This discussion of *Laws of Form* was led by George Spencer Brown at the Esalen Institute in California, March 19–20, 1973. After two days, Spencer Brown left, leaving the followers without their sage.

The sessions were audiotaped by Kurt von Meier and transcribed by Cliff Barney.

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Prolog: Gurus in the Mud

By Cliff Barney
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Despite its grand name, and its spectacular setting at the Esalen hot baths in a cliff by the sea, the AUM[1] conference on the *Laws of Form* proved something of a bust for many of the participants, who failed to achieve intellectual enlightenment in the week it lasted. Nor was it a success for the intellectual focus of the show, British mathematician G. Spencer Brown, who fell out with the sponsors and left after spending only two days of the scheduled seven. Without Brown, the others organized tentative seminars around various ways to ask "What do you suppose he meant?" They didn't have a lot of success.

Laws of Form, the calculus, and G. Spencer Brown, who put it into the marked state, had enjoyed an ambiguous reputation since the book, *Laws of Form*, was published in 1969.[2] Brown himself was an enigma: on one side, he was a student of Ludwig Wittgenstein and Bertrand Russell, the logico/mathematical heavyweights of the early 20th Century, and Russell had praised the book. On the other, Brown was notoriously eccentric and had published, as well as mathematics, poetry and belles-lettres in which he hinted at deeper meaning to his mathematics than mere descriptions of functionality. One epigraph to *Laws of Form* is from William Blake: "Tho obscured, this is the form of the Angelic land." This is not simply a pun; in the text that follows, Brown promises to show

[1] "AUM" is an acronym for "American University of Masters," created by the always inventive Alan Watts.

[2] George Allen and Unwin Ltd, London.

laws that operate where the concepts of mathematics and religion have degenerated and are not distinguished.

For reasons that will be suggested below, the Esalen meeting left most of its participants more puzzled at the end than when they had assembled. *Laws of Form* has remained almost an intellectual curiosity, largely ignored by the mainstream and investigated mostly on the fringe, both mathematical and mystical. For a long time, the book was out of print in the United States.

However a new edition has now been published,[3] and a German translation, *Formenkalkul*, was published in 1994.[4] There seems to be a resurgence of interest in Brown's calculus. A World Wide Web search on `"Laws of Form"` returns links to half a dozen url's, one of which yields a bibliography of work on Spencer Brown and the *Laws of Form* that contains hundreds of items. There is even a *Laws of Form* home page. One computer scientist, William Bricken of the University of Washington, has interpreted *Laws of Form* as a computer language (`LOSP`) and has built the language into a chip that is now powering a very fast video board for virtual reality applications. In 1994, *EE Times*, a trade magazine, printed several articles on the use of the *Laws of Form* in designing logic circuits (their original application). Several computer scientists, including the inventor of the computer language called Forth, Chuck Moore, were at that time designing logic circuits that use imaginary values in calculating states, thus simplifying chip design, as demonstrated in the *Laws of Form*.

The scientists are thus plugging onward, but the mystics and metaphysicians, not understanding math, have mostly given it up. This is too bad because *Laws of Form* is too rich to be left to the scientists. Therefore perhaps it is time, twenty-three years after the AUM conference, to stir this pot again. Kurt von Meier and I were among the twenty or so people present that March week at Esalen to meet and talk with Brown. It was a transforming experience. I had no idea what I was getting into, beyond the prospect of spending a few pleasant days on the California coast, steaming in the

[3] Cognizer Connection, Portland, OR, 1995.
[4] By Suhrkamp.

Esalen sulphur baths and basking the intellectual glow of the hip literati of the day—Alan Watts, John Lilly, Ram Dass, Heinz von Foerster, Karl Pribram, Michael Murphy, Charles Tart, Stewart Brand, John Brockman, various other scientists, artists, psychologists willing at least to speculate that there might be some formal relationship between hard science and math and the more spiritual pursuits that were then beginning to become popular. At that time, Lilly was seriously trying to talk with dolphins and had not yet announced that he was a visitor from another star system. Watts, an Anglican clergyman, had become a cult figure in the hippie world with his lively, entertaining books on the psychedelic experience and Buddhism. (Even today, more than twenty years after his death, Watts's taped lectures are still broadcast and sold.) Brand's *Whole Earth Catalog* had enchanted a whole new demography with its stunning array of concise reviews and pointers to offbeat products and intellectual resources that were considered useful for living independent, productive lives.

Among the entries in the Catalog was a review of *Laws of Form* signed by Prof. von Foerster. And what a review it was! "At last the *Laws of Form* have been written," it began, surely one of the most arresting sentences possible, implying compactly that *Laws of Form* existed and that at least one person had been eagerly awaiting their publication. *Laws of Form*, von Foerster wrote, was "A 20th-Century transistorized version of Occam's razor."

The review was accompanied by a brief excerpt from the book—terse, even cryptic:

- Draw a distinction.
- Call it the first distinction.
- Call the space in which it is drawn the space severed or cloven by this 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.
- Let any mark, token, or sign be taken in any way with or with regard to the distinction as a signal...

Draw a distinction? What did that mean? Why did it matter what we called it? What was Brown getting at? That was the point of the AUM conference, since a lot of people, none of them principally mathematicians, were beginning to read into the idea of "distinction" something basic about the way that human beings organized information and in fact constructed their entire reality. So if one could in some way codify the idea of distinction, hmm, well, perhaps that might be worth looking into, especially if one were a psychologist or a therapist or an anthropologist or any kind of religious, artistic, or social analyst looking for a firm scientific peg on which to hang one's aura. Lilly and Watts prevailed on George Gallagher, a Hawaiian psychiatrist, to put up some money, rented part of Esalen for a week, hired Brown as a lecturer, and sent out invitations to their friends and colleagues to come and hear him, gratis. It was an invitation not to be turned down.

I obtained entrance to this illustrious group only through my association with Kurt, then as now a professor of art and mythology at California State University, Sacramento, and an old friend of John and Toni Lilly's. I had just moved in with Kurt and his family at the quaint Diamond Sufi ranch in the Napa Valley, and we were casting about for intellectual pursuits. The AUM conference looked like just the ticket. Kurt was a natural for the list; a true polymath, he combines a thorough grounding in his academic discipline, art history, with a wide-ranging interest in all of the arts and sciences, and a willingness actually to learn and practice other disciplines, rather than simply to read and write about them. Kurt has shown his classes a thousand ways in which all human culture is one, in lectures delivered with the precision and detail of a Joseph Campbell and frequently in the style of the late Lord Buckley.

I had no such claim to entry but had long been trained in the art of freeloading by the profession that knows it best, journalism. I called a friend who was an editor and wangled an assignment to cover the AUM conference for the Saturday Review, a venerable magazine then publishing its final feeble editions from San Francisco. The editors cooed over the guest list, chortled over the site

(a hot springs where people of both sexes took off their clothes and sat naked together in the baths), and gave the piece a working title: Gurus in the Mud. (They must have confused it somehow with the mud baths in Calistoga north of San Francisco.)

So it was that we rolled up our magic carpet and piled into my Volkswagen bus one Sunday and rolled down the valley toward Esalen—not just Kurt and I, but his lady friend Mary Evans as well, with their baby Amanita, and our friend Paula Reineking and her current boyfriend Chuck, who were then also living at the ranch. The others hadn't exactly been invited, but in those days we went everywhere together.

In 1973, Esalen was at the beginnings of its popularity as the center for innovative therapeutic and psychological activity. Its hot baths, steaming out of a Big Sur cliff high over the Pacific ocean, had been made the centerpiece of a bustling commerce in spirituality and health. Fritz Perls had done much creative work on the practice of Gestalt therapy while in residence there. Pioneering research on psychedelic drugs had taken place in Esalen's friendly environs. The practice of communal nude bathing hinted at sexual adventure. Doing a weekend at Esalen soon became fashionable for many folks searching for new answers to existential angst. So many came that the Esalen management invested in a motel a few miles up the road from its main center to handle the overflow. It was here, in the South Coast motel, that the AUM conference took place.

Spencer Brown showed up, British to the nines, and plunged gamely into a discussion of the *Laws of Form*; but from the very start, the audience's unfamiliarity with mathematics caused the discussion to flounder. Brown tried to make clear the difference between mathematics, a calculus, and the interpretation of that calculus; but the conferees had trouble with even this simple distinction. We got tangled up in the idea of the mathematics of a state of mind—how could there be such a thing?

Even more subversive to our goal of understanding, however, was the difference of opinion, unknown to us at the time, between Brown and the sponsors, particularly John Lilly. Apparently it

concerned money, but whatever its substance, it resulted in Brown packing up after two days and heading back to England, leaving the rest of us with the rest of the week to tease out some of the clues he had left. Lilly and Watts organized a series of seminars in which individuals could give their own interpretations of the *Laws of Form*, in the hope that from this rough collaboration could come some sort of consensus. This was not, alas, to be, although some of the presentations, particularly that of Heinz von Foerster (himself a logician of note) managed to shed light on the process of calculating without numbers. Kurt, who from the very first understood Brown's method, if not his matter, gave a version of the Buddha's Flower Sermon—he silently covered a blackboard with symbols of the calculus, wrote at the bottom "Homage to all teachers," and bowed himself out. A rump underground, led by Stewart Brand, washed its hands of the whole affair on grounds that Brown himself had let us all down, and a few people actually went home, foregoing the remaining days of Esalen hospitality.

I was as lost as the rest until Heinz, at the end of his lecture, illustrated the formal nature of Brown's calculus by singing us a couple of the mathematical expressions. This is not as silly as it may sound. Written music is, after all, simply an agreed-on set of notation in which musical intervals are represented by steps on a scale. All Heinz did was map certain notations in the calculus into musical scales, assign values to the notes, and read the music.

Later he and I discussed this idea privately, and even managed to harmonize on some of the expressions in the calculus; and from these exercises I got my first inkling of what Brown meant by *Laws of Form*, not thought or idea or physics or anything else, simply form—and how it was represented—and of how powerful a tool it was to isolate purely formal values.

While still enchanted by the idea of setting the calculus to music, I providentially encountered a group of musicians who were staying at Esalen. They picked up on the process immediately and had no trouble whatever understanding the process of making music from mathematics. We found rehearsal space and began to compose; our initial (and only) work, based on Consequence 1 of

the *Laws of Form*, was performed at the closing session of the conference, Sunday morning on the deck at the main Esalen lodge.[5]

Despite this minor triumph, however, the mood on that occasion was anything but clear. It had been, we all agreed, a most interesting time, quite stimulating, a great deal of fun—but what had we really learned? No one was willing to commit. The prevailing emotion was relief at not having to think about *Laws of Form* any more.

Not for Kurt and me, though. By now thoroughly imbued with the magic of the Laws, and convinced that Brown, willingly or unwillingly, was a major teacher and discoverer, on the order of a Dante or a Newton, we went back the Napa Valley and spent the next three years studying his texts and puzzling out some of the hints he had provided. We had the *Laws of Form*, of course, plus two other Brown books: *Probability and Scientific Inference*, an earlier publication, and *Only Two Can Play This Game*, a book of poetry and belle-lettres that Brown had published under the cabalistic name of James Keys. (It is the latter book that got Brown into his deepest trouble with his mathematical colleagues, since in it he specifically relates religious forms like angels with mathematical theorems.)

We began to look at formal structures, dice, and probabilities with new eyes. From purely formal structures we were led to labyrinths, and from labyrinth to the Morris dance, and the Cretan double axe, and from Crete to Dædalus, and thence to James Joyce, and gradually we began to see some of the larger patterns, and the *Laws of Form* began to make sense.

We knew we could never calculate with them. Painstakingly, I had puzzled out the process of pattern recognition by which the *Laws of Form* carries out its transformations; having done so, I could see that one would need intensive mathematical training to become adept in their use. (I have never seen this aspect of the *Laws of Form* discussed. Transformations in the *Laws of Form* are made by substituting one pattern for another, the patterns being shown by the calculus to be equal in value. The patterns themselves may

[5] This performance was recorded and still exists on reel-to-reel tape.

be of any scope and may change from step to step in a demonstration. It is not always obvious—in fact it is seldom obvious—where to look to see pattern similarities.)

Nevertheless, one could still invoke the power of the calculus simply by seeing how it is structured, how it inevitably grows and develops out of the initial instruction quoted above, "*Draw a distinction.*" The difference between this kind of injunctive language and the descriptive language that we use most of the time took on ever greater significance. As a student and teacher of Gestalt therapy, I was familiar with Fritz Perls's remark that injunctions, commands, constitute the clearest form of communication; however I still considered the indicative mood as the main vehicle of speech and the imperative as a mere appendage. Brown insisted that instructions must maintain an inner coherence that is not demanded of descriptions, and pointed out that it is not a matter of opinion what the result of carrying out an instruction will be, whereas descriptions constantly give rise to differences of opinion. That is, if I give you a musical score, which may be interpreted as a series of instructions, and say "Play this music," it is not a matter of opinion what the music will sound like. (Whether the music is pleasant or not may definitely be a matter of opinion.) After many years of living with this distinction I find myself increasingly uninterested in anyone's opinion about anything.

The first thing I did on returning home was to write, with Kurt's felicitous assistance, the piece for *Saturday Review*. Given their vision of the various Masters rolling around in mud, the editors did not look favorably on my account of turning the calculus into some form of New Age music. Before they could reject it completely, however, the *Saturday Review* itself folded, and I was left with an orphan manuscript. I sold it for $100 to my friend Don Stanley, who was then editing a lively Marin County weekly called the *Pacific Sun*, and in due course it saw print, plugged on page one and with marvelous illustrations by a staff artist, in one of which Brow's visage replaces the Charioteer on the seventh Tarot key. The piece drew two letters, both of which cast aspersions on

my intelligence, if not my basic sanity; still, I was happy enough to be published.

Kurt, meanwhile, began teaching *Laws of Form* to his art history classes at Sacramento State. Together we devised a syllabus and put together a reading list that embraced texts as far apart as the *I Ching*, Robert Graves's *The White Goddess* and D'Arcy Thompson's classic *On Growth and Form*, with the transcript of the Esalen conference as a centerpiece. "*Learn to draw distinctions,*" Kurt told his astonished students, who were accustomed to being told "Repeat after me...."

And together, we began composition of "*The Omasters*," our fantastic fictive account of how the *Laws of Form* could be promulgated to the world. It was Kurt's idea to tell it as a kind of Sufi teaching story, and he began to make up characters and situations, mingling Tarot cards and current headlines into an utterly riotous adventure that combined space opera, a parody of the American dream, and an East-West fantasy farce. We would haul our typewriters out on the deck and write alternate pages, exchanging them and cackling with glee as we read aloud to whoever would stay around long enough to listen. There weren't many of the latter, and although Kurt and I had a lot of fun, we wound up with stacks of manuscripts and tapes and a reputation as possibly loony or possibly onto something really big, with no possibility of anyone else ever knowing which it was.

We had one flirtation with mainstream publishing, when John Brockman induced an editor from Doubleday to make a special trip to the ranch to consult with us; but although he laughed more heartily than most at our pages, he, to put it kindly, could not see their commercial possibilities. Stewart Brand agreed to consider publishing the Esalen transcript in the WEC, and then managed to lose the manuscript, an event that led to some coolness on both sides.

After three years, the Napa Valley community began to break up and I found myself needing to go back to civilization and start earning a living. It was time to move on from the *Laws of Form*. We made a big bundle of all of our manuscripts and mailed it off to

Brown at his last known address in Cambridge, England, together with a letter saying how much we had enjoyed writing them and that we hope he liked them too.

A few weeks later he called us on the telephone from Cambridge. We were the only people at Esalen who'd got it, he said. He'd love to come to the States and visit us and how would we like to get together on a new publishing venture? He would offer as capital some fifty thousand copies of his latest book, a dictionary of music in which tunes were classified according the sequence of their musical intervals. (I have never actually seen this book.[6]) He also sent along a wonderful manuscript, a group of fables called *Stories Children Won't Like* (never published, so far as I know), and announced that he had discovered a proof for the four-color theorem using the *Laws of Form*.[7]

Of course Kurt and I were delighted and immediately put ourselves at Brown's disposal. We had been working with no outside encouragement for three years, and here the fellow calls up and says yep, that's it, let's play ball. We knew we were right, understand. We had already shrugged off the feedback, from a well-known biographer of Wittgenstein, that we were mathematical innocents whose interpretation would be laughed at by Brown. Still, to have direct contact with the source was stimulating, to say the least.

The story of what happened when Brown—or James Keys, his alter ego, as we came to know him personally—came to live at the Diamond Sufi ranch in Oakville is one of the best in the whole saga, funny and embarrassing and strangely bittersweet. It deserves telling if only for the truly mortifying events surrounding the reception we gave Brown on Alan Watts's houseboat in

[6] Parsons, D., *The Directory of Tunes and Musical Themes.* Spencer Brown & Co., Cambridge, England, 1975.

[7] At this time two American mathematicians had announced "proof" of this classic theorem (which states that four colors are sufficient to color a map on a surface of genus 0) that was actually a kind of demonstration, since it used a computer to exhaustively test all possible maps. Brown took a different approach and tried to prove that any map could be generated by four colors. A book by Brown on the four-color theorem was announced by Scribner's in 1974, but it apparently never saw print.

Sausalito. Watts had by then died, but left behind a Society that continued (and still continues) to promote his tapes and books; this group very kindly lent us the houseboat and invited haute Marin County over for wine and cheese on a Sunday afternoon, to chat with the visiting Master. James never showed up, having found a popsy and driven her down the coast for a Big Sur weekend, and I found myself making apologies to a crowd that was only slightly more puzzled by not seeing the guest of honor than they had been for being invited to meet him in the first place. Brown and the lady showed up ten days later and took me to lunch at the Cliff House in San Francisco, and no one said a mumbling word about the Alan Watts Society.

We had many other adventures of a similar order, some of them uproariously funny, and we never got anywhere in promoting Brown's literary venture. In fact I never found out what it was. We did promote a couple of Brown seminars, at Nepenthe near Esalen and at Wilbur Hot Springs in Colusa County, and then we went our separate ways. James moved to Palo Alto, where he taught for a while at Stanford University and at the Xerox Palo Alto Research Center. The last time I saw him he was living in a house with no furniture, and he took twenty dollars from me at Frisbee golf.

Enlightening as it was, our experience with Spencer Brown himself was only a coda to the sessions Kurt and I held in Oakville during the writing of the ur-text, *The Omasters.* The fact that we are not accomplished writers of fiction (consider how few people are) does not affect our vision of the *Laws of Form* as a powerful paradigm. And Brown himself remains a figure worth study. I am unqualified to comment professionally on the *Laws of Form* as mathematics; I have, however, earned my bread for forty years as a writer and editor, during which time I learned something about prose construction, and I am perfectly clear on the fact that, whatever his merits as a mathematician, Brown is one of the great prose stylists of the century. He uses words with great precision, he writes clearly and simply, and he has command of the basic forms of English.

Some of this mastery spills over into Brown's speech, and the Esalen transcript is a remarkable document. Brown talked for four sessions over two days, presenting in one form or another his vision of what amounts to the mathematics of consciousness. The text is witty and subtly funny, as well as explicitly descriptive of some of the connections Brown makes between the language of mathematics and the language of experience.

Whether this text can still find an audience 23 years after its creation may be questionable. Still, a considerable literature has grown up around Spencer Brown and the *Laws of Form*; the Internet bibliography ranges over mathematical, metaphysical, practical and even fictive aspects of the *Laws of Form*. There is apparently an audience for this material, although it is formed of many distinct parts.

A few years ago, when the editor of *Formenkalkul* sought to print the Esalen transcript, with our introduction, along with the German text, Brown demurred. He no longer fully supported his remarks at Esalen, we were informed. Nevertheless, though old and disowned, the Esalen text yet retains baraka, we think, and is certainly worth reading if only for pleasure.

It currently exists as a 110-page typescript, which I transcribed in 1973 from tapes made by Kurt von Meier. If there is sufficient interest in it on the web, I will have it scanned and enter it here.

Introduction: The First Message From Space

By Cliff Barney and Kurt von Meier

> *Lave a whale a while in a whillbarrow (isn't it the truath I'm tallin ye?) to have fins and flippers that shimmy and shake. Tim Timmycan timped hir, tampting Tam. Fleppety! Flippety! Fleapow!*
>
> *Hop!*

The Wanderings of MAN:

This introduction to the transcript of G. Spencer Brown's remarks at Esalen Institute March 19–20, 1973, draws inspiration from Karl Pribram's suggestion that it be cast in the form of a Sufi story, which teaches by its own example. Upon examining the text, we find that, for those who care to cross into the vision of the morality play, the voices of LILLY:, BATESON:, WATTS:, VON MEIER: and the others, particularly the universal, anonymous questings of MAN:, ever seeking to get it just right, make up, with the patient, measured, precise explanations of SPENCER BROWN:, the Touring Champ, the antiphonal chorus accompanying the Unveiling of the Mystery. We experience G. Spencer Brown's "informal" discussion of the *Laws of Form* as one of the possible manifestations of the long-awaited first message from Space. It is about Time. (The opposed thumb, at the fifth crossing, was the stroke enabling what is manifest to be grasped.)

We call attention to Brown's discussion[1] of the properties of the number 2311, prime factorial plus one for 11, which is the fifth prime and the number whose powers give the coefficients, or constant aspects, of the binomial expansion, $(a + b)^n$. Melvin Fine, the Hasidic mandarin, has called our attention to the fact that Leibniz knew these same coefficients to govern the hexagrams of the I Ching, according to the number of yin and yang lines in each group. It did not cross our path until much later that 2311 is also the index to the sequence listed by N. J. A. Sloane, in the invaluable *A Handbook of Integer Sequences*[2] as a "friendly beginning" for communication with Betelgeuse. Sloane calls the name of sequence 2311 as "non-cyclic simple groups." Brown refers to it as "Big M Plus One".[3]

Betelgeuse being in the armpit of Orion, we might look for a glyph of this message in the figure of the first martyr, according to the Western tradition St. Puce, the flea reported by hearsay to have been impaled by the Roman centurion's merciful spear. However the tradition is perhaps somewhat richer if we focus on Orion as the (blind) Wanderer, which, according to Robert Brown (!) Jr., cited by Richard Hinckley Allen in *Star Names/Their Lore and Meaning*,[4] of page 304, we may do. Here, as Dr. Fine reminds us, we meet Lź, the Wanderer, hexagram #56 in the subtle ordering of the I Ching offered by the Duke of Chou, or #13, the

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[1] In *Session 2, Prime Numbers*

[2] Sloane, N. J. A., *A Handbook of Integer Sequences*, Academic Press, New York & London, 1973, pp. x, 181.

[3] We note here the remarkable "coincidence" that Big M Plus One, or 2311, is reflected as 1132 A. D., when "Men like ants or emmets wondern upon a groot hwide Whallfisk which lay in a runnel," on pp. 13 of *Finnegans Wake*, by Joyce, James (Viking Press, New York, 1955). We have elsewhere discussed the reflection of the other Joycean year, A. D. 566, as 665 A. D., date of the Synod of Whitby, at which King Oswy of Northumberland bowed to the wishes of his Kentish queen and her Roman advisors and accepted the solar reckoning for the date of Easter; thus cutting the cord, as Yeats put it, that bound Christianity to the Druids, and setting the course of the Western yang empire.

[4] a 1963 Dover reprint of *Star-Names and Their Meanings*, first published by G. E. Stechart in 1899

number of Dionysus, in the simpler binary notation of Boolean logic.[5]

The Wanderer is also Wotan, Odin, through whose 540 doors went 800 warriors[6] each to fight the Wolf, thus making up a force of 432,000 warriors: one for each year, we learn from Joseph Campbell, of the reign, between the Creation and the Flood, of 10 mythical Sumerian kings, and one-tenth the number of years in the Hindu kapla. Campbell argues persuasively[7] that these numbers refer to the precession of the equinoxes. The Sumerian number system was based on the *soss* (60, the second term in the series as published by Sloane, though actually the first in the sequence of non-cyclic simple groups), and $432 \times 60 = 25,920$, the number of years required for the earth to make one complete nutational wobble, one trip through the Zodiac, if we figure the precession at the Sumerian rate of 50 seconds of arc per year, or 72 years per degree,[8] and the 22nd number in the Sloane sequence.[9] Campbell also points out that in the Hebrew tradition the years of the patriarchs from Adam through Noah (until the Flood) total 1,656. We may hypothesize that James Keys, the yin persona of the Brown guru, had this in mind when he published *23 Degrees of Paradise.*

The number 54(0) we associate with SHAKUHACHI UNZEN, who practices the 54 steps of his yang form T'ai Chi Chuan exercise as he mops the floor and removes the garbage from the Teahouse of Necessity, where every night is served an installment of the Feast of 4001 Fools. His numerical token is actually 54.5,

[5] *Above* Li, the Clinging, Fire; *below* Ken, Keeping Still, Mountain; this hexagram, Lź, the Wanderer, may be mapped into binary numbers as 001101, or 13 to a decimal base.

[6] Orion as Wanderer is revealed in the constellation's earlier name, ***, from ***, "roaming." The word "Orion," Allen says, is from Greek ***, which is cognate to English "warrior."

[7] Campbell, Joseph, *The Masks of God: Oriental Mythology*, The Viking Press, New York, 1970 (Compass edition), pp. 115–130.

[8] Modern observers put it at 50.27 seconds per year, for a 25,780.783 year round trip.

[9] 432 appears between the 6^{th} and 7^{th}, and 12^{th} and 13^{th}, terms in the first derivative, in the calculus of finite differences, of the Sloane sequence.

based upon a transformation of the standard unit of measure employed in ancient Japan, in particular the tradition that eight *shakus* (eight = hachi) determines the standard TUNED length of a bamboo flute (made, perhaps, of bamboo from the very grove in which the teahouse is situated). Such a flute might be measured at 54.5 centimeters, by those following the units established by Napoleon Bonaparte after his mystical visit to the Great Pyramid of Cheops, having entered the King's chamber by torchlight, alone and at midnight (in meditation, we may speculate, upon the nature and action of Amoghasiddhi Buddha: black hat, green eyes, crossed double rDorjes). Napoleon never did talk about what he experienced until late in his life in exile (latin *ex(s)ul*, wanderer) on St. Helena, wasn't it, island named for the mother of Constantine (arithmetic being about constants, as Brown explains in the text, Session 2). Then he declined to tell the story, saying "You wouldn't believe it anyway."

What story? What sort of message can we read in this rendering of the spoken word of the Brown messenger? We note that the oracle of the tortoise is specifically referred to on several occasions.[10] Although little is known about consulting this oracle, we deduce from the fact that among the earliest Chinese artifacts are tortoise shells with writing on them that the secret concerned writing itself. During the Shang Yin dynasty (1523–1027 B. C.) the priests of the royal court divined the secrets by heating the shell until it cracked and then noting how the cracks intersected the 13 interior and 25 circumferential divisions grown naturally by the tortoise. When the written language went public, the oral tradition went into silence, exile, cunning. For public consumption we are referred to the vegetable oracle, the yarrow stalks of the I Ching.

The tortoise gives us the transformation to a new constellation, Lyra, known as the Little Tortoise, or Shell, "thus going back to the legendary origin of the instrument from the empty covering of the creature cast upon the shore with the dried tendons stretched across it" (Allen, pp. 283). This is later Apollo's lyre,

[10] Session 2

sevenstringed, discovered by Hermes, inventor of dice, three of which can permute the 56 minor arcana (Wotan again) and two the 21 major arcana, which, with the Fool, who is *hors commerce*, make up the deck of cards known as the Tarot, whose name has the same root as "tortoise" (indo-european *wendh*, to turn, wind, weave), which is also the root of "wander." The twisting of the snakes on Hermes' staff, or perhaps the right-hand DNA double helix. One can pick up the skein at any point and begin to tease out a thread that will lead one through the labyrinth.

"This is indeed amazing." So wrote Brown upon surmising that the world we know is constructed "in order (and thus in such a way as to be able) to see itself." (*Laws of Form*, pp. 105; notes to Chapter 11, reflected 1's, "Equations of the Second Degree," or self-referential functions) We are referred to the maze at Knossos, where the spider lady, Ariadne, had Theseus dangling by a string. We take hold of the string: LABYRINTHOS, from LABYRIS, not Greek but a Lydian word for "double axe." And we use the iconic representation of the double axe, `[missing graphic]` as a framework upon which to construct the map of the labyrinth.[11] We are being told here that all representations of life, e. g. stories, myths, fables, pictures, mathematics, are explicitly representations of themselves, self-referential. Re-presentations. And the thread we hold, that leads us out of the labyrinth, where no path seems to go anywhere, since they all come back on themselves, is language; we follow it to learn the order of the labyrinth. With the text (i.e. *teks*, to weave, fabricate) as a clue to the identity of the Vajrayogini as the mythical Joyce James, one can anywhere and everywhere pick up the thread upon which Brown has strung the pearls he has divined.

Points of View

Nevertheless, to make an expression meaningful, "we must add to it an indicator to present a place from which the observer is invited to regard it." (Page 103, *Laws of Form*.) These pages reflect

[11] Cf. Richardson, L. J. D., *The Labyrinth*, Dover, pp. 285–296, especially pp. 291.

in one facet of the crystal mirror the vision of the real (meaningless), the true, the false, and the imaginary, mapped out on the plain crossed by G. Spencer Brown. The text, for instance, purports to be a transcript of the words Brown spoke at the South Coast Motel, a mile or so down the road from the sulphur baths at Big Sur, California, on the occasion of the AUM conference conceived by Alan Watts and John Lilly (the Master passing over the pole on the occasion of the last full moon before the vernal equinox). Confirmatory evidence for this viewpoint, definitely northern hemisphere (London) may be obtained from Henry Jacobs, Box 303, Sausalito, Calif. 94965, in the form of audio tapes of the conference. Anyone who listens to these tapes can verify that Spencer Brown's remarks are reproduced here with close, if not perfect, fidelity.

Arriving at Cape Town, however, we cast the net tied by N. J. A. Sloane and catch the icon of an all-of-a-piece, multidimensional message to inner space—that is, the space of the eternal regions, where we find numbers, including the number represented, in the Arstic notation, as "2311."[12] Here nothing is hidden, since the space is created "before the time came for time to begin," as Brown says C. E. Rolt says in his (Rolt's) introduction to the *Divine Names* of Dionysius the Areopagite, and the eyes of the (one-way) blind are opened and the ears of the deaf unstopped. Messages from and to space are all around us, and we have only to read them. "In nature are signatures/needing no verbal tradition,/oak leaf never

[12] "2311" is only one of the names assumed by Big M Plus One. This number is constructed by adding 1 to 2310, which is "prime factorial" for 11—that is, the product of all the primes up to and including 11: $2 \times 3 \times 5 \times 7 \times 11$. Under this alias, Big M Plus One is prime, not divisible by any numbers except itself and 1. In his next manifestation, however, as 30,031 (prime factorial plus 1 for 13), our space messenger is composite. Thus he confirms Brown's assurance, that "if you go on long enough, getting the final factorial, adding one, you will find one that is not prime; but that doesn't matter, because it will be divisible by a prime (in this case, two, 59 and 509) that is bigger than the biggest prime (13) you have used to produce it." As a messenger of Apollo, 11^{th} god on Olympus, Big M Plus One is pristine, prime; as a representative of Dionysus, the 13^{th}, he is ecstatic, beside himself.

plane leaf."[13] Caught in the net of number, Big M Plus One provides name, rank, and serial, as required by convention, and stands revealed in an entirely different role, the index of non-cyclic simple groups and thus a nodal transfer point to the one-eyed Wotan, who braided the hairs of the Night Mare's tail.[14] We tie the net one knot at a time, and from any node, 2311 leads us to infinitely numerable license plates, phone numbers, grocery bills ($23.11) and the like.

Wotan (Woden's Tag/Wednesday/mercredi/Mercury/Hermes/crossroads/messenger/traveler/wanderer/medium/Mittwoch/midweek/balance/4th chakra/path with heart) carves the runes on a staff cut from Yggdrasil, the world ash, which binds together earth, heaven, and hell, branches mirroring roots, which we may allude to, but may not uncover without killing the tree. Sloane, p. 12, points out the mathematical aspect of trees, rooted and otherwise, as graphs containing "not closed paths" (unlike the net, in which we catch the icon). For the English language, a knowledge of which is assumed by Spencer Brown on the part of a reader of *Laws of Form*, the roots are named with psychedelic clarity in *The American Heritage Dictionary*, Houghton Mifflin, New York, pp. 1503–1550. In these pages, the (conjectured) Indo-European sources of the language are cross-indexed to the common words of the vocabulary; so that, for instance, having been referred from "tree" to the entry *deru-*, meaning "firm," or "solid," we find the collapsed meaning of "tree," "truth," "Druid," "trust," "trough," "troth," "durable," etc. The path leads through Greek *drus* (the d-t shift having been found out by the Brothers Grimm, who knew that fairy tales were about language, self-referential): oak for Oakville, Napa County, wine valley of Dionysus, where, at 7700 St. Helena Highway (named for the mother of Constantine, wasn't she?) under 700-year-old oaks this mad introduction is being written.

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[13] *Canto LXXXVII*, Ezra Pound

[14] See *"The Theory of Braids"*, by Emil Artin in The American Scientist, Vol. 38, No. 1, pp. 112–119, January, 1950, and other references cited for the article *"Group Theory and Braids"* in Martin Gardner's *New Mathematical Diversions* from Scientific American, Simon & Schuster, New York, 1966.

Turning scales to feathers, like dinosaurs, we take flight for Christchurch, entering the imaginary state in which Shakuhachi Unzen, Woody Nicholson, and Primo the Fool braid their destinies, and in which these pages are a program note for the great Chaco Canyon Eisteddfod of 1976.

This sitting of poets, musicians and shamans provides a mythic counterbalance to the electoral process, which, as the United States marks its 200th anniversary having lost, or forgotten, its committment to due process, shows signs of breaking down (in accordance with the instructions formally built into the Constitution by the 55 Freemasons who wrote it one summer in Philadelphia, on the 40th parallel. Unzen it is whose Sufi listening post in the heart of California (state named for the white goddess of Don Quixote's impossible dream, she to whom all poetry is addressed, according to Alun Lewis, according to Robert Graves, attest G. Spencer Brown),p. 107, *Only Two Can Play This Game* is the scene of the appearance of the Yellow Pearl, who, in another era, as the 12-year-old T'ai Chi star of the touring Peking Opera, becomes an international cause celebre and focal point of the eisteddfod.

Shakuhachi's guide and guru is the busboy who, in the same teahouse for which the monk serves as Cold Mountain Pratyeka janitor, each night concocts a special brew which bears the name Ti-Tseng. This he mixes after all the ordinary guests have been served, and the choice can be made of the person who shall reign as the King (or Queen) of the Fools aboard the space/time, gravity/grace warpship Adamantinus, into which the teahouse periodically transforms all within its Mandala of energy/void. The stuff in the pot of Ti-Tseng turns out in the clear light of the Bright Early Morning Star to be dregs collected from all the partially emptied receptacles returned on his tray to the scullery. To this much the regulars and old-timers are hip; indeed, the service of Ti-Tseng is ritualized, as when the jaguars, bursting into the temple and desecrating the altar, repeatedly, through generations of the priesthood, become elements of epiphany in the Kafkesque Tantra. Now there is the bank of Watchers, who ever decline

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Can Play This Game ,

the sip, but appear faithfully at the subsequent convocation: latecomers, fruhsplitters, Yzakers & your 1 in 10 schizoid, prepared for the culmination of yet another one of the fantastic (but finite) Feast of 4001 Fools (dishes prepared for the Uwaysiyya Sutis, 4000 of whom are said to be wandering the face of this earth at all times, without credentials from Soofi Central, the Bodhidharma Certification Board, or the Magister Ludi contest committee.)

The Eisteddfod is arranged by the country's No. 22 vice president, Woody, that he may receive advice on how best to proceed, he having been thrust into a position resembling power when the president and the first 21 vices were wiped out at Ahab McGaff's Double Cross Saloon in Las Vegas (Vega being the alpha star in Lyra). Woody, who travels from national park to supermarket parking lot in the Last of the Winnebagoes, a superbly outfitted camper equipped with heliport, swimming pool, and satellite reception station, is assisted by the mysterious agents of the Sufia, among whom we note the Bodhisufi Bismullah Tariq and Melvin Fine, the Chasidic mandarin.

In this context Joyce James appears as an aide to the llama Al Paca, liaison man between the Sufia and the spiritual materialist arm, MaFie, or MyFee, which is simultaneously trying to fix the Eisteddfod in favor of Ahab and his all-girl security force, the Kritiquettes, and, through Ahab's Miasma Beach cousin Jackie, to produce it for global television. She discovers the Spencer Brown text while researching the form of distinction that appears in the medieval vision of quests, which were tragedies, and pilgrimages, which were comedies.[15] The document presents the Joycean hypothesis that *Laws of Form*, with its demonstration of the generation of Time, offers a means of mapping cultural transformations which themselves reflect our own transformations as refugees in Time.

Brown's performance at Esalen certainly earns him a place in the Eisteddfod finals, along with Ahab's black vision, the entry from the teenage author of essay #768 in the Working With

[15] See J. Holloway, *Figure of Pilgrim in Medieval Poetry*, unpublished doctoral thesis, Berkeley, 1974

Negativity Sweepstakes, the taped hoax perpetrated by members of the Imaginary Liberation Front, and the dance of the Yellow Pearl herself, our first female "leader"—who, being uncommitted to any particular truth, replaces government by control of information, secrecy, and deceit with leadership through inspiration, education, and enlightenment, calling to account our Kings, corporations, Imaginary Persons before, and frequently above, the law.

Meanwhile Primo puzzles out the controls of the Adamantinus, which have been locked on a course for the Black Hole in Cygnus by the captain, Jetsun Rainbowshay, who has vanished. In the crystal navigation table, Primo finds maps to the cosmos—Laws of Form, the tortoise oracle, the I Ching, the Tarot, the dice of Hermes—which he can read only with the help of Melvin Fine.

The Adamantine Isomorph

These three stories fit together as the net, tree, and array structures for which the present text provides the transformation rules. The terms were introduced to us by Christopher Wells, Center for Music Experiment, University of California, San Diego, in preliminary abstract 9/22/74:

- "Web [net] grammars map (iconic descriptions) onto directed graphs [digraphs, i. e. 'trees'] or (iconic descriptions).
- "Tree grammars map (iconic descriptions) onto hierarchical directed graphs or (symbolic descriptions).
- "Array grammars map matrices of point terminals onto transformed...matrices or (images)." And the key:
- "Metagrammars map the other three grammars' elements onto each other as plan/command learning or (extensions)."

The adamantine isomorph! To its four elements we may conventionally assign air-earth-fire-water, Matthew-Luke-Mark-John, Epimetheus-Atlas-Prometheus-Menoetius (the four Titan brothers who warred on Cronos with varying success), etc.; or we may see the whole shebang as a set of Chinese boxes, one inside the other, until the seventh box turns out to be on the outside after

all. And why precisely SEVEN boxes may be demonstrated in Consequence 7 of the Laws of Form, in which we may see how a twice-cloven space in four divisions may be represented as a single space cloven seven times. There seems to be a non-numerical relation between ordinal four and cardinal seven: the relation of Name and Form. We know from the Laws of Form that once we make any distinction whatever we generate inevitably the eternal archetypes. The forms are always the same and every story is the same story, which is about Time. History, from Greek *histor*, wise, learned, from Indo-European *wid-tor-*, from *weid-* to see. The image and its mirror; sun and moon.

Return to the Form

The Father, Son, and Holy Ghost sitting around Mary's place one day, weighing contemplations upon Time, which is the inevitable harmonic of all that moves, whirls its way through the mother space; and her body quivered with the energy, as born from the star; and the message transmitted through the body, the Soma, into the Form of the Kingdom of Heaven, the way seen through PEARL/GATE with one eye, bloodshot, close-to for about an hour in Buenos Aires (the piece by Marcel Duchamp in Noo Yawk's MOMA). *Om gate gate paragate parasamgate bodhi svaha.*

She say, "I want to get in lights, front billing instead of the shadow me, nobody. Bear me, as a star." And the swastika in the sky began to spin... Santa Lucia on the South Sur coast; in the Sky with Adamantinoids, cast to the serpent in the peaceful ocean to appease the Wrath of War on the surface, beneath the peaceful brow, the lambda curl of the wave, shaken from within the earth, in one of her periodicities, the signature for which, her handwriting, is the sequence indexed 2311 by N. J. A. Sloane of Bell Labs. Lucy in the Sky, with her pet Beetle Goose. The sign in the sky for Constantine, the Paramahamsa, the Great Himalayan Goose or Gander! Goosey-goosey Gander, where shall you Wander?

They say, "All right, MS! `[Mother Superior]` We give you the cultus, see? We champion Mariology. We do everything but spell it out."

Mary: So start spelling out the sign & beans.

HG: We're sniffing, Apollo-like, lupine around da point here and coiling upon an oomphalosity white tower of ivory, such as that coveted by the hungry ghost of Ahab, who, we three Kings remember, ruddy-coiled out into the well drainage at the Good Lady (was it?) Samaritane (SOLDS!)... in the bottom of the Chariot, cancer, whirlpool, in the depth of the Form. And so we fain hunt the Whale. There shall be no personal rejection of the life of great beings. No more whales, elephants, dolphins to die. That is the tip of the balance, the stated, stipulated bias toward "compassion," which places others above ourselves, dedicating the benefit, if there be any, of this meditation to others. To the kings of the air, the generation of brave eagles who hunt the jet planes, kamikaze! Bees, humming birds, the red tail hawk, PALAKWAIO, Simurgh, Garuda bearing the Buddha of all the Buddhas, carrying the standard, from out of the dismal maze of the men in their fury contending for the right!

Father: There. We now have the Holy Spirit out into the Marked State. Memory and genetics, the arithms as perceived by our senses and programed into our biocomputers. What seem to be invariants: K is for konstant. Now there's no sense everybody getting out at once. If Mary wants out into the Marked State, then who goes back into the Form to keep it all balanced?

Son: Me again?

HG: Look, I been in there long enough. Anyway, wasn't the logic of it me coming out, so that all secrets should be revealed?

Father: Hmmmm. What wd Mr. Natural do in such a situation?

Mark: Don't chicken out, Baba, golden fleese.

Mary: That's a good one of my boys.

Father: Looks like it's my turn. Om doubt.

Transcript Session One: Monday Morning, March 19, 1973

JOHN LILLY: G. Spencer Brown—enigmatic figure to say the least. His book preceded him. We know less about him than we know about Carlos Casteneda. His book expresses a good deal that is impersonal, universal; and hence, the man is kind of hidden by the book. I began to find the man when I found his second book, published under a pseudonym, James Keys, called *Only Two Can Play This Game*, and as soon as I read footnote One, I suddenly realized what *Laws of Form* was all about. And with that I will leave the discussion to G. Spencer Brown: *James*.

G. SPENCER BROWN: Well, I don't know what to say. It is a great pleasure, a great honor, to be here. I don't feel that I deserve the honor in any way. It is also—I think I feel rather nervous, as this audience has so many and so different qualifications.

Mathematics and Logic

I don't hope to do anything but really answer any questions that anybody has to ask about the nature of what I was trying to do when I began to write Laws of Form and the very different answer, what I actually found, that had appeared when I had finished the book, which was not what I had set out to do. I guess that is the only way that I can begin to talk about the work, which is as far as I am concerned entirely impersonal. It has as little to do with me personally as anything I can imagine. I have no particular attachment to it. I wouldn't do it again if anybody asked me to. I was conned into writing it by thinking that it would have an entirely different effect from what it did have; and, in completing

it, I unlearned what I learned, the kind of values that present-day civilization inculcates into us soon after we are born. And I learned that it was all the same anyway, whichever state one went into. It is only by assuming that some states, or that a state, one State, may be better than another, that the universe comes into being. The universe, as I then discovered, is simply the result of if it could be that some state had a different value from some other state. But that is to start at the end.

At the beginning, what I was concerned to do was—having left the academic world and gone to living in London, I became an engineer. And I was detailed to make circuits for the use of the new transistor elements that were coming into being for making special purpose computers. I was employed by a firm then known as Mullard Equipment, Ltd. a branch of the Phillips organization, and I was employed not because of any engineering qualifications but because I had taught logic at Oxford and it was recognized that, in fact, the study of logic in some form or another-was necessary to designing circuits involving on-off switches. So I began with the very specific task of applying what I knew to these circuits, to see if we could devise rules for designing that would save money.

I rapidly found that the logic I had learned at the University and the logic I had taught at Oxford as a member or the lofty faculty wasn't nearly sufficient to provide the answers required. The logic questions in university degree papers were childishly easy compared with the questions I had to answer, and answer rightly, in engineering. We had to devise machinery which not only involved translation into logic sentences with as many as two hundred variables and a thousand logical constants—AND's, OR's, IMPLIES, etc.—not only had to do this, but also had to do them in a way that would be as simple as possible to make them economically possible to construct—and furthermore, since in many cases lives depended upon our getting it right, we had to be sure that we did get it right.

For example, one machine that my brother and I constructed, the first machine I mentioned in *Laws of Form*, counts by the use

of what was then unknown in switching logic; it counts using imaginary values in the switching system. My brother and I didn't know what they were at the time, because they had never been used. We didn't at that time equate them with the imaginary values in numerical algebra. We know now that's what they are. But we were absolutely certain that they worked and were reliable, because we could see how they worked. However, we didn't tell our superiors that we were using something that was not in any theory and had no theoretical Justification whatever, because we knew that if we did, it would not be accepted, and we should have to construct something more expensive and less reliable. So we simply said—"Here it is, it works, it's OK," and British Railways bought it, we patented it, and the first use for it was for counting wagon wheels. It had to count backwards and forwards, and we had one at each end of every tunnel. When a train goes into a tunnel, the wagon wheels are counted, and when it comes out, they are counted. If the count doesn't match, an alarm goes out, and no one is allowed in that tunnel–at least, not very fast.

This had to be not only a very reliable counter, it had to count forwards and backwards, because—you know what happens when you get on the train: it goes along and then it stops and then it goes backwards for a bit, goes forwards. So, if the train was having its wheels counted, and then, for any reason, ran out of steam and got stuck and then slipped back, then the counter had to go backwards. So all this we had—but we made it in a way which was very much simpler than, and very much more reliable because of being so simple, than the counters in use at that time, which amounted to much more equipment, many more parts. This device was patented. The patent agent of the British Railways, who patented it—of course, we never told him what he was writing out. We just told him to write this down. And it worked, it has been used ever since, and though there have been many disasters in British Railways since that time, not a one of them has consisted of any train running into a detached wagon in a tunnel. Fingers crossed, touch wood.

We made many other devices, and during this time I realized that, unfortunately, it would be necessary for somebody to write up the mathematical basis of the new principles that we were using. And I realized that if I didn't do this, it would be very hard to find anybody who would. And so I started writing it up.

After we had been using the new principles for about a year, most of the discoveries had been made. I wasn't quite sure of the theoretical basis of some of them. For example, to realize that what we were using in the tunnel was imaginary Boolean values to get a perfectly safe, reliable answer, which was quite definite. This I didn't realize for another six years. But most of the principles, by that time, I did realize. They were the whole of the mathematical basis of what we were using, which was switching algebra, commonly called Boolean algebra and the algebra of logic.

I must point out for emphasis at this time that the switching use and the use in checking a logical argument are two entirely different applications from the same mathematics. The same mathematics underlie both, but it is not the same as any one of its interpretations. In other words, the mathematics in *Laws of Form* is not logic, logic is one of many of its interpretations. Just as, when one does electronics, the electrical application is not itself the mathematics but one of the interpretations of mathematics.

Boolean Mathematics

Logic, in other words, is itself not mathematics, it is an interpretation of a particular branch of mathematics, which is the most important non-numerical branch of mathematics. There are other non-numerical branches of mathematics. Mathematics is not exclusively about number. Mathematics is, in fact, about space and relationships. A number comes into mathematics only as a measure of space and/or relationships. And the earliest mathematics is not about number. The most fundamental relationships in mathematics, the most fundamental laws of mathematics, are not numerical. Boolean mathematics is prior to numerical mathematics. Numerical mathematics can be constructed out of Boolean mathematics as a special discipline. Boolean mathematics is more important,

using the word in its original sense: what is important is what is imported. The most important is, therefore, the inner, what is most inside. Because that is imported farther. Boolean mathematics is more important than numerical mathematics simply in the technical sense of the word "important." It is inner, prior to, numerical mathematics—it is deeper.

Origins

Now at the beginning of 1961, the end of 1960, having set out, first of all, as an exercise in what I thought was logic, I began to write it out. Realized it wouldn't fit. Took it back. Took it back, got it farther and farther back until I got it right back, what we had been working on in engineering and the principles of it, right back to the simplest ground and the simplest obvious statements about the ground one had constructed. And at the end of 1960, I had become conscious that the whole of this mathematical world could be taken to the simplest of all grounds, and the grounds were only that one drew a distinction. The defining of a distinction was a separation of one state from another—that is all that was needed.

* * *

This was all that was needed to make the whole of the construction which is detailed in *Laws of Form*, and which will suffice for all the switching algebra, train routing, open/shut conditions, decision theory, the feedback arrangements, self-organizing systems, automation—and, amusingly enough, the logic by which we argue, the logic that is the basis of the certainty of mathematical theorems. In other words, the forms of argument which are agreed to be valid in the proof of a theorem in mathematics. To give you a simple one: "If x implies not-x, then not-x." That is a commonly used argument... I can be sure that it is valid by the principles of the mathematics itself that underlies it.

The arguments used to validate the theorems in *Laws of Form*, as we now begin to see, are themselves validated by the calculus dependent upon those theorems. And yet, in no way is the argument

a begging of the question. Now this is rather hard to understand, and perhaps it may come up in discussions later. *Principia-principii*, begging the question, it not a valid argument; it is a common fallacy. In no way is the question begged but in producing a system, in making its later parts come true, we use them to validate the earlier parts; and so the system actually comes from nothing and pulls itself up by its own bootstraps, and there it all is.

Nowhere does this become more evident than in this first and most primitive system of non-numerical mathematics; and I am quite sure—no, I will not say I am quite sure, when one says "I am quite sure" it means one is not quite sure—and I guess, I guess that why it is a branch of mathematics so neglected hitherto is that it is a bit too real. It is a bit too evident what game one is playing when one plays the game of mathematics.

If one starts much further away from the center, then you don't see the connections of what you are doing. You don't see that what comes out depends on what you put in. You can devise an academic system that goes on the assumption that there is objective knowledge, which we are busy finding out. We have come along here with wide-open eyes, and what we see over there—we come along and we give a demonstration, and we write it out, etc., and when somebody says, "But just what is it that gives the formula that shape? Why is it that shape and not some other shape? What is it that makes these things true? What is it that makes it so that when we see this, what makes it so–why isn't it otherwise?" And the stock answer is—"Ah, well, that is how it is, and that is the mystery."

Mystery, after all, doesn't mean that we scratch our heads and look in astonishment and amazement. Mystery means something closed in. A mystic, if there is such a person, is not a person to whom everything is mysterious. He is a person to whom everything is perfectly plain. It's quite obvious. And the person who designates himself a non-mystic, and has nothing to do with that kind of "woolly thinking," is a person, an ordinary academic, who writes down his mathematical formulae, and when people say "Why do they look like that, why don't they look some

way else"—"Well, they just are that way–it's perfectly justified by mathematics—if you do mathematics, that's what you have to learn to do." In fact, when one starts from the beginning, there is nothing to learn. There is everything to unlearn, but nothing to learn.

KURT VON MEIER: When you told us about tunnels I saw the great psychocosmic projection of images and tales of the parable of Plato's cave. So I imagine you have provided us with the parable of the tunnel. It is in the shape of the hole of doughnut, topologically, so we could look for the seven-color rainbow with which to color it. See the map of a torus–it is seven colors.

SPENCER BROWN: Do you know the proof of that?

VON MEIER: I think there have been many attempts–

SPENCER BROWN: It has been proved. I haven't actually followed the proof of that, although the question is interesting topologically.

Coloring a Torus

I believe the principle by which you can prove that you can color the surface of a torus with seven colors is wholly different from the principle by which—if it is true that you can color the surface of a sphere with four colors—by which it would be proved. I have a feeling about the general question... have you looked at it like this: in any surface, if you take a small enough part of it, you have again the problem of the plane. Because a small enough part of any surface is, for all intents and purposes, a plane. You take a little bit of a torus and now you have a four color theorem again. As long as you don't go round... and round [Figure 1].[1] The four-color theorem is contained in every theorem about surfaces... And so it is a different kind of theorem.

MAN: Is there a question of which is prior, or that sort of thing?

[1] missing?

SPENCER BROWN: Well, I think there is a difference like this: you can prove the color number—like, a torus is seven. It needs a minimum of seven colors to be sure of coloring a map on a torus is that no two bordering areas are the same color. I think that these are all decidable using what is currently allowed in mathematics: Boolean equations of the first degree only. I think that why we cannot, why we never have decided the four-color theorem and a number of other theorems, like Fermat's last, and Goldbach's, is not that they are undecidable. The questions can be asked, and, Wittgenstein was right about this, if a question can be asked, it can be answered. There is a definite answer to all these questions, these theorems are actually true or false. Why we cannot decide them is that they need, in fact, at least equations of the second degree in the Boolean argument, and possibly use of the imaginary values. The answer would be quite definite, Just as the answer to the number of wagon wheels, although the actual logic has used imaginary values. The answer is quite definite.

VON MEIER: We are getting into interesting space. I can see a wagon wheel as something of an iron doughnut, if you like. It's been put on the axle of a train. And if you see the tunnel of the British railway system and consider the space that flows through that tunnel as going around the whole earth and inside the tunnel and then around up to the sky, what we have, in fact, is a superdistended doughnut. And what you were explaining about the wagon wheels passing through the doughnuts, then, would seem to me to be something to do with the space that's ruled by the spirit of inside the doughnut, provided by the doughnut hole. What kind of changes can take place inside that domain? It is in a field—there are analogs in physics that define the inside of the doughnut as continuous, and get, nevertheless, in a special way distinguished from the space of the rest, the outside, of the doughnut.

SPENCER BROWN: I pass on that one.

ALAN WATTS: A human being is topologically a doughnut.

LILLY: Have you formulated or recommended an order of unlearning?

SPENCER BROWN: I can't remember having done so. I think that, having considered the question, the order of unlearning is different for each person, because what we unlearn first is what we learned last. I guess that's the order of unlearning If you dig too deep too soon you will have a catastrophe; because if you unlearn something really important, in the sense of deeply imported in you, without first unlearning the more superficial importation, then you undermine the whole structure of your personality, which will collapse.

Therefore, you proceed by stages, the last learned is the first unlearned, and this way you could proceed safely. Related to what is in the books, we know they say that in order to proceed into the Kingdom, one must first purify oneself. This is the same advice, because the Kingdom is deep. What we talk of in the way of purification is the superficial muck that has been thrown at us. First of all that must be taken off, and the superficial layers of the personality must be purified. If we go to the Kingdom too soon, without having taken off the superficial layers and reconstructed in a simpler way, then there is a collapse. The advice is entirely practical. It is not a prohibition. There is no heavenly law to say that you may not enter the Kingdom of Heaven without first purifying yourself. However, if you do, the consequences may be disastrous for you as a person.

This is why in psychological, in psychotherapeutic treatment, normally the defenses are strong enough. As the psychiatrists will usually tell you, "If I push in this direction, you will be able to withstand me if you really need to." And it is much the same in all medicine. A rule I learned—I guess one learns it here, John, in the treatment of physiotherapy, manipulation of the limbs, etc.—we are allowed to go and pull them around with our little strength, but not to use machinery, because that may break something. The body can normally defend against one other body, and you don't

usually break anything as long as you use one physiological equipment against one other. Usually the same; one mind against one other, the other mind is strong enough to withstand it. Start using other methods, drugs and/or mechanical treatment, and there you may do damage. You may get past defenses which were there in order that the personality should not be broken down too much, too soon.

WATTS: There is a value assumption in here about what is broken down. What is disaster, what does that mean?

SPENCER BROWN: Well, it is a value judgment, true enough. In reality, it is all the same. In reality, it is a matter of indifference, but we are not here in reality. We are here on a system of assumptions, and we are all busy maintaining them. On that system, then we can say, "Well, that will keep the ship afloat, and this will pull the plug out and we will all sink."

Degree of Equations and the Theory of Types

DOUGLAS KELLEY: As we go from second order equations to third order, I imagine you would like to maintain your two, and only two states, the marked and the unmarked. And if that is the case, in going from second to third order, do you get a more generalized concept of time, or a little different- I am just wondering what a third order equation would look like.

SPENCER BROWN: Well, I think you mean "degree" equations first, second, and third degree equations.

KELLEY: A degree of indeterminacy, yes.

SPENCER BROWN: Now, basically, once we have gone into the second degree, and it applies in numerical mathematics as elsewhere, you have added another dimension to your system. In going to higher degrees, you don't really add; because, when you start with the form, the form is just having drawn a distinction. You now have two states. It's the simplest, widest term I could possibly use here–states on earth, any thing, you see,

states of minds anything at all. You have two states, which are distinguished. That is all you need.

Now, the whole of the first degree equation in the Boolean form are in terms of these two states. When you do this peculiar thing of making something self-referential that is making the answer go back into the expression out of which the answer comes, you now automatically produce this set of possibilities which are well-known in numerical mathematics and of which everyone's been terrified of looking at in Boolean mathematics And Russell/Whitehead were so frightened of these, that they just had a rule with no justification whatsoever that we Just don't allow it, we don't even allow people to think about this.

Now what nobody saw was that in numerical mathematics we had this going for years. As I showed in the preface to the American edition to *Laws of Form*, any second degree equation—perhaps, for those of you who don't know it, perhaps I should put it up on the blackboard if nobody has objections to my using chalk.

You see, what Whitehead/Russell didn't allow, was a self-referential statement; they didn't allow to say that this statement is true. `["This statement is false" written on board.]` Suppose that this statement is true, then it can't be true because it says that it is false. O. K. then, supposing it is false, then it must be true because it says that it is false. And this is so awful, so terrifying, that they said, "Right. We will produce a rule. We call it the Theory of Types to give it a grand name." The Theory of Types says—it is as much unlike what it says as possible, so that when someone says, "Well, what is the rule by which you can't have this?"—"It's the Theory of types," so that the people who are learning think that there is a huge theory, you see, and when you understand this theory you will realize why it is that you can't have such a thing. There is no such theory at all. It is just the name given to the rule that anything like this you must do this to. `[Erases it.]` That is the Theory of Types.

What they hadn't done was scratched out something like this. `[Writes` $x^2 \rightharpoondown 1 \ / \ 0$`.]` I'll just put it in the mathematical form. You see, Russell, as a senior wrangler, or second wrangler,

in mathematics, should have been familiar with this equation. But he never connected it with what he had done.

Now here is an equation which admittedly had a bad name for years. But it was so useful that all of phase theory in electricity depends on it. So let's fiddle with it. Here is our equation. We want to find the roots. We want to find the possible values of x. So let's fiddle with this and have a look for them. Well, here we go. Here we just subtract one from both sides; now we'll divide both sides by x. Well, x^2 divided by x is x, equals >1 over x. Well, now, we see that we have in fact a self-referential equation. Everybody can see that. Let's have a look at this equation x / $>1<x$, and see whether it is amenable to any form of treatment, psychiatric or something. You have to psychoanalyze it.

The thing that makes the former statement so worrying, so frightening, is that we have the assumption that the statement, if it means anything at all, is either true or false. Here, we have the assumption that the number system runs ...-1, -2, -3, zero, 1, 2, 3... and it goes on infinitely in an exact mirror both ways. So we assume that the number is not zero—zero is meaningless in the logic form. The statement is not meaningless. It is either positive or negative. We have got to make that analogy here. We equate "positive" with "true," and "negative" with "false"—it doesn't matter which is which. So here is our number system as defined. Here is our equation from which we are supposed to find the possible values that x can take. Now, we know that the equation must balance...so first of all we'll seek the absolute numerical value of x, irrespective of the sign, whether it's positive or negative. Now suppose x were greater than one—not bothering about the sign for the moment—suppose it were greater than one—then this clearly would be—not bothering about the sign—less than one. If x were less than one, then you have got something bigger over something smaller, this would be greater than one. So the only point at which it is going to balance numerically is if x is a form of unity. Because you can see perfectly well that if this is greater then that would be smaller, if that is smaller, this would be greater.

So we have only got two forms of unity—plus one, minus one. So we'll try each in turn. So suppose x equals plus one, now we'll substitute for x in this equation and we have minus one over plus one equals minus one. $\multimap 1 \;/\; {}^{\backprime}1 \triangleleft {}^{\backprime}1 \;/\; {}^{\backprime}1$. So you've got plus one equals minus one. So try the other one, there is only one more. x equals minus one. Now we have minus one equals minus one over minus one equals plus one. ${}^{\backprime}1 \;/\; {}^{\backprime}1 \triangleleft {}^{\backprime}1 \;/\; \multimap 1$. So we have exactly the same paradox this time. Instead of "true" and "false," we have got "plus" and "minus." So using the Theory of Types consistently, the whole of the mathematics of equations of degree greater than one must be thrown out. But we know perfectly well that we can use this mathematics. What we do here is that effectively we have an oscillatory system—just as in the case of *Laws of Form*, if you put it mathematically, we have x cross equals x, $\backprime\!\!\multimap x \backprime\!\!\multimap \;/\; x$, or a cross going back into itself, ∂x).

Supposing it is the marked state, then it puts the marked state back into itself, and the marked state within a cross produces the unmarked state outside. $\backprime\!\!\multimap\backprime\!\!\multimap\backprime\!\!\multimap \;/\; \triangleright$ So this rubs itself out and so you get the unmarked state fed back in, and so out comes the marked state again.

* * *

Well, you see here the paradox which was overlooked by Russell, who wasn't a mathematician, although he was senior wrangler, and by Whitehead, who was, although he wasn't, well... Russell was a mathematician, he wasn't a man of mathematics. Whitehead was a man of mathematics. Russell knew the forms, but he actually had no instinctual ability in mathematics. Whitehead actually had. But Russell, being a stronger character, was able to program Whitehead, and you will see this if you examine the last mathematical work Whitehead wrote, which is called the *Treatise on Universal Algebra with Applications, Vol. 1*. I asked Russell where Vol.—I said I had never been able to get *Vol. 2*, and Russell said, "Oh, he never wrote it." So it's all sort of a mystery. But the mathematical principles of algebra, in the usual complicated way, are set out, including the Boolean algebras, in this volume pro-

duced in 1898, an only edition. By that time Russell, who was the stronger of the two characters, had got together with Whitehead to do *Principia Mathematica*, which nobody was ever going to digest... It was a very ostentatious title, because they had chosen the title which Newton had used for his greatest work.

Incidentally, it is an extraordinary thing in the academic world—people are very silent about these things—but it was a very, very presumptuous title, I think, to take for this work. `[Inaudible comment, to the effect, "Hasn't` *Laws of Form* `been used?"]` Oh, no, nobody has used that title before—no, sir. If I had called it "Laws of Thought," that was used, many people have used that title, but it was not laws of thought. Oh, no, you are on the wrong track, sir. I am not being presumptuous in taking that title... I have called the book what it is, I have not done what Russell/Whitehead did and taken a very great book and called it by the same title. That is totally different.

Now, this is what they overlooked in the formulation of the Theory of Types, which simply says you mustn't do this. However, both Russell and Whitehead had done it to get their wranglerships, get their degrees. But they had not done the simple thing of reducing this equation to this to see exactly what it was.

In fact, if you go to the Boolean forms and use something like this—there's your output—and you take it back in, input there and these are transistors used in a particular way, you have what is called a memory. And, if you put "minus" instead of "plus" there, $x^2 \rangle 1 \;/\; 0$ *instead of* $x^2 \rightharpoondown 1 \;/\; 0$, now what we have here, back in this form here, is our equation. Now we'll put it all in brackets and we'll take out the answer. Now we have exactly the same thing. And just as this is a memory circuit, if this is the marked state here, that must be the unmarked state.[2] And if this is unmarked state, we've got no marked state here, so this will be marked. And we have a marked state feeding itself back into there, and if you

[2] Transmission of Spencer Brown's marks on the blackboard has been absorbed elsewhere in the system. We invite outside constructions. The general discussion concerns re-entry at an odd level and at an even level. If odd, as in $\leftharpoondown x \leftharpoondown$, we get marked state in and unmarked out, an oscillation. If even, $\leftharpoondown \leftharpoondown x \leftharpoondown \leftharpoondown$ we get marked in, marked out, a memory.

rub that out and this goes unmarked, you still have marked here, so it remembers. Equally, if you now put a marked state here, that must be unmarked, and then you can take that off and it doesn't matter because now since you have got unmarked and unmarked this becomes marked, and this, you remember, is unmarked. Similarly here, if you put "plus one" for x, you get plus one over plus one equals plus one, *in* $x \,/\, 1\triangleleft x$, there is no paradox. You can also find a different answer for x, and that is minus one. You get plus one over minus one equals minus one, so that's all right too. So you have, in effect, a memory circuit, and if you put it this way, you can see that. You have an equation with two roots, and this is similarly an equation with two roots. Whatever root you get out, you put back ins and it remembers itself. If you are getting out "plus one," it feeds plus one in there, and it remembers it's plus one. You have a thing to knock it off and turn it into minus one; it feeds a minus one into there and out comes minus one, here, and it remembers it's minus one. Any equation of the second degree that is not paradoxical—that goes through two stages and not one—are the same, and this is a way of producing a memory circuit electronically. It is exactly analogous to this memory circuit numerically. And where, in fact, you put it back, instead of here, you put it back through an odd number such as one, now you have a paradoxical circuit. Because whatever it gets out it feeds back in and it changes. And if you turn that into "minus," $x^2 \,/\, 1$, you now have a paradoxical equation. It can't remember, it just flutters.

* * *

Suppose it were an electric bell; in fact, here under our very noses all the time we have in mathematics the mathematics of the electric bell. And to show how the human mind works, in all the mathematics textbooks it says there is no mathematics of the electric bell. Here it is, all before our eyes. She simplest and most obvious things are the last and hardest to find because we have to get so awfully complicated before we get there.

Feedback

MAN: Are those analogous to positive and negative feedback?

SPENCER BROWN: Yes. It's all straight feedback. A positive feedback remembers itself, a negative feedback oscillates. We have got the mathematics of the oscillator.

* * *

Fluttering

How often do you use this operator, i / ›1, which is derived from the paradoxical equation? Now, why is i used so much? Because i is the state that flutters, is the oscillation. This has been totally overlooked in mathematics, that i is in an oscillatory state. Because in order to get over this paradox of x^2 / ›1, we see that we can't use any ordinary form of unity so we invent in mathematics another form of unity and we-call it i, which is the root that satisfies that equation. And the root that satisfies that equation is that you have —›1, ›1, and here's a state between; and the root that satisfies that equation, whatever it is, it isn't. And this is why i is so useful in dealing with that kind of curve—because it is, by its very nature, that kind of curve. i is an oscillation.

Time and Space

It is really an oscillation defining time; but it is the first time, and, therefore, being the first time, the oscillations are without duration, so the wave has no shape at all. Just as the space or the first distinction has no size, no shape, no quality other than being states. This is one of the things that tend to upset people. It is part of the mathematical discipline that what is not allowed is forbidden. That is to say, what you don't introduce, you can't use. And until you have introduced shape, size, duration, whatever, distance, you can't use it.

In the beginning of *Laws of Form*, we defined states without any concept of distance, size, shape—only of difference. Therefore the states in *Laws of Form* have no size, shape, anything else. They are neither close together nor far apart, like the heavenly states. There is just no quality of that kind that has been introduced. It's not needed.

The same with the first time. The first time is measured by an oscillation between states. The first state, or space, is measured by a distinction between states. There is no state for a distinction to be made in. If a distinction could be made, then it would create a space. That is why it appears in a distinct world that there is space.

Space is only an appearance. It is what would be if there could be a distinction.

Similarly, when we get eventually to the creation of time, time is what there would be if there could be an oscillation between states. Even in the latest physics, a thing is no more than its measure. A space is how it is measured; similarly, time is how it is measured. The measure of time is change. The only change we can produce—when we have only two states—the only change we can produce is the crossing from one to another. If we produce an expression, like the ordinary expressions in the algebra, we have to make the crossing. We have to do something about it. We have to operate from the outside. If we produce that cross that feeds into itself, now we don't have to do any thing. It is a clock, just as an ordinary distinction is a rule. A rule makes or defines space, and a clock defines time. In making our first distinction all that we have done is introduce the idea of distinction. We have introduced nothing else. No idea of size, shape, distance, and so on. They do not exist, not here. They can be constructed, and they will be, but not yet. They are what happens when you feed the concept back into itself enough times.

Again, when you first construct time, all that you are defining is a state that, if it is one state, it is another. Just like a clock, if it is tick, therefore it is tock. But this time is the most primitive of all times, because the intervals are neither short nor long; they have no duration, Just as these states have no size.

There were some books written about time by a man called J. W. Dunn that I read when I was a schoolboy. I realized that he must be right. I also was sufficiently aware of the social context to go along with the general opinion that he was off his head. He wasn't. He was dead right. Time is a seriality, and he was quite right. In order to get a time such as the one we experience, you have to put it back on itself, because in our time you have duration, which you can measure; and you can only measure the duration with another time. In the first time, you have no time in which to measure how long your duration is, and so, naturally, you can't have any duration. Time is something you have to feed back into itself several times. Like the space of this room, where you can actually measure it–you have to have space to measure space.

LILLY: Is that frequency of oscillation either zero or infinity?

SPENCER BROWN: It is neither. No, it has no duration at all. Just as you can't specify the size of the states of the first distinction.

LILLY: So that it has no determined frequency.

SPENCER BROWN: No. It can't be infinite, it can't be zero. So, the space determined by the first distinction is of no size.

HEINZ VON FOERSTER: It's just "flippety" and not frequency.

SPENCER BROWN: Yes, just "flippety."

MAN: And that's saying it could be any size you want.

SPENCER BROWN: No—you see, all this is a children's guide to the reality, "as if it had some size." It is not right to say it could be any size you want. Because you have to learn to think without size. Anything like that is misleading, just as it's misleading to say this can be any duration you want. It doesn't have duration. It just don't have it. Just like the void don't have quality.

GREGORY BATESON: What about the "then" of logic? "If two triangles have three sides, etc., then..." so-and-so. The "then" is devoid of time.

SPENCER BROWN: Yes. There is no time in logic, because there can't be time without a self-referential equation, and by the rule of types, which is now in operation in the defining of current logic, there is no feedback allowed. Therefore all equations in logic are timeless.

BATESON: So we add sequence without adding duration.

SPENCER BROWN: If you make a feedback, which Russell and Whitehead disallowed, you have a thing which if it is, it isn't.

MAN: A paradox circuit.

SPENCER BROWN: A paradox circuit, yes. In putting it this way, this is the mathematics Of it. I can put it in numerical mathematics, it's the same paradox. Make something self-referential, it either remembers or it oscillates. It's either what it was before or it's what it wasn't before, which is the difference between memory and oscillation.

WATTS: In introducing the word "before", haven't you introduced time? You have a sequence.

SPENCER BROWN: I have to apologize, because you realize that in order to make myself understood in a temporal and even a physical existences as by convention is what we are in, remember I have to use words about the construction of the physical existence in order to talk about forms of existence that do not have these qualities. And if that were easy this is one of the obstacles put in- our way. Basically, to do what I am attempting to do is impossible. It is literally impossible, because one is trying to describe in an existence which has them–one is trying to describe in an existence which has certain qualities an existence which has no such quality. And in talking about the system, the qualities in the description do not belong to what we are describing. So when I say things like, "To oscillate, it is not what it was before; to remember, it is what it was before," I am describing in our terms, something that it don't have. But, by looking at them, you can see.

This is why in all mystical literature, people say, "Well, it is absolute nonsense." It has to be absolute nonsense because it is attempting to do this. But it is perfectly recognizable to those who have been there. To those who have not, it's utter nonsense. It will always be utter nonsense to those who have not been to where the speaker is describing from.

The theory of communication is absolute nonsense. There is no reason whatsoever why you should understand what I am saying, or why I should understand what you are saying, if I don't recognize from the blah, blah, noises coming out of your mouth, that mean nothing whatever, where you have been. You make the same noises that I make when I have been there, that is all it is.

For example, Rolt, in his brilliant introduction to the *Divine Names* by Diongsius the Areopagite, begins describing the form at first, and then he actually describes what happens when you get the temporal existence. It is all the same thing, but he is describing it in terms of religious talk, theorems become angels, etc. When he comes to the place, which he says most beautifully, having described all the heavenly states and all the people therein, etc., and he says, "All this went on in absolute harmony until the time came for time to begin." This is quite senseless. But it is perfectly understandable to someone who has seen what happens, who has been there. One cannot describe it except like this. It is perfectly understandable. Re had described the form and then he had done that, and this is the time for time to begin.

— *Mathematics and Its Interpretations: Nots and Crosses*

There is just one question that I have been asked to answer, and I think it is something that you, Gregory, asked, wasn't it? to do with "not." Was the cross—the operator-was it "not." No it ain't.

If I can, I'll try to elucidate that. I am reminded of one of the last times I went to see Russell and he told me he had a dream in which at last he met "Not." He was very worried about this dream.

He had a dream, and he met "not," and he couldn't describe it. But by the time we are using logic, we have in logic "not."

We say: a implies b. I am assuming that we know the old logic functions. You can describe this, a, as "not a." Now that is not–that is a shorthand for "not" in logic. "Not" in logic means pretty well what it means when we are talking, because after all, logic is only mildly distinguished from grammar. Just as we learn after reading Shakespeare's sonnets that after all they are full of grammar. Some people seem to think that all we have to do is learn grammar to be able to write like that—not so. So, they're full of grammar—they're also full of logic.

Grammar is the analysis of the constructions used in speech, and logic is the analysis and the formulation of the structures and rules used in argument. Now in arguments, there are the variables, "if it hails, it freezes," and the forms; we can say in that case, it means the same thing as "either it doesn't hail, or it freezes," and find this is actually what "implies" means. We can break down "implies" into "not" and "or."

Now when we are interpreting whenever are using the mathematics... we write a for "it hails," and b for "it freezes." If it hails, then it freezes; either it doesn't hail or it freezes. And in the primary algebra we can write, "a cross b," $\rightharpoonup a \rightharpoondown b$. The primary algebra does not mean that. We have given it that meaning for the purpose of operation, just as we may take a whole system of wires, electric motors, etc., and we can put it into a mathematical formula, or we can take some cars and weights, etc., and put them in one of Newton's formulae for findings acceleration. But the formula is not about cars, and so on and so forth; nor is this formula about statements in logic. Just as here we have used a to represent the truth value of the sentence, "it hails," and b to represent the truth value of the statement "it freezes," we are in fact applying, because we recognize the structure is similar, the states of the first distinction to the truth values of these statements. We recognize the form of the thing. And in fact, "not" is in this case, although it is represented by the cross, the cross itself is not the same as "not." Because if it were—well, we can see obviously that it isn't, because,

in this form we have represented "true" by a cross and "false" by a space... if you represent "true" by a space and "false" by a cross, then wherewith our "not"? We have swapped over and identified the marked state with untrue this time, and the unmarked state with true. And here we have identified it with untrue. Change over the identification, which we may do, and now here is the statement. And if this were "not," this would now have two "nots"—but it is not "not." We have only made it representative of "not" for the purpose of interpretation, just as well can give a color a number and use that in altering an equation. But the number and the color are not the same thing. This is not "not" except when we want to make it so. But it has a wider meaning than "not" in the book.

WATTS: Well, it means that it is distinct from.

SPENCER BROWN: No, no—it means "cross."

Marked State/Unmarked State

If you go back to the beginning of the book, you see—you remember this is not what really happens, because nothing happens. We represent what doesn't actually happen but might happen if it could. We represent it in the following way: we may draw a closed curve to represent a distinction, say the first distinction. Now we have a form. And we will mark one state, so, in fact. The mark is, in fact, shorthand for something like that, because it is only a bracket we marked it with. If we don't mark it with a bracket, we find that we have to mark it with a bracket, as I show in the notes.[3]

WATTS: Well, you have got it in the frame of the blackboard.

SPENCER BROWN: Never mind about that. Now, let there be a form distinct from the form. Let the mark of the form be copied out of the form into such another form. Bet any such copy of the mark be taken as—a token of the marked state. Bet the name as the token indicate the state. I missed out a sentence. Bet the token be taken as the name, and let the name indicate the state—right.[4]

[3] Chapter 2, *Laws of Form*.

[4] See p.4 *Laws of Form*.

Now, here, this indicates the state. We now derive our first equation from Axiom One—if you call a name twice or more, it simply means the state designated by the name by which you call it. So we have the first equation ⌐⌐⌐ / ⌐⌐.

Then, let a state not marked with a mark be called the unmarked state, and let any space in which there is no token of the mark designate the unmarked state. in other words; we did away with the second name. This is essential. It's the fear of doing away with the second name that has left logic so complicated. If you don't do away with the second name, you can't make the magic reduction.

BATESON: Are you saying that the name of the name is the same as the name?

SPENCER BROWN: No, no, no. I said here, if you call a name twice, it is the same as calling it once. Your name is Gregory. If I call you twice, it is still calling you.

What people have done is that they have given a name always to both states. There is no need to do that; you have got quite enough to recognize where you are, because you do a search, and if you find the mark, you know you are in the marked state. If you do a search and you don't find it, you know you are in the unmarked state. So that, mathematically, is all that is necessary. So you don't do the second thing. There has been already fear, you see, to have a state unmarked.

MAN: How did the printer feel about this. It must have driven him crazy.

SPENCER BROWN: Oh, he didn't like it–he kept putting things in. The printer and the publisher went absolutely haywire because of equations like this, ⌐⌐⌐⌐ /.

MAN: The American military documents, because of the number of pages that have to be printed, frequently have a blank page, And to be sure that nobody gets confused about it, there is always a

statement on that page that says, "this page is deliberately left blank," which, of course, it is not.

SPENCER BROWN: You see, why it has taken so long for the Laws of Form to be written is that one has to break every law, every rule, that we are taught in our upbringing. And why it is so difficult to break them is that there is no overt rule that you may not do this—why it is so powerful is that the rule is covert.

There is no rule that is overt anywhere in mathematics which says this may not happen, it may not be done. And it is because I found no such rule that I gathered that it could be done, and that it must be done. If you don't do it, you are not doing the mathematics properly, and that is why it is all such a mess. This is only a social rule that you may not do it. And there is no mathematical rule that you may not do it; and in fact, you have to do it. Otherwise the mathematics is a mess and you can't get the answers because you are blocked.

* * *

Now to go on to what I was going to say, which is: next we want to use the mark, which could be a circle. We want to use it. We haven't, in fact, discovered its shape. In the second equation, we discover, really, what the shape is. And we'll see it is inevitable. Having marked one side-if there is no mark, then we know we are on the other sides

WALTER BARNEY: Those m's[5] are outside the circle or inside the circle?

SPENCER BROWN: Well, this one is outside.

BARNEY: I wasn't clear on which is the inside.

SPENCER BROWN: In fact, it depends on where you are. This is already beyond what we have said mathematically, because, in fact, this is only an illustration. Just as, when you play

[5] ?

> Beethoven's music it is only an illustration of what Beethoven wrote. All mathematics in books is only an illustration of what cannot be said. This illustration is misleading because there is no outside or inside when you have drawn the first distinction. You have just drawn a distinction—we can illustrate it with a circle because it happens to be convenient. Then we mark one side, and we know, in this case that it is the outside. But remember that in the mathematics there is no outside. There are just two sides. We have marked one of them, and if we find the mark, we know we're in that state. We call it the marked state because it is convenient to call it by something, which, having marked it, we'll say it is a marked state. Simply for something to call it. And having not marked the other side, we call it the unmarked state. That is all that is needed. We now have every concept we need.

First of all, we have taken the mark as a name. And if you call a name twice, you are simply indicating the same state twice, and indicating the same state twice is the same as indicating the same state once. Now, instead of just calling this m, let us give it certain properties. Bet it be an instruction to cross the first distinction.

Now here is our illustration of the first distinction.[6] Now this is why we've drawn this line on our blackboard, because here is an illustration of the first distinction. Here is a record of instructions referring to the first distinction—right. Now let m, the mark, be taken as an instruction to cross the boundary of the first distinction. So, if one is here, m says go there. If one is here, m says go there. O. E.? m is now not a name, so we can ring that for the moment, don't confuse yourself with that, m is now an instruction. And all m means is "cross." So whenever you hear or see it, you've got to step over the boundary. That is all it means. Now, we will produce more conventions.

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[6] For illumination of what follows, see pp. 82–83 in the notes to Chapter 2, *Laws of Form*.

We will say that we have got a number of crosses considered together, and these we will call "expressions." Now suppose you have this. We'll say—right—we'll represent m like that. And we'll say m means "cross" and we'll make a convention so that whatever is represented in here, you'll have crossed to get what is represented out there. So if there is nothing represented here, absence of the mark indicates the unmarked state. You cross when you are in the unmarked state and you find you are in the marked state. So out here by representation will be a value attributed to this mark, will be the marked state, and that is the value we attribute to that expression.

Now let us put the marked state in here, and we can do that simply by putting another cross in here. Now the convention is that wherever you see nothing you-are in the unmarked state. Wherever you see this, you must cross. So, here we are. We hear nothing, we see nothing, we are in the unmarked state. Our instructions now say "cross," so we cross, and then our second instruction says "cross," so we cross. So here we are, we started here and we have crossed, and we have crossed here, and so we can derive our second equation, $\prec\prec\succ\succ\ /$. So that all this says in mathematics is "cross." It does not say "not." It says "cross."

(End of first session.)

Transcript Session Two: Monday Afternoon, March 19, 1973

SPENCER BROWN: I am aware of a number of different pulls as to which way we could go from here, and in a universe where there is a degree of exclusion, one way excluding the other in a finite amount of time, I'd like to get some consensus as to which way we might go from here. If we could Just ask questions of people as to what we could profitably talk about next.

Algebra and Arithmetic

VON FOERSTER: I think it would be lovely if you would make again for us the very important distinction between algebra and arithmetic. Because the concept of arithmetic is usually—although every child knows about it, and it is plain everyone knows about arithmetic—and here arithmetic comes up in a more, much more, fundamental point. And I thank, if this is made clear, I think a major gain will be made for everybody.

SPENCER BROWN: I'll do what I can to make the distinction clear. I was going to say, "make the distinction plain," which means to put it on a plane. I suppose that most people know that the meaning of the word "plain," if you look at its root, is just another word for plane, plane like blackboard.[1] To make plain is to put it on a plane. So that's what I will do. I will try to put this

[1] The Indo-European root is *pela:* flat, to spread. Related words in English are PLAIN, FIFrn, FLOOR, PALM, PLANET ("to wander," i.e. spread out) PLASMA, POETIC, POTTS. From related roots we get FLAEE, FLAG, PLEJA, PIANO, PLACENTA, FIAT, FICUNDER, PIANO, PEACE, OPIATE, bed.

distinction between algebra and arithmetic on a plane. The reason it should go on a plane is that in a three-space it is difficult to disentangle the connections. So we project it onto a plane. On a plane, we can take a plan, which is the same word. We can see the relationships of the points on inner space, which is not too difficult to comprehend.

Now to make a distinction between algebra and arithmetic, I should go to the common distinction which is made in the schoolbooks, where you have—there are two subjects in kindergarten, perhaps a little beyond kindergarten—a subject called arithmetic, which is taught to you first, and then we have algebra, which is what the big boys and girls get onto and look rather superior about. First of all, let me explain—this word keeps coming up, "out on a plain"—that even arithmetic is not what is taught at school. Mathematics certainly isn't. What the child is first taught is the elements of computation—the computation of number, not of Boolean values. He is taught the elements of computation, which is wrongly called arithmetic. Whereas arithmetic is the—

Let's be clear, for the moment. I'll go back and start again. We should approach this slowly and deviously. I don't want to give the game away before we have got there. In arithmetic, so-called, which the child is—it is true that it doesn't begin with arithmetic, because the child is given an object, two object, three objects, four objects, and he is—I don't think that he is taught that there is something called a number, but he is then taught to write "one, two, three, four," etc., and he is not given that there is somewhere between that—that it one object, that is two objects and that and that, that, that—there is somewhere between these a non-physical existing thing called a number. As I point out in *Only Two*,[2] a number is something that is not of this world.[3] That doesn't mean to say that it does not exist—it surely does. In fact, there are many extant groups of numbers.

VON MEIER: Exstacy? Exstasis.

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[2] *Only Two Can Play This Game*.

[3] See Note 4, pp. 134–5.

SPENCER BROWN: Well, yes, that's "outstanding." Existence, *ex*, out, *stare*, to stand, outstanding. What outstands, exists. And numbers do not outstand, they do not exist in physical space, They exist in some much more primitive order of existence. But they, nevertheless, do exist. But not in the physical universe.

This, by the way, is the first way to confound the material scientist who thinks that physical existence is all there is. You ask him—"Well, you know that there are numbers?" He will perhaps have to say that there aren't any numbers; in that case, you can't beat him. If he admits that there is such a thing as a number, then you say, "Well, find it, where is it, show it to me," and he can't find it. It does not exist here.

Now, a child may come to learn very much later, here, there are objects arranged in groups, here are figures. Number is to be found in another space. Not in this space. However, these are the symbols, tokens of number, which can be in any form—Roman, etc. Playing around, saying "two plus three equals five," an elementary computation with numbers, is discovering relationships with numbers, and how they are constructed and what they do together. Sounds a bit rude, but that's what we do.

When the child gets a bit older, he is taught what is called algebra. The first teaching of algebra that was given to me, it may be the same here, was that we were given things like "a plus b equals c; find c when a equals five and b equals twelve." And we all scratched our heads and learned to do this sort Or thing. Eventually we came to formulae that were algebraic, and were finally told things that were universally true. We were taught that an algebraic relationship is true irrespective of what numbers a and b stand for. In other words, as we learned algebra, we learned it as an extension of arithmetic.

As we got a little older still and went to the university, we learned different names; and—we were taught that, whereas, these were *constants* and these were called *variables*, you could learn the science of algebra without ever knowing what those words stood for at all, treating algebra as a possible system, and having derived, actually, your rules of what to do, in the case of an ordinary algebra

of numbers, from experimenting with the arithmetic. Eventually you see what the rules are, and you operate and find things out without referring back to the constants.

I have given the game away now. This is the difference between an algebra and an arithmetic. The algebra is about the variables, or is the science of the relationships of variables. It is a science of the relationships of the variables when you don't know or don't care what constants they might stand for. Nevertheless, the constants aren't irrelevant, because whatever arithmetic this is an algebra of, if you were to substitute constants for this variables, *a*, *b*, etc., then these formulae still will hold.

A lot of people have said, you see, "How can you have an arithmetic without numbers?"—as the primary arithmetic in *Laws of Form* is without numbers, we will go back in a moment to that. But just at the moment will emphasize, or return to, for memory purposes, the fact that the definition—the difference between algebra and arithmetic is that arithmetic is about constants, the algebra is about variables. The arithmetic is a science of the relations of constants.

In a common arithmetic for university purposes, which for a less vulgar name is called the Theory of Numbers, is the same thing. The Theory of Numbers is arithmetic, it's common arithmetic. The Theory of Numbers, the most beautiful science of all in mathematics—I happen to like it myself, so I praise it—or one of the most beautiful, is the science of the individuality of numbers. A number theorist knows each number in its individuality. He knows about the relationships it forms, and so on, as an individual, as a constant. An algebraist is not interested in the individuality of numbers, he is interested in the generality of numbers. He is more interested in the sociology of numbers that applies, whatever individual numbers come there; he has produced a rule where these people go there and there and there, and so on, and he's not interested in individuals at all.

A very interesting point here is the illustration of Gödel's theorem in the difference between, in number theory, an algebraic factoralization of a number and an accidental factoralization. As

you know, we know from Gödel's Theorem that in the common arithmetic, that's the arithmetic of the integers, the algebraic representations, the rules of the algebraic manipulation of numbers, do not give you the whole story. It doesn't give you the complete story of what goes on in arithmetic. And so we have this factorial relationship—any number that is in that form, we know will factorize into that form. But there are what are called in Number Theory "accidental factoralizations," which happen over and above and irrespective of any algebraic factoralizations that you can find. And this is a very beautiful illustration of Gödel's Theorem. Nobody has ever used it. I think this is because, in general, mathematicians don't-understand Gödel's Theorem or even know what it says. I have lectured to an audience of university mathematics teachers Of maybe rifts. "Can anybody tell me Gödel's Theorem?" Not one. Not one knows what it is. It is one of the extraordinary breaks which mathematics took about the turn Of the century. Where a logic broke off from mathematics, and the two, you know, despised one another; like in gliding and power flying, they weren't speaking the same count. Hence we have this tremendous break, this schizophrenia, in mathematics, where common illustrations of one thing in another field just aren't seen as such. Accidental factoralization is a most beautiful illustration of Gödel's Theorem, if a somewhat technical one, in number theory.[4]

Now having seen, therefore, the difference between algebra and arithmetic—simply that arithmetic is concerned with constants and algebra is concerned with variables—we have—well, as Whitehead points out in the *Treatise on Universal Algebra, Vol. 1*, he points out that Boolean algebra is the only for non-numerical algebra known. Shortly after that, there was a book written by Dickson, who is also a number theorist of some considerable fame, who wrote a very wonderful book called *The History of the Theory Of Numbers*, now published by Dover;[5] and anybody who is inter-

[4] The illustration below that the algebraic system is incomplete, since its rules do not generate all of its possible states.

[5] In the United States, by the Chelsea Publishing Co., New York. A reprint Of Carnegie Destitute Publication #256 (28). By Leonard Eugene Dickson.

ested I think should get it because it contains all that would be of interest, except a very few later things. And he starts right at the beginning with amicable numbers, and shows that the early mathematicians, if they wanted to be friends with somebody, would find a pair Of amicable numbers, and they would then swap numbers and they would eat the number of their friend, to keep the friendship. All this is in the *History of the Theory of Numbers*, by Dickson, which is a wonderful book. He also wrote a book called *Algebras and their Arithmetics,* which—I don't think he actually said it, but it was obvious that every algebra has an arithmetic.

At the same time, mathematical popularized such as W. W. Sawyer were writing popular expositions Of various forms of mathematics, including Boolean algebra. And Sawyer heads his chapter on Boolean algebra, "The algebra without an arithmetic." This can't be. This can't be. If it is an algebra, it must have an arithmetic. And if any mathematician could write this—I am not blaming Sawyer; Sawyer was only standardizing what is common mathematics taught in universities today. He is standardizing the common confusion and block. The fact that mathematics teachers in universities today do not understand the difference between an algebra and an arithmetic, which is simple.

How to Find Laws of Form

So, to find the arithmetic of the algebra of logic, as it is called, is to find the constant of which the algebra is an exposition of the variables—no more, no less. Not, just to find the constants, because that would be, in terms of arithmetic of numbers, only to find the number. But to find out how they combine, and how they relate—and that is the arithmetic. So in finding—I think for the first time, I don't think it was found before, I haven't found it—the arithmetic to the algebra Of logic—or better, since logic is not necessary to the algebra, in finding the arithmetic to Boolean algebra, all I did was to seek and find a) the constants, and b) how they perform.

And the first four chapters of *Laws of Form* are just about this arithmetic, And the nine theorems, with which the two connec-

tive theorems later form what would be called in any other algebra *postulates*, are called here *theorems*, because they are proven. They are not postulates—you do not have to postulate. These are the basis upon which we can build the algebra. The initial equations... are the rules of the arithmetic—or rather, they are all the equations necessary for the arithmetic.

* * *

VON MEIER: What geometries would follow from this?

SPENCER BROWN: None whatever.

VON MEIER: Would there be any relationship?

SPENCER BROWN: Well, geometries are sciences Of spaces Of this kind, of a three-space or something like that, where you already have measurement. In the initial space which we are concerned with, where you have just drawn the distinction, there is no size and therefore no measurement, and no geometry can follow from it. Or, if you like, this is the geometry of it. In other words, we are in a place where geometry and arithmetic condense. Later on we can see, of course, in the Euclidean geometry, for example, that we can express it algebraically and, therefore, arithmetically, without figures.

VON MEIER: This is a plan of geometric icons, then.

SPENCER BROWN: Well, the point is that you don't have any geometry as distinct from the arithmetic here, because if you go into the definition of mathematics in a textbook, you will see that it is the science of spatial relationships—it's about space. The simplest science, the simplest form of space, is of distinction.

Proof vs. Demonstration

KARL PRIBRAM: Is this related to the difference between demonstration and proof?

SPENCER BROWN: Ah, the difference between demonstration and proof is that a demonstration is always done by the rules. A computer can do a demonstration. We can demonstrate this, ⌐⌐⌐⌐⌐⌐⌐⌐⌐⌐ /: condense—we get—that goes out and we get that and that goes out, you see and it goes to nothing. And here, ⌐⌐⌐⌐⌐⌐⌐⌐ /, we just condense twice and it is nothing—not condense, cancel twice and it is nothing. So you demonstrate that-there, that's demonstrated...that's OK, you see. And we can demonstrate algebraic forms. This is a demonstration of arithmetic and a demonstration of algebra as well.

Now proof is quite different. Proof can never be demonstrated. I will give an example of proof—one which is familiar, I am always giving it as an example; and those who have been given this example will forgive me if I give it again now, because it is a very beautiful theorem, a very beautiful proof by Euclid To show the difference between a proof and a demonstration, I go to the illustration—rather than to the Boolean form, I go to the common school form, the arithmetic of numbers, which is so familiar to us all, and therefore, I thinks better for illustration.

We can give a demonstration, a computer can demonstrate, we just follow the rules within the calculus. Where we have to prove something, we always have to find–we cannot find it with the rules within the calculus. In other words, no computer will compute a proof.

Prime Numbers

And we take, for example—or for the purpose of illustration—Euclid's proof of his beautiful theorem; the question asked, "Is the number of primes infinite?" As we see, the prime numbers, and it's obvious when you think of it, as they go on, they get sparser. It's very obvious that they will, if you consider it, because every time we have a new one, we have a new divisor which is likely to hit one of the numbers we're looking for to see if it's prime. If it hits it, if it divides into its then it won't be prime. So, the bigger the number, the less likely it is to be prime. A strange sort of

statement. The science of certainty, taken in probability terms. Because the more primes there are that could divide into it. So for fairly obvious reasons, as we continue in the number series, the primes get, in general, further and further apart. there are fewer and fewer of them. And what Euclid asked was, do they get so thinly scattered that in the end they stop altogether? Or does this never happen?

This is an example, now, of a mathematical theorem. To make it into a theorem, you actually give the answer, you actually state the proposition, "The number of primes is endless." You may not be certain whether it's true or not; you may still be asking the question, do they come to an end or do they go on?

Well, to illustrate the difference between mathematical art, because it now needs an art to do the theorem, where it only used a technique, a mechanical application, to demonstrate something, and we don't need to do it ourselves, as computers can do it so much better, we will now do something that a computer can never do. Because what we are going to do is find the answer to this question–do the primes go on forever or not? We are going to find this answer quite definitely, and we are not going to find it by computation, because it cannot be found by computation; but it can be found like this. This is the way Euclid found it. Be said, supposing they come to a stop—all right, if they come to a stop, then we know they are going to go on for a long time until we come to big primes, but, if they do come to a stop, there will be some largest prime, call it big N. That's it. That is the last prime, the biggest of the lot. If they come to a stop, there must be such a prime. Now, if there is such a prime, and there it is up there, let us construct a number which looks like this: all primes, every single one of them, up to and including Big N. Right. We have made this number by multiplying all the primes together Now, Big N being the largest, this is a number which is made of all the primes there are, there isn't another prime. Because we have assumed that this is the largest.

On the hypothesis that this is the largest, this number is now all the primes multiplied together, and we'll do this multiplication

and get the answers and we'll call the answer Big M. We'll take this number Big M, and we will add one. Now we will examine the properties of Big M Plus One. You see this is why arithmetic is so lovely: it is about individuals. Here is our number Big M, as an individuals here is Big $M \multimap 1$. It is a hypothetical number, actually, it is a nonexistent number—this is why we can't speak of numbers not existing, because some of them do and some of them don't. Big $M \multimap 1$, let's examine its properties. Well, it is obviously not divisible by any other prime, including N. because we know they all divide M; therefore every single prime leaves a remainder of one when we attempt to divide it into $M \multimap 1$. So $M \multimap 1$, therefore, must either be prime, because it is not divisible by any existing prime; or if it ain't prime, then it must be divisible by a prime which is larger than N. Therefore, by assuming that there is a biggest prime, call it N. we have ineluctably shown that this assumption leads, absolutely without any doubt, to the construction of a larger prime, which is either $M \multimap 1$ or another dividing $M \multimap 1$. And that is how Euclid did it, and that is—there are many other proofs, of course, but it still is one of the simplest and most beautiful, and the answer is absolutely certain that there is no largest prime, that they do go on forever. This cannot be done by a computer. Currently there is no computer that has done that.

BATESON: There must be intervening primes, you might say accidental primes, just like that accidental factorization business.

SPENCER BROWN: Between when? Where?

BATESON: Between primes that are made by multiplying sequences of primes and adding one.

SPENCER BROWN: It is not necessary to make primes, you see. This is not necessarily prime, you see.

BATESON: It is not necessarily prime?

SPENCER BROWN: No, it isn't.

MAN: Multiply three by five, add one, that's 16. Non-prime.

SPENCER BROWN: We have to add two. You get 33 and it's non-prime.

BATESON: Non-prime. Why in heaven's—

SPENCER BROWN: It doesn't have to be prime, you see.

MAN: Thirty-one, Thirty-one! Not 33. Thirty-one is prime.

SPENCER BROWN: Right, we get 31.[6] But if you go out far enough, you will find that you get one that isn't prime. But they will be divisible by a prime bigger than the largest prime you have used. Bet's see if we can find one. Uhe-ya, here, wait a minute, 211 is prime, isn't it? I'm just thinking of the prime factorial plus one; at seven, it's two, one, one. That's prime factorial plus one. 211 is prime, as far as I know. We want a table of primes here. Not divisible by 13, is 4... we multiply the next one, 11, 2, 1, 1, 2, 1, 2, 3, 2, 1. Sorry, 11, 2, 1, 0. 2, 1, 0, 2, 1, 3, 1, 0. and so it comes out 2311. Is that prime? Probably not. I am very bad at figures. Divisible by 13... 4... not divisible by 13...

Anyway, I do assure you that if you go on long enough, getting the final factorial, adding one, you will find one that is not prime; but that doesn't matter, because it will be divisible by a prime that is bigger than the biggest prime you have used to produce it. If it were always prime, you would have immediately a means–you would have a formula for producing primes, and this we haven't got. There is no formula for producing primes except going about it the hard way and seeing as they don't divide by anything.

Theorems and Consequences

Now, this is totally confused, the idea of the difference between demonstration and proof in mathematics. In fact, Russell, you see, in suggesting it, completely confused them, and people have done so ever since. What he called theorems are in fact consequences,

[6] Multiplying the first three primes, 2 3 5, and adding 1.

they are algebraic consequences, which can be, in fact, demonstrated. And indeed, he says, "These theorems"—he calls them theorems, they are consequences—"can be proved." And then he does the demonstration and then he calls it *Dem. Dem.* is short for "demonstration."—The two words are used interchangeably and wrongly. There is a difference, and what can be demonstrated is done within the system and can be done by computer. And what cannot be demonstrated, but may be proved, cannot be done by computer. It must have a person to do it. No computer can prove it, because it is not proved by computation. The steps of this proof, Euclid's proof, were not computational steps. No one could do it on a computer, because we were not doing computation. We were divining the answer, we were divining what had to be done by making certain deductions and seeing what they led to. This was an artistic process, not a mechanical one.

The computer cannot do it because it is not computation. Computation is counting in either direction, no more, no less. There is nothing more to computation than that, nothing more.

MAN: I am trying to determine what it is that a human can do that a computer can't do.

SPENCER BROWN: Let's go through the steps again. Where is the computing? We compute nowhere. There is no computation in this proof. Not a single computation can be made, not one. The whole process is a proof. In the whole process of a proof, there is not one single computation, nothing that a computer could do.

MAN: Well, there are two fake computations.

SPENCER BROWN: There are no computations. They were fakes because there were no such numbers. We were imagining doing a computation of a particular kind—we weren't actually doing it, because there were no numbers to put in the places. In fact, there only could have been a computation if our number Big N. being prime to the largest, happened to exist, res. If it happened to exist, and we knew what it was, then we could do this whole thing on a computer. But it doesn't happen to exist.

But in order to find it doesn't happen to exist, we go through the imaginary steps of computing in this particular way, and then we find that if we did that we would find another number which is prime or contains a larger prime.

MAN: John Lilly, what does the biocomputer offer as the possibility of doing this, if the computer doesn't?

LILLY: Well, the biocomputer does the whole thing.

MAN: Say it again.

LILLY: The biocomputer invented the whole thing.

SPENCER BROWN: I know, as an engineer, the computer boys have vastly oversold their products by saying that they can do anything that the human mind can do, and this is not so. They cannot do the most elementary things that the human mind can do. And I blame, I blame Russell/Whitehead for totally mixing up proof and demonstration. If you go through *Principia*, there is not a single theorem, not one theorem.—I think I am right about that, Dr. Von Foerster—because what they call theorems are consequences.

Also, they had a precedent in that Euclid himself already rightly called this a theorem, calls it algebraic. His geometric consequences, he called theorems, they are not. So the confusion developed right at the beginning with Euclid, who called his geometric consequences, they can be computed, he called them theorems. Wrongly. So Euclid was the first offender. And from him, it just shows how we copied. We have copied his error through hundreds of years.

VON FOERSTER: I think the *QED* thing makes it appear as though it were a demonstration—*quod erat demonstrandum*. It should not have been called *demonstrandum*.

SPENCER BROWN: I may be wrong, you see. My Latin—I have little of it—perhaps he was OK. He said *quod erat demonstrandum*, "this has been demonstrated." It is OK after a demonstration, it is misleading after a proof. And maybe he did not make this error, but

we have. We have called them theorems when we should call them consequences. And this has been responsible for—a vast system of error has grown up there. Because a computer has been found to be able to demonstrate consequences—because all you need is the calculating facility to do this. And consequently the demonstration of consequences, in other words, calculations, has been confused with the proof of theorems, which is another matter altogether. Because of this confusion, it has been thought that a computer therefore can do practically all that a man's mind can do. But it can't, because only the most minor function of a man's mind, done very badly, is to compute. And we have, in fact this tremendous emphasis, because of the confusion in mathematics—the difference between computation and actual mathematical thinking–which has led us to believe that computers have minds, can do what we can do.

For example, they put Russell's consequences on the Titan computer at Cambridge. It managed, with great hesitation and very slowly, to demonstrate a few of them, but the more complicated of them it couldn't demonstrate. However, it could have done it, eventually. It was very slow and expensive. Even here, what a computer can do, a man can do better if he gives himself to the problem, because he has the capacity of seeing in—a way the computer never can.

MAN: Can you say what that capacity is? That makes us different?

SPENCER BROWN: Can I say what it is? No, I can only represent it. I can only be it. Just as you are. How can one say what it is except to give examples Computing is 1, 2, 3, 4, 5, space, space, space, space, space, 6, 7, 8. That's five plus three is eight. that's how a computer does it.

* * *

SPENCER BROWN: I have been asked earlier if I would go through with you the main mathematics of the book, and I think this is

not possible because there is not enough time, and it is so varied an audience.

I did do this in London, but it was a series of 20 lectures. I gave it seasonally every year, and even then it wasn't enough to do anything but in outline. Only in the last two or three lectures was it possible, having got most—of the audience to an understanding of what it was about, was it possible to show how it was related—how it could possibly relate to the disciplines of everyday life.

Unless there is a very strong expressed desire here, I don't feel that it would be terribly desirable, for the majority of people here, if I did actually go through technically and get as far as one could—because it wouldn't be far enough to draw on the conclusions that are possible after more detailed study. I don't think it could be done.

* * *

It's just not possible to do everything all at once. You can't make the rice grow by pulling on the stalks. If there is anything further that you would like to discuss now, we'll see what we can do. Or would you like me to suggest one?

First Distinction, Observer, and Mark

LILLY: At the end of Chapter 12, you make a sort of covert statement. You do not develop it, and I'd like you to develop it a little further. You mention that it turns out that the mathematician is one of the spaces.

SPENCER BROWN: The mathematician?

LILLY: Yes, this one of the spaces.

SPENCER BROWN: The part of the observer? "We now see that the first distinction, the observer, and the mark, are not only inter-

changeable, but, in the form, identical."[7] I don't see how you didn't get it already.

The convention is that we learn to grow up blithe game that we are taught to play is that there is a person called "me" in a body called "my body," who trots about and makes noises and looks out through eyes upon an alien, objective thing we call "the world," or, if we want to be a bit grander, called "the universe," which the thing called "me" in "my body" can go out and explore and make notes about and find this, that, and the other thing, find a tortoise, and make notes about a tortoise, and drawings, etc. The convention is that this tortoise is somehow not me, but is some object independent of me, which I in my body have found.

We also have a further convention—well, depending on what sort of people we are, if we are behaviorists, we may not think this—most of us think that the tortoise also sees life in much the same way—that it is a being that has "my shell," "my feet," "my tail," "my head," "my eyes," out of which I look through the hole in the front of my shell and I see objects, big things walking around on two feet, etc., which are different from me. And we think that the tortoise thinks that.

Now, supposing that this is only a hypothesis. Supposing that—if there were a distinction—if there were that—only supposing that, if it could be, what would happen—well, if one imagined—supposing one imagined, well, this is me and that ain't me. Surprise, surprise, what ain't me is exactly the same shape as what is me. Surprise, surprise.

Come to this another way. Take it philosophically. take it philosophically and scientifically. Scientifically, on the basis of, there is an objective existence which we can see with our eyes and feel with our fingers and hear with our ears, and taste with our tongues, smell with our nose, etc., and then we take it to ants. Now ants can see ultraviolet light, which we can't see, and therefore the sky looks quite different to it. Take it to extremes. If there

[7] pp. 76, *Laws of Form.* & also Blake couplet quoted on pp. 126, *Only Two Can Play This Game*, "If you have made a circle to go into/Go into it yourself and see how you would do."

are beings with senses, none of which compares with ours, how could they possibly see a world which compares with ours? In other words, even if one considered it scientifically, the universe as seen appears according to the form of the senses to which it appears. Change the senses, the appearance of the universe changes. Ask a philosophical question and you get a philosophical answer. What therefore is the objective universe that is independent of these senses? There can be no such universe, because it varies according to how it is seen, the sensory apparatus. Take this a little further, and we see that we have made a distinction which don't exist. We have distinguished the universe from the sensory apparatus. But since the universe changes according to changes in the sensory apparatus, we have not distinguished the universe from the sensory apparatus. Therefore, the universe and the sensory apparatus are one. Row, then, does it appear that it is so solid and objective looking?

Now, the answer to this profound question takes a lot of thought, but I will try to give it all to you in a very short time. Because it takes a whole series of remarkable[8] tricks before it can be made to appear like this. But since, if there ain't no such thing, then any trick within the *Laws of Form* is possible, this happens to be one of the possible tricks. If there is no such universe, if there is only appearances then appearance can appear any way it can. You have only to imagine it, and it is so.

BATESON: Can you go into the proof?

SPENCER BROWN: The proof, my dear sir, has nothing to do with the objective world, the proof is mathematical. Nothing in science can be proved.

BATESON: I see.

SPENCER BROWN: It can only be seen. But where it is co-extensive with mathematics, in that, in fact, what is so in mathematics— The basis of what is so in mathematics is what can-be seen. Theorem and theatre have the same root.[9] they are the same word.

[8] Re-markable, markable again ("a whole series").

[9] Greek *theasthai*, to view.

It is the spectacle[10] that we see, and the discipline of mathematics is to go to what is so simple and obvious that it can be seen by anyone. Without doubt, it can be seen. And from this—

BATESON: By turtles. Can it be seen by turtles?

The Turtle's Specialty

SPENCER BROWN: I don't know whether turtles see it. If they do, they have a different discipline whereby they communicate it. We don't talk with turtles, and I can't answer that. I have never spoken to a turtle. But I am sure that turtles can see. Well, they can certainly contemplate reality. I don't know whether they need to see mathematical theorems. I don't know whether they play that game.

VON MEIER: Yes, they carry their numbers on their back—13 variations in the shells in a certain pattern. It's the second avatar of Vishnu, so that when you see the turtle, you're seeing it from the point at which the Ethologists named it God. They have named the serpent the first avatar of Vishnu. She's the cosmic turtle swimming in the sea. And things that run around, run around on the back of the turtle.

LILLY: This is called "maya-matics."

Solid State

PRIBRAM: Why so solidly—Why is objective, so-called reality, so solid?

SPENCER BROWN: Well, it has to be, after all. Oh, dear, what we need is a 20-year course to get to that point.

* * *

[10] L. species, a seeing, from (SPECIES), from Indo-European *spek-* to serve. Related is i. *speculum*, a mirror.

JEAN TAUPIN: Any reality is real, the moment you perceive it as real?

SPENCER BROWN: Well, "reality" means "royalty." The words have the same root.[11] Whatever is real is royalty. And what is royalty but what is universal—the form of the families of England.

VON MEIER: The measure, the *rex*, the *regulus*.

SPENCER BROWN: Yes, that is true.

LU ANN KING: You said two things. The motive precedes the distinction. And then, later on, you said that one has to determine their relevance, that in searching for a clue, you also have to determine its relevance.

SPENCER BROWN: You have to make a relevant construction, yes.

Separating Figure and Ground

KING: Well, just personally, what process do you–

SPENCER BROWN: How do I do it? Just contemplate. One also tries all sorts of ways to get familiar with the ground. Why it may take you two years to find a proof which could be exposed in five, fifty seconds, is that you get familiar with the ground. You try in many ways that won't work, and then you try and try and try and then you realize that trying—One day you stop that. And then, almost certainly, you will find—or seeing it, seeing anything to be so

I had been working on the second-degree equations for five years at least. I was thoroughly familiar with how they worked, and so on—hadn't seen what they were, theoretically. I was wondering whether to put them in Chapter 11, or some other beautiful

[11] *American Heritage Dictionary* gives REALI from Indo-European root *rei-*, "possession, thing" (Latin *res*, thing.); ROYAL from IE *regi-* "to move in a straight line" (Latin *rex*, king), REAL a Spanish coin; *rectus*, right, straight RF&YM; RECTOR RECTUM; L. *regular* straight piece of wood, rule REGULATE, RULE; Middle Dutch *rec-* framework RACE; Sanskrit *raiati*, he rules RAJAH.

manifestation of the form, whereby you break up the distinction and it turns into a Fibonacci series. Well, I won't go into that now because it is another thing altogether. In *Laws of Form* there is only about one twentieth of the discoveries that were actually made during the research. There is enough for 20 books, mathematically, and I had to decide what I could put out, and what I could put into. But the actual research in London is 20 times of what is in the book. And I wasn't quite sure whether to put it in at this point—because the book had to be finished. I wasn't quite sure whether to put in, with this chapter, this beautiful breaking up of the truth where you get the rainbow, which turns into the Fibonacci series. You break up white light and you get the colors. You break up truth and you get the Fibonacci.

VON MEIER: The logarithmic growth spiral?[12][13]

SPENCER BROWN: Yes. I decided in the end that it was more practical to put in the expressions which went into themselves, because we did have practical engineering uses for this. But I still didn't recognize the theory.

* * *

We had been using it, my brother and I, in engineering, but we still didn't recognize what it was. So I sat down to write Chapter 11 and without thinking I wrote down the title. I wasn't sure what I was going to call it, but I wrote something without thinking. I looked at it and I found what I had written was "Equations of the second degree." Now, I was not aware of writing this down. The moment I had written it, that was—Eureka—that is what it was. The moment that I spoke of it to my brother and then to other mathematicians, it began to focus. Yes, of course. And then it was only a matter of an hour or so to go through and see the analogy, which I did on the blackboard this morning. To see the

[12] The Fibonacci series goes 0, 1, 1, 2, 5, 5, 8, 13, 21, etc.

[13] That is, $f(n+1) = f(n) + f(n-1)$.

paradoxes and everything, all the same, all existent in the ordinary common arithmetical equations of the second degree. And this is what we were doing in the thrown-out Theory of Types; the coming to the knowledge of what it is.

How actually does this happen? It happened something like that, after five years of scratching one's head but thinking, nevertheless, let's find out more about it. And then it comes, in a way, quite unexpectedly; in a way, really, for which one can take no personal credit.

—— *Educating the Child into the Material World; The Covenant of the Cradle*

RAM DASS: Is the five years the method to get to the space—from which all titles are, or there was an implication in what you said that your familiarity with the ground was the prerequisite for your then stopping trying and then out comes this thing, which is like a subliminal, or a latent, or something inherent in the analytical process—nothing more?

SPENCER BROWN: Well, I will distinguish the proceeding. It goes very much like the education of the child. The child is born knowing it all, and it immediately has this bashed out of it. It's very disturbing. So it learns the game then. It learns the game that is played all around it—and with variations, it is much the same game in any culture, whether it is the ghetto, or ten thousand years ago, or today in America, or today in England, or today in China, or wherever it might be. It's much the same thing, with variations, of course, in the particular cultural pattern. It has its original knowledge bashed out—it must be bashed. Those of us who have gone back and remembered our births, remembered what we knew, and remembered the covenant we then made with those standing around our cradle, the realization that we now have to forget everything and live a life—

RAM DASS: Excuse me, is the word "know" the proper word to use? Doesn't that imply a knower and an object that is known? Couldn't you say that the infant was being it all?

SPENCER BROWN: If you like, yes. I am only using words—you see, the language is no good for talking this way. We have to use these imperfect terms, which are based on distinctions. And you are quite right, it is not knowing, it is only in its interpretation, knowing. It is like dreaming a funny dream. While the dream is going on, it isn't funny. But bring it out into the critical atmosphere of waking life—now it appears funny. The child is bringing out into this, and it remembers it an knowing it. That is the way it is taught the disciplines.

Can't Have One Without the other

RAM DASS: But you never can get into knowing it. You can only get back into being it again. You can only know a segment or a—

SPENCER BROWN: Well, it's dual, of course, because getting back from the—There is no enlightenment without un-enlightenment.

RAM DASS: There is no survival without un-enlightenment, actually.

SPENCER BROWN: Well, I'll come to that.

VON MEIER: The planted seed is always regarded by primitive cultures as having died.

SPENCER BROWN: Enlightenment is different for every form of culture, because every form of culture is a form on un-enlightenment. And the enlightenment matches it, as the form of enlightenment for our culture matches our culture. It matches the way in which we have been unenlightened. Enlightenment by itself, there is no such thing, just as there is no black without white. But to be enlightened, having been

un-enlightened, is not the same as having been un-enlightened before. Because one wasn't really unenlightened at all.

MAN: We need another word.

SPENCER BROWN: Ta. Before, you are neither enlightened nor unenlightened. Then you become unenlightened, from which you have to be enlightened. That is not the same. You remember your original unenlightenment.

PRIBRAM: Original lightenment.

SPENCER BROWN: Well, that would be, in a way, but it might hurt.

VON MEIER: When one sees the light for the first time, from the interior of logical models, or from the cosmic tortoise in the sea, or from the inside of the womb. You see light.

PRIBRAM: What happens ontologically is that somehow as you go on through those five years you distribute the thing, get it split up into parts all over the place, and then, what seems to occur, is that some new constellation, new way of getting it put together again, occurs at that moment of enlightenment. It's some process of that sort.

MAN: After the five years, what happens?

PRIBRAM: I don't know, I just got it to that stage.

SPENCER BROWN: Let's simply go through the procedure again. the covenant with the world that the child rapidly has to make is—"Right. I am not allowed to notice this." But the child perceives where the lines are drawn and not drawn, and then suddenly it realizes that is must put on the same blocks, otherwise it will not be accepted. There is a moment of sanity when this happens. However, it's "good-bye" for quite a long time, I don't know how long. If it is to survive, it's "good-bye," and "hello"—"Hello, world." And now instead of it being able to deduct, because it sees that is fully outlawed, now it goes through the game of those people who know best, and who are teaching it; and in order that they can have the game, and it can play it, it must pretend to know nothing, so that they can

now pretend that they are bringing it up and educating it. And so it then has the—It goes through the learner stage of playing the game, of looking at things and being surprised. "Oh, look at that" "What's this for?" and so on. And thus, the whole proceeding of playing the game that there is an objective world which you can run around and look at and pick flowers and bring them back and say, "Look." It's when one gets very far in this game and begins to wonder what it's about and how it is that we do find something outside, and it does appear to have some structure, and so forth, and to come back and base it on what we are doing, that we begin to see—that we begin to ask the question, well,-what is there outside? We begin to realize that what is outside depends on what is inside.

* * *

Why We See the Same Things

One of the questions that we might ask is why we appear to see the same things. Why does it appear—I can see the moon and you can see the moon. If you are a different shape from me, then you should see a different thing. Well, if you take it-back far enough, we have this, ⌐¬⌐⌐¬¬ / ⌐⌐⌐¬¬¬. In other words, from one mark, we have any number of identical marks. This is a process here. Actually, mathematically, this arrangement is still only one distinction. It has essentially the same rules as this one. Just let's have a look and see where you are. Outside, outside, inside, inside, making one crossing. Outside, outside, inside, inside, outside, outside. There is no difference mathematically between that and that. You make the same number of crossings, you get the same thing. This is the inside and this is the outside. In other words, we can form another illustration of, that is the same as this, in the point where they condense; but even so, we can make it look like two.

Insofar as you and I see the same moon, we do so because it is an illusion that we are separate. We are the same being. We only

appear separate for the convenience of filling space. Of course, we can't have empty space—we'll have to fill it up with something.

WATTS: Parkinson's Law.

SPENCER BROWN: Yes. And with only a limited material to fill it up with. So since space is only a pretense, the observer, in filling space, undergoes the pretense of multiplying himself, or stationing himself. But two people are only like two eyes in one of them. The scientific universe, the objective form which we examine with telescopes and microscopes, and talk about scientifically, is not the form which our individual difference distinguish, It's the form which our basic one-ness, our multiplicity condensed to one—⌐¬⌐¬ . . . / ⌐¬—It's the scientific, objective universe observed with the part of us that is identical for each of us. Hence its apparent objectivity.

What is called "objective" in science is where we actually use our individual differences, where we say, "Well, that's rather different from that," if, in fact, what we observe depends upon that, and so forth; therefore, that's not an objective distinction, that is something which is a personal view. And that is not what science is about.

WATTS: Well, how would you react to the remark that what you have been saying is a system that used to be called "subjective idealism," in which you have substituted the structure of the nervous system for the concept of mind?

SPENCER BROWN: Well, I can go along with the nervous system, because the nervous system is an objective thing in science as well as a thing we observe—as the constants of what is called a body, which is an extension into hypo thetical space of a hypothetical object. I have never had this thing about brain at all. "Inside my something brain"; "my teeming brain." I have never felt that my brain is particularly important.

WATTS: Are we talking about the structure of the sense organs?

SPENCER BROWN: Yes, only to bring us back to the fact that we have made the distinction between the world and ourselves. I have played the science game to show that even in science, playing the science game, which is to say, "Right. The reality is thus: there is a distinct *me* with senses. There is an objective world with objects and lights and things flashing about, and when I see that window there it means because there is light coming through that window focused through the lens of my eye on my retina in a certain pattern, which goes through the nervous channels to the visual area of the brain, where it all project into a muddled, upside-down—" and so on, with the whole scientific story. And the trouble with the whole scientific story is that it leaves us no farther, it leaves us no wiser than we were before. Because nowhere does it say, "And here, this is *why* that is how it appears." But if you play that game, as I was doing for the purpose of illustration, one still finds that, operating philosophically, and saying "Suppose I change all my sensory forms," now the whole universe is changed, I am only doing this to show that even playing the science game, whatever game we play, must leave us the same place. Even playing the science game, we see that there is no distinction between us and the objective world, except one which we are pleased to make.

KELLEY: Can you tell us something about the Fibonacci development?

SPENCER BROWN: Since not everybody here has mathematical training, it is something which, if I have the breath, I will do later with you and perhaps a number of other mathematicians. To explain it to the people-beautiful ides mathematically—it does involve some rather lengthy exposition.

——— *Godel's Theorem: Completeness and Consistency*

KELLEY: Maybe another question that wouldn't be too far out: what's the definition of the accidental factorization?

SPENCER BROWN: I was hoping you weren't going to ask me that. It has been a long time since I've done this. Again, it is something that I would—

KELLEY: As I recall, I think that Gödel's Theorem basically says that in an algebra, you don't have completeness and consistency.

SPENCER BROWN: Not in an algebra. In the common algebra of numbers you can't have both. This is where so many people go wrong over it.

KELLEY: But the result is no more general than from the common algebra of numbers?

SPENCER BROWN: No. For example, in this algebra you do have completeness. I have proved it. And consistence. I have proved both. In *Laws of Form*, you find proven consistency,[14] and, in Theorem 17, proof of completeness.

KELLEY: OK, now, does Gödel's Theorem only apply to the algebra based on real numbers? That is, it's beyond the integral, it's a field, right? The field of real numbers, where you've got multiplication, addition, and associativity.

VON MEIER: A system at least as complex as arithmetic.

KELLEY: Well, I am trying to find out where the boundaries are.

SPENCER BROWN: It does, in fact, have interesting boundaries. This is a very common error among mathematically trained people, that it does, in fact, apply all over. It doesn't—it's not applicable to the primary algebra, which is both consistent and complete. It is not applicable in a modulus where algebraic factoralizations are the only factoralizations. Gödel's Theorem doesn't apply. The modulus is both consistent and complete.

The ordinary algebra of number, not introducing the complete system—for example, the algebra of the positive and negative integers—now Gödel's Theorem applies, provided you use both constants, multiplication and addition. The difficulty is that you

[14] Theorems 3, 4.

have got two voids—you have got a void of zero in addition and you have got a void of one in multiplication. The constant you put in makes no difference. Interestingly enough, it doesn't apply to the complete number system.

KELLEY: It applies in an integral domain, but it doesn't apply in the field.

SPENCER BROWN: In the whole, in the complete field, using real and imaginary number, no. Complex numbers. It doesn't apply.

KELLEY: OK, what if you have just the field of real numbers, not including complex numbers?

SPENCER BROWN: Then I think it applies.

KELLEY: Now I think I am beginning to get an idea of where the boundary is: when the field just includes real numbers, it applies; but when you have complex numbers, it doesn't.

SPENCER BROWN: It happens that way, yes. But it is beautifully illustrated in cases where you are working with a modulus where you have no accidental factoralizations. If you find the algebraic factoralizations, you have found them all. Whereas when you are not working with this modulus, when you are working with the integers, when you have found the algebraic factoralizations, you still haven't found them all. The others are called the accidental factoralizations.

(End of Session Two.)

Transcript Session Three: Tuesday Morning, March 20, 1973

SPENCER BROWN: I was asked if I would deal with certain technical points yesterday. I said that I would, but I feel that it would not be in order for me to do so because it does seem talking to a very few people—just one or two—who are interested in specific, narrow questions of research; and I do feel that this is more in order if, in fact, the audience was oSethe same kind of peoples and then we could talk about whatever technicality may be in order and required.

Also, in respect to certain technicalities, I do like to prepare myself for them. I once went before an audience during a course of 20 lectures, and I had to prove a theorem which I thought I knew so well I didn't need notes; but I started on the proof and I couldn't remember it, and so I asked for help from the audience and they were helpless. And I spent the whole lecture trying to find the proof, and they were trying to help me, and in the end it was wasted. That was the only time I have ever done that, and as soon as I got book home, of course? I remembered the proof.

I don't think any of the technical points are as technical as that, but I do like to be prepared and I do like to give a technical exposition to a wholly technical audience; because, if there are others who are not specifically interested in the technical question or haven't sufficient training to understand it, I think it would be a little unfair to them to have to listen to something which doesn't mean very much as far as they are concerned–even though they may be very obvious points to someone with mathematical training.

There was a mathematical lecturer, a professor at Cambridge in my college, Trinity, who was giving a lecture...and he was just

coming to the end, he was just rounding off and saying "It is obvious that—" "But sir—I don't see that it is obvious." So he had a look at the blackboard formulae and did a few calculations, and the time for the lecture was finished and everyone got up and went away. And this student who had asked the question still staged on. And he tried something else, and then said, "Excuse me just one moment, I must go back to my room and look up some books." And so he went back to his room, And then five hours later he walked back into the lecture room and there was the student, still waiting. And he got up triumphantly onto the platform and said "Yes, it is obvious." that is what *is* obvious in mathematics—the more obvious it is, the longer it takes to find it.

No 'Not' Sense

BATESON: To take off from yesterday's turtle, somewhat—

SPENCER BROWN: The turtle, the tortoise—oh, yes.

BATESON: My interest, if there is anybody who will go along with it—if it's a nuisance to them, would they say so—is in, amongst other things, animal communications. And what goes on between animals is evidently characterized by, amongst other things, the absence of "not"—the absence of a simple negative. While they can forbid each other—say "don't"—they can in general not deny a message which they themselves have emitted. They cannot negate.

Now, the messages which they emit tend to go in the form of intentional groups, or something which is part action, and part stands as a name for the whole, in some sense. So their showing of a fang is a mentioning of battle. Not necessarily the beginning of a battle; possibly a challenge, possibly a mentioning with a question mark—I mean, "Are we here to fight each other?"

It's sort of in the hope, that I am here, that your *Laws of Form* calculus might be the sense on which to map this sort of sound. We have a two-legged language which is very unsuitable for mapping

what goes on between animals. Indeed, it is unsuitable for mapping what goes on between people.

SPENCER BROWN: Before I answer that, I should have to explain that Prof. Bateson has written most lucidly on this theme, particularly in a little metalog, in the form of a duolog, isn't it, between a father and his daughter.

BATESON: It's merely a dialog, yes.

SPENCER BROWN: —about instinct and about the language of animals compared with the language of us. This is, I believe, now published, and the title is *Steps to an Ecology of Mind.*

There is this delightful little duolog in that book. When I first read it, some years ago in London, I found it contained very profound observations on communication and—excluding, really, in terms of animals like whales and dolphins which do seem to have a form of communication, which, if you could divine it—I hope I am right, John—is at least as efficient as ours and probably something like it and maybe better. I think that this causes something—possibly the same problems that they have. Although they may have something superior to *Laws of Form*, in fact, having got something that is more important, or more fundamental, than not. *Laws of* Form comes effectively from the licensing of the not operator in logic. What is of interest in Gregory Bateson's account of the animals is that they don't so much communicate as commune with us and with each other. And I would like to make this distinction.

Communication and Communion

Amongst the other distinctions that are not commonly made, or, if they are made, are not made consistently, is the distinction between communication and communion. Communication happens according to physical existence, in some physically detachable sense, and the characteristic of communication is that what goes on goes on at the same level. One can take at the level of physical existence, nervous events ordered by sound waves. For

example, wireless waves, or what have you, all detectable in physical existence, followed by a perceptor of information, etc. etc. etc.

Now, it is my thesis that communication is superficial to communion, and without communion, there is no communication, really, at all. That is to say, if there were no communion, which I will now define as a fitting on another level between the communicants–if there is no communions as indeed there sometimes is not, then what is communicated, when it reaches the other end, it not understood.

* * *

The more perfect the fit on the communion level, the less needs to be communicated, the more that can be crossed from one being to another in fewer actual communicated acts. In *Laws of Form*, this is expressed in these two laws—or at least there are pictures of it in the two laws early on, in the canon of contraction of reference,[1] whereby, as people get to know each other better—a gang of kids go about and one word or even half a word is used to express a whole community between them. Whereas when people do not know each other, this has to be expressed in a whole book. But between people who do know one another, however, there is no need for a book, it can all go in half a syllable.

Now when one is communicating, for example, with one's cat, that doesn't have the sort of language we have, or if it does, we don't know it, then it is done in this kind of way. It is done because you know each other. And when my cat says "Meouw," I sometimes say, "What do you mean, 'meouw!'" But this is a game, because if I consider it, there is never a time when my cat says "Meouw" that I don't know exactly what he means. Why I sometimes say, "What do you mean, 'meouw'?" is because I can't be bothered to get up and give it the fish or open the door or pet

[1] pp. 8, *Laws of Form*: "In general, let injunctions be contracted to any degree to which they are followed." The other canon referred to may be *The Hypothesis of Simplification* (pp. 9): "Suppose the value of an arrangement to be the value of a simple expression, to which, by taking steps, it can be changed."

it. If I am honest with myself, there is never any doubt whatever. Although it says "Meouw" it makes it quite plain to me, by the context in which it says it, exactly what it means. And if I pretend that I don't understand, it knows perfectly well that I am being awkward.

* * *

So, to put it on the positive side, if one doesn't make this pretending game and say "Really, the cat ought to be talking like we are," but goes on the level to how it can respond, the communication between a man and the animal can be so complete as to be almost unbelievable. The understanding can be very much greater than between two human beings.

Now, with this question of how is it—I am going a little beyond what Prof. Bateson says in his duolog, where he raises this point. The question of how people get into fights, when, in fact, this is a mistake, they got into one by mistake, through one or the other—people or animals taking what—you see, for example, if I tease my cat and it begins to think "this is enough," then it comes round and gives me a little nip. Now this is not nearly as hard as it can do it. The nip is the same, when it is a warning nip, as when it is a completely playing nip. knd where I have seen things go wrong, then—to get on the subject of where things go wrong—you may have an entirely neurotic animal who does not distinguish between the gradations of nip. Because when an animal has been made neurotic, what it's lost is its capacity to distinguish. And what has happened in its place, it's been devastated in some way; and it either is completely anaesthetized to what is going on, or if it perceives it, it perceives it fully. It perceives a nip of a certain strength as complete war.

BATESON: It's not a problem of your initial thing and the token of it?

SPENCER BROWN: Well, I am going to that.

* * *

I am trying to treat it, first of all, getting into the open, as you are doing with metalogic—getting into the form of extremely simplified and get extremely sensitive communication of animals. The cat has not a great many modulations of its voice and still fewer twistings of its tongue to make what comes out different.

WOMAN: It has the widest range of sounds of any animal.

SPENCER BROWN: It has a wide range, yes, but it doesn't have words like we do. For a lot of things, it says the same thing, but in a different context, looking a different way, or what have you, which can mean in one case "play with me," in another case "feed me," in another case "open the door for me," and so on. Now it does not have any problem with other cats unless they are neurotic, unless they have been in some sense devastated, in which case it may get into a fight mistakenly. And it has more difficulty with humans, because humans tend to be more neurotic. But it doesn't have the problem with a human being who understands the gradations the cat does, and is sensitive to them.

Now, having gone that far, let us consider something which Gregory Bateson posits, and I tend to agree with him: The one thing that a human being has in his language, which other animals, if they have a similar language, don't yet have is a word or an expression having the effect of *not.* Now just as human flesh can accommodate cuts and bruises better than burns—it doesn't seem to know that so well—so the human mind can accommodate to positive sentences much better than to the same sentence with "not" stuck on there somewhere. "Not" appears to be a recent acquiry in language. In fact, if this is so, it would be that wewere least adapted to it, most unreliable with it, and we do agree that we—Indeed, it is well known in business when one has to get something done, that you have to be very careful to put what you want doing in positive terms. Don't put it—like I'm putting it.

My professor of anatomy, J. D. Boyd, didn't appear to understand this. Because he was a very good lecturer—he had if anything one fault. When he was describing some part of the human

anatomy, he would make a list always of the common mistakes that students made as to where a nerve went, of whatever it may be, you see. It doesn't go there, he would always write, and it doesn't go there, and this doesn't happen and that doesn't happen like that. And then he would–this would come out in his lectures and he would say "I cannot understand this," he would say, "I told my students exactly the mistakes they should avoid, and these are the very mistakes they always make."

LILLY: They were following directions.

SPENCER BROWN: They were following directions. And whether the directions have "not" tanked on somewhere or not, is something which they forget. And indeed, this is so obvious that there are ways of maligning people-for example, a picture of somebody in the paper and the caption underneath—"Denies Cuddling Policewoman."

Or one could even go further to the well-known joke of the king who wanted to be able to turn lead into gold; and who—He put an advertisement in the local paper for a magician who could do this. And the conditions were that if the recipe failed, the magician would have his head cut off. Well, lots of magicians came for the pleasure of having their heads cut off—there is one born every minute. And finally a very good magician came and—Well, he would get oil and bring it to a boil, and put in a toad's liver, as an experiment; then you put your lead in and count to 15 and then you add a pinch of salt. You do all these things, you see–this, that, and the other, and so on.

Having finished the recipe—the king was writing it down—he was just about to be taken off to where he would have his head cut off if the thing doesn't work. And just as he is about to be taken off, he says "One moment, your Majesty, one moment. There are just two more instructions that are necessary to this recipe. One is that it must be done by your Majesty himself—you may not delegate. And one more thing, your Majesty, one more thing, you must not think of a hippopotamus while you are doing this."

He kept his head. We are least adapted to "not." "Not" is the worst order to give anybody, the most confusing order, and the most unlikely to be carried out properly. I do think that, apart from possible animals who have a language as evolved as ours, I do think that it does make for a very different wag of seeing the world; or, to put it more accurately, it does make for a very different world. The world waxes or wanes as a whole. The world of the happy is totally different from the world of the unhappy.[2]

Manifesting the Form

So one can either say, "there are various ways of seeing the world," or one could say, "There are various worlds," which means the same thing. How could there be a difference between these two. As soon as we have *not*, we have a kind of world that no animal without *not* ever sees. And since, in *Laws of Form*, the laws of form can be described as coming from granting a license to *not*, it is, therefore, this universe of the *not*-speaking animal that this particular form is about. The form itself manifests in as many ways as there are ways of distinction. As in the *Tao Te Ching*, we start with the first proposition, "The way, as told in this book, is not the eternal way, which may not be told." The eternal way may not be told[3] because it is not susceptible to telling. It is too real for that. It manifests in as many different ways or different expressions as there are differences in the beings to which it manifests. So that—I speak of "The form," that is never the form that is spoken. The form which is spoken is the form as it is manifest to us, as the particular beings we are, with our particular *not* culture, our particular not language, and our particular conventions of life.

And when one looks at a cow in a field and somebody says "What's it doing?" well, I say, "Well, I thank it is contemplating reality." And they say "Don't be ridiculous, how can a cow contemplate reality?" "Why not?" I say. "What else does it have to do all day? What else has it to do?" The thing is contemplating

[2] See Note 2, pp. 133, *Only Two Can Flay This Game*.

[3] The root of *tell* is Indo-European *del-*, to count, Recount, (compute).

reality, what else could it be doing? But the form as it is apparent to a cow—although it is the same form, it is the Way without a Name—how it manifests to a cow is not how it manifests to me. How it is expressed to a cow is not how it is expressed to me.

BATESON: Could one have identified self, without a not?

SPENCER BROWN: Well... that's where you return to the tortoise—because of the game we play, where we have defined there is a "me" inside—"my body" and the "world outside," and we don't even wink when we are doing it. We take it dead seriously. And what we have, you see, to make all this so dead serious, is we take so dead seriously the *not* boundary. And to us the form of the fiction is a boundary with *not*—*not* one side or *not* the other.

Now to recapitulate, how of course can there be any space, where would there be for it to be? How of course can there be any time, when would it exist? The world being the appearance of what would appear if it could, if the impossible were able to come about. Now if the impossible comes about, or appears to come about, in as many different wags as it can, according to the form. And in this particular existence, we have the privilege, if you put it that way the privilege of actually viewing from the apparent outside, other points of view, like tortoises, which are other wags in which the impossible would manifest if it could.

MAN: Do you distinguish between "appearance" and "is"?

SPENCER BROWN: Not at the moment. I would do it if it was needed.

MAN: The reason I ask is that to me the primitive is not but is, and the distinction between animal communication—and I got this from Gregory, standing on his shoulders as it were, looking either down or up, depending on how you interpret my interpretation—it seems to me that the is, the Dizziness of communication is what is particularly human. An animal just—

VON MEIER: No, it's only peculiar to a language. Russian has no copula. Chinese doesn't use the verb "to be"—doesn't articulate being with a special verb in the language. It sets things bedside one another, which is a sense of the Greek word "paradigm."

WATTS: Chinese indicates "is" with "that."

VON MEIER: To translate English?

MAN: To me, I can distinguish between just pointing, saying "Lois," and saying "that is Lois, she is Lois."

WATTS: There's a statement in Buddhist literature, "Void is form." Now the "is" word is not our "is" word. It's "Void that form."

Being and Existence

SPENCER BROWN: Well, one must distinguish between being and-existence, being being deeper than existence. existence is less important than being. However, even being is not the most important. As to existence, well, there is a whole world that be, which don't even exist, and the world that don't exist is far more real than the world that do.[4]

We have an astronomer who talks on the television, and he answers questions—he gives a monthly program and then he also reads his letters. And the letters are usually, "Well, what happens in the center of the sun?" Or "Is the Andromeda nebula a spiral? What colors come out of it?" and so on and so forth. And he was answering the questions in one program and the final question was from a lady who asked on a postcard, asked a short question: "What I would like to know is none of these specific questions-what I would like to know is, why the universe exists at all?" And he put on his most Satanic expression, and just before the fade out he replied, *"Does it?"*

[4] "...to experience the world clearly, we must abandon existence to truth, truth to indication, indication to form, and form to void." pp. 101, *Laws of Form*. See also discussion of five eternal levels, below, p.102.

WATTS: Would you reflect briefly on the word "not" in the context "Whatever is not expressly permitted is forbidden"?

SPENCER BROWN: You mean, "What is not allowed is forbidden"?[5]

WATTS: Yes.

SPENCER BROWN: Well...this is the form of all documents that have to be precise. And mathematical and legal documents are the same in this respect. The point is that you cannot be precise in the expression of anything at all unless you make this rule. Bow otherwise could one, you see—Because one would never know, if you didn't expressly allow it, what was allowed. If you let any "allows" slip through the gate, now you cannot be precise.

The reason we don't realize in ordinary speech or ordinary communications that this is the law of precision is that we have so many unspoken conventions, which in the same society are the same for the same people. That is why, when somebody is playing a game and they suddenly realize that something new that nobody has ever done before in this game is in fact permitted by the rules, and they do it, there is a cry of "unfair," "uaking advantage of the rules" and so on. And then sometimes the rules are changed. Since it is required that it is absolutely precise what may or may not be done, there must be this rule that what can be done is what is specifically allowed.

BARNEY: Can you turn it around and say "whatever isn't forbidden is allowed?" That was the rule in the Garden of Eden.

SPENCER BROWN: Yes, you can do that. What is not forbidden is allowed. Because whenever you have one law, in the next level of existence you have a reflection of it. And, in that sense, you're not talking of mathematics. In mathematics, which has to speak precisely, this is the first canon. I don't actually know that it has been expressed before in any mathematical document.

[5] First canon, Convention of Intention; pp. 3, *Laws of Form*.

WATTS: It has been expressed politically.

SPENCER BROWN: I am talking mathematically, yes, it may have been expressed politically. It is the most commonly broken law when people come up with false proofs; a mathematician will immediately recognize that they have done something which they haven't in their rules actually allowed. And this is how anything can be proved. It's known and it is immediately recognized that the canon is broken in mathematics, but as far as I know, it has not been expressed before as a mathematical canon.

VON MEIER: Identity elements in a group?

SPENCER BROWN: No.

VON MEIER: In number series, zero?

SPENCER BROWN: No, no, this has nothing to do with the elements. This is a canon of how you begin to make your laws. And the first canon is that while you are making the system of the laws of instruction, unless you allow something, then you forbid it.

LILLY: In other words, no covert contracts.

SPENCER BROWN: Yes, no covert contracts. It's all overt, this is the game in mathematics. The whole thing is overt. That is why, whatever we do, we must allow.

WOMAN: Does this cover right or wrong?

SPENCER BROWN: No, this is mathematical. We are not anywhere near right or wrong, you see. The mathematician who is used to the fact that we have, in fact—well, it began with the covert convention, that became overt, that we are only allowed, in defining operator, to define it as operating on two variables. That's what gets us into such trouble, you know. The Sheffer stroke, for example, it is not allowed on more than two and it is not allowed on less than two. So "not A," with a Sheffer stroke, must be done "A stroke A" In fact, if you will read the first few chapters of *Laws of Form*, we specifically allow the operation on more than one variable. Since we have allowed it, we may do

it. And it is not relevant to refer to the forbidding of it in other calculi.

This is the difficulty of reading mathematics, one has to be able to read just what it says, because there is nothing in it that one may assume, apart from the knowledge of the language used and how to count...these are the only things taken as common.

(End of Session Three.)

Transcript Session Four: Tuesday Afternoon Morning, March 19, 1973

SPENCER BROWN: Well, on this last occasion I have received many requests to speak about different things, so perhaps I should deal with the requests in order. The first request is for some guidance on how I use the principles in the book Laws of Form in everyday life. And, since one of the principles which is exemplified in *Laws of Form* is that you don't tell how it is that you use the principles in *Laws of Form* in everyday life, I cannot comply with this request.

I have had another request to talk about the relationship, or distinction, call it what you will, between *male* and *female.* I guess you are asking the wrong director of the company that I represent. It is my fellow-director who is always going off on courses about how to get along with the opposite sex; while I have to stay home and actually do the work. So I get so little time—I have so little experience of either sex that I don't feel that I am qualified to say anything, apart from the fact that, even if I could say something, the subject is so big that it would seem a pity to start it on what must be the good-bye occasion. I can only say, that the more I have to deal with the opposite sex, the less I think I know about either myself or themselves, or vice versa.

In other words, I think both of these subjects are, to some extent, personal and private talks, and other games, rather than for a relatively public lecture, for which I don't feel I have the experience to talk in any way which I feel would be authoritative.

I do feel there's little left now for me to fiag except to thank you all very much for listening and for being such an extremely good audience as to prompt me with what to say for, some, how long is it, two, four, seven—maybe nine, ten, twelve hours, since I have been here. I feel I ought to be making a speech. But, all good things come to an end, and I could I suppose answer maybe two questions, if they don't fall within the limits of what is unanswerable. If anybody has any last requests.

LILLY: I have one.

Footnote One in *Only Two Can Play This Game.* You say[6] "To cut a long story short, it turns out that there are five orders, or 'levels' of eternity." Would you diagram those for me?

SPENCER BROWN: Diagram them?

LILLY: Put five lines and a label at the end of each line. Starting with zero. I find that the following discussion gets a little unclear, because sometimes you are going in and sometimes you are coming out, And I am not clear where you are when you are doing this.

SPENCER BROWN: Well, it looks like an electron [[Fig. 2].] [7] Indeed, in some circles it is an electron. Level ought. Level one. Level two. Level three. Level four. There is a diagram of the five orders to eternity, the five levels. They are brought about—there is no about until they are brought so—by it being, it seeing, it being seeing being, it seeing being seeing being, it being seeing being seeing being, it seeing being seeing being seeing being, it being seeing being seeing being seeing being, and it finally seeing—it being seeing being seeing being seeing being—and if it tries to see that, it finds it can't without going half blind and coming out into time.

LILLY: So time appears where?

SPENCER BROWN: Next one. The first time.

LILLY: The first time appears outside the four levels.

SPENCER BROWN: That's the next look it takes, but it finds it can't see that without going half-blind. After all, as I say there, after all, time is a one-way blindness, the blind side being called the future.

LILLY: Where's "flippety"?

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[6] Page 116.

[7] Missing?

SPENCER BROWN: Well, it corresponds in *Laws of Form* to the void, the form, the axioms which see the form. You have to get this number right, you see; because it is the number that Dionysius counts on his orders of angels, but he doesn't always arrive at the same answer.

* * *

Then you get the arithmetic, which is seeing what becomes of the axioms. And then you be it to do it, and in being and doing it, you find that, being and doing, you see the generalities of it, and that is the algebra. And while you are seeing you notice you have got equations, something equals something else, and then suddenly you decide—aha, supposing what it equals goes back into what it comes from? Now You have generated time and matter all at once; There can be no matter without time. Time and matter come simultaneously. But this is the first matter in which the orders are counted, and it's called the "crystalline heaven," but it is not, really. Technically speaking, it's not really a heaven. And as it keeps recompounding, and re-inserting, it gets the appearance of being more and more solid, until it really, you know, is pretty durable.

LILLY: It can kill you.

SPENCER BROWN: Well, that may be.

VON MEIER: It will sustain our life.

SPENCER BROWN: At the grave, you begin to wonder, Just who is there to be born, to be duped, to be killed? Just where is there for it to be, and just when is there for it to happen? Or, as some sage said, when he was dying and somebody was crying, and he said "Why are you crying?" and he said "Because you are leaving us. Just where did you think I could go to?"

Consciousness

LILLY: Where does consciousness first appear in that setup?

SPENCER BROWN: Well, it's there all—what we consider to be consciousness, in the sense of—you see, it's not called "consciousness" until suddenly you have names to begin with... but there is no meaning—it is co-extensive with existence; because what could it possibly be, anything be, let alone exist, without its being a form of consciousness of its existence. There is no problem of consciousness, none whatever. Its meaning is coextensive with whatever there is.

WATTS: "There was a young man who said, though it seems that I know that I know, what I would like to see is the 'I' that knows me." When I know that I know that I know... I think that's what you've diagrammed.

Waves and Particles

SPENCER BROWN: In the construction of matter, all that happens is that we create the temporal and the material together by imagining that the outside feeds back into the inside. We then have a succession like this of marked and unmarked states generated by this.[8] As long as the tunnel is there, this goes on, and when the tunnel disappears, this is of a particular length, a wave train. But, if this [Fig. 2] were to go past, similarly, this would also appear as a wave train, and yet, as it is, it is—it could be an electron. If there is only one electron left—you know, all the rest were done away with—it would be quite sufficient to recreate everything. So long as there were one bit of space left, it would be quite sufficient. All would grow out of it. If there were nothing left at all, it would be quite sufficient.

"If It Is. It Isn't."

BRENDAN O'REGAN: One wonders how there can be mathematical theorems which exist about space which does not exist.

[8] See p. 60, *Laws of Form* (Fig. 1 and Oscillator Function).

SPENCER BROWN: Who said space did not exist?

O'REGAN: You did yesterday. I was just following you through.

SPENCER BROWN: Oh no, no, I said, you see—in the common usage of existence, space only exists. On the other hand, if we go deeper, go to another level, and say "What does existence consist of?" then we can produce these semiparadoxical statements that say "Well, it is what would appear if it could." This leaves it open as to whether it has or hasn't. It doesn't go one side or the other of the bound. It leaves you still intake[9] form, at the point of indifference.

It is so difficult, in the Western teaching, not to plug for one team or the other—to think that one must make a choice between either and or. In reality, it is neither one thing nor the other. There is no need of this choice. It neither is whatever we say it is, nor is it nothing. It neither exists nor does not exist. Because, remember, we have created it out of what is, in the Russellean paradox—the forbidden contradiction. It has been created out of "If it is, it isn't—if it isn't, it is."

And this is why, to get back to the reality, we have to undo this. We do see it precisely because it neither is nor isn't whatever we see it as. Because if it is, it isn't, and if it isn't, it is, and that is why we see it as a material.

O'REGAN: This point that Earl Pribram was making about that with our abilities to perceive from the sensorial point of view—one might argue that we can only perceive difference, and, in a certain sense, if you say that we can only see it because it is or because it isn't, is the process of it becoming and not becoming that we perceive?

SPENCER BROWN: Yes. hence, once you get to this stage, where you are once in time, now everything is a vibration of it. Vibrations—as we know, the mathematics of vibrations is al-

[9] what should this be

ways the equations with the imaginary value—if it is: it isn't, if it isn't: it is. Whichever it is, it isn't.

VON MEIER: It seems like the inverted image when we see with our eyes, corresponding to our tactile knowing that it is not upside down; so it's an internal systems check.

SPENCER BROWN: I am not sure that is on the same level.

VON MEIER: We have two aspects of reality to deal with—our tactile sense of gravity, knowing something, a pyramid, to be like that; but, nevertheless, seeing it and then having to translate it in our brains. We have to go through that redundancy step.

Understanding and Standing Under

SPENCER BROWN: What has to be learned in any understanding is that one can stay at the same level—one of these levels—or the others as we get on, but there is no understanding by making—say, here is the level of physical existence, with all the light waves and solid objects, and so on. They are not really very solid. You know, when you get down to trying to see them, they disappear. It is the illusion of solidity.

If as much of the science game, in certain aspects of it, goes and says, "right; well, we explain that in terms of this," everything at the same level, there is no understanding. Because "understanding" means literally what it says. You go into another level and stand under. And this is what we are forbidden to do.[10] It takes a long time of relearning, to go from level to level. When you are talking in one level, what is described is quite different from when you go to another level; and, having translated down to another level, we don't have language that will enable Us to do this. And that's why when we talk with understanding, it sounds to people at the same level all the time, it sounds like nonsense. They say: "you are contradicting yourself." Of course you are contradicting

[10] In science.

yourself, because what is at this level is Man[11] image. It is all reversed.

Contradictions

MAN: Do you shoot back and forth?

SPENCER BROWN: Yes. That is why all the mystic utterances contradict themselves. Wittgenstein pointed out that a measure of a tautology, a statement which is true by the very nature of its form—"If A, then B and A, therefore B," that's a tautology—a form of words which has the same truth value as being true whatever you substitute for the variables—Wittgenstein pointed out in Tractatus that all tautologies say the same thing, i. e. nothing. They say not a thing. What he missed out was that—He missed out the image of this—he missed out the other end of this continuum, the other end being the contradiction, which says everything. You can't say all about it without contradicting yourself.

We have so many social values that spill over into our university training, even in so-called objective subjects like logic. Somehow, contradictions are good—sorry, somehow tautologies are good and contradictions are bad. Now this is childish, childish pratings, and you can see how it has arisen. It comes from the nursery, as do most of these things. The nurse says, "naughty Johnny you have told an untruth." "Good Johnny here is a sweet—you have told me the truth." Since tautologies are true, and contradictions are untrue, technically speaking, we have carried this over—contradictions are naughty and tautologies are nice, good things. So one of the reasons for the whole cultural forbidding of mysticism is that it deals in statements that say everything and, therefore, must be contradictory, therefore must be logically false, and, therefore, are naughty.

[11] fix...?

WATTS: A contradiction is a no-no. We've become used to that expression in the United States.

SPENCER BROWN: Well, I don't know what that means.

I am going to come back to one of the beautiful things of Roth, you see. As I called it in *Only Two*, the spectacular introduction to Dionysius the Areopagite. It really is spectacular. I do recommend it. It is much better than Dionysius. It is much better than the book. He originally has this marvelous thing which we were talking about earlier—"and all this went on in perfect harmony until the time came, for time to begin." Utterly contradictory, but, you know, it's the only way to talk of this, because we have to talk in language which—language, you see, is built for a level. That's why when you learn a language, you know, you are confronted with such fatuities as "The pen of my aunt is in the posterior, whereas my—";[12] you know that sort of thing. It's all on this level because this is what makes it respectable. Language is not something designed for shifting gears up and down the levels.

Injunctive Language

LILLY: You talk about the injunctive use of language, however.

SPENCER BROWN: Yes. This is the only way we can do it[13] because it has to be done in mathematics, and also has to be done in the tutelage of any discipline. The descriptive use of language just describes, you know. We say "describe a circle," and here we have described it, you see. The injunctive use of language now enables us to cross—cross the line.

Injunctive language has to be used in any field in which the discipline itself is to move from level to level; and this is why the whole of mathematics, which is simply about this—apart from the precision and description, which is an art in itself, taken at one

[12] huh?

[13] Latin *pungere*, to prick, gives PUNCTURE and PUN; the pun pokes a hole through the boundary.

level, and this is why the language of mathematics is so beautiful—but apart from that it is nothing but orders: do this—stand there—consider that—observe this—move here—call that over there—mix these two.

LILLY: Once you have absorbed the cookbook for changing levels, do you need it any more?

SPENCER BROWN: Once you have observed the what?

LILLY: Absorbed. Once you have taken all the injunctions, the list, your set of instructions, and absorbed it, and now it's part of your thinking machinery, yourself, do you deed it any more?

SPENCER BROWN: Only—well, it's like saying, "do you need it if you want to play a piece on the piano?" "Do you need it if you want to read a bit of mathematics?" You need the experience of being able to read injunctions. You see, most people cannot read injunctions. One of the things one has to learn is to read injunctions.

LILLY: —And use them.

SPENCER BROWN: And follow them, yes.

LILLY: A cookbook can only be used by a cook.

SPENCER BROWN: Well, a cook has the experience. If it is used by a non-cook–'-a non-cook has to take more care. It can be. Just as mathematics can be used, you know, by somebody who has never seen it before. But the care has to be very great. In a cookbook, you know, the recipe only lasts a few pages, whereas in mathematics, a complete argument may last 150 pages, maybe, and that means that every step previous, in order to be able to follow what's going on, has to be remembered. Otherwise you lose track of what you are doing. And part of the discipline is learning to remember.

WATTS: The point might also be made that a great deal of mystical literature is injunctive and is misunderstood by philosophers as being descriptive.

SPENCER BROWN: Oh, yes. I would guess so.

WATTS: Take Patanjali.

Opinions and Knowledge

SPENCER BROWN: Yes, people without the injunctive discipline in mathematics, apart from cookery and things that aren't generally admitted into the academic curriculum—mathematics is the only subject of any importance in the academic curriculum which uses injunctive language. And it is not chance that it is the only subject which doesn't deal in opinion. Because, in the use of injunction, it is not a matter of opinion what the result is going to be, you know.

And it's when we get very—these people who have been very sloppily educated; and they have, as we did back in England recently, a program on the television and they were all social scientists, and they said "Well, we have a measure of madness, and it is to know something." If you know it, you are mad, you see. If you only think it, well, that's sane. The great ignorance these people displayed, you see, is the ignorance of the queen of the sciences, as mathematics is often called. For example, let's take this book I was mentioning before, which is such a beautiful book in three volumes—Dickson's *History of the Theory of Numbers*. Oh, I don't know—there is 1500 to 2000 pages[14] absolutely crammed full—not a single opinion—it's all knowledge—it is all what is so. The gross ignorance expressed by these people, you see. This dealing in opinion can only be done by the ignoring of the disciplines of knowledge. Because, if it is an opinion, then it must be wrong-because if it were not so, if it were not wrong, then it would be knowledge, and it wouldn't be an opinion. So when—you know, when somebody comes and says "I think so"—well, that's an opinion. If you knew it, you wouldn't think it.

As for the other trick which is played, which is—"you know, you don't know anything, you see, you don't know a thing, you

[14] 1601 in 3 vols; 486, 802, 313.

know." You say, "oh yes, I know what I had for breakfast." "Oh no, you may have forgotten, you may have made a mistake." The proposition that such people produce is that anything—Russell, himself, was one of these. You know, he said "I don't even know that two and two make four. You see, I may have been mistaken—" It is put more cogently than I could put it, my heart isn't in it. He was laboring a point because it was necessary for his subsequent statement that he should establish this, you see. So the theory—"you don't know—you know nothing at all—it's all a matter of opinion"—and, well, the question I always ask such people is "how do you know this? How do you know that nobody knows anything? How do you know it is only a matter of opinion?"

WATTS: Isn't that the same kind of a question, when you say to a relativist—"You mean that everything is absolutely relative?"

SPENCER BROWN: Well, it is the same kind of throwing back his own system at him to show that he cannot support himself. There is the bland statement which really comes out in the form, "I know that nobody can know anything."

MAN: That's the paradox.

SPENCER BROWN: Well, all you have got to do is say "how do you know?"

MAN: I can't tell you.

SPENCER BROWN: No.

O'REGAN: Some of your analysis of contradiction, and whole notion of crossing over from marked to the unmarked would almost suggest that contradiction, in a sense, is the form of form. It is what we can see when one arrives at that stage. Maybe the book could be the "Laws of Contradictions" just as much as the *Laws of Form.*

SPENCER BROWN: Well, I am always careful about putting something greater into a smaller pot. Yous see, whenever we are speaking of contradiction, it is at such a more superficial level, because we are now already in language, and so on. Whereas

in *Laws of Form* the form is operative at every level. Whereas contradiction is only operative in something like our speaking. That's why, you know, although it's illustrative, it wouldn't do as a substitute.

LILLY: In the act of creation, using a self-referential tunnel feedback, can you move from inward to outward on your five levels, or your orders here, or is this just restricted to the first distinction?

SPENCER BROWN: I am not quite sure—you mean, "can you distinguish the five eternal orders?"

LILLY: Right. One from the other, moving from one level to the other, using the self-referential feedback, in each case, so that you get an oscillation between the two levels.

SPENCER BROWN: There's no feedback in heaven.

LILLY: OK. At what point do you create feedback?

Feedback at the Fifth Crossing

SPENCER BROWN: When you go into the first temporal existence.

LILLY: So you have got to be on six?

SPENCER BROWN: Five.

MAN: Going up.

SPENCER BROWN: It's the fifth crossing.

LILLY: So the paradox does not appear until the fifth crossing.

SPENCER BROWN: That's right. No, there is no time before that, and that is why they are eternal, the others. You think that it is going to. You don't know that it is going to happen, you see. Yous are coming out, you know—it's OK, it's still eternal, you know, you can still see the whole. And you get one too—you know, you get a little overconfident. Well, why stop here? Let's try going out a bit-farther. Now where are we?

LILLY: You spoke of the fifth order equation as being runaway.

SPENCER BROWN: That's in numerical mathematics, yes.

LILLY: Now, where do they apply here?

SPENCER BROWN: Oh, they are not in here—this is just an analogy.

LILLY: : This is outside them.

SPENCER BROWN: Yes, the fifth order—you know, there is evidence all over the universe of a special state where you come to the fifth degree or the fifth whatever it may be, and bang, it changes.[15] It was all self-contained before that. This is a technical point mathematically in the question of solving equations for the varying degrees. You can solve degree one, this is ordinary numerical algebra. We can solve degree two. There is a formula, an algebraic formula, which most of us learn in school, for doing that. And by an extension of that we can solve degree four, also by an algebraic formula. I missed out three—we can do that, you see, and then the further extension of four. And everybody thought for quite a long time, I don't know just exactly when it was, not so long ago, that if only we could find this, we could find the formula for degree five equations—find the roots, and so on. In fact, we can't, because, without going into detail, something has been—something overtakes something else. Instead of your being able to reduce it to the equations of a lesser degree, you suddenly find that your reduction uses degrees that are higher degrees than you have already started with.

LILLY: It's an expanding system.

SPENCER BROWN: It runs away, and there is no winning formula for finding the roots–you just have to find them ad hoc.

LILLY: So it becomes a partial feedback system.

[15] Humpty Dumpty had his great fall, from which he could not be put together again, on the fifth crossing. *Through the Looking-Glass* is instructive in following the discussion of the levels of the cosmos. Alice starts on the zero square, and takes her first step through the mirror (Monkey dives through waterfall) landing on Q2—the second square, cardinal number one, in the marked state behind the glass.

VON MEIER: Divination.

SPENCER BROWN: Yes, it runs away, it runs away. Before, you could get back by rule. After that, there are no rules for getting back. You may hit upon a rule, but there is no rule for finding it... It becomes more, you know, lots of rules of thumb. Like in the present existence—run away with itself a long way. And, you know, there are no formulae for getting back. There are a lot of ad-hoc rules.

WATTS: We should pause to change the tape, James.

SPENCER BROWN: Well, is it finished? Nice meeting you. We have been spinning it out, but in the end there is really nothing to say.

LILLY: Well, thank you very much for coming all this way to talk to us, and we hope that you will come back.

WATTS: If you'll come back for a more leisurely session.

SPENCER BROWN: Well, I hope it can be yes.

MAN: The beginning of the end.

LILLY: We've gone from zero to—

(End of Session Four.)

(End of tape.)

Book Proposal: The OMasters

By Cliff Barney and Kurt von Meier

The OMasters is an imaginary adventure framing real events: the sudden appearance of a teacher or teaching that tokens the radical reformulation of a prevailing world view. The fantasy story is about a group of children from the present generation with an extraordinary capacity for embracing paradoxes—logical and psychological—who enter higher orders of complexity motivated primarily by aesthetic delight.

The OMasters, sublime though innocent generalists, contemplate sophisticated processes while we are still computing products. A precocious and powerful inner circle of the group, known as The Lords of Form, move about the world in disguise developing intellectual foundations for *NOVACULT* from imaginary holograms generated by interference patterns between pure mathematics and Tibetan Vajrayana Buddhism, whale songs and Hopi Kachina dances. As refined by the Lords of Form, the "Flippety" principle of Distinguish/Embrace is put into practice by *The OMasters*, producing technological advances such as the Optical Process Bio-Interface Computer, the Adamantine Bit, and a new critical apparatus for literature and the arts.

Principal historical hero for *The OMasters is G. Spencer Brown*, a "mythematician," also sportsman, inventor, poet and former philosophy don. He appears at a conference of psychocosmic scientists, scholars and artists (attended clandestinely by one of the Lords of Form), where he offers a discourse on "laws of form"—a highly conceptualized vision of the Void—explaining what these laws are and how they are generated. A paradigm of how we may imagine them to appear is already published: an ultra-condensed textbook

called *Laws of Form* (Julian Press, New York, 1972). It is a calculus of indications in which the use of imaginary values provides a new theoretical basis for electronic switching, Boolean algebra and all binary systems, and so too for more complex orders of number and measure.

As read by *The OMasters*, *Laws of Form* is a major poem on the order of the *Divine Comedy*, in that each contains a vision of what has been called "Eternity." Both poets describe what remains constant in a universe of change: Dante's epic recounts the journey inward, toward a mystical union with God, while Brown's system indicates the Void at the center, and as in Buddhist sutras works outward through the use of injunctive language, generating archetypal patterns from the basic act of distinction. "Angels" in the *Commedia* become "consequences" in the calculus, which relationship Brown makes explicit. The two texts are reports on a vision not merely private but common to all sentient beings, and capable of being understood in the same way by all humanity.

The "Eternal" realm has been described by all major religions, documented in the West by Jung, among others, and experienced through inspiration, meditation, and psychedelics. The Laws of Form show how it is that all these visions are technically and formally the same. *The OMasters* use Brown's teaching to define a basic ground for thoir associative metaconsciousness version of the Glass Bead Game.

With the Lords of Form as vanguard, *The OMasters* acquire and analyse a transcript of Brown's excurses on the text. As though it were a golden fleece, they spin from the transcript their thread of associations, which are woven into a Sufi story/science fantasy illustrating the discourse and commenting on it. Brown's avatar appears as an intergalactic voyager who assists in deciphering the diamond-hard message, providing the keys for step-down transformations from the abstract calculus to everyday life situations, and for step-up transformations to interspecies and outer space communication.

The frame story unfolds as three interlacing accounts of *The OMasters* in action, featuring Primo the Fool, Woody Nicholson,

and Shakuhachi Unzen, in respectively a space opera, a celebration of the myth of America, and an East-West fantasy farce. Historical, technical and utterly fictive events are arranged as mirrors in a fun house to catch the play of real and imaginary values. *Through the warp of science and scholarship we shuttle the thread of fantastic delight.*

Primo has all the correct maps—*Laws of Form*, the *I Ching*, a Tarot deck, Robert's *Rules of Order*—but he doesn't know how to read them. They lie on the Crystal Navigation Table of the Gravity/Gracewarpship. *Adamantinus*, whose captain has vanished, leaving the controls on a course set for the Black Hole in Cygnus. From the confused advice and theoretical formulations offered by the desperado experts of his cosmic crew, he selects a true course through the warp, guided by contemplating the Yellow Pearl, an incarnation of the Queen of Heaven herself.

As Woodrow Nicholson, our hero appears at the head of his party in '76, by which time we have a whole string of backup Vice Presidents. Woody is the 22nd, kept roving (for security) in the last of tho Winnebagoes on a circuit of national parks and supermarket parking lots. However, he is impelled to pick up the standard when his precedents are all wiped out in a wicked game of "21" by Ahab McGaff, proprietor of the Double Cross ([TBA]) Saloon in 'Vegas, and international purveyor of contraband whalemeat. Supported by the Sufia, Woody openly challenges Ahab, who is also the secret head of MaFie, the spiritual materialist monopoly. Following the tradition of the Eisteddfodd in Wales, Woody schedules a special competition to replace elections: the Grand Noshinals, to be held on the Fourth of July—with the winning recipe from the eat-offs to determine the identity of the Vajrayogini, our first woman president. Ahab tries simultaneously to fix the Eisteddfodd and, through his show business connections, to produce it for global television.

Shakuhachi Unzen is dishwasher and garbageman at the Teahouse of Necessity, where late each night he serves an installment of the Feast of 4001 Fools. Despite his clownish circumstances, Shakuhachi operates in the ancient tradition of Ninja, martial arts masters of invisibility. In compiling a cookbook of spontaneous

concoctions, he discovers a magic recipe which induces the illusion of instant enlightenment—but he must await the appropriate recipient before the real transmission can be completed.

Our book is in the tradition of Alice's *Adventures*—an imaginary, someways serious consideration of logic and paradox. There really was a conference, organized by John C. Lilly, M. D., and the late Alan Watts, and attended by the present authors, at Esalen Institute, Big Sur, Calif.; G. Spencer Brown did appear there and discuss his calculus and the *Laws of Form* generally. Complementing actual events, the stories provide a vehicle for our own commentary on the *Laws of Form*, and frame contributions from Brown and other participants in the conference. We also provide a bibliography of the reference net with which we hunt the white whale of imagination, Moby Blick. Such a paradigmatic approach to information systems offers refreshing possibilities for scholarship: a positive, cheerful blueprint for reconstruction after the seemingly imminent collapse of the Tower of Babel, when Finnegan Falsegain.

A receptive audience for this book may be found among the literary/spiritual/body movement/consciousness adepts who have made Carlos Castaneda's adventures with Don Juan best-sellers. The text should have a campus market, and a place in university libraries as a map of the territory explored in depth by disciplines with tree-logic structures. There is potential for a mass audience; science-fiction fans will enjoy the book, and likely as well readers of the *New Yorker*, *Scientific American*, and the slick and hip media (Today, of course, one would add *Wired*). Out of the three Sufi stories we can derive a television series and perhaps an animated cartoon. Presumably we could spin off Shakuhachi T-shirts, nickel Woody buttons, models of the *Adamantinus*, and other promotional gimmix.

Recalling Gurdjieff's recommendations for reading *Tales of Beelzebub* three times through, we all but guarantee Complete Enlightenment when our book is read as directed: once as a child, again when mature, and finally when mellow with age.

I. Frame

Recognizing Laws of Form as a vision of the Eternal regions, the Lords of Form dispatch Philip Taoed, secret agent 109, to Esalen to make contact with G. Spencer Brown. This chapter is Taoed's report, confirming Brown's role as intergalactic messenger and culture-bringer. It contains a dossier on Brown, and introduces the other participants in the conference. Discussion of the nature of the fifth crossing, from Eternity into the imaginary (temporal) state.

II. Processing

Transcript of Brown's remarks, obtained by Taoed, analyzed by the Lords of Form. They want to get his number, which is coded into the discussion of primes in Session 2 of the text. Technical experts from Sufi Central provide data on injunctive and descriptive language, myth and folklore, the Synod of Whitby, and the nature of Brown's cosmology. Particular attention paid to the "covenant of the cradle." Notes by Taoed on obscure sections of the transcript. This document, profound, precise and most eloquent in its argument, a discussion of the formal relationships of science and culture, makes up a significant portion of the chapter.

III. Models

To balance his own report, and illuminate its biases, Taoed provides an appendix detailing what happened at Esalen after Brown left: mini-synod over the issue of how to chant the sutras of *Laws of Form*; the calculus put to music by the Brown Cross Chorale (sheet music provided); Carl Pribram lectures on cognitive processing and brain structure, with introduction of the adamantine isomorph, a grammar for information processing; Heinz von Foerster constructs reality, and John Lilly simulates it.

Interlude

Listening to the Brown tapes, *The OMasters* focus on the Yellow Pearl, onion-formed around a diamond seed and containing in its layered patterns the Fourier transform of the three Sufi stories of Primo the Fool, Woody Nicholson, and Shakuhachi Unzen. Scanning the Pearl with telepathic transmissions at microwave frequencies, *The OMasters* perform the ecstatic group meditation that generates the dream, in the form of an animated hologram (as outlined by Pribram in the preceding chapter).

IV. Primo

Alone on the bridge, Primo must discover how to control the Adamantinus and divert it from its course for the Black Hole in Cygnus. He is coupled to the ship through the bio-interface computer, which he programs through changes in his metabolism and brainwave patterns induced by diet, chanting, and meditation. Over the videocom, he is instructed in the use of the maps on the Crystal Navigation Table by Melvin Fine, the Hasidic mandarin and expert on the I Ching; gestalted by the Phantom Shrink; taught formal rituals by the gurus of Apura, a branch of MaFie; led into the paths of vegetarianism by Richheart Nobleson, stoned-out playboy desert painter; and occasionally heckled by the captain himself in the guise of the omniscient Jose Que.

All efforts to control the ship fail, however, until Primo is distracted by the sudden appearance of the very pregnant Red Queen of Heaven. Following instructions from Joyce James, graduate Wellesley medievalist, he acts as midwife for the delivery of the infant Yellow Pearl. In the act of catching the baby, he staggers backward into the control panel, short-circuiting the board and jolting the Adamantinus off its course, through the gravity/gracewarp into the America of Woody Nicholson's struggle with Ahab McGaff.

V. Woody Nicholson

In this episode, Primo assumes the role of Matt Wells, agent for Scotland Fields, who progresses through the archetypes of the Tarot deck in his search tor the Yellow Pearl. She appears this time as the 12-year-old T'ai Chi star of the Peking Opera, whose disappearance during a tour of the United States has created an international incident. The government itself is in turmoil, the president and the first 21 vices having been wiped out by Ahab at the Double Cross Saloon. Woody Nicholson directs affairs of state from his superbly outfitted Winnebago, shuttling from national park to strip mall parking lot to avoid the agents of MaFie, Ahab's spiritual materialist monopoly.

Though this chapter has a number of subplots, such as Matt's mission and the race between MaFie and the Sufia to discover the secret of interspecies communication with whales and dolphins (and thus to receive messages from the galactic center), the climax is the Grand Noshinals, the Eisteddfodd arranged by Woody to restore poetry and music to the electoral process. The winning recipe is submitted by the Yellow Pearl herself; it is for the Ling Chi, the ancient Chinese elixir of life, in the form of an amanita muscaria hors d'oeuvre topped by a special black mayonnaise. To prevent the Yellow Pearl from becoming the first woman president, Ahab seeks an injunction against her on the grounds that she is not an American citizen. Scholarly research into her ancestry reveals the history of the Teahouse of Necessity and the role of Shakuhachi Unzen as the unrecognized master chef.

VI. Shakuhachi Unzen

The Teahouse of Necessity where Shakuhachi works as dishwasher and garbageman is set in a bamboo grove planted by the Oriental immigrants to California during gold rush days. Late each night after the cook gets off, Shakuhachi selects dregs for mixing into a sometimes magical concoction that is offered to distinguished visitors, carefully documenting the recipes and reactions. Philip Taoed, in a time-warp disguise as the 4001st Fool,

the wandering King of Troy, is ushered by Unzen to the Yellow Pearl in an earlier American incarnation, who anoints Taoed with the Shakti Lymphatic Massage. Pressing his button, the Yellow Pearl causes Taoed to reveal the true motive of his cosmic travels before the llama Al Paca, resident spiritual materialist secretly on a warp of hls own.

Al Paca deviously programs the Gravity/Gracewarp capture of the Teahouse and its occupants, but is eluded by Shakuhachi, who hides in the well, where he meets various ghosts claiming to be Abbott and Costello, Rowand and Martin, Martin and Lewis, Lewis and Clark, etc. Unzen is forced to wander, as he completes a tour of the New World, retracing the Hopi migrations, retaining in his memory the magic recipe without which Al Paca and the others cannot return.

Matt Wells and Shakuhachi cross paths at Four Corners just as Primo backs into enlightenment. After a wild goose chase through Monument Valley, they join up with Woody and the Sufia for a titanic encounter with Ahab McGaff, Mafie and the Llama Al Paca. This resolution of the three stories is carefully attended by *The OMasters*, who award honors for style in a critical bibliography, and elevate the Yellow Pearl as Queen of Indices.