 're-entry' in *Laws of Form*, Chapter 11, 'Equations of the Second Degree'.

Readers of Von Foerster's review were quick to notice the similarity to Daoism's classic symbol, the *yin-yang*. When Buddhist scholar and cybernetic dabbler, Alan Watts, got ahold of the book, he reportedly jumped on a plane to England so that he could meet the author. The meeting apparently went smoothly enough that Watts came back to the west coast positively flushed with excitement at Spencer Brown's masterful breakthrough.⁹

He and the other countercultural spiritualists were all abuzz. Everyone was reading and talking about it, and yet, even with Von Foerster's review, a general sense that no one really *understood* the book seemed to hover over every reading. And who was this masterful guru anyway? This real-life creator of what Herman Hesse had called, in his fiction, the 'glass bead game' of logic and art?¹⁰ Back at Esalen, Watts began gathering a crowd, eager to learn more from its author. He incorporated a new institute he called the American University of Masters (or AUM, punning on the yogic chant, 'Om'), and began looking for donors. The leaders of the West's most innovative spiritual centers had found a new shaman, and they wanted to sit at his feet.

9 John C. and Antonietta Lilly, *The Dyadic Cyclone* (New York: Simon and Schuster, 1976). Page 178.

10 Stafford Beer wrote a poem in which he described Spencer Brown's work as fulfilling Hesse's prophetic vision: '...in a plane space make a mark / the world will follow from this / whose science is a glass bead game', in 'The Nth-1 Game', *Transit: Poems* (Wales: CWRW Press, 1977).

II. The Problem of Self-Reference

For those who actually knew G. Spencer Brown in England, the thought that he was on the cusp of ascending to mystical guruhood would have seemed rather odd. As an English scholar trained in analytical philosophy, Spencer Brown had been educated in the stuffiest halls of Oxford science — brushing up against the limits of language with Ludwig Wittgenstein, wandering through logic with Bertrand Russell, and puzzling over questions of statistical probability with a host of other scholars. In fact, in one of his first publications, in the prestigious journal *Nature* (1953), Spencer Brown had attacked, with devastating precision, the assumptions ostensibly grounding an experiment conducted by the Society for Psychical Research in England.¹¹ The authors of the experiment had concluded that statistical anomalies generated by a 'chance machine' provided evidence of 'psychokinetic' activity on the part of participating mediums, but, as Spencer Brown explained, the assumption that random series 'behave' in a certain way was itself a contradiction in terms — their evidence could not possibly match their claims.

Believers in telepathy and other paranormal activities (many of them fellow scientists in Cambridge and London) wrote a furious letter to the editor of *Nature*, exhorting readers to not be 'led by Mr. Spencer Brown's article' to conclude that there was any reason to doubt 'the validity of the experimental work of the past twenty years in establishing the reality of phenomena commonly referred to as extra-sensory perception'.¹² But the

11 G. Spencer Brown, 'Statistical Significance in Psychical Research', *Nature* 172 (Jul. 25, 1953). Page 154 — 156.

12 S.G. Soal, F.J.M. Stratton, and R.H. Trouless, Letter regarding 'Statistical Significance in Psychical Research', *Nature* 172 (Sept. 26, 1953). Page 594.

damage was done, and in a brilliant follow-up volume titled *Probability and Scientific Inference* (1957), Spencer Brown further demystified their approach.¹³ In a clever experiment, he selected a set of 'random numbers' from a volume published for statistical research (Figure 4) and discovered, lo and behold, that a number of seemingly 'significant' patterns — if one went looking — could be located within it.¹⁴ The real question, he argued, had to do with what one meant by the term 'random'. Would a list of digits seem 'random' if they consisted of a million consecutive zeros all printed out in a row? Certainly not. But if one were examining a much larger 'set' of numbers, one with, say, $10^{10,0007}$ digits (a ridiculously large number, somewhere on the order of the amount of books in Borges' imaginary Library of Babel¹⁵), then it would be surprising if one did *not* find a million zeros, all strung together somewhere in the list — in fact, Spencer Brown estimated, one could expect to find about ten such sets of a million consecutive zeros in such a list.¹⁶ The point, he argued, was that attempts to exploit 'random series' tended to 'lead all too frequently [to the] curious results which have been thought of in the past by psychical researchers to be evidence of telepathy and whatnot'.¹⁷

- 13 G. Spencer Brown, *Probability and Scientific Inference* (London, UK: Longmans, Green and Co., 1957).
 14 *Probability and Scientific Inference*. Page 117 — 120.
 15 As William Goldbloom Bloch calculates in *The Unimaginable Mathematics of Borges' Library of Babel* (New York: Oxford University Press, 2008), if our entire universe were completely full of nothing but books, it would still only be about 10^{84} books (page 19).
 16 *Probability and Scientific Inference*. Page 54 — 56.
 17 *Probability and Scientific Inference*. Page 117.

TABLE XXXIII. RANDOM NUMBERS (V)

28 89 65 87 08	13 50 63 04 23	25 47 57 91 13	52 62 24 19 94	91 67 48 57 10
30 29 43 65 42	78 66 28 55 80	47 46 41 90 08	55 98 78 10 70	49 92 15 12 07
95 74 62 60 53	51 57 32 22 27	12 72 72 27 77	44 67 32 23 13	67 95 07 76 30
01 85 54 96 72	66 86 65 64 60	56 59 75 36 75	46 44 33 63 71	54 50 06 44 75
10 91 46 96 86	19 83 52 47 53	65 00 51 93 51	30 80 05 19 29	56 23 27 19 03
05 33 18 08 51	51 78 57 26 17	34 87 96 23 95	89 99 93 39 79	11 28 94 15 52
04 43 13 37 00	79 68 96 26 60	70 39 83 66 56	62 03 55 86 57	77 55 33 62 62
05 85 40 25 24	73 52 93 70 50	48 21 47 74 63	17 27 27 51 26	35 96 29 00 45
84 90 90 65 77	63 99 25 69 02	09 04 03 35 78	19 79 95 07 21	02 84 48 51 97
28 55 53 09 48	86 28 30 02 35	71 30 32 06 47	93 74 21 86 33	49 90 21 69 74
89 83 40 69 80	97 96 47 59 97	56 33 24 87 36	17 18 16 90 46	75 27 28 52 13
73 20 96 05 68	93 41 69 96 07	97 50 81 79 59	42 37 13 81 83	92 42 85 04 31
10 89 07 76 21	40 24 74 36 42	40 33 04 46 24	35 63 02 31 61	34 59 43 36 96
91 50 27 78 37	06 06 16 25 98	17 78 80 36 85	26 41 77 63 37	71 63 94 94 33
03 45 44 66 88	97 81 26 03 89	39 46 67 21 17	98 10 39 33 15	61 63 00 25 92
89 41 58 91 63	65 99 59 97 84	90 14 79 61 55	56 16 88 87 60	32 15 99 67 43
13 43 00 97 26	16 91 21 32 41	60 22 66 72 17	31 85 33 69 07	68 49 20 47 29
71 71 00 51 72	62 03 89 26 32	35 27 99 18 25	78 12 03 09 70	50 93 19 35 56
19 28 15 00 41	92 27 73 40 38	11 05 75 16	98 81 99 37 29	92 20 32 39 67
56 38 30 92 30	45 51 94 69 04	00 84 14 36 37	95 66 39 01 09	21 68 40 95 79
39 27 52 89 11	00 81 06 28 48	12 08 05 75 26	03 35 63 05 77	13 81 20 67 58
73 13 28 58 01	05 06 42 24 07	60 60 29 99 93	72 93 78 04 36	25 76 01 54 03
81 60 84 51 57	12 68 46 55 89	60 09 71 87 89	70 81 10 95 91	83 79 68 20 66
05 62 98 07 85	07 79 26 69 61	67 85 72 37 41	85 79 76 48 23	61 58 87 08 05
62 97 16 29 18	52 16 16 23 56	62 95 80 97 63	32 25 34 03 36	48 84 60 37 65
31 13 63 21 08	16 01 92 58 21	48 79 74 73 72	08 64 80 91 38	07 28 66 61 59
97 38 35 34 19	89 84 05 34 47	88 09 31 54 88	97 96 86 01 69	46 13 95 65 96
32 11 78 33 82	51 99 98 44 39	12 75 10 60 36	80 66 39 94 97	42 36 31 16 59
81 99 13 37 05	08 12 60 39 23	61 73 84 89 18	26 02 04 37 95	96 18 69 06 30
45 74 00 03 05	69 99 47 26 52	48 06 30 00 18	03 30 28 55 59	66 10 71 44 05
11 84 13 69 01	88 91 28 79 50	71 42 14 96 55	98 59 96 01 36	88 77 90 45 59
14 66 12 87 22	59 45 27 08 51	85 64 23 85 41	64 72 08 59 44	67 98 36 65 56
40 25 67 87 82	84 27 17 30 37	48 69 49 02 58	98 02 50 58 11	95 39 06 35 63
44 48 97 49 43	65 45 53 41 07	14 83 46 74 11	76 66 63 60 08	90 54 33 65 84
41 94 54 06 57	48 28 01 83 84	09 11 21 91 73	97 28 44 74 06	22 30 95 69 72
07 12 15 58 84	93 18 31 83 45	54 52 62 29 91	53 58 54 66 05	47 19 63 92 75
64 27 90 43 52	18 26 32 96 83	50 58 45 27 57	14 96 39 64 85	73 87 96 76 23
80 71 86 41 03	45 62 63 40 88	35 69 34 10 94	32 22 52 04 74	69 63 21 83 41
27 06 08 09 92	26 22 59 28 27	38 58 22 14 79	24 32 12 38 42	33 56 90 92 57
54 68 97 20 54	33 26 74 03 30	74 22 19 13 48	30 28 01 92 49	58 61 52 27 03
02 92 65 68 99	05 53 15 26 70	04 69 22 64 07	04 73 25 74 82	78 35 22 21 88
83 52 57 78 62	98 61 70 48 22	68 50 64 55 75	42 70 32 09 60	58 70 61 43 97
82 82 76 31 33	85 13 41 38 10	16 47 61 43 77	83 27 19 70 41	34 78 77 60 25
38 61 34 09 49	04 41 66 09 76	20 50 73 40 95	24 77 95 73 20	47 42 80 61 03
01 01 11 88 38	03 10 16 82 24	39 58 20 12 39	82 77 02 18 88	33 11 49 15 16
21 66 14 38 28	54 08 18 07 04	92 17 63 36 75	33 14 11 11 78	97 30 53 62 38
32 29 30 69 59	68 50 33 31 47	15 64 88 75 27	04 51 41 61 96	86 62 93 66 71
04 59 21 65 47	39 90 89 86 77	46 86 86 88 86	50 09 13 24 91	54 80 67 78 66
38 64 50 07 36	56 50 45 94 25	48 28 48 30 51	60 73 73 03 87	68 47 37 10 84
48 33 50 83 53	59 77 64 59 90	58 92 62 50 18	93 09 45 89 06	13 26 98 86 29

Fig. 4: List of 'Random Numbers', in R.A. Fisher and F. Yates, *Statistical Tables For Biological, Agricultural, and Medical Research* (London, UK: Oliver and Boyd, 1938), page 86. Spencer Brown used these numbers to debunk assumptions about randomization made by researchers in 'extra-sensory perception'.

These were hardly the credulous musings one might expect from a new age mystic — especially compared to those of, say, C.G. Jung, whose rather uncritical fascination with psychic research (and particularly the work of J.B. Rhine's Parapsychology Lab at Duke University) set the philosophical stage for his entire theory of 'synchronicity' — a term that circulated with earnest zeal among the spiritual seekers at Esalen who were hoping to hear from the author of *Laws of Form*.¹⁸

Still, there were signs, even in the mid-1950s, that Spencer Brown was taking on more ambitious questions in epistemology and scientific inquiry. Near the beginning of *Probability and Scientific Inference*, for example, as he is teasing out some of the problems of induction (can a scientist conclude that his experiment proves a 'law' of nature or has he only ever demonstrated that x or y happens a certain way thus far?), Spencer Brown observes that eventually one might begin to wonder, 'why are there any worlds at all?'¹⁹ Why should there be this particular universe, that is, as opposed to some other?

'Let us try something', he suggests — a thought experiment: What sort of 'other' universe might we imagine if we still wanted it to have 'desirable properties'? First, it would be real (it being better to exist than to not); next, it would be 'neither morally nor aesthetically offensive'; and finally, 'we might like it to be symmetrical'. One way of 'answering all these descriptions', he writes, would be to imagine a 'universe with nothing at all in it'. Certainly, it would be inoffensive. And it would 'have the advantage of being highly symmetrical'. It would also be necessarily 'changeless, and therefore, presumably tremendous-

18 C.G. Jung, *Synchronicity: An Acausal Connecting Principle* (Princeton, NJ: Princeton University Press, 1973). Page 16 — 21.

19 *Probability and Scientific Inference*. Page 5.

ly real'. The only drawback, then, would be that in this nothing-universe, 'there would be no one to expect it, and this would interfere with its reality'. It would be a universe, in other words, that could never see itself — a universe without observation.

So, he continues, 'let us try another'. Imagine the inverse of the nothing-universe: the *everything*-universe. It would be just as symmetrical, of course, and made 'of heavy and stable construction, built to last, and, like the nothing-universe, containing no unreality'. The only problem, again, would be one of observation, 'the difficulty of distinguishing anything' from within the thick loaf of everything's everything. This lack of any possibility for self-reference, once more, registers a 'blemish' on our ideal universe. Perhaps this is why, he suggests, 'the universe we live in seems to be something between these two extremes ... rather like an everything-universe where, mercifully, we are prevented from noticing everything all at once'. Self-reference, in other words, is already contained in the primary fortuity of the possibility of *distinction* — and thus at the primal scene of our universe's very ground of Being.²⁰

One could certainly argue, then, that the most creative insights of *Laws of Form* (minus the Boolean algebraic extensions) were already in place for Spencer Brown by the mid-1950s. But, again, he was hardly in a personal or cultural position to promote them as a new metaphysics or a means of attaining 'higher consciousness'. Throughout most of the 1950s and early 1960s, he was basically just working in a number of careers, never really distinguishing himself in any of them (although he seems to have excelled at engineering problems). He experimented

20 *Probability and Scientific Inference*. Page 5 — 6.

in transistor circuit design²¹; patented a novel system for elevator button operation (elevators, one is reminded, used to require a human operator at all times)²²; invented a circuit that counted the wheels of a train as it entered and exited a tunnel (making sure, that is, that no cars were left dangerously inside for another train to smash into); and worked in publishing (a job that cyberneticist Stafford Beer got for him, though he doesn't seem to have done very well). All during this time, he was hardly a spiritual 'seeker', and seemed generally uninterested in the mysteries of metaphysical speculation.

At some point, however, in the mid-1960s a kind of break began happening in the mind of Spencer Brown. It is difficult to know exactly what triggered the transformation, or if it was simply a gradual disintegration. His brother DJ (also a brilliant mathematician) died, possibly by suicide, and his mother seems to have summarily cut both he and his brother out of her will.²³ He was also struggling with romantic relationships — at least one ended so badly that he wrote an embarrassing (and deeply sexist) screed against the woman and her family, publishing it eventually as a 'companion' piece to *Laws*

21 G. Spencer Brown, *Design with the Nor* (Crawley, UK: Mullard Equipment Limited, Technical Publications Department, 1961).

22 G. Spencer Brown, 'Lift Control System' and 'Lift Control Circuit Arrangement', British Patent Specifications 1006018, 1006019 (UK: Intellectual Property Office).

23 Many of these details are included in the first (and only) volume of Spencer-Brown's autobiography, *Autobiography: Volume 1: Infancy and Childhood* (Germany: Bohmeier Verlag, 2004), page 97 — 99. The book itself is a difficult read. The passages detailing his family life are shrill and vindictive; his descriptions of his own accomplishments and abilities are obviously exaggerated; his views on gender and sexuality are blatantly misogynist and homophobic; and his complete reversal into absolute credulity regarding telepathy and other magical thinking evidences a mind in serious decline. It is hard to fathom that its author is the same as that of the brilliant *Probability and Scientific Inference*.

of Form.²⁴ What is certain is that by the time he was drafting *Laws of Form*, Spencer Brown was undergoing extended psychiatric treatment, struggling terribly with various mental illnesses — paranoia at least, if not schizophrenia (as he speculated) and generalized anxiety. During this time, he became a patient of the famous psychiatrist R.D. Laing and spent some weeks at Kingsley Hall (Laing's anti-institutional experiment in which patients lived communally alongside therapists).²⁵ There, and in other sessions, Laing would administer LSD to Spencer Brown as they discussed his strained relationship with his mother, his failed love life, his emerging interest in Eastern mysticism, telepathic projection, and reincarnation, and his growing obsession with questions of memory and regression.

It is not difficult to see the parallels between the mechanisms of memory that haunt psychotherapy and the formal systems Spencer Brown was developing regarding 'self-reference' and 'recursion' (certainly the same could be said for the 'memories' of past lives in the doctrine of reincarnation). There is ample evidence in his letters to R.D. Laing that Spencer Brown was thinking in precisely these psychotherapeutic and Eastern mystical terms when he wrote the relevant chapters in *Laws of Form* on 'memory function' and 're-entry'. In one letter, for instance, he reflects on the 'shattering importance' of Laing's comment that 'regression is undertaken to undo repression' — a comment that, Spencer Brown writes, 'I should like to consider further, especially in relation to what I am doing in chapter 11 of *Laws of Form*'.²⁶ Two

24 James Keys (pseudonym for G. Spencer Brown), *Only Two Can Play This Game* (New York: The Julian Press, Inc., 1972).

25 For more on Kingsley Hall, see Zbigniew Kotowicz, *R.D. Laing and the Paths of Anti-Psychiatry* (New York: Routledge, 1997). Page 108 — 109.

26 Typed letter from G. Spencer Brown (signed as 'David' — one of several

days later, he wrote again, warmly, “You, as a psychiatrist are engaged in blessing people where they have been cursed. You take them back through time. ‘Show me,’ you say, ‘where the curse was sown’. And there you plant a blessing, which will grow up by the side of the curse, and intertwine with it, and neutralize it”. Just a few pages later, he comments on ‘the mystery I felt since my first LSD, when I watched the transformations of my right hand.’ Those transformations, he writes, felt like the ‘memories’ of someone else (perhaps a ‘carry-over from other existences’, or maybe even the transferred remembering of someone ‘actually alive today’).²⁷ Indeed, the project of *Laws of Form* was so deeply intertwined with his own psychological regression, it is tempting to speculate that what he saw in the symbolic notation for ‘re-entry’ in *Laws of Form* was as autobiographical as it was mathematical (is there a ‘G’ hiding there in reverse?).

pseudonyms he took during his life) to R.D. Laing (Apr. 14, 1967) on IPC Group Management Limited letterhead (publishing company where Stafford Beer had secured employment for Spencer Brown), page 1 — 2; University of Glasgow, Special Collections, Item MS Laing GB636-637. According to one of Laing’s colleagues with memories of their interaction, Laing had agreed to take on Spencer Brown as a patient in exchange for tutoring him in experimental mathematics (Leon Redler, email to author, Dec. 20, 2015). In a biography of his father, Adrian Laing remembers R.D. Laing ‘enjoying the intellectual stimulus’ generated by his ‘friendship with the mathematician and author David George Spencer-Brown’, unaware, apparently, that he was also his father’s patient; see Adrian Laing, *R.D. Laing: A Life* (Gloucestershire, UK: Sutton Publishing Limited, 2006). Page 19.

27 Handwritten letter from G. Spencer Brown to R.D. Laing (Apr. 16, 1967), page 30, 33 — 35. It is perhaps no surprise that Spencer Brown would eventually follow Laing down the kooky path of ‘rebirthing,’ arguing that only by ‘purging’ oneself of the trauma of childbirth (returning to the repressed memories of those early moments) could one finally achieve personal freedom. For more on Laing’s involvement in the rebirthing movement in the late 1970s, see Adrian Laing, *R.D. Laing: A Life*, page 201 — 205; and for Spencer-Brown’s convictions regarding the same methods, see his *Autobiography*, Vol. 1. Page 36 — 37.

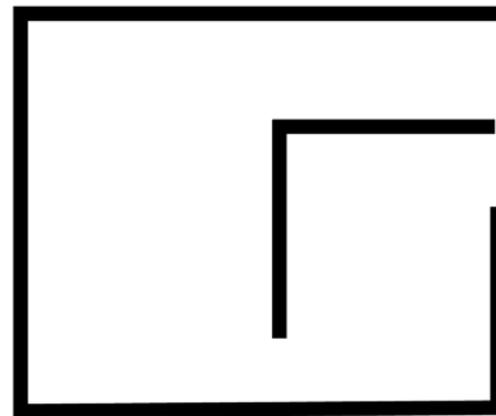


Fig. 5: Notation for ‘re-entry’ in *Laws of Form* (reversed by the author).

III. The American University of Masters

Given these professional and psychological complications, when Spencer Brown received Alan Watts' and John Lilly's official invitation to come to Esalen as a special guest of the newly established American University of Masters (AUM), he may have felt less than capable of performing the part of charismatic and peaceful shaman. He seems to have almost immediately regretted accepting the invitation, and came close to bowing out entirely.²⁸ When he did arrive, attendees remember him somewhat horrified by the jokey, laidback atmosphere (at Esalen, seminar attendees sit on the floor on pillows, the co-ed hot tubs are swimsuit-optional, and people generally laugh and express feelings with a breeziness that would have been completely out of place at Oxford). Recordings of the three-day event do not give much of a hint at how he seems to have been feeling (his voice is smooth and pleasant, if somewhat meandering and tentative), but there were attendees who saw through the façade.²⁹ Writing about the conference for *The Realist*,

28 Joan Tabernik, the administrative assistant coordinating Spencer Brown's visit, was forced to scramble, sending all of the conferees a letter just three weeks before the scheduled start of the conference, explaining, 'We regret that G. Spencer Brown may not, because of business and personal commitments, be able to attend this conference. If Mr. Brown does attend it will be for only a few days. Despite this change, the conference will proceed as planned, with the exception that it will only last through Sunday the 25th of March rather than the 28th of March. Drs. Lilly and Von Foerster will teach the 'Laws of Form' in Mr. Brown's absence.' It is certainly possible that this vacillation is why some of the luminaries invited to the conference did not come (including I.A. Richards at Cambridge, Willis Harman at SRI in Menlo Park, CA, and Theodore Roszak in Oakland, CA); see letter from Joan Tabernik to Heinz von Foerster, 'Dear Conferee,' (Mar. 9, 1973); Heinz von Foerster Papers, University of Illinois at Urbana-Champaign, University Archives, Series No. 11/6/26, Box 67.

29 I was able to digitize some of the old reel-to-reel tapes from the

for instance, Carole Levine kept a running diary of events, writing on March 19, 1973, 'G. Spencer Brown has arrived. He looks as if he died yesterday. He is drawn, tired and obviously terrified. He looks no one in the eye at breakfast. I [only] know he is answering *my* questions because the top of his head is pointed squarely in my direction.'³⁰ Still, once the official Q&A gets underway, she is impressed. 'He is obviously a brilliant and self-conscious mystic,' even if 'he appears to be talking about 'oneness' and 'unity' from behind a locked door. I feel a strong urge to hug him. I control the urge.'

That he would have expressed some reservations about speaking to an audience of, as he put it, 'so many and so many different qualifications' made sense. The list of those who actually attended reads like a who's who of hip sixties scholarship, including not only John and Toni Lilly, Alan Watts, and Heinz von Foerster, but also Gregory and Lois Bateson, Ram Dass, Stewart Brand, Loraine King, Kurt von Meier, John Brockman, Karl Pribram, and a dozen or so other scholars, psychotherapists, reporters, mathematicians, students, and self-proclaimed 'seekers'. Spencer Brown stumbled through a few days of awkward discussion and left as soon as he could (see Fig. 6 & 7, page 28).

In the days following Spencer Brown's hasty departure, Von Foerster made a valiant effort to clarify and expand on the text — it was perhaps the only truly lucid moment of the conference.³¹ Most of the conferees,

AUM conference that had been languishing in cardboard boxes for decades in the personal archive of Kurt von Meier who had attended the conference; these (and a host of other amazing memorabilia) are now showcased on a website run by Larry Barnett dedicated to Kurt's memory; see <https://www.kurtvonmeier.com/blog-1/?category=AUM>

30 Carole Levine, 'Defying the Laws of Form at the AUM Conference,' *The Realist* (San Francisco), (April 1973). Page 6 — 7.

31 For a helpful commentary on Heinz von Foerster's contribution to the



Fig. 6 (top): Photograph of Alan Watts, March 1973, at the AUM conference in Esalen, CA (Heinz von Foerster Archives, University of Vienna).



Fig. 7 (bottom): Photograph of John and Toni Lilly, March 1973, at the AUM conference in Esalen, CA (Heinz von Foerster Archives, University of Vienna).

Fig. 8 (next page): Illustration for Walter Barney, 'Who is G. Spencer Brown and Where is That Marvelous Music Coming From?', *Pacific Sun*, Sept. 6 — 12, 1973. Page 5 — 7.

however, had come to have a 'far out' experience, and they were not going to let the weekend languish in dry lessons of math and logic ('I got back to my room,' Carole Levine recorded in her diary following his departure, 'got stoned').³² Sensing things needed spicing up, Ram Dass suggested that all conferees chant the entire book out loud together (to which they replied with a collective groan). Amid the chaos, it occurred to local reporter Walter Barney and trickster/art historian Kurt von Meier that the symbols in the book looked a bit like musical notation, and within a few hours they had put together a band with some local musicians, performing, on the final day of the conference, a few 'numbers' from *Laws of Form*.³³ In an article for the *Pacific Sun*, Barney reported on this dazzling visit from 'a wise man from the East', with a musical score and an illustration that enshrined Spencer Brown as a figure in the Tarot deck (Fig. 8, page 30).³⁴ Alan Watts passed away not long after the conference, but his writing on *Laws of Form* would appear posthumously the following year in *Cloud-Hidden Whereabouts Unknown* (1974), referring to Spencer Brown's text as 'an approach to mystical experience by way of mathematical logic'.³⁵

post-GSB conversation at AUM, see Albert Müller, 'Computing a Reality: Heinz von Foerster's Lecture at the AUM Conference in 1973', *Constructivist Foundations* 4.1 (November 2008). Page 62 — 69.

- 32 Carole Levine, 'Defying the Laws of Form at the AUM Conference'. Page 7 — 8.
- 33 Barney and Von Meier were so impressed by the conference that they also set out on a years-long attempt to create a novelization of the mystical states generated by the sacred book. Excerpts of the (unfinished manuscript) *The Omasters* and their proposed introduction can be found at <https://www.kurtvonmeier.com/kurts-words-1?category=Omasters>.
- 34 Walter Barney, 'Who is G. Spencer Brown and Where is That Marvelous Music Coming From?' *Pacific Sun*, Sept. 6-12, 1973. Page 5 — 7.
- 35 Alan Watts, *Cloud-Hidden Whereabouts Unknown* (New York: Vintage, 1974). Page 197.

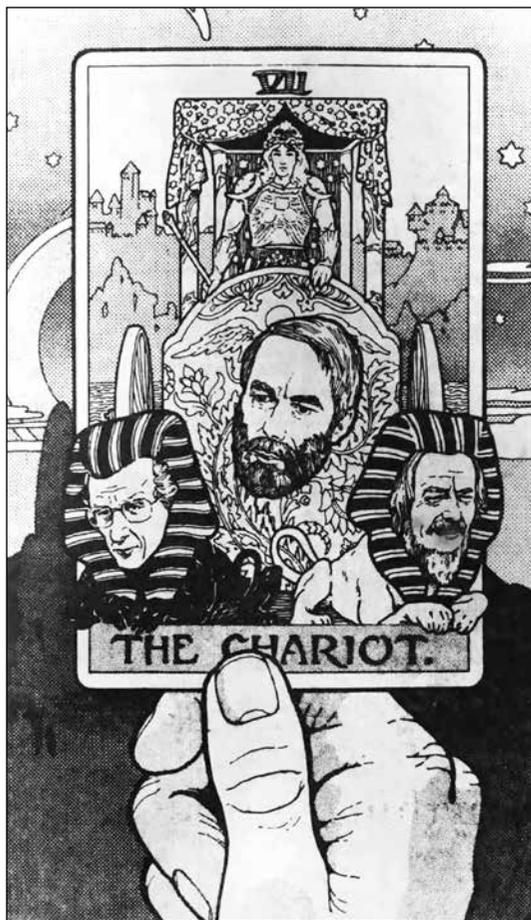


Fig. 8

John Lilly went perhaps the farthest down the rabbit hole with *Laws of Form*, finding in its occult symbology a kind of key or metaphysical 'code' for transcending the neurophysiological wetware of the 'human biocomputer'. He wrote poems about it while in his sensory deprivation

tank ('...Where am I in these Brownian abstractions?').³⁶ He gave copies of the book to everyone who got in his tank. And when he went into a coma following a near-fatal crash on his bicycle (he had been high on Ketamine while speeding down a hill in Santa Monica), he later claimed that he had been 'anything but unconscious'. On the contrary, he said, what had looked on the outside like a 'coma' was merely his 'traveling from one domain to another' using Spencer Brown's sacred symbols, eventually 'transiting explosively into the Void'.³⁷

When Spencer Brown came back to California a few years later, it was at the invitation of John Lilly and his colleague, Francis J. Busco. They had been working on a new sensory deprivation tank, which they called the 'Isolation Module' (the name and overall design of the unit clearly intended to invoke the 'Command Module' of NASA's Apollo missions, offering users the chance to blast off to 'inner space' as it were; see Fig. 9 & 10, page 32). Busco and Lilly had also organized what they called the Phenomenology Experimental Research Center (PERC), offering 'theoretical/experimental' seminars on the experiences of 'Form and the Void', Spencer Brown's *Laws of Form* being, of course, required reading. Spencer Brown reportedly showed up just long enough to float for a few hours before skipping out on a lecture that he had agreed to give, renting a car, and speeding off down the coast with a girl he had just met.³⁸

³⁶ John C. Lilly, *Simulations of God* (New York: Bantam, 1975). Page 271.

³⁷ John C. and Antonietta Lilly, *The Dyadic Cyclone*. Page 146 — 153.

³⁸ The girl was Katherine Lynn Parker, who now lives in Colorado. She remembers him as a captivating, wiry, high-strung guy, with a penchant for paranoid thoughts and domineering jealousy. They spent the next six months together in the US and UK (interview with the author, October, 2015). According to paperwork found in Spencer Brown's personal archives in the UK, he did apparently still send in his travel receipts (my thanks to Randy Dible for this archival information).

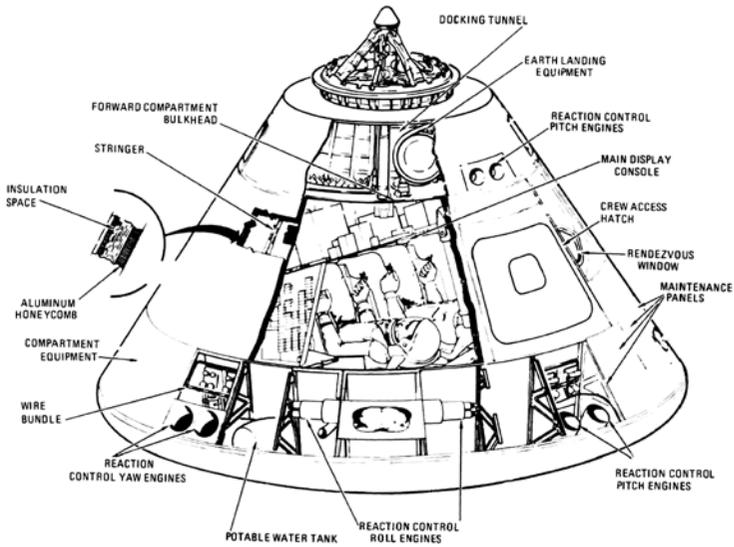


Fig. 9: Design for Command Module, Apollo 11 mission, NASA (1969).

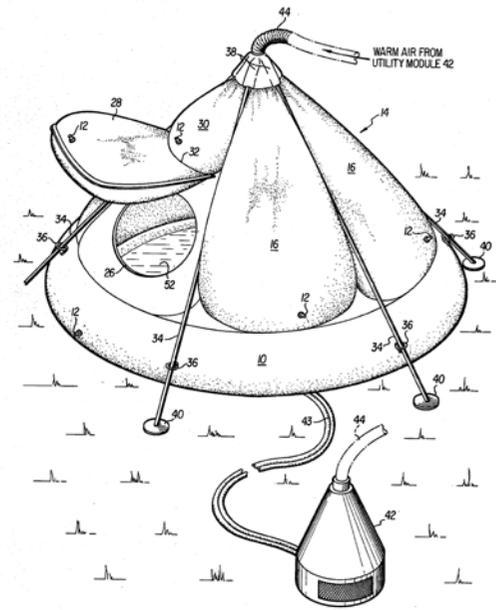
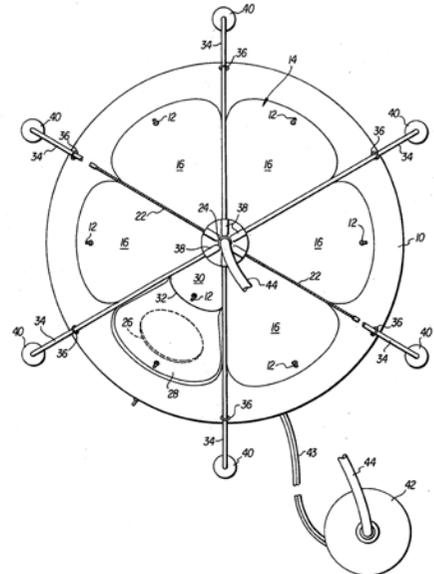
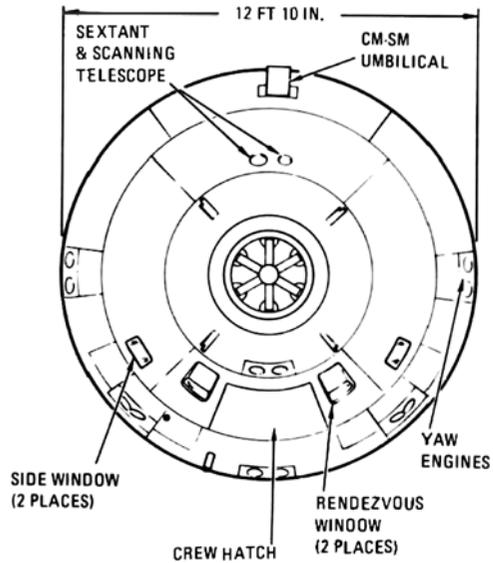


Fig. 10: Design for Isolation Module, United States Patent #4,000,749, by Francis J. Busco (filed May 30, 1975).



It is hard to guess where Spencer Brown's career and his puzzling book might have gone if he had been willing (and had been capable of the personal and professional savviness) to cultivate the spiritual mantle so many of his readers wanted him to assume. And perhaps there is a parallel in these failed expectations with the uncertain historical reception of the book itself. For every reputable and prestigious adaptation of *Laws of Form* in the fifty years since its publication, (certainly one cannot ignore its utility in everything from neocybernetics and neuro-phenomenology to experimental mathematics and social systems theory), a host of extravagant and unfounded expansions have emerged alongside it — for every distinguished, 'marked' state, an unrestrained, 'unmarked' one as well. This, I believe, is where Spencer Brown and his *Laws of Form* will always be: in the oscillating realms of precision and imprecision, seriousness and play, illumination and occultism, truth and lies, hetero- and self-reference, science and art.

Crossing the Letter

Dirk Baecker

I.

A stroke is no letter, a letter, no word, a word, no proposition, and a proposition has sense, yet not yet meaning. 'The proposition *shows* its sense' (Wittgenstein, TLP 4.022), yet its meaning must be decided upon by observers who see the facts either corresponding to the proposition or not.¹

Yet without the stroke, there would be no letter, without the letter, no word, without the word, no proposition, and without the proposition, no sense.

The stroke is a fact as well. It reveals itself, and it can be seen. Merely attending to it, it is impossible to distinguish sense and meaning, however it is what it is. And as such, it can be seen.

We must therefore consider another stroke. That is the stroke distinguishing the letter from the stroke. It is one thing to mark a space with a sign, like the character

¹ Wittgenstein has no notion of the observer, yet in Appendix I of his 'Notebooks' he distinguishes between the 'sense' (*Sinn*) of a proposition which is 'essentially true-false' and its meaning (*Bedeutung*) being true or false depending on the fact actually corresponding to it (Wittgenstein, 1961, 94). Had he had knowledge about the cognitive sciences' distinction between the body's senses, the mind's perception and language's communication (e.g., Varela, 1999), he could have known that sense and meaning do not necessarily play on one and the same system's level.

QfwfQ in Calvino's story about 'A Sign in Space' (Calvino, 1976), only to have to learn that space becomes illegible as unknown others begin to do the same. Yet, it is a different thing to call a stroke a cross as Spencer-Brown does when introducing the cross as the letter of his calculus of indications (Spencer-Brown, 2008). Only the stroke understood as a cross is set to raise, not solve, the question of reference, which necessarily arises in any language (Deacon, 1997).

II.

How does a stroke become a letter? Henry Maurice Sheffer (1913) reduced the possible logical constants, negation, \neg , conjunction, \vee , and disjunction, \wedge , to just one sign: the stroke,



which, as in the expression a / b , can be read as neither a nor b and as such is rejection combining negation and disjunction.

Spencer-Brown refers to Sheffer in the proofs of his postulates (Spencer-Brown, 2008, 87 — 89), and probably understands his notation as a reference to Sheffer's stroke, writing a mark of distinction,



for the cross (ibid., 3). The stroke becomes asymmetrical, distinguishing an inside from an outside. It also resembles the sign of negation, \neg , opening the space for an inside still connected to an outside, and an outside with connection to an inside. Referring to a possible interpretation of

his calculus in terms of logic, Spencer-Brown (ibid., 91) notes that negation also means implication.

The stroke is already a letter. It demands to be read. It demands to be read with regard to its form, indicating, as it were, both an inside and an outside. By doing so, it even indicates a third term, the cross itself, separating the two sides. All three of those terms together are one operator and are called by Spencer-Brown 'the form'. The mark of distinction, denoting the crossing of a boundary from its outside, or unmarked state, to its inside, or marked state (ibid., 1), becomes a letter on which it is possible to construct a calculus which allows computing crosses, following two axioms,



the law of calling and



the law of crossing,

and allowing an 'excursion to infinity' (ibid., 48) which is produced by the re-entry of the form into the form and will be written as follows (ibid., 53):



These strokes, interpreted within a calculus, become letters as observers comprehend the appropriate distinctions and write and read them as letters. Does this answer our question of how a stroke becomes a letter, a word, a word, a proposition, and a proposition, a meaning? Not quite. This might cut a long story too short. Spencer-Brown's calculus is a text of 63 pages, not

counting the various prefaces, introductions, notes and appendices. As one dutifully follows its first instruction, 'Draw a distinction' (ibid., 3), the reader is allowed, and even compelled, to experience the calculus. However, arriving at the last sentence of the text we read 'We see now that the first distinction, the mark, and the observer are not only interchangeable, but, in the form, identical' (ibid., 63). What has happened in between? How does the reader become an observer? And how does the observer recognize him or herself as a mark of distinction? Following both Shakespeare (Sonnet 108) and Warren McCulloch (1989), who asked 'What's in the brain, that ink may character?', we may ask several questions at once which eventually are one and the same question:

What is a stroke, that it may be a letter?

What is a letter, that it may be written and read
by an observer?

What is an observer, that may write and read a letter?

What are human beings, that they know letters?

What are letters, that they can be known by human
beings?

III.

Friedrich Nietzsche, in the opening paragraph of his 1873 lecture 'On Truth and Lying in an Extra-Moral Sense' pondered similar questions. (Nietzsche, 1989, 246): *In some remote corner of the universe that is poured out in countless flickering solar systems, there once was a star on which clever animals invented knowledge. That was the most arrogant and the most untruthful moment in 'world history' — yet indeed only a moment. After nature had taken a few breaths, the star froze over and the clever animals had to die.*

One of the observations about these clever animals is that they not only used language and knew how to write and to read, but that they also seemed more or less able to understand each other by doing so. Nietzsche, being an careful reader of the neurophysiological research of his times, emphasized that the clever animals did not use language to inquire into the essence of things but to somehow manage their relationships to those things and among each other (ibid., 248f.): *The 'thing in itself' (which is precisely what the pure truth, apart from any of its consequences, would be) is likewise something quite incomprehensible to the creator of language and something not in the least worth striving for. This creator only designates the relations of things to men, and for expressing these relations he lays hold of the boldest metaphors. To begin with, a nerve stimulus is transferred into an image: first metaphor. The image, in turn, is imitated in a sound: second metaphor. And each time there is a complete leap from one sphere, right into the middle of an entirely new and different one.*

The lecture was only posthumously published because Nietzsche, I assume, did not want to give the philosophy he was about to develop away by referring to neurophysiology as one of its most important sources. Somehow, he took a jump of his own from his scientific readings into a philosophy of its own, not wanting to show the 'evidence-base' of his thinking. The 'Genealogy of Morality', he was to write, became possible in large part because neurophysiology helped him to look at the daily struggle between organism, mind and communication without having to draw upon some normative ethics. Besides, the work he still had to do himself, translating the discoveries of neurophysiology into possible philosophy, or post-metaphysical ontology, were still far from evident.

Yet, Nietzsche may have been one of the first to realize what it means to account for the operational closure of those spheres — organism, brain, mind and even language all explained in terms peculiar to themselves — as well as for the 'leaps' connecting them. He rejected causality as the medium connecting the spheres and instead proposed aesthetics (ibid., 252): (...) *between two absolutely different spheres such as subject and object, there can be no expression, but at most an aesthetic stance, I mean an allusive transference, a stammering translation into a completely foreign medium. For this, however, in any case a freely fictionalizing and freely inventive middle sphere and middle faculty is necessary.*

Stoic philosophy and logic, as McCulloch (1989, 390) reminds us, called this middle sphere or middle faculty *lekton*.² The *lekton*, the 'said' and 'meant' (from Greek *legein*), is neither the thing signified nor the signifying sign but that which is understood by our mind as being different from both the thing and the sign, i.e. an aspect of talk 'Barbarians would never comprehend' (Sextus Empiricus, *Adversos Mathematicos*, VIII 11, quoted by Bocheński, 2015, 19.04).

So how may this *lekton* leap over the borders, between the spheres it is at the same time called on to respect and even maintain for any further understanding,

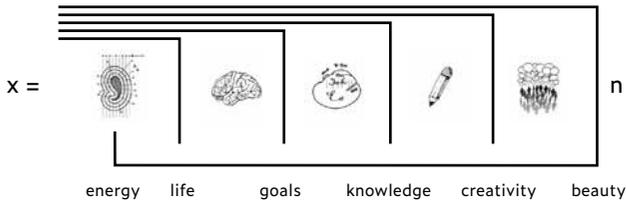
² Stoic logic is in opposition to Aristotelian, term logic is propositional, as is most of modern logic. Truth and falsity are judged in reference to propositions not to terms. Propositions involve people saying them and listening to them. Remember the epistemology of operational constructivism: Anything said is said by an observer (Humberto R. Maturana) and to an observer (Heinz von Foerster). Most of Stoic texts are lost due to a lack of interest in that alternative to Aristotelian philosophy. — Derrida (1982, 9) as well speaking of the 'middle voice', when trying to explain the peculiar character of a *différance*, which is neither active nor passive, neither an operation nor not an operation, yet constitutes the play of language itself.

able to proceed? How does the *lekton*, within its aesthetic operations of translation, address organism, brain, mind and communication while at the same time accepting their autonomous functioning? Niklas Luhmann (1992) considers salutary that the first words were actually noises, more clearly marked off from their surroundings than visible signs could be, given a world without voids but with pauses. This means that the *lekton* could only gain its value of its own because it asked for observers observing observers. Those people producing noises among pauses had to be recognized as people speaking before letters could be strokes producing words and propositions. Organisms individualize people; brains distinguish between sound and vision; the mind tries to understand by relating to what others are saying, writing and reading as the others' saying, writing and reading; and communication hides these preconditions of the use of words to enable fast and reliable responses to situations. Yet these responses are only the beginning of the work that the *lekton* must accomplish in order to produce meaning.

IV.

A letter is a *lekton*, and *lekta* refer to observers understanding them as playing roles in talk, action, communication. These observers are constantly leaping between spheres without noticing. Meaning is a shifter (Jakobson, 1971) — a sign like 'here', 'there', 'you' or 'I' the sense and meaning of which depends on the place where it appears and the context which it summons. Such shifters are not only active in propositions but also between the spheres of nerves or organisms, of images or minds and of sound or communication.

Spencer-Brown's cross is not only the perfect example of a letter actually being an operation of producing meaning by being a stroke combining with other strokes to form words, propositions and texts; it gives us also the means to write down and model what is going on among the clever animals who once populated and still populate a remote corner of the universe. Among them, any letter is an X for which holds the following form equation (see also Baecker, 2019):



- with
-  = organism | irritability
 -  = brain | prediction
 -  = consciousness | sense-making
 -  = technology | devices
 -  = society | double contingency
 - Π = unmarked state | transcendence

The equation is a form in the sense of Spencer-Brown's laws of form in that any one of the crosses concatenated within it reads as the mutual implication of the two sides of the distinction separating them. The equation describes an interdependency which in Nietzsche's sense is not a causal but an aesthetic one.

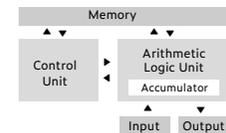
The very co-evolution of life on earth gives us the letter as a stroke coped with by organisms, a sign read by the brain, a reference understood by consciousness or mind, a character produced by a device such as a pen, a

symbol understood in society and an improbability which refers to the miracle and singular case (Lovelock, 2019) of such a thing happening in our universe in the first place.

- The form refers to the states it describes in terms of the current state of research, which defines:
- life in terms of irritability;
 - the brain according to the idea of predictive coding;
 - consciousness as a function imagining sense and meaning;
 - the pen as a physical device actually bringing something forth in matter;³
 - society as a social system both producing, solving and reproducing the problem of double contingency, that is of people trying to maintain independence, dependency and interdependency at the same time, any one of them more or less waiting for the other to make the mistake to commit him or herself first (Leifer, 1991);
 - and an outside of the distinction as including the unmarked state within the form.

Any distinction may be understood in terms of the problems it solves and those it reproduces, organisms consuming energy, organisms and brains defining life as we know it among sentient beings, organisms and consciousness struggling for goal-seeking behaviour, consciousness and various devices producing knowledge, technical devices used in society to create and that very society contemplating the unmarked state in terms of, say, beauty. Talcott Parsons (1978) is among the few to have contemplated the human condition in terms not only

3 The pen here is taken as a general case including the computer, (see Fig.), as a special case. In any case, letters, taken as strokes, need to be written using a technological device which may or may not follow its self-set programs.



as broad as these but also controlled with regard to the interdependency of problems they raise, solve, and raise again.

V.

The letter, like any *lekton*, is the product of the practice of sentient beings producing societies on a planet in a universe. As it takes, as the saying goes, a whole village to educate a young person, you also need a whole universe to explain a letter.

When modelled as a cross, we understand that a letter is only a letter as long as it is produced and understood as a letter. Letters, just like crosses, do not exist all by themselves. They are made, adopted and used in a social context and forgotten as they go out of use.

Letters, like crosses, are operations made and distinctions drawn by observers. These observers are not just human beings with open eyes and ears but highly improbable inhabitants of a universe composed of sometimes uneasy alliances of bodies, brains, minds, social situations and physical, chemical and technical environments. The letters will transform, or they may disappear, according to how the uneasy alliances play out.

Just imagine being able to read — and write — any letter, together with other letters composing a word, combining more words to compose a proposition, like a cross produces meaning which is comprehensible for organisms, brains, minds and communication all at the same time and all of them in their own mode. Many boundaries must be crossed at the same time, relying on different time modes, in order to compute these crosses, and yet they must also be synchronized to produce a meaningful image.

There is distinction between the spheres and co-evolutionary consequence at the same time. Yet, for any one letter to be of informative value in the first place (Shannon/Weaver, 1969), there must be some surprise, a breakdown of entropic probability, the emergence of some improbable order.⁴ The letter may be captured by redundancy at the very next moment. But without that little surprise, there would not be any cross. Take that surprise as indicative of the re-entry of the letter into the universe the letter bears witness of.

⁴ Note that Shannon and Weaver introduced an understanding of 'information' which emphasized that any message is only informative with regard to other messages, as it has to be '*selected from a set of possible messages*' (Shannon/Weaver, 1969, 31; see Baecker, 1997) to be identified at all. Even among letters, any one letter has to cross a boundary, helped along by an observer, without any grounding in positive things already out there, true to Ferdinand de Saussure's (1959, 120) understanding that 'in language there are only differences *without positive terms*'.

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Writing the Mark

Akiem Helmling & Baruch Gottlieb

George Spencer-Brown's book *Laws of Form* is a brilliant and eloquent endeavor to explore the fundamentals of logic and thinking, perhaps also writing. While many people admire the book for its language, only few have remarked on the special notation he created which allows him to communicate everything (and nothing), using a single symbol or character, the 'Mark of Distinction' (MoD). Though Spencer-Brown calls his glyph neither a letter, nor a sign nor a character but a mark, from a typographical point of view, it is a character and for linguistics, it is a mathematical form, similar to '+', '&' or '%'. And while it would be interesting to reconsider the appropriateness of character categories such as letters, mathematical forms, symbols and emojis, it is notable that the Unicode Consortium, responsible for the global encoding of language, generally ignores this distinction. Their mandate is restricted to: *'providing a unique number for every character, no matter what platform, device, application or language'*. According to this, the MoD should be understood as a character of a language. It is of secondary concern whether this language is mathematical, logical, or the Spencer-Brown-language. Similar to the way the MoD communicates the Spencer-Brown calculus, the calculus itself may at a certain point perhaps allow for something greater; perhaps even a language, within which the calculus itself can be situated: a re-entry, through the character, back into the character. Once one becomes attentive to what characters are truly about, one immediately sees how the basic principles of Spencer Brown's calculus may apply, where characters have formal and formative particularities combined in a single form.

The MoD differentiates itself from lexical systems with conventional characters such as 'A', 'B', and 'C'. Such characters have their own specific meanings located within a space which could be defined as the 'letter logic': a logic, which makes it possible to distinguish between 'A', 'B' and 'C', specific formal shapes, which deliver specific meanings. The logic can also be reversed: certain specific shapes are defined by the meaning they are expected to convey. Although the MoD is located in this letter-logical space, just as are the letters we use every day (e.g. 'A', 'B' and 'C'), it also transcends this space by representing the logic of the space within which it is located. In general, it represents nothing less than the essence of every character: an interplay of formal and formative distinctions. It thus becomes possible to argue that the same way we call the character 'A' 'the letter A', we may call the MoD 'the character character': a character which represents the emergence, the existence, and the dissolution of a character using the same character. In this way, the MoD embodies from the start what is finally accomplished in the infamous 11th chapter of the book: the re-entry of the form into the form.

Like any other character, the MoD is also a shape defined by an author, resulting out of a separation and created by closing a contour. For the MoD to be usable on digital platforms, it would need to be constructed like every other character, according to the following rules:

1. Declare points
2. Interpolate a contour
3. Close the contour (create perfect continence)
4. Declare the character

Writing with the MoD can be challenging. The first obstacle is that the character has not yet been included into Unicode. It is therefore not available by default as are characters from scripts like Latin or Greek. This problem can be bypassed by type-designers through adding this character to a typeface and using a code point from the Private Use Area (PUA). This Unicode feature was specially designed for situations like the one described here, where a user needs a specific character not yet included in Unicode. This is probably the most elegant and correct way of making the MoD available in a typographic context, such as on a laptop or smartphone.

A simpler but hackier way would be to use a similarly shaped character like \neg or γ , which already exists in Unicode. Even though we are using a 'wrong' character, this hack might still work sufficiently and satisfactorily if the end result is only to be printed (like the text you are reading now). In such a case, only the formal aspect of the character (its form) survives. The meaning (defined by its unique Unicode number) evaporates at the very moment when digital information is used to affix ink to specific areas of a surface. As part of this same process, a distinction between printed and unprinted, or marked and unmarked states, is produced. At the moment of printing, the meaning of the character is separated from its form and can only be brought together again by an observer looking at or reading the character.

And while there are certainly other solutions, a much greater challenge arises once we try to transcribe the basic axioms of Spencer-Brown's calculus. At this moment, we realize that the particularity of his notation does not lie in the character it employs, but in how the notation functions.

Normally, we compose characters linearly in a specific direction (this may be linear or planar, as when writing math). Linear writing can also be called sequential, because it is a sequence of meanings composed by an author on a page. But writing with the MoD transgresses this logic, compelling the writer to choose between two options: sequential or nested. These two options are also echoed in the two basic axioms of Spencer-Brown's calculus.

Writing the MoD sequentially recalls axiom 1

The law of calling: $\neg\neg = \neg$

Using nested writing recalls axiom 2.

The law of crossing: $\neg\neg =$

Especially for typographers, there is an important difference between nested writing and sequential writing. In sequential writing, typified characters are arranged in a line, by composing the characters on a plane. With nested writing (as employed by Spencer-Brown in *Laws of Form*), we are using only a single character: the character character, the MoD. This single character can be nested, a process similar to putting a box inside another box. In order to be able to accomplish this, one box has to be bigger than the other one, and one instance of the character needs to be different from another. It is thus necessary for the character itself to be variable. The important thing to note here is that changing the proportions of the character creates meaning. Any formal adjustment is therefore at the same time a formative one.

This makes nested writing very different from writing letters typographically in a sequence where the meaning of a single character does not change when you change

its proportions. Nested writing with the MoD exceeds our conventions and definitions operative in the writing logic we call typography, and which has been standardized by Unicode. Writing with the MoD is not writing with pre-fabricated letters, as defined in typography. Writing with the MoD is done with 'the character character', creating meaning relationally. Writing with the MoD is grammatographical in the purest possible way. It is writing (graphia) with a single letter (grammato), which is adjusted while it is written.

Because everything we write on the computer, smartphone or tablet is typographical, it might be as hard to perceive the limitations of sequential writing logic, as it is to appreciate the possibilities offered by nested writing. It may be difficult to accept that sequential writing is just one possibility for writing, and a rather crude one at that. Is it perhaps due to the Unicode standard that we believe that writing must be sequential?

The current Unicode standard, introduced in 1991, which is still the basis for global communication through networked computation, assigns a unique code point to every character. While this great initiative works for sequential writing, it does not provide what is required for nested writing. Once a character is assigned a unique number, this character's meaning can no longer change. And while this is essential for sequential writing, it is contrary to the logic of nested writing, for in this latter writing it is a prerequisite that a character's meaning may change depending on its nesting. In Unicode, anything written with the MoD would be reduced to a linear series of the same character: character, character, character. In writing the MoD sequentially, all the formative meaning is lost.

This limitation of Unicode has long been known. Take, for example, the problem of typing the square root of $A + B$. Does one type $\sqrt{}$, 'A', '+' & 'B'? The result would be $\sqrt{A+B}$, and immediately the problem becomes apparent: how to get the '+' and the 'B' under the square root? Reflecting on this, one might resolve the problem by writing $\sqrt{(A+B)}$. From a formal point of view, this seems awkward. Everyone learns at school how the square root should appear: it starts with a hook, which is then followed by a long vertical line, defining the 'content', and ends with a small hook down. While we are all very well aware of these formal distinctions of the square root, it is impossible today to write this character in a formally correct way because Unicode is a system made for sequential writing.

When Adobe, Apple, Google & Microsoft introduced Variable Fonts at ATypI 2016, they were not thinking about the square root problem (or nested writing). Instead, they were driven by a structural and very pragmatic problem: making the web faster. Considering that over 99.9% of all webpages use fonts, it seemed clever to develop and deploy a new technology that could help to make those fonts faster by making their file size smaller. This was achieved by introducing a new format — OT 1.8, variable fonts — which could interpolate various weights from a single font file. In this way, various static fonts (Light, Regular and Black) can be substituted by a single variable font. And in the same way as variable fonts allow us to interpolate various weights, it can be also used to interpolate any form to any other form. Now, we can not only interpolate A to **A**, and $\sqrt{}$ to $\sqrt{}$, but even from A to B, if needed.

Most importantly for the Spencer–Brown community, we can also use it to change the shape of an MoD and produce nested writing (see writingthemark.org). Having achieved this, we realize the most significant difference between sequential and nested writing. The former is based on static shapes, which are connected to static meanings. The latter uses 'multidimensional' characters where locations within the 'character space' are chosen while we write. In this way, nested writing and the MoD can not only reproduce the calculus behind *Laws of Form*, but also introduce a higher order writing logic. And until we have developed a pen which allows us to write natively in higher order logics, we will have to use our two-dimensional keyboards and some kind of parser to convert our crude sequential writing into higher order writing logic and vice versa.

www.writingthemark.org

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The **Alphabetum** is an artistic space to explore the formative and formal aspects of language. These aspects are mostly considered separate. Typographers and type-designers are primarily focused on the letterform and writers mostly do not pay attention to the forms of the letters they form into words. The ambition of the Alphabetum is to reveal that these two properties of written language are much more interlinked than is commonly acknowledged. A letter is a letter because it resembles a letter; and because it resembles a letter it is a letter.

Joseph Beuys said that every human being is an artist. Hans Hollein translated this idea into space and time, suggesting that everything is architecture. John Cage proposed that everything we do is music. Would it therefore not be acceptable to declare that every thing is type? When we look at art, music and architecture from a more general point of view, we see that all three disciplines have emerged from the languages we created. We might even argue that art, architecture and music are themselves languages. It is noteworthy that Beuys's, Hollein's and Cage's statements are not formulated in art, architecture and music, but in letters, forming words, combined in statements. Ludwig Wittgenstein once said that the limits of our language are the limits of our world. Could it also be the case that the limits of the alphabet are the limits of our language? This would bring us back to the typographic tautology. A letter is a letter because it resembles a letter, and because it resembles a letter, it is a letter.

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