

RELATIVISTIC PHYTOSOPHY: TOWARDS A
COMMENTARY ON “THE *PLANT TIME MANIFOLD*
TRANSCRIPTS”

Justin Katko

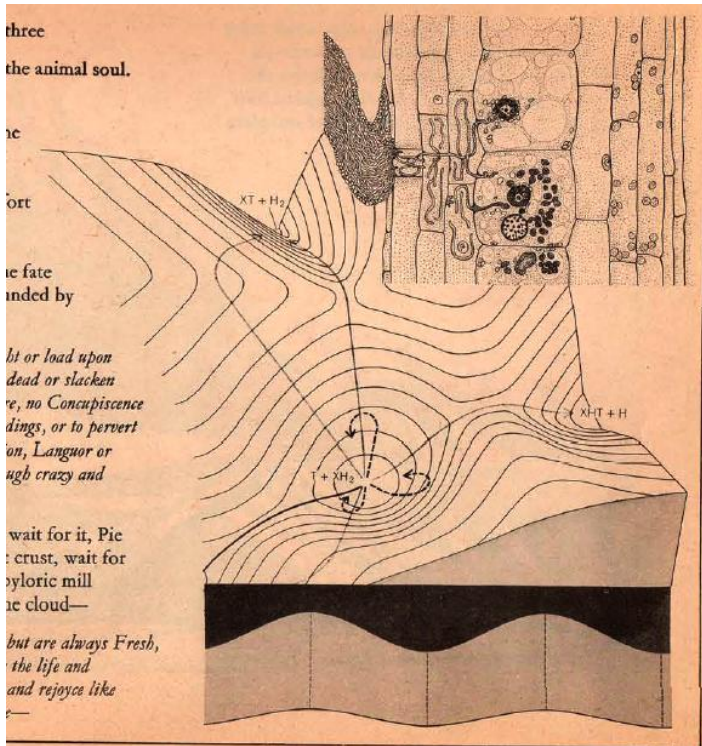


Fig. 1. J.H. Prynne, Collage from “Of Sanguine Fire,” *Georgia Straight* (1971; p 8).

It may be proper here to apologize for many of the subsequent conjectures on some of the articles of natural philosophy, as not being supported by accurate investigation of conclusive experiments. Extravagant theories however in those parts of philosophy, where our knowledge is yet imperfect, are not without their use; as they encourage the execution of laborious experiments, or the investigation of ingenious deductions, to confirm or refute them. And since natural objects are allied to each other by many affinities, every kind of theoretic distribution of them adds to our knowledge by developing some of their analogies.¹

Theoretical Physics is a well recognized discipline, and there are Departments and Professorships devoted to the subject in many Universities. Moreover it is widely accepted that our theories of the nature of the physical universe have profound consequences for problems of general philosophy. In strong contrast to this situation, Theoretical Biology can hardly be said to exist as yet as an academic discipline. There is even little agreement as to what topics it should deal with or in what manner it should proceed; and it is seldom indeed that philosophers feel themselves called upon to notice the relevance of such biological topics as evolution or perception to their traditional problems.²

It is instructive and sobering to be aware of the wide latitude of disagreement that exists over the interpretation of even the most elementary intermolecular phenomena, particular in aqueous media.³

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¹ Erasmus Darwin, *Apology*, 1791; p vii.

² Waddington, *Preface*, 1968; unpaginated.

³ Kavanau, 1965; Vol. 1, p v.

INTRODUCTION

This essay is a commentary upon J.H. Prynne's *plant time* hypothesis, which is put forward in one of several pre-texts to "The *Plant Time Manifold* Transcripts" (1972).⁴ The basic proposition of the *plant time* hypothesis is that there exists a form of temporality specific to all plants, wherein the plant's upper half (or stem) moves *forward* in time, and the plant's lower half (or root) moves *backward* in time. In attempting to describe the scientific imagination which makes this hypothesis possible, principles from numerous branches of the sciences will be introduced. These principles will not be explained in terms very different from those of the original texts in which they are proposed, and as such, the reader will be expected to make certain imaginative leaps on behalf of the *plant time* hypothesis itself. Which is to say, the reader will have to both think seriously about a number of scientific concepts and take seriously the consequences of their unification under *plant time*. It is the aim of this commentary to illuminate the actual science upon which the *PTM* is based, and if the result is a rather dark interface, readers may look to the near future for a more didactic and extended commentary. The structure of this work is as follows: after the introduction, there will be a survey of the *PTM* criticism, followed by a reproduction the inaugural *plant time* treatise ("& Hoc Genus Omne"), and then the *plant time* commentary proper, which is broken into three large sections, entitled Relative Time Scales, Phytology, and Relativity; the conclusion will be given over to some general reflections on the *PTM*'s scientific language.

As a preliminary companion to the *PTM* rather than a gloss of any of its texts, readers should not expect analysis of the set of five transcripts spanning 1st April to 17th July 1972, which comprise the authoritative *PTM*.⁵ The text whose terms and propositions will

⁴ "The *Plant Time Manifold* Transcripts" will be referred to as the *PTM*. Their publication in Prynne's *Poems* (2005) will be referred to by title and page number.

⁵ The *PTM* as such has been published on five occasions: *Grosseteste Review* (Summer 1974), *Wound Response* (1974), and *Poems* (1982, 1999, 2005). Minor differences exist between the version published in *Grosseteste Review* and the version published four times thereafter.

guide our investigation is the transcript of 14th March 1972,⁶ known as “& Hoc Genus Omne,”⁷ which is reproduced here. “& Hoc Genus Omne” provides a “ground plan” for those *PTM* texts which follow it, including the transcript of 25th March 1972,⁸ known as “Full Tilt Botany: Ideal Weapons for Suicide Pacts.”⁹ These “bulletins” have only been published in Edward Dorn’s newspaper *Bean News* (1972),¹⁰ and along with the five-text sequence in *Poems*, they appear as correspondence typescripts among Dorn’s papers in the Thomas J. Dodd Research Center at the University of Connecticut. The typescripts among Dorn’s papers appear to be the nearest approximation to a draft of the *PTM*, composed in a serial journalistic mode on the dates heading each transcript. Because *Bean News* itself introduces elisions and reformatting which prove detrimental to the clear transmission of the *plant time* hypothesis, “& Hoc Genus Omne” is reproduced here in its correspondence typescript form.

⁶ Prynne to Dorn, 14th March 1972. This text will be referred to as “& Hoc Genus Omne.” The Linnean pun “et hoc genus omne,” an analogue of *et cetera*, could be literally rendered as “and the origin of it all” (relative to a universal *plant time*), which phrase in the correspondence typescript extends the epistolary address to “Dear Ed and family.”

⁷ Prynne, “& Hoc Genus Omne,” *Bean News*, [1972; p 2]. The attribution of the term “transcript” to “& Hoc Genus Omne” is only possible because the *PTM* text which succeeds it, “Full Tilt Botany,” declares: “These two bulletins, so far, have been taken down at the dictation of a stand-up hierarchic tree, now identified as the albino cypress giving the first research paper at the London conference on ‘Plant Time Manifolds’” (Prynne to Dorn, 25th March 1972).

⁸ Prynne to Dorn, 25th March 1972. This text will be referred to as “Full Tilt Botany.”

⁹ Prynne, “Full Tilt Botany,” *Bean News*, [1972; p 8]. *Bean News* was also home to the “leap second” transcript of 1st July 1972, published under the headline “When Is Now” [p 4]. Additionally, there are two unpublished *PTM* texts: the telegraphic collage “Beans out—but they’re likely to come back in!” and the lyric “N.B. Peas Pudding.” Both texts are held in the Dorn’s papers at the University of Connecticut, where “Beans out” is mischievously ascribed (in Prynne’s hand) to the year 1970. This backwards time leap would have it precede the influential “Night Letter” of Dorn’s *Gunslinger*.

¹⁰ Due to the rarity of *Bean News*, a provisional photographic reproduction has been made available online by the author. The appropriate web address is cited in the bibliography, at the end of all *Bean News* text entries.

Bean News seems to have been at least partly inspired by *Georgia Straight* (1971),¹¹ a poetry magazine in newspaper-format which was collaboratively compiled and printed at the York Street poets' commune in Vancouver, where Prynne and the Dorn family spent some weeks in the summer of 1971. It is from *Georgia Straight* that this essay's title image is sourced, being one of five collages in the margins of Prynne's "Of Sanguine Fire;" for its splicing of conventionally incommensurate microbiological and electro-magnetic systems, it is brought forward as a formative analogy for the hybrid science of the *PTM*. The gravity and intensity of scientific imagination in the *PTM* has rendered it just about untouchable, if not wholly illegible. To some extent, the *PTM*'s singular difficulty is a function of the general unavailability of *Bean News*.

In its correspondence typescript, the transcript of 1st April 1972 (the first of the authoritative five-text sequence) opens by citing its "especial interest to readers of *Bean News*,"¹² but its published version is addressed only to "readers."¹³ The original readership of the *PTM* was therefore to be those few poets and intellectuals into whose hands would fall a rare copy of the first (and only full) issue of Dorn's "super-newspaper."¹⁴ *Bean News*, which Dorn would describe late in life as "marvellous non-sense,"¹⁵ was the right kind of organ for a text written on April Fools' Day. *Bean News* was in its earliest conception a fictional publication to be edited in an extra-diegetic fantasy by the characters of Dorn's verse epic *Gunslinger* (1968-1975). *Gunslinger*'s mad scientist Dr. Jean Flamboyant, who plays an unacknowledged heroic role in the climactic resolution of the poem, is at least partially construable as a mask for Prynne,¹⁶ and in an early single-page

¹¹ *Georgia Straight* is also the *Writing 8 Supplement*. Its front page, which features a photograph of Prynne and the Dorn family posed in a totem pole formation, has the title positioned vertically to read: "*Writing ∞*" (Prynne, 1971).

¹² Prynne to Dorn, 1st April 1972.

¹³ *Poems*, p 234.

¹⁴ Dorn, 1980; p 54. For a brief history of the conception and production of *Bean News*, see Alastair Johnston's *Zephyrus Image: A Bibliography* (2003).

¹⁵ Johansson, 1997; p 148.

¹⁶ "Dr. Flamboyant is based in large part on JHP...That's why I mentioned the way he fixed cars with matchsticks, etc" (Dunbar Dorn, 10th November 2009).

manuscript design of *Bean News*, Dorn gives Dr. Flam the editorial function of “Roving Cosmologist and Brain Trigger.”¹⁷ The *PTM* requires not only the context of the *Bean News* phenomenon, but more specifically, those *PTM* texts which found their way into the newspaper. The *PTM*’s full textual history must be reconstituted if we are to come to terms with any one of its constituent parts.

There is yet a greater difficulty, however, which is more properly historical. In his *Introductory Sketch Outline of American Literature* (2005), Prynne writes: “[Ezra Pound] did not have the attitude of a conventional scholar because he was determined to be a poet and to USE all his knowledge to experiment with new ways to write poetry.”¹⁸ The *PTM* would not be possible without Pound’s grand philological project, but we must recognise the particular critique of Pound which the *PTM* implies. By his intellectual entanglement with scientific authority, Prynne has raised an unprecedented bar for modernist poetic research. Pound’s subordination of scholarship to poetry is not quite inverted; rather, Pound is taken to task for his ultimately limited scientific scope. The *PTM* smears the boundaries which render discontinuous not only poetry and modern science but the scientific disciplines themselves. The radical philological method here practiced is perhaps a metonym for the reorganisation of all available means of knowing, along ethical, aesthetic, and logical axes, in order to “deliver them / from their Vicious Isolation.”¹⁹ The critical labor of teasing out and piecing together the specialty discourses hybridized in interdisciplinary cross-implication from the depths of scientific history by the *PTM* is the ambitious task now set before us.

PTM CRITICISM

The *PTM* must be considered within the terms of its own vocabulary, so that its original thinking in natural philosophy may be more readily perceived and understood. This kind of close reading has yet to be adopted by the *PTM*’s critics, of which there are few. While the available criticism typically addresses only the authoritative five-text sequence, making its interpretations and valuations

¹⁷ Dorn, undated.

¹⁸ Prynne, 2005; p 41.

¹⁹ Dorn, 1989; p 89.

somewhat marginal to our stated aim of explicating the science of the *plant time* hypothesis, a survey of the criticism will indicate to us the types of reading engendered by impoverished or non-existent comprehensions of the *PTM*'s scientific basis. In all but one case,²⁰ the body of secondary literature is distributed across brief accounts in essays addressing more general topics. In “Archaeologies of Knowledge” (1999), Brian McHale makes a passing reference to the *PTM* as “mock-scholarship.”²¹ Peter Middleton makes a commensurate claim in the “Dirigibles” chapter of *Distant Reading* (2005), stating that the *PTM* “cleverly parodies scientific rhetorics of diminished agency and ballooning...abstractions.”²² This position is amplified in Middleton’s “Strips: Scientific Language in Poetry” (2009), where he writes that the *PTM* is a challenge to the “grandiosity” of scientific authority and a “mockery of much of the self-importance of contemporary science.”²³ On the surface, the *PTM* might seem to wholly confirm this point, and Dorn himself states in an interview with Roy K. Okada that Prynne’s *Bean News* contributions were “linguistic forgeries in biology.”²⁴ This must be an understatement, perhaps betraying the possibility that the positive thetic stability of the *plant time* hypothesis might not have been fully grasped by Dorn and his *Bean News* staff. So if the position taken by Middleton, McHale, and Dorn himself can be considered a surface response to a complex and unpredictable textual interface, we may look to other criticisms for more penetrating descriptions.

In her Prynne monograph, *The Engineering of Being* (1997), Birgitta Johansson reaches out to one of the *PTM*'s several explicit references—A.N. Whitehead’s *Process and Reality* (1929)—though her inquiry is limited to the sentence quoted here:

Whitehead’s contention that ‘no entity can be conceived in complete abstraction from the system of the Universe’, suggesting an interrelation between individual elements

²⁰ Jow Lindsay, “Excerpt from An Open Letter to J.H. Prynne” (2006).

²¹ McHale, 1999; p 253.

²² Middleton, 2005; p 194.

²³ Middleton, 2009; pp 950-951.

²⁴ Dorn, 1980; p 55. The Okada interview, conducted 2nd May 1972, was first published in *Contemporary Literature* (Summer 1974).

and the whole, agrees with Prynne's frequent references to the multifariousness of the Cosmos and its interrelationships.²⁵

Whitehead's "philosophy of the organism" is at the heart of Prynne's hybrid science, making possible his forging of affinities between relativistic and phytological systems. This essay is an implicit explication of "the multifariousness [or manifoldness] of the Cosmos," at least in respect of the new world-continuities posited by the *PTM*. Johansson's description of the *PTM* is quite brief, noting that it "satirises an academic discussion about higher versus lower organisms."²⁶ This is certainly a reduced account, as the *PTM* cannot be reduced to the argument between Professor Quondam Lichen and Dr. Albino Cypress in the transcript of 1st April 1972.²⁷ This account is reproduced by Drew Milne in "The Art of Wit and the Cambridge Science Park" (2006), and his noting of "moments of undergraduate knockabout" in the *PTM* might be an acknowledgement that the work's satirical force is complicated by the self-implication of its own generic history.²⁸ Milne identifies a two-tiered engagement in these "knockabouts," insofar as their "wit," he claims, "strains readerly patience by being mischievously frivolous *while also* implying a more 'serious' or radical challenge to scientific thought."²⁹ The *PTM*'s "radical challenge" is not only a function of Prynne's philological method, but of the relentless reorientation (via wit and hybridisation) of all specialised discourses it subsumes. The "challenge to scientific thought" is radical precisely because the *PTM* knows itself to constitute actual scientific thinking, even if wit sets philosophical and aesthetic conditions upon conventional logic functions. Milne writes that within the *PTM*, "[d]ifferences between satirical mockery and ontological challenges frame the indeterminacy of post-metaphysical wit."³⁰ In this differential light—carved out as it is by the distinction

²⁵ Johansson, 1997; p 90.

²⁶ *Ibid.*

²⁷ *Poems*, pp 235-237.

²⁸ The Lichen/Cypress dialogue, for instance, ventriloquises lines from William Blake's satirical work *An Island in the Moon* [1784].

²⁹ Milne, 2006; p 180 (my italics).

³⁰ *Ibid.*

between “satirical mockery” and “ontological challenges”—there is room to account for Milne’s oblique valuation: “Prynne’s more convincing poems offer less naked contrasts between scientific jargon and poetic experience.”³¹

The *PTM*’s *nudity*—or what makes it “one of [Prynne’s] least characteristic texts”³²—is in some ways a function of its occasional specificity. The apparent lack of *PTM* manuscripts or drafts, beyond the correspondence typescripts, is characteristic of Prynne’s honed epistolary practice, whose improvisatory vehicle, in respect of the *PTM*, is fueled by a hyper-fluency in the scientific discourses. The timeline articulated by the dates heading each transcript is a function of Prynne’s own expectation the publication schedule of *Bean News*, the *PTM*’s motivating occasion. This supreme poetic hoax must be one source of the work’s peculiar “indeterminacy,” and the will to laughter is made performative along the time axis, as the first transcript of the authoritative five-text sequence was composed on April Fools’ Day. There is also a *Zeitgeist*-function at play, as for example, in the first paragraph of “& Hoc Genus Omne” we find the pun “laser been,” which also occurs in the opening of the song “Fallin’ Ditch” on Captain Beefheart’s *Trout Mask Replica* (1969).³³ Furthermore, the *PTM*’s philosophical attention to living systems and corresponding will to aesthetic economy is reflected in the motivations of emergent interdisciplinary collaborations like that which occurred at the *Biology and the History of the Future* symposium (1969), for which C.H. Waddington writes:

Most of the recent [revolutionary] movements are occurring in a sphere which is much broader and deeper than mere politics and economics; they are concerned with the total character of human life and its social setting.³⁴

³¹ *Ibid.*

³² Tuma, 2000; pp 48-49.

³³ “[Crunch; Inaudible speech of woman] Now we won’t have to worry about Rocket Morton with any of those girls. [Take-off sound] *Rocket Morton takes off again into the wind!* What do you run on, Rocket Morton? [Aside] Say beans. *I run on beans!* [Laughter] *I run on laser beans!* [Laughter]” (Beefheart, 1969; track 18).

³⁴ Waddington, 1972; p 2.

From within this total critique, poets are uniquely licensed to employ the deflationary and liberatory power of humour, as Dorn famously writes in *Gunslinger*:

Entrapment is this society's
Sole activity, I whispered
and Only laughter,
can blow it to rags³⁵

Speculating on the ideal future of *Bean News*, Prynne writes to Dorn several months after the composition of the final *PTM* text:

[T]he network of future acts ought to map nicely into wit at its highest bent, there would be that random array of what looked like “recent news” but was actually feedback switched through 180°.³⁶

If we may read “feedback switched through 180°” as an oblique description of the *PTM*, then the *PTM*'s nudity can also be attributed to the literal reflection of its own discourse base. While thetic subtexts are nothing new to Prynne's writing, the bare material of scientific prose is certainly a novelty, unmediated by all but wit and the theoretical juxtaposition of conventionally discontinuous scientific disciplines. The literality of scientific prose sets up a field of absolute transparency, subjecting potential witticisms to uncompromising exposures. There is no margin for humour in professional scientific writing, but scientific *journalism* may conceivably maintain humour among the sub-routines of its repertoire. As the multiple discourses through which the *PTM* is synthesised are made familiar, the eloquence and daring of its humour reveals a substrate of conditional truth values upon which a systematic and improvisatory cognition is engaged.

In his article “Ed Dorn and England” (2000), Keith Tuma is the first critic to have stated the connection between *Bean News* and the *PTM*, which historical approach sets the conditions for the most

³⁵ Dorn, 1989; p 155.

³⁶ Prynne to Dorn, 25th October 1972.

generous reading of the work yet available, next to Jow Lindsay's wayward and necessary "Excerpt from An Open Letter to J.H. Prynne" (2006). Lindsay's essay includes a useful comparative description of the *PTM*:

Conspicuous, eclectic, insouciant erudition has become a standard feature of hysterical realist / maximalist prose, your Thomas Pynchon, your David Foster Wallace, your Mark Leyner, your . . . but with *this* poem we might as well be in 1601, it has the tumbledown fustiness of a Thomas Nashe originall, we might as well be in 1735, it has the neo-Pindaric table-talk variety of Pope's Horatian epistles, we might as well be dining at Thomas Love Peacock's *Crotchet Castle*, it has that compiled richness, indeed, we might as well be listening to Erasmus Darwin's over-justified porno at the dawn of the nineteenth century, mightn't we?³⁷

Lindsay's dramatic exposé points to Prynne's use of the pseudonym Erasmus "Willbeen" Darwin in his *Bean News* texts.³⁸ Erasmus Darwin (1731-1802), romantic biologist and grandfather of Charles Darwin, was an early reader of Linnaeus and an influential natural philosopher, physician, poet, and polymath.³⁹ Lindsay claims to have discovered in the *PTM* some act of plagiarism committed upon Darwin's *Loves of the Plants* (1789); while the *PTM* contains numerous unacknowledged sources, the plagiarism of any Darwin has yet to be confirmed.

The *Bean News/PTM* connection has been on the record since at least the 1974 publication of Roy K. Okada's interview with Dorn. Johansson mentions *Bean News* in a footnote of her monograph and

³⁷ Lindsay, 2006; p 35.

³⁸ It should be noted that in the original typescripts, Prynne does not employ the Darwin pseudonym until "Full Tilt Botany."

³⁹ Desmond King-Hele has documented Darwin's influence upon the Romantic poetics in *Erasmus Darwin* (1963) and *Erasmus Darwin and the Romantic Poets* (1986). In *The Poetry and Aesthetics of Erasmus Darwin* (1936), James Logan describes "the really vast scientific equipment at the command of Darwin, a knowledge which represented progressive investigation instead of theories that faced backwards toward the past" (Logan, 1936: p 133).

might suspect a resemblance with the *PTM*, noting the newspaper's publication of "Full Tilt Botany" and "When Is Now" (aka the transcript of 1st July 1972).⁴⁰ Peter Manson makes the connection implicitly in his translation and commentary on Prynne's runic poem, in which the pun on "be / bean / bee" is interpreted in light of similar puns in the *PTM*, such as the neologistic copula "willbeen."⁴¹ While Tuma's interpretation of the origin of Prynne's *Bean News* texts falls short of addressing them as the first units of a serial production, he does approach a full description of the referential vectors which comprise the *PTM*'s discursive building blocks. Accounting for the "density of botanical or pseudo-botanical and scientific or pseudo-scientific languages" in the *PTM* and their *Bean News* counterparts, Tuma writes:

Prynne's *Bean News* articles seem to have been based on or reworked and extended for [the *PTM*]. As I read it, the complete [*PTM*] and the botanical bulletins in *Bean News* are partly pastiche, sending up botanical writing as one discourse among warring discourses, scrambling Romantic and contemporary poeticisms and much else...They are surely meant to be funny.⁴²

"& Hoc Genus Omne" certainly opens with a good anti-television joke—"So you aim the laser been at the tube & watch the frags like a

⁴⁰ Johansson, 1997; p 148.

⁴¹ Manson, 2006; p 42. The been/bean pun is itself a function of Dorn's *Gunslinger*, in which it is a recurring trope, first made explicit in the poem's middle book, *The Cycle* (1971). The pun is operative along an Anglo-American pronunciation differential, whereby the British "been" sounds like the American "bean," and the American "been" sounds like the British "bin." In "& Hoc Genus Omne," Prynne's "urgent" request for news from "the outstations of beenville" is also a reference to *Gunslinger*. For a discussion of Dr. Flamboyant's "3 Great Beenville Paradoxes" in the third Book of *Gunslinger*, see Reitha Pattison's forthcoming dissertation, *Cosmology and Capitalism in the Writings of Edward Dorn* (2010).

⁴² Tuma, 2000; pp 48-49. The few critical resources on the cross-relevance of Dorn and Prynne include: Douglas Oliver's "J.H. Prynne's 'Of Movement Towards a Natural Place'" (1979) and Sam Ladkin's "'as they wander estranged': Ed Dorn's *Gunslinger*" (2004).

busted speedometer”⁴³—but this is just about the extent of the transcript’s humour. As we now initiate our extended commentary upon the plant time hypothesis set forth in that treatise, it should be frankly stated that any projection of irony or satire onto the core propositions of this treatise would be detrimental to a clear-eyed grasp of the hypothesis. Though the transcript warms up with a string of witticisms, the satirical frame is not locked in until the end of “Full Tilt Botany,” where we enter the diegetic framework of the actual *PTM* conference. Our commentary should illustrate that conventional interpretations of the *PTM* cannot withstand the gravity and of the “really serious” plant time hypothesis.⁴⁴

ET HOC GENUS OMNE

The correspondence typescript of “& Hoc Genus Omne,” which is significantly altered in its *Bean News* version, is reproduced below. The text is printed on the verso of *Bean News*’ front page and attributed pseudonymously to Erasmus W[illbeen] Darwin of the Bean News Service, London. “& Hoc Genus Omne” articulates the bilinear temporality of the *plant time* hypothesis, which is never glossed quite so explicitly in the authoritative *PTM*. The root/stem diagram of the *plant time* metric reproduces Prynne’s hand-drawn original, and text appearing only in the *Bean News* version is placed within brackets.

[& Hoc Genus Omne]

[BNS, London]

44 Carlyle Road, Cambridge; 14th March 1972

Caro Eduardo et hoc genus omne: all the has that's fit to
been, my great jumping haricots! The world tube of those

⁴³ Prynne to Dorn, 14th March 1972.

⁴⁴ We have not dealt with Anthony Mellors’ claim in “Mysteries of the Organism” (1996) that the tone of the *PTM* is based on CIBA Foundation symposia proceedings. The CIBA Foundation is certainly a useful analogue for the *PTM* conference, and while the significance of this model will be treated in future *PTM* commentary, suffice to say that Prynne will have been privy to innumerable conferences and symposia with similar levels of inter-participant contention and dramatics.

the Carlyle Road organic ~~freak~~ has yet penetrated, coaxing his delphiniums out of their sulky hibernation (hemmed down by winde & snowe, the extra e's of freezing knees all too much to bare).

More on the tensor analysis of plant space-time in our next bulletin. Meanwhile from the outstations of beenville news is urgently awaited, so write when you can. The true metric of post-Nixon hydraulics is Yet To Be Found Out, and awaits its very own Skald. Meanwhile love to everyone & how are they well & chirpy I trust.

Jeremy
[ERASMUS W. DARWIN]

Relative Time Scales

No April Fools' hoax, this treatise inaugurates the interdisciplinary speculations of the *PTM*, though its corresponding London Conference was by 14th March not yet imagined as the project's diegetic frame. *Plant time* is presented here as a "really serious" proposition, whose origins might have something to do with an obscure article on chemical embryology by the great historian of Chinese science and mentor of Prynne's, Joseph Needham. Needham's "Chemical Heterogony and the Ground-Plan of Animal Growth" (1933) is one of several scientific texts listed in a 120-entry bibliography compiled by Prynne, entitled "Some Works Containing Discussion of Scientific and Christian Time, History, and Causal Explanation" [1964].⁴⁵ Needham employed a double logarithmic graph—suggested by Julian S. Huxley in "Constant Differential

⁴⁵ Prynne, "Some Works...", [1964]. This bibliography appears among Dorn's papers at the University of Connecticut, and Keston Sutherland claims in his unpublished dissertation that it was compiled specifically *for* Dorn, calling it a "bibliography 'on time' for Ed Dorn" as if it were a wholesale response to Olson's "Bibliography on America for Ed Dorn" (1955, first published 1964). It should be noted that the bibliography also appears among Needham's papers at the Needham Research Institute, Cambridge.

Growth-ratios and their Significance” (1924)⁴⁶—to analyse published data on the progressive chemical constitutions of animal embryos and their organs. In the letters section of *Nature*, a brief contribution to the project made by Waddington suggests that the growth curves of chemical magnitudes within different species may be converted *into one another* (i.e. made relatively commensurate) simply by “choosing a suitable unit for the measurement of time,” and thereby transforming relative time scales into a single metric.⁴⁷ Huxley had found an isomorphic growth curve in the shape of “a remarkably straight line” across a range of organs within different species,⁴⁸ and similarly for their chemical constitutions, Needham found that “the slope of the straight line for a given substance or group of substances, is identical or very similar in widely different organisms.”⁴⁹ These straight lines

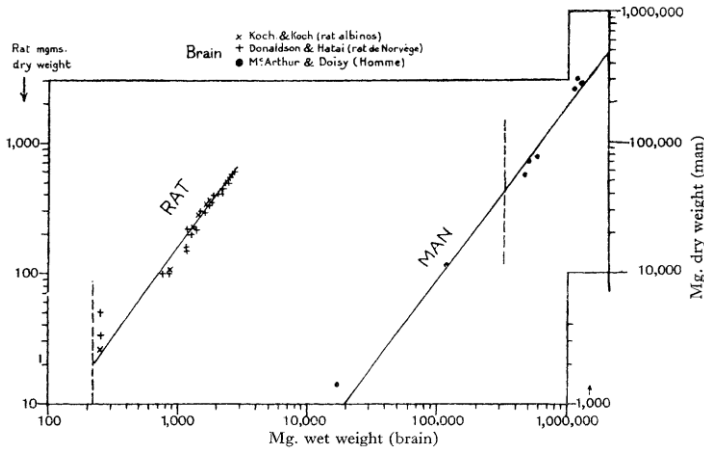


Fig. 2. Needham, Dehydration of the brain of the rat and of the brain of man; the dotted line is birth, (1933; p 98).

⁴⁶ Huxley, 1924. See also his *Problems of Relative Growth* (London: Methuen, 1932), as well as the third and seventeenth chapters of D'Arcy W. Thompson's *On Growth and Form* (Cambridge University Press, 1917/1942).

⁴⁷ Waddington, 1933; p 134.

⁴⁸ Huxley, 1924; p 895.

⁴⁹ Needham, 1932; p 846.

represent “a system of ratios and relations, which may be possibly the same in all animals, in a word, a chemical-ground plan of animal growth.”⁵⁰

Needham’s article, with its monistic subtext permitting a Whiteheadian conclusion,⁵¹ is exemplary in its search for a chemico-temporal metric common to the entirety of animal life (inclusive of mammals). On this “chemical ground plan,” he writes:

The disturbing influence of time makes this plan difficult to see when growth is considered as a function of time, but in heterogonic plotting, the time factor is short-circuited, *i.e.* made implicit, and the plan revealed.⁵²

The “short-circuit[ing]” of the “time factor” allows for such disparate data as that of “mouse time” and “elephant time” to be plotted upon a single graph,⁵³ that is, “in one and the same picture.”⁵⁴ The x-axis of the double logarithmic graph does not posit a time value, which is “made implicit,” and the y-axis posits two incommensurate metrical scales, corresponding to Rat and Man. Though the time scale of Prynne’s root/stem diagram does not employ an exponentially increasing metric, there is in both Prynne’s and Needham’s graphical devices a consonant *implication* (or folding under) of time. In *plant time* (rather than animal time), the time value *d* (“diurnal alternation”) is dimensionally “orthogonal” to the bilinear axis of “opposed exfoliation along functions of *m* [mineral salt concentrates] and *g* [gravity] mapped against *d*”:

Plant time 1*d*, 2*d*, 3*d* *nd* (by mirror symmetry orthogonal to all values of *g* and *m*) is thus incremental in

⁵⁰ *Ibid.*; p 104.

⁵¹ Needham, 1933; p 107. The concluding statement of Needham’s article reads: “Potentiality offers to Actuality a formula in which substitution may be freely made from a wide, but not infinite, range of values.”

⁵² *Ibid.*; p 104.

⁵³ *Ibid.*; p 107.

⁵⁴ *Ibid.*; p 81.

bilinear format, negative values increasing steadily along the r-axis (-g, -m) [...]⁵⁵

Unfortunately, *Bean News* edits out this swath of prose completely, as well as the predicate of the preceding sentence: “is *permanently been*.” Reconstituting the newspaper’s edit suggests that the set “r (-g, -m)” (which in Prynne’s original “is *permanently been*”) implies an internal copula, whereas it is clearly the leading noun phrase of the second half of the compound sentence beginning “Minus values of g and m...” More significantly, this edit irresponsibly elides the crucial description of the dimensional relationship between the time value (d) and the dependant variables (g and m) mapped against it. While it remains unclear how many dimensions must by extension be implicit to *plant time* (where relativistic space-time maintains four), the *Bean News* editing must fall short of Prynne’s intentions when he wrote to Dorn: “Don’t omit to subedit as you go along, you must clip & trim to make the whole thing fit the topic layout on the event horizon.”⁵⁶ Dorn’s own editorial practice may in this way be read as contributing to the impoverished readings so far conducted by most critics of the *PTM*. *Bean News*’ failing of the *PTM* does not end at philosophical subtlety or syntax, for the metrical *plant time* diagram also falls victim to editorial distortion, this time perhaps attributable to the newspaper’s printer, Holbrook Teter.

Universal like Huxley and Needham’s “remarkably straight line,” Prynne’s root/stem diagram construes a temporal metric for the entire plant kingdom. The diagram is hand-written in the correspondence typescript, though *Bean News* does it injustice, primarily by folding the horizontal display vertically onto itself, and second, by placing the root tip axis *above* the stem tip axis. There might be an argument for the coherency of this setting, on the basis that *Bean News* is itself an embodiment of total reversal, with both its pages and columns (and some of its text) reading from right to left. The problem with such an interpretation (by either the reader or *Bean News* staff) is that the “opposed exfoliation” of *plant time* is already implicated in total reversal, projecting mass relativity functions onto the ground-level interface between root and stem.

⁵⁵ Prynne to Dorn, 14th March 1972.

⁵⁶ *Ibid.*, 19th April 1972.

$$\begin{array}{r}
 r \quad g^{nd} \mid \dots \mid g^{3d} \mid g^{2d} \mid g^{1d} \\
 - \quad m^{nd} \mid \dots \mid m^{3d} \mid m^{2d} \mid m^{1d} \\
 \hline
 s \quad g^{1d} \mid g^{2d} \mid g^{3d} \mid \dots \mid g^{nd} \\
 + \quad m^{1d} \mid m^{2d} \mid m^{3d} \mid \dots \mid m^{nd}
 \end{array}$$

Fig. 3. Prynne, *Plant time* metric, “& Hoc Genus Omne,” *Bean News* [1972; p 2].

The significance of the original form of both the prose and schematic of this first *PTM* text occasions an introduction here of the term “manifold,” a treatment preemptive of the *PTM*’s own usage, which doesn’t occur until “Full Tilt Botany.” A manifold is a kind of heuristic maquette which represents a space (or space-time) using one less dimension than the real space actually contains.⁵⁷ Manifolds operate metonymically, bracketing the homogenous global complexity of a non-Euclidean space by representing it as a local fraction of itself. This reduced model must “resemble Euclidean space, and hence localized problems can be dealt with by means of all the tools of classical analysis.”⁵⁸ The historical context of Prynne’s usage may be approximated by what the conveners of a 1969 conference on the *Topology of Manifolds* called “the extraordinary development of recent years in the geometric topology of manifolds,” insofar as “[m]any of the historic problems that have motivated much of the development of topology in this century have now been solved.”⁵⁹ The newfound disciplinary stability of topology, roughly contemporaneous to the *PTM*’s composition, would perhaps make its phytological application imminent, though certainly not inevitable.

⁵⁷ “[A] metaphor is not a suppressed simile, even if you chop out a dimension and then make a drawing of the result” (Prynne to Oliver, 18th January 1972).

⁵⁸ Wells, 1973; p 37.

⁵⁹ Cantrell and Edwards, 1970; p vii.

This is especially so in light of earlier research, initiated by Georges Reeb, in which sub-manifold “foliations” (i.e. leaf-like components of a greater manifold) were employed as geometrical devices for the study of manifolds.⁶⁰ Prynne’s *plant time* metric (both in logical ideation and diagrammatic embodiment) is itself a manifold, just as are Huxley and Needham’s double logarithms. The time axis is equilaterally divided out of the equation, presenting a model which, by dint of its dimensional reduction, both represents less than what is truly being proposed and makes possible an otherwise impossible higher analysis.

PHYTOLOGY

While the orthogonality of *plant time*’s topological manifold is a central and not heretofore readily apparent feature of the *PTM*’s speculative science, the two-way flow of the metric (mappable to the polar root/stem physique), must be recognised as its most explicit and operative feature. In a section of his *Developmental Neurobiology* (1970), entitled “Polarity as a Flow or Gradient of Materials,” Marcus Jacobson discusses the development of the study of gradients (or ranges of inclined value) throughout the twentieth century.⁶¹ Jacobson posits “gradients of time of origin of cells”⁶² and claims that “[i]f the gradient is produced by an ion or by a molecule carrying a charge or having a specific metabolic action, a reactive gradient will be produced in the opposite direction.”⁶³ The “main axis” of the *plant time* metric is a “chemical gradient,” along which the “translocation of mineral salts” is a function motivated by “the increasing gradient of the bilinear time flow.”⁶⁴ It is possible here to imagine a motivating physics for the “opposed exfoliation” of bilinear *plant time*, in which

⁶⁰ See Wu Wen-Tsun and Georges Reeb’s *Sur les espaces fibrés et les variétés feuilletées* (1952), and for a later development, Bruce Reinhart’s “Foliated Manifolds with Bundle-Like Metrics” (1958). Reinhart’s essay is cited in Shoshichi Kobayashi and Katsumi Nomizu’s textbook *Foundations of Differential Geometry* (1963), which was itself cited in a letter from Prynne to Dorn, dated 24th October 1971.

⁶¹ This work is cited in: Prynne to Dorn, 30th May 1972.

⁶² Jacobson, 1970; p 79.

⁶³ *Ibid.*; p 84.

⁶⁴ Prynne to Dorn, 14th March 1972.

multiple dimensions of intra-plant gradient functions have discrete spatial and temporal orientations which are mutually dependant within a relativistic paradigm. Where the “specific metabolic action” of an ion might be unidirectionality in time—i.e. if time’s arrow were in plant systems the function of an ionic stream—then a “reactive gradient” could be expected to follow suit, opposing time’s arrow, tail to head. Prynne writes accordingly:

Have I not by this graceful new future participle solved one of the great problems of plant kinetics, viz., the translocation of mineral salts in the stem?...Truly a new dimension to the celebrated paradoxes...⁶⁵

Michael Richardson writes in his Preface to *Translocation in Plants* (1968):

The circulation of water, minerals, and metabolites within plant tissues via the xylem and phloem was one of the earliest problems to attract the attention of plant physiologists. Studies on translocation, which have long been noted for the fascinating novelty and ingenuity of many of the techniques employed, received a great stimulus from the recent advent of radioactive isotopes, electron microscopy and methods involving the use of viruses and phloem-feeding aphids. Despite these recent advances, however, many problems and areas of dispute remain unresolved.⁶⁶

Erasmus Darwin ponders translocation in a footnote from the fourth Canto of *The Economy of Vegetation* (1791),⁶⁷ and twentieth century research made significant findings in that “great problem of plant kinetics,” findings which seem to both support and destabilise the empirical basis of the *plant time* hypothesis.

Protoplasmic streaming is defined in J. Lee Kavanau’s encyclopedic monograph, *Structure and Function in Biological Membranes*

⁶⁵ *Ibid.*

⁶⁶ Richardson, 1968; unpaginated.

⁶⁷ Darwin, 1791; pp 100-101.

(1965),⁶⁸ as “a counter-current process involving the *jet propulsion* of elements of the endoplasmic reticulum [a net-like extra-nuclear organelle] with a concomitant retrojection of matrix [or protoplasmic medium].”⁶⁹ Kavanau’s two-volume work addresses “a wide range of phenomenological knowledge concerning the molecular and interfacial chemistry of lipids, proteins, and lipid-protein complexes,”⁷⁰ and his chapter on protoplasmic streaming explores a number of explanations of translocation in light of “the sheer diversity of streaming phenomena.”⁷¹ Protoplasmic streaming is intercellular, operative right through membrane walls, as Richardson illustrates with this “demonstration of simultaneous bidirectional movement within the smallest functional unit of conduction, i.e. within a single file of phloem sieve cells.”⁷²

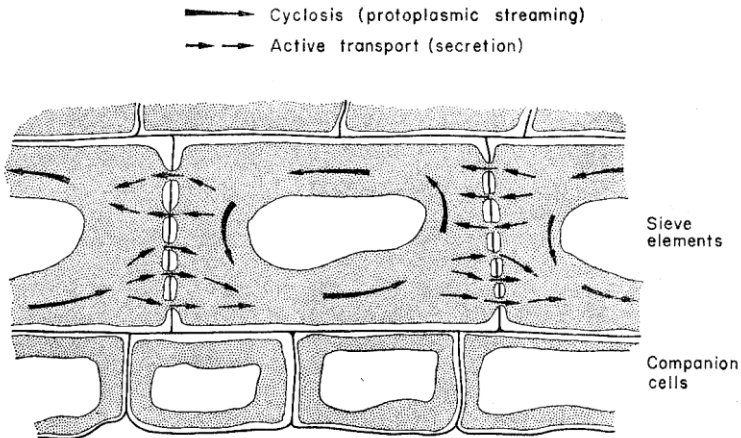


Fig. 4. Richardson, “Diagrammatic illustration of protoplasmic streaming concept of translocation” (1968; p 51).

⁶⁸ This work is cited in: Prynne to Dorn, 30th May 1972.

⁶⁹ Kavanau, 1965, Vol. II; p 354 (my italics).

⁷⁰ *Ibid.*, Vol. I; p v.

⁷¹ *Ibid.*, Vol. II; p 354.

⁷² Richardson, 1968; pp 49-50. See also Palmquist, 1938.

There is, however, evidence suggesting that protoplasmic streaming has no causative relation to bidirectional flows; the latter continue even at “-1.5° C, at which temperature it is known that protoplasmic streaming is completely prevented.”⁷³ The temporal bilinearity of *plant time*’s “main axis chemical gradient” may not therefore be reduced to protoplasmic streaming. Bidirectional flows in space-time must be a function of some novel feature unique to the plant kingdom, which, as a result, would itself be translocation’s motive force. The answer is of course *plant time*, and the next feature of that hypothesis which we must interrogate is plant memory, or rather, the embodiment of its lack within a metaphorical extension of the root function.

Just as Needham glimpsed the metric of a universal *animal time*, Prynne proposes a universal *plant time*, common to all phytological species, *et hoc genus omne*. The explanation of the mnemonic functionality in plants constitutes perhaps the most enlightening moment in Prynne’s treatise, offering *plant time*’s warrant by inter-class comparison. Distinguished from *plant time*, which moves both ways along the horizon of time’s arrow, is the *monolinear* “mammal time,” which Prynne describes thus: “‘negative’ values accumulating in respect of successive states of s [stem tip] increasing from r [root tip] static as zero limit to memory store.”⁷⁴ That is, the non-plant goes backwards via memory. Prynne’s “‘negative’ values” are not those of the plant’s root tip (which travels backwards in time as it travels down into the earth); they belong instead to the organisms of the mammalian class,⁷⁵ which, like the rest of the animal kingdom, lack

⁷³ *Ibid.*; p 52.

⁷⁴ Prynne to Dorn, 14th March 1972.

⁷⁵ The use of “mammal time” rather than *animal time* significantly excludes the avian class. The poet’s special relation to birdsong would make an implicit claim to mammalian/avian spatio-temporal affinity quite dangerous. A sequel to the *PTM*, in the guise of some “*Bird Time Manifold Transcripts*” would be a welcome contribution, and a probable point of departure for such a project would be G.J. Whitrow’s synoptic work, *The Natural Philosophy of Time* (1961/1980), cited by Prynne in a letter to Dorn dated 10th January 1973. In his chapter on “Biological Time,” Whitrow gives a generous treatment to birds, and states that “some of the most exciting research concerning biological time-keeping processes has resulted from the study of bird

roots. While the bodies of typical plants are immobilised to a spot of ground which sends them both down into and up above it, animals are significantly automobile. Animal memory is a function of the brain's positive growth, or "successive states" of relative "s," the stem being here an analogue for the mammalian body's upward growth through forward-moving time. The physiological analogue to the plant's root would be the legs, which as the motor of superterranean mobility, make the mammal's "r" the "static" abscissa upon which forward moving growth takes place, articulating a materially unbreachable threshold. But with necessary symmetrical grace, "'negative' values" are manifested as successive levels of memory acquisition; the counter-force to "r static" is "zero limit to memory store," with memory extending back as long as the body is impelled forward through space-time. "Mammal time" is corporeally monolinear and cognitively bilinear, so that phytophysiology is anthropocentrically matched up to psychology.

The roots of the mammalian are traceable in auto-historiography, which Prynne gives back to plant life in the form of the lecturing of Professor Quondam Lichen (Edinburgh Institute for Plant History) on "Palaeomenonic Resonances" in the April Fools' transcript.⁷⁶ So the *plant time* hypothesis locates in the plant root an operative mnemonic organ, providing access to the literal past, via "*positive mnemonic pressure*."⁷⁷ This embodied plant memory requires the notion of "prehension"—the cognitive or *extra-cognitive* interaction with any entity or event. Alfred North Whitehead, whose great work of synthetic cosmology, *Process and Reality* (1929), is referred to by Dr. Myrtle Gale in the transcript of 18th April 1972,⁷⁸ writes:

The philosophy of organism is a cell-theory of actuality. Each ultimate unit of fact is a cell-complex...The cell can be considered genetically and morphologically...In the genetic theory, the cell is exhibited as appropriating for the foundation of its own existence, the various elements of the

navigation" (p 130). Whitrow also discusses the time-keeping practices of bees at some length.

⁷⁶ *Poems*, pp 234-237.

⁷⁷ Prynne to Dorn, 14th March 1972.

⁷⁸ *Poems*, pp 237-239.

universe out of which it arises. Each process of appropriation of a particular element is termed a prehension.⁷⁹

Within the “double-ended world tube” of the plant organism, time-flow is unique to both ends of its spatial curvature. The surrounding earth is consumed into the backflow, as the root’s “appropriation” of subterranean mineral excavates the geological timeline of past organic life, now fossilised and compressed into plant food. Prehension defines the condition of the organism’s relationship to past events, which data are received as present inputs, making possible the future (or future past); the extra-cognitive base of a conventional account of phytological prehension is through the *plant time* hypothesis bestowed with a wholly cognitive function: plant memory.

The inherency of memory in nature is the fundamental claim of Rupert Sheldrake’s hypothetical account of morphogenesis, which he calls “the hypothesis of formative causation” or “morphic resonance.”⁸⁰ In the mid-60s, Sheldrake was a member of the Epiphany Philosophers, a Cambridge-based “group of scientists and philosophers engaged in the exploration of areas between science, philosophy and religion.”⁸¹ Sheldrake’s paradigmatic intervention into the mechanistic lean of contemporary science, conceived in 1974 and proposed in *A New Science of Life* (1981),⁸² holds in tautological perfection that the forms of all things are a function of “morphic field” resonances emitting from the very things that already have those forms; novelty is the prime mover in this system, made possible by a grounding in Whiteheadian monotheism. Sheldrake, whose

⁷⁹ Whitehead, 1929; p 219. Conventionally, prehension has both a zoological sense (“the action of physically grasping or holding something” and a philosophical sense (“perception of and response to an object or event”).

⁸⁰ A comprehensive account of morphic resonance would require a more extended look at Whitehead’s “philosophy of the organism.”

⁸¹ While Prynne’s friendship and intellectual provocation is acknowledged in Sheldrake’s *A New Science of Life* (1981; p 15) he was not a member of the Epiphany Philosophers, as James Keery claims in “‘Jacob’s Ladder’ and the Levels of Artifice” (Keery, 2002; online).

⁸² Copies of Prynne’s extensive annotations to drafts of *A New Science of Life* are among Dorn’s papers at the University of Connecticut.

early biochemical articles are quoted in the penultimate transcript of 17th July 1972 (entitled “Affine transform”),⁸³ became personally acquainted with Prynne just before the end of the *PTM*’s composition. It seems probable that Sheldrake’s controversial hypothesis was influenced by that of *plant time*, which the two would have discussed with the utmost gravity.

The history of science has plenty of other double agents at the crossroads of mechanism and vitalism, and *Bean News* gives us two useful cues. The first takes us back to Erasmus Darwin: in the “Vegetable Animation” section of his medical work *Zoonomia* (1794), Darwin is motivated by the inter-plant attraction of the “vegetable amourettes” to speculate on plant sentience.⁸⁴ He goes on to hypothesise the existence of vegetable organs for the sentience of heat, moisture, light, and touch, ultimately ascribing an intellectual capacity (inclusive of memory) to plants.

I think we may truly conclude, that they are furnished with a common sensorium belonging to each bud, and that they must occasionally repeat those perceptions either in dreams or waking hours, and consequently possess ideas of so many of the properties of the external world, and of their own existence.⁸⁵

Self-consciousness is certainly possessed by the lecturing plants of the London *PTM* Conference. The other cue from *Bean News* is another specimen of Romantic biology and can be glimpsed at the top of the newspaper’s front page, which advertises “Plants with Brain! Sir James Tupper on Rational Vegetables p. 2.”⁸⁶ The extract from Tupper’s *Essay on the Probability of Sensation in Vegetables* (1811) is printed thus:

⁸³ *Poems*, pp 240-241. As the date indicates, this was the final *PTM* transcript which Prynne composed.

⁸⁴ Darwin, 1794; p 106.

⁸⁵ *Ibid.*; p 107.

⁸⁶ Dorn, [1972; p 1]. The notice for the *PTM* texts reads: “For the worst kept secrets on World Tubes and Muzzle Energy of Tulips turn to Erasmus pp 2 & 8.”

Veg. Dil.-

“The Probability of Sensation in Vegetables” – Sir Jas. Tupper

for BNS, LONDON, July 20, 1811 If this accommodation to particular circumstances, or these correspondent observations were to be considered as sure indications of the presence of a *rational mind*, the *rationality* of vegetables might be contended for on similar grounds; for, they have also the power of accommodating themselves to new situations; and in their instincts, the same species likewise show a correspondency of actions, the nature of which, is in many instances very remarkable. But who will seriously contend for the existence of a rational power in vegetables? From this view of the subject, we may form some idea how far instincts may supply any deficiency of intellectual power, and even compensate for the total want of reason in the brute creation. But where shall we find any power, or quality, as a substitute for sensation? The idea of *instinct* is naturally associated with that of *life*, and the idea of both, either jointly, or separately, with that of *sensation*; and as sensation does exist in animals independently of those eminent attributes with which it is combined in our natures as rational agents, may we not reasonably infer that vegetables have likewise their share of sensitive power, and consequently the means of enjoying their own existence?⁸⁷

Which is to say that the poet’s experiment in scientific journalism is imagined through history, its diction and philosophy founded upon a precedence of usage and ideation. But that discipline (and epoch) of Romantic biology is not the only vein running through this complex of discourses. All of the novelty and grace of the “*plant time manifold*” (as schematised in the root/stem metric) is compressed into “*will-been*”: “the not-yet completed negative increments within the r-system of a plan unit comprise the *will-been* of the double-ended world tube.”⁸⁸

⁸⁷ Tupper, *Bean News*, [1972; p 2].

⁸⁸ Prynne to Dorn, 14th March 1972.

RELATIVITY

Involuntary time reversal, at least along the inner sphere of the relative spatial axis through which the plant body transects the Earth's core, would be a glorious acquisition for any biological kingdom. Yet from the disciplinary perspective of astrophysics or cosmology, such a phenomenon (conceived at world-level) is a frequently treated (if marginalised) problematic.⁸⁹ A more comprehensive account of the time reversal literature, i.e. one that accounts for at least all of the cues given by Prynne himself in the *PTM* and his correspondence, must await future commentary; but a few central texts can at least set the reading list in train.⁹⁰ In "World Structure and the Expansion of the Universe" (1932), which is referenced in the transcript of 1st April 1972,⁹¹ E.A. Milne writes:

[E]very kinematic system possesses a well-defined epoch $t = 0$ whether it was "initially" started at $t = 0$ or not. $t = 0$ is an epoch peculiarly associated with the system, and it will be natural to reckon all times from this epoch; it is a *natural origin of time*...At epoch $t = 0$, time is unidirectional, in the sense that the system behaves in the same way whether time actually runs forward or backwards. "Time's arrow",

⁸⁹ Regarding time reversal, two points of marginal interest may be noted: Prynne's unpublished comments upon his runic poem (*Poems*, p 244), written during the composition of the *PTM* and printed in galley-proofs of *Bean News* 4 [1975], employ the neologism "prejected" (Prynne, 12th June 1972); and Part II of Erasmus Darwin's poem *The Botanic Garden*, entitled *The Loves of the Plants* (1789), was written *before* Part I, *The Economy of Vegetation* (1791).

⁹⁰ The possibility of time progressing in any direction other than "the upper half of the world, $t > 0$ " (Minkowski, 1908; p 77) is refuted by Ya. B. Zel'dovich and I.D. Noyikov in the second volume of *Relativistic Astrophysics* (1975); their apology for so much as addressing the time reversal problem is of especial interest: "the only excuse we have for mentioning these erroneous views about the arrow of time here is that they have appeared so frequently in the literature" (Zel'dovich and Noyikov, 1975; pp 671-673).

⁹¹ "For we can trace the motion of any celestial system through its natural origin $t = 0$ to negative values of t 'and there is nothing to prevent the system *having existed* at such negative values' (Milne, *ΣS Ap.*, 1933, p. 14)" (*Poems*, p 234).

to use Eddington's phrase, has at time $t = 0$ a barb at each end. This property holds for no other instant. For at any other instant reversal of velocities produces expansion in a contracting system and contraction in an expanding system. The epoch $t = 0$ is thus theoretically recognizable by inspection. We have simply to reverse the velocity and compare the pre-reversal motion with the post-reversal motion. If the two are indistinguishable, then the epoch of reversal must be at the natural origin of time; if they are distinguishable then the epoch can at once be recognised as being either before or after the natural origin of time.⁹²

Under this rubric, there is “a natural origin of [plant] time” contained within every phytological specimen. We know this because, via the *plant time* metric, the only distinguishing factor between forward and backward (conceived as functioning in “mirror symmetry”) is the morphological distinction between stem and root. In a letter to Douglas Oliver dated 18th January 1972, Prynne discusses Renè Thom's foundational essay on catastrophe theory, “Topological Models in Biology” (1969),⁹³ which seems to have had a great influence upon the modeling of the *plant time* hypothesis. Significantly prior to the *PTM*'s composition, Prynne's criticisms of Thom can be read as an oblique rationalisation of the plant's immanent natural time origin, wholly unrecuperable with “local parametric constraints” or conventional accounts of relativistic space-time's local effects. Prynne writes:

[N]ot to recognise and accommodate locally inhomogenous manifolds embedded discontinuously within a set of such sub-manifolds which can be mapped on to an isotropic and homogenous total-manifold, and with a high accuracy of correspondence to the observed statistical data, is to languish within positively Euclidean archaism. If you see what I mean. There are discontinuities with respect to some major functions, “life” amongst others; but if a

⁹² Milne, 1933; p 13.

⁹³ Prynne's letter seems to indicate that Oliver was responsible for bringing the Thom essay to his attention.

singularity is not to be just “point of view” determined, it must comprise a condition of closure with regard to every axis of its reference frame (or co-ordinate system). Without this, binary instability, breakdown of symmetry, the whole idea of catastrophic bifurcation, can be smoothed into a crypto-continuous function of the survivingly continuous gradient or vector, and thereafter recuperated more or less completely according to the local parametric constraints.⁹⁴

Prynne’s projection of macroscopic relativistic kinematics onto the microscopic dynamics of the plant organism refuses “crypto-continu[ity],” maintaining “catastrophic bifurcation” by the proposition of an emphatically improbable and explicitly elegant model. Where this the application of macroscopic dynamics to microscopic systems may be critiqued as a categorical error, the *plant time* hypothesis is redeemed by an inversion of the topological basis of catastrophe theory. Instead of “reconstruct[ing] a global form, a topological space out of all its local properties,” Prynne reconstructs a local topological space from global properties.⁹⁵ Because cosmological time unfolds identically from its natural origin ($t = 0$), whether time is proceeding or reversing, the natural origin of *plant time* must also do so, even if this demands the existence of micro-singularities within every plant organism.

The bilinear temporality of *plant time* is discussed in another letter to Oliver, dated 6th September 1974:

The sign change for the time axis is more difficult. I started mostly from the sections 8 and 9 of [Wolfgang] Rindler, “Visual Horizons in World-Models,” *MNRAS*, 116 (1956), 662-677, which is at least comprehensible and which hybridises nicely with, e.g., sections 7 and 8 of G.N. Leech, *Towards a Semantic Description of English* (London, 1969). The spoken sign change is probably negation, of which a neat recent mapping is Pieter Seuren, “Negative’s Travels” in

⁹⁴ *Ibid.*

⁹⁵ Thom, 1969; p 89.

his volume of Oxford Readings in Philosophy called *Semantic Syntax* (London, 1974).⁹⁶

The unexpected triangulation of relativistic astrophysics and para-Chomskyan linguistics⁹⁷ is realised ontologically in the spirited projection of the “*will-been*” verb tense. A new copulative compound defining the conditions of being for that which habituates negative time values (or “*positive mnemonic pressure*”). This is a novel account of the zero-point threshold at which positive and negative time flows peel apart in “opposed exfoliation,” made possible by nothing less than poetic ingenuity. With reference back to Richardson’s illustration of the full-axis bidirectional flow of translocation, we must wonder what is actually going on at the metric’s continental exfoliation horizon (if we may call it that), upon either side of which time flows towards its own open boundary; that is, can we really take seriously a system in which two opposing flows of monodirectional time *emit* from a horizontal threshold within the plant, conceivably located at ground-level, the midpoint between conventional root and stem tip. Rindler’s influential essay, cited by Prynne, provides the tools necessary for circumscribing this question; but before addressing this work, it is necessary to discuss an essay by Albert Einstein’s teacher Hermann Minkowski which will communicate the basic framework within which Rindler’s theory operates.

Minkowski’s major contribution to the relativity theory is delivered in “Space and Time” (1908), where he is the first to subtract the conjunction, and for the resulting *space-time* he develops a four-dimensional diagrammatic representation of the cosmos. In *The Logic of Special Relativity* (1967), S.J. Prokhovnik explains the Minkowski diagram:

The graphical representation of world-lines of particles, light-rays or bodies (that is, systems of particles which can be considered as sharing a set of co-ordinates) is called a

⁹⁶ Prynne to Oliver, 6th September 1974. Rindler’s “Visual Horizons in World-Models” is quoted in the transcript of 1st July 1972.

⁹⁷ Immediately following the verses in the transcript of 18th April 1972, there is a line detoured from Noam Chomsky’s “The Formal Nature of Language” (1968).

Minkowski diagram. For uniform motion in a straight line, the corresponding world-line can be described in terms of two dimensions—one of space and one of time—and this type of Minkowski diagram is widely used to illustrate various aspects of relativity theory and the associated properties of space-time.⁹⁸

That is, any one or two of the three coordinates for the spatial dimensions (x, y, z) is mapped against the single coordinate for the temporal dimension (t). The consequences of this world-map are best described by the cartographer himself:

[I]n correspondence with the figure described above, we may also designate time t' , but then must of necessity, in connexion therewith, define space by the manifold of the three parameters x', y, z , in which case physical laws would be expressed in exactly the same way by means of x', y, z, t' as by means of x, y, z, t . We should then have in the world no longer *space*, but an infinite number of spaces, analogously as there are in three-dimensional space an infinite number of planes. Three-dimensional geometry becomes a chapter in four-dimensional physics. Now you know why I said at the outset that space and time are to fade away into shadows, and only a world in itself will subsist.⁹⁹

Reproducing three versions of the Minkowski diagram should communicate the necessarily general nature of the model, two of which represent a three-dimensional space (e.g. x, y, t).

⁹⁸ Prokhovnik, 1967; p 29.

⁹⁹ Minkowski, 1908; pp 79-80.

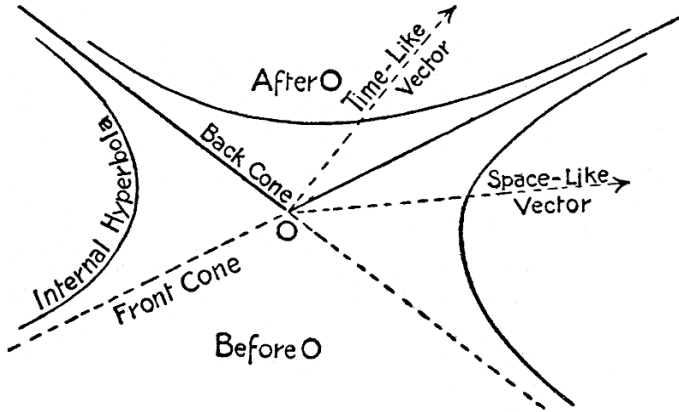


Fig. 5. Minkowski, "Space and Time" (1908; p 84).

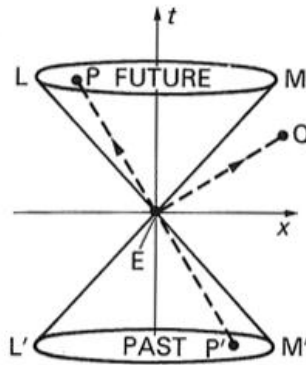


Fig. 6. Whitrow, *The Natural Philosophy of Time* (1961; p 353).

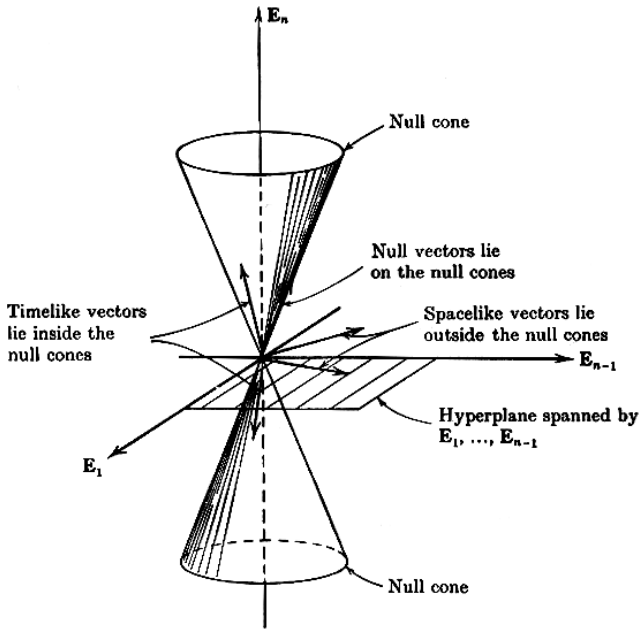


Fig. 7. Hawking and Ellis, "The null cones defined by a Lorentz metric" (1973; p 39).

Where it is natural to want to read all of the vectors within this rendering as spatial, the resemblance of temporal vectors to spatial vectors is an obstruction of the graphical materiality; commensurate difficulty exists in the interpretation of Needham's double logarithms. There is a peculiar way in which manifolds are never quite what they appear to be, and Prynne accordingly writes to Oliver: "Only relativistic cosmology has fully recognised that the description and the function are equivalent."¹⁰⁰ It is important to remember that even when three dimensions are represented in a Minkowski diagram, there is always one spatial dimension which has been "short-circuited," so to speak. A generous reproduction of G.J. Whitrow's account of Minkowski's basic contribution to the theory of relativity

¹⁰⁰ Prynne to Oliver, 18th January 1972.

should provide some insight into the far-ranging implications of this elegant diagrammatic method.

A point of space at a point of time [Minkowski] called a *world point*, [Footnote: The terms *point instant* and *event* have since been used.] and the totality of all conceivable world points he called the *world*. A particle of matter or electricity enduring for an indefinite time will correspond in this representation to a curve which he called a *world line*, the points of which can be labeled by successive values of a *parameter t* associated with a clock carried by the particle.¹⁰¹

A particle of matter is represented in the Minkowski diagram associated with any event E in its history by a line which lies (strictly) inside the light cones at E. Any direction pointing from E to the interior of these light cones is called *time like*, because it can represent a sequence of instants in the history of a material particle. We can therefore regard a particle of matter as a structure that is represented in the Minkowski diagram by a world line that is everywhere time like. Similarly, a photon (in free space) is represented by a world line, or segment of a world line, lying along a generator of a light cone.

A world line lying in that part of the Minkowski diagram which is outside the light cones (at E) is called *space like*, because it can represent a set of simultaneous events according to a suitably chosen observer who is himself represented by a time-like world line.¹⁰²

And finally, perhaps the most important function of the Minkowski diagram:

Although in the Minkowski diagram associated with a given inertial frame of reference A and an event E (chosen as space-time origin of the frame) any point (t, x, y, z)

¹⁰¹ Whitrow, 1980; pp 270-271.

¹⁰² *Ibid.*; p 356. Whitrow's coordinates correspond to those of his own Minkowski diagram, above.

represents a potential event, only those events P which lie *inside* or *on* the forward light cone LEM...can be said unequivocally to lie 'in the future' relative to E, and similarly those events P' which lie *inside*, or *on*, the backward light cone L'EM'...can be said unequivocally to lie 'in the past' relative to E. For, *they are the only events that can stand in the corresponding causal relations to E.*¹⁰³

Minkowski's "world-line" becomes the "double-ended world tube"¹⁰⁴ of "& Hoc Genus Omne," and in "Full Tilt Botany," the plant physique is described as a "four-dimensional world tube." A nudging reference is made to "the Minkowski diagram for apical growth."¹⁰⁵ Plants are not quite a literal embodiment of the Minkowski diagram; rather, *plant time* proposes a world enclosed unto itself, one of Minkowski's "infinite number of spaces."¹⁰⁶ Thom's "Topological Models in Biology" opens by stating that "the problem is to explain the stability and the reproduction of the global spatio-temporal structural *in terms of the organization of the structure itself.*"¹⁰⁷ Likewise, Waddington writes in *Biology and the History of the Future* (1972):

Students of living things, who approach them on their own terms have to develop types of thinking capable of dealing with entities of extreme complexity which yet exhibit global characters of a definite – and therefore in some sense simple – kind.¹⁰⁸

¹⁰³ *Ibid.*; p 352.

¹⁰⁴ Prynne to Dorn, 14th March 1972.

¹⁰⁵ *Ibid.*, 25th March 1972.

¹⁰⁶ Minkowski, 1908; p 79.

¹⁰⁷ Thom, 1969; p 89. Thom's essay importantly lists eight types of "ordinary catastrophes" whose occurrence in four-dimensional space-time enables the entire range of perceivable morphologies. Future commentary will focus attend to the seventh of these catastrophes, the "elliptic Umbilic," which is quite obviously an influential model for Prynne's *plant time* metric. This catastrophe's spatial interpretation is "needle/spike/hair," and its temporal interpretation is "to drill/to fill/to prick" (*Ibid.*; p 97).

¹⁰⁸ Waddington, 1972; p 3.

The *plant time* structure does not only operate within a matrix of world-horizons; its morphological stability is a function of its own matrix of internal world-horizons, necessarily discontinuous with those of the world exterior to plant temporality.

A horizon in relativistic cosmology is defined by Rindler as “a frontier between things observable and things unobservable.”¹⁰⁹ Rindler specifies two types of horizon, qualified by event and particle. An event-horizon, “for a given fundamental observer A...divides events into two non-empty classes: those that have been, are, or will be observable by A, and those that are forever outside A’s possible powers of observation.”¹¹⁰ A particle-horizon, “for any given fundamental observer A and cosmic instant t_0 ...divides all fundamental particles¹¹¹ into two non-empty classes: those that have already been observable by A at time t_0 and those that have not.”¹¹² Keeping in mind this model, which lends itself to a kind of logarithmic cartography of those furthest bounds of extra-galactic space-time which no light can ever cross over, we must consider Rindler’s discussion of time reversal within such a matrix.

[I]n...all the cosmological models of General Relativity... the direction of time can be reversed without violating the hypotheses on which the model is constructed. In any case there is nothing to prevent us from contemplating the dual of any given model formed in this way. The one result that is of interest in this connection is that an event-horizon transforms into a particle-horizon and vice versa....On time reversal the point-creation event transforms into a point-annihilation event in the finite future. The particle-horizon transforms into an event-horizon in the sense that events occurring beyond it will not be observed in the finite stretch of time left to the observer before annihilation.¹¹³

¹⁰⁹ Rindler, 1956; p 134.

¹¹⁰ *Ibid.*; p 135.

¹¹¹ By fundamental particles, Rindler means “the representations of the nebulae in the world-model” (*ibid.*).

¹¹² *Ibid.* This passage and all preceding Rindler quotations are italicised in the original.

¹¹³ *Ibid.*; p 149.

Via this transformation, the exfoliation horizon of the *plant time* hypothesis might be a particle-event interface, meshing the horizons of particle and event.¹¹⁴ Translocation sends minerals both up and down the *entirety* of the plant, so that “mineral salts” (m) are the fundamental particles translocating across the hybridised exfoliation horizon. But the plant organism’s constituent matter (phyto-temporal *aether*) is exfoliated only one way or the other from the virtual null point of the relativistic system, making each *other* side (relative to root or stem tip) truly other, where the exfoliation horizon’s event-function divides a bifurcated progression of mutually exclusive eventualities. This interpretation, of a particle/event-horizon, is motivated by the fact that Prynne does not effect a singular reversal upon a unidirectional timeline; his system goes *both* ways along the axis defined by time’s arrow, making the exfoliation horizon a true “*natural origin of time*” accordingly fitted out with “a barb at each end.”¹¹⁵ Conventional time’s arrow *and* its mirror are definitive of *plant time’s* two-way flow. This hybrid threshold is perhaps commensurate with what Prynne refers to as the “inference horizon” in a letter to Dorn written one month after the composition of “Full Tilt Botany”:

If we infer logically the existence of what we cannot observe then the inference horizon exceeds the event horizon by the limits of logical extensibility; by Rindler’s theorem on time reversal the inference horizon (lines towards which are orthogonal to time-flow, plus or minus alike) also exceeds the particle horizon and by the same amounts.¹¹⁶

Inevitably, the exfoliation horizon seems embodied in a singular *Bean News* logo, an infinity symbol cast upon a crosshatch, with *NB* and

¹¹⁴ One apposite line from the transcript of 18th April 1972 reads: “Time-averaged protein tubes comprise the meshwork of willbeen functioning, held in simigrind array by double reverse backflow or ‘dream membrane’” (*Poems*, p 238).

¹¹⁵ Milne, 1932; p 13.

¹¹⁶ *Ibid.*, 25th April 1972.

BN respectively occupying the step and root tips, rendered in red ink and appearing next to the equational element of the transcript of 1st June 1971 (printed under the headline “When Is Now”).¹¹⁷ The equation’s solution “for $t=0$ ”¹¹⁸ is infinite compression in time, or “ ∞ (will be).”

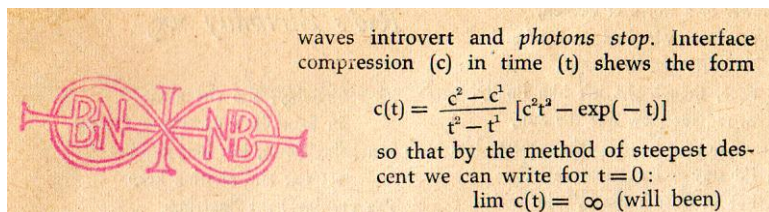


Fig. 8. J.H. Prynne, *Bean News* device and *PTM* equation, “When Is Now,” *Bean News*, [1972, p 4].

To jump now briefly beyond “& Hoc Genus Omne” and into the second *PTM* transcript, and to thereby effect the downward slope to a conclusion, our interpretation of the exfoliation horizon must be qualified (and complicated) by the fifth paragraph of “Full Tilt Botany.” In this passage, Minkowski’s “causality assumption” (as founded on a necessarily unidirectional temporal paradigm) is not only “violated” but elegantly negated by the plant system’s vitalistic “self-motivation” and the exfoliation horizon’s “[o]smotic time pressures.” The passage, headed “Null Holes” in *Bean News*, reads:

At this stage we can attempt a geodetic mapping of the double shoot. In General Theory we would have the double cone of null lines joined at the common vertex (the “worm-hole” of recent acquaintance). This is for world points whose tubes are consequently time forms which cannot have more than metric existence. But if the common vertex is itself a tube, and if its development in

¹¹⁷ In this light, the mirror symmetry of Prynne’s pseudonymous initials (E.W.D.) to Dorn’s (E.M.D.) must have played some role in Prynne’s choice of *nom de plume*.

¹¹⁸ Or as, in the discourse of cellular automata, *Gunslinger’s* Dr. Flamboyant might say: “a Garden of Eden Pattern” (Dorn, 1989; p 137).

time is self-elongating, then interpenetration must take place of the classically separated “active future” and “passive past”. Each plant stem is such a tube and its self-motivation naturally violates the causality assumption. Osmotic time pressures, the logarithmic but also the cyclical, take the place of absolute causal constraints, giving rise to “is been” and “will been” in the root systems and “is being” and “has being” in the leaf & flower counterparts.¹¹⁹

Via tubular self-elongation, the exfoliation horizon cannot be as simple as a static divide from either side of which crests new root/stem *plant time* matter. The bidirectional hinge is not a two-dimensional swath along a value of the vertical third axis, but a four-dimensional tensor (i.e. the formalisation of coordinate transformations of a body or field of coordinates). And so our exfoliation horizon may be more realistically called an exfoliation tensor; as such, “Full Tilt Botany” makes good on the promise in “& Hoc Genus Omne” of a “tensor analysis of plant space-time.”¹²⁰

With this we must draw our commentary on the *plant time* hypothesis to a close.¹²¹ It should be evident that Prynne’s first column for *Bean News* is a dedicated pre-text, giving the successive transcripts a logical track along which to course and deviate. A passage from Thom’s “Topological Models in Biology” seems to describe the *PTM*’s own methodology:

Practically any morphology can be given such a dynamical interpretation, and the choice between possible models may be done, frequently, only by qualitative appreciation and a mathematical sense of elegance and economy. Here we do not deal with a scientific theory, but more precisely

¹¹⁹ Prynne to Dorn, 25th March 1972.

¹²⁰ *Ibid.*, 14th March 1972.

¹²¹ One neglected aspect of “& Hoc Genus Omne” is the line: “The true metric of post-Nixon hydraulics is Yet To Be Found Out, and awaits its very own Skald.” *Bean News* leaves out the final predicate phrase “and awaits its very own Skald,” implying that Dorn might have thought the Skald—himself? Prynne? Tom Raworth?—to have already discovered that “true” historical poetic.

with a *method*. And this method does not lead to scientific techniques, but strictly speaking, to *an art of models*.¹²²

CONCLUSION

In *Speculum Mentis* (1924), R.G. Collingwood writes:

[L]anguage never is its own meaning, and is therefore always symbolic or metaphorical; but when this fact is as yet undiscovered by the user of language we say that he is using it ‘metaphorically’, and when he realizes that words are mere symbols and distinguishes what they are from what they mean, then by facing and accepting the metaphorical character of all language he has overcome it and is henceforth using language ‘literally’. This revolution in the use of language is the birth of science.¹²³

Via Collingwood, Prynne’s own scientific authority, taken for granted as the poet’s right, can be seen to require the use of not only scientific diction and theory, but a baseline of transparent literality. The deviations of wit and pun, whether subliminal or bathetic, are the mark of the poetic, and may be said to be a tactical praxis, where the punctuating of latent cracks allows for the vertical flight or slip. Leo Spitzer, in “Language—The Basis of Science, Philosophy and Poetry” (1953), writes:

[L]anguage is not only a banal mass of communication and self-expression, but also one of orientation in this world: a

¹²² Thom, 1969; p 114.

¹²³ Collingwood, 1924; p 157. *Speculum Mentis; or The Map of Knowledge* had a great influence upon Joseph Needham, and in “The Makings of an Honorary Taoist” (1973), he writes: “[I] reached the conviction that life consists in several irreducible forms or modes of experience. One could distinguish the philosophical or metaphysical form, the scientific form, the historical form, the aesthetic form and the religious form, each being reducible to any of the others, but all being interpretable by each other though sometimes in flatly contradictory ways. This conclusion was supported by many thinkers, but particularly R.G. Collingwood in his book *Speculum Mentis*” (Needham, 1973; p 5).

way that leads toward science and is perfected by science, and on the other hand also a means for freeing us from this world thanks to its metaphysical and poetic implications.¹²⁴

The *PTM* draws from the scientific literature's philological depths as much if not more than its empirical database. In his 18th January 1972 letter to Douglas Oliver, Prynne writes on poetic authority: "What we say is what it is; that's a level of adequation we must be vigilant about, nothing to do with nineteenth century naturalism etc."¹²⁵ Preceding this quotation, Prynne discusses his reading of Dominic Edelen and Albert Wilson's *Relativity and the Question of Discretization in Astronomy* (1970), stating that "any use" of it which "occurs" in his writing "will certainly not be mere extrapolated figuration."¹²⁶ The poet's usage will instead constitute a dialectical extension of the scientific theory, operating along the parallel axes of imagination and scholarship. The *PTM* both embodies and contradicts its science, avoiding the reification of the prefabricated theoretic germ in which "mere extrapolated figuration" would result.

Prynne's scientific imagination is necessarily illegitimate, precisely because his poetic license enables a destabilization of the very sciences it employs. Illegitimacy's calling card is wit, the blatant and persistent claim to an anachronistic polymathy. This is the poetic at its most radical, challenging real world practices to confront their ethical relationship to beauty and truth. Though the *PTM* is not exactly poetry, it was also never meant to be. It is pioneering scientific journalism conducted as the preliminary engagement with an inconceivably high register of poetic intensity, making it an apt final word to *Wound Response*. The stark condition of the *PTM*'s excess is the poet's faith that his description bears absolute fidelity to the total logic of his own experience: "What *we* say is what it is."¹²⁷

¹²⁴ Spitzer, 1953; p 93.

¹²⁵ Prynne to Oliver, 18th January 1972.

¹²⁶ *Ibid.* The poet's usage of Edelen and Wilson is manifested most explicitly in the "Beans out" text, but future commentary will be unable to avoid addressing this textbook as one of the most influential scientific resources for the radical epistemology which impels the *PTM*.

¹²⁷ Prynne to Oliver, 18th January 1972 (my italics).

BIBLIOGRAPHY

Archival Texts

Thanks are due to the Thomas J. Dodd Research Center at the University of Connecticut for awarding me a Strochlitz Research Travel Grant to read their Edward Dorn Papers. Thanks are also due to Matt ffytche for supplying correspondence between J.H. Prynne and Douglas Oliver from the Albert Sloman Library at the University of Essex. Correspondence and archive material cited or referred to and authored by Edward Dorn is cited and referred to by permission of Jennifer Dunbar Dorn. Correspondence and archive material cited or referred to and originating or authored by J.H. Prynne is done so under the copyright of J.H. Prynne.

The following archival texts are located at the Archives and Special Collections at the Thomas J. Dodd Research Center, unless otherwise noted.

- Dorn, Edward. *Bean News* [undated manuscript]. Ed Dorn Papers, Box 44, Folder 647.
- Dorn, Jennifer Dunbar. Email to author, 10 November 2009.
- Prynne, J.H. "Some Works Containing Discussion of Scientific and Christian Time, History, and Causal Explanation" [1964]. Edward Dorn Papers, Box 19, Folder 327.
- [pseud. Erasmus "Willbeen" Darwin]. "Beans out—but they're likely to come back in!" 20th April [1972]. Edward Dorn Papers, Box 44, Folder 657.
- [pseud. (ppKew)]. Rune poem commentary (12th July [1972]). Galley, *Bean News*, No. 4 [1975]. Edward Dorn Papers, Box 28, Folders 456-458.
- [pseud. Tut (rex)]. "N.B. peas pudding" (28th April 1972). Edward Dorn Papers, Box 44, Folder 657.
- to Edward Dorn, 24th October 1971. Edward Dorn Papers, Box 19, Folder 334.
- to Edward Dorn, 14th March 1972 ["& Hoc Genus Omne"]. Edward Dorn Papers, Box 44, Folder 657.
- to Edward Dorn, 25th March 1972 ["Full Tilt Botany: Ideal Weapons for Suicide Pacts"]. Edward Dorn Papers, Box 44, Folder 655.
- to Edward Dorn, 1st April 1972. Edward Dorn Papers, Box 44, Folder 655.

- to Edward Dorn, 18th April 1972. Edward Dorn Papers, Box 44, Folder 655.
- to Edward Dorn, 19th April 1972. Edward Dorn Papers, Box 44, Folder 657.
- to Edward Dorn, 25th April 1972. Edward Dorn Papers, Box 44, Folder 657.
- to Edward Dorn, 30th May 1972. Edward Dorn Papers, Box 44, Folder 657.
- to Edward Dorn, 25th October 1972. Edward Dorn Papers, Box 19, Folder 334.
- to Edward Dorn, 10th January [1973]. Edward Dorn Papers, Box 44, Folder 657.
- to Douglas Oliver, 18th January 1972. Douglas Oliver Archive, Box 9, Albert Sloman Library, University of Essex.
- to Douglas Oliver, 6th September 1974. Douglas Oliver Archive, Box 9, Albert Sloman Library, University of Essex.

Texts

- Beefheart, Captain & His Magic Band. *Trout Mask Replica*. Produced by Frank Zappa. Straight Records, 1969.
- Blake, William. *An Island in the Moon* [1784]. Manuscript facsimile, transcribed and annotated by Michael Phillips. Cambridge University Press, 1987.
- Cantrell, James C. and C.H. Edwards, Jr., editors. *Topology of Manifolds*. Proceedings of the University of Georgia Topology of Manifolds Institute, 1969. Chicago: Markham Publishing Company, 1970.
- Chomsky, Noam. "The Formal Nature of Language." Appendix A to *Biological Foundations of Language*. By Eric H. Lenneberg. New York, London and Sidney: John Wiley & Sons, Inc., 1967 (pp 397-442).
- Collingwood, R.G. *Speculum Mentis; or The Map of Knowledge*. Oxford University Press, 1924.
- Darwin, Erasmus. *The Botanic Garden; A Poem, in Two Parts. Part I, Containing The Economy of Vegetation* (1791). *The Collected Writings of Erasmus Darwin*, Vol. I. Edited by Martin Priestman. Bristol: Thoemmes Continuum, 2004.
- *The Botanic Garden, Part II. Containing The Loves of the Plants, A Poem with Philosophical Notes* (1789). Oxford and New York: Woodstock Books, 1991.

- *Zoonomia; or the Laws of Organic Life*, Vol. 1 (1794). New York: AMS Press, Inc., 1974.
- Dorn, Edward. *Gunslinger* (1968-1975). Durham and London: Duke University Press, 1989.
- *Interviews*. Edited by Donald Allen. Bolinas: Four Seasons Foundation, 1980.
- “Where Is Now.” *Bean News* [No. 1]. [Edited by Edward Dorn.] San Francisco: Hermes Free Press and Zephyrus Image, [1972; p 4]. Reprinted in *Sagetrieb*, Vol. 15, No. 3. Orono: National Poetry Foundation, Winter 1996. Online: plantarchy.us/dorn/bean-news-reconstructed.pdf.
- Edelen, Dominic G.B. and Albert G. Wilson. *Relativity and the Question of Discretization in Astronomy*. Berlin, Heidelberg, New York: Springer-Verlag, 1970.
- Hawking, S.W. and G.F.R. Ellis. *The Large Scale Structure of Space-Time*. Cambridge University Press, 1973.
- Huxley, Julian S. “Constant Differential Growth-ratios and their Significance” (27th November 1924). *Nature*, No. 2877, Vol. 114. London: 20 December 1924 (pp 895-896).
- Jacobson, Marcus. *Developmental Neurobiology*. New York: Holt, Rinehart and Wintson, Inc., 1970.
- Johansson, Birgitta. *The Engineering of Being: An Ontological Approach to J.H. Prynne*. Umeå University: Umeå Studies in the Humanities 135, 1997.
- Johnston, Alastair. *Zephyrus Image: A Bibliography*. Berkeley: Poltroon Press, 2003.
- Kavanau, J. Lee. *Structure and Function in Biological Membranes*, Vol. I. San Francisco, London and Amsterdam: Holden-Day, Inc., 1965.
- *Structure and Function in Biological Membranes*, Vol. II. San Francisco, London and Amsterdam: Holden-Day, Inc., 1965.
- Keery, James. “‘Jacob’s Ladder’ and the Levels of Artifice: Veronica Forrest-Thomson on J.H. Prynne.” *Jacket* 20. Edited by John Tranter. December 2002. Online: jacketmagazine.com/20/vft-keery.html.
- King-Hele, Desmond. *Erasmus Darwin*. London and New York: Macmillan and St. Martin's Press, 1963.
- *Erasmus Darwin and the Romantic Poets*. Basingstoke: Macmillan, 1986.

- Kobayashi, Shoshichi and Katsumi Nomizu. *Foundations of Differential Geometry*. New York and London: Interscience Publishers, 1963.
- Ladkin, Sam. "as they wander estranged: Ed Dorn's *Gunslinger*." *"The Darkness Surrounds Us": American Poetry*. Edited by Sam Ladkin and Robin Purves. *Edinburgh Review*, No. 114, 2004 (pp 59-95).
- Lindsay, Jow. "Excerpt from An Open Letter to J.H. Prynne." *Quid 17: For J.H. Prynne*. Edited by Keston Sutherland. Brighton: Barque Press, 24 June 2006 (pp 35-39).
- Logan, James Venable. *The Poetry and Aesthetics of Erasmus Darwin*. Princeton University Press, 1936.
- Manson, Peter. "BIRCH, BIRCH, BIRCH..." (17th May 2006). *Quid 27: For J.H. Prynne: In Celebration*. Edited by Keston Sutherland. Falmer, Brighton: Barque Press, 24th June 2006 (pp 40-42). Online: petermanson.com/runepoem.htm.
- McHale, Brian. "Archaeologies of Knowledge: Hill's Middens, Heaney's Bogs, Schwerner's Tablets." *New Literary History*, Vol. 30, No. 1, Poetry & Poetics. Edited by Ralph Cohen. Johns Hopkins University Press, Winter 1999 (pp 239-262).
- Mellors, Anthony. "Mysteries of the Organism: Conceptual Models and JH Prynne's *Wound Response*." *A Salt Reader*. Edited by John Kinsella. Western Australia: Folio, 1996 (pp 238-255).
- Middleton, Peter. *Distant Reading: Performance, Readership, and Consumption in Contemporary Poetry*. Tuscaloosa: The University of Alabama Press, 2005.
- "Strips: Scientific Language in Poetry." *Textual Practice*, Vol. 23, No. 6, 2009 (pp 947-958).
- Milne, Drew. "The Art of Wit and the Cambridge Science Park." *Contemporary Poetry and Contemporary Science*. Edited by Robert Crawford. Oxford University Press, 2006 (pp 170-187).
- Milne, E.A. "World Structure and the Expansion of the Universe." *Zeitschrift für Astrophysik*, No. 6. Springer-Verlag, 1933. NASA Astrophysics Data System (ADS) Abstract Service.
- Minkowski, H. "Space and Time" (21st September 1908). *The Principle of Relativity: A Collection of Original Memoirs on the Special and General Theory of Relativity*. Translated by W. Perrett and G.B. Jeffery. London: Methuen and Co. Ltd., 1923 (pp 73-91).
- Needham, Joseph. "Chemical Heterogony and the Ground-Plan of Animal Growth" (1933). *Biological Reviews and Biological Proceedings of the Cambridge Philosophical Society*, Volume IX,

- Number 1. Edited by H. Munro Fox. Cambridge University Press, 1934 (pp 79-109).
- “Heterogony and Chemical Ground-Plan of Animal Growth.” *Nature*, No. 3292, Vol. 130. London: 3rd December 1932 (pp 845-846).
- [pseud. Henry Holorenschaw]. “The Makings of an Honorary Taoist.” *Changing Perspectives in the History of Science: Essays in Honour of Joseph Needham*. Edited by Mikuláš Teich and Robert Young. Holland and Boston: D. Reidel Publishing Company, 1973 (pp 1-20).
- Oliver, Douglas. “J.H. Prynne’s ‘Of Movement Towards a Natural Place.’” *Grosseteste Review*, No. 12. Pensnett, England: 1979 (pp 93-102).
- Palmquist, Edward M. “The Simultaneous Movement of Carbohydrates and Flourescein in Opposite Directions in the Phloem.” *American Journal of Botany*, Vol. 25, No. 2. Botanical Society of America, February 1938 (pp 97-105).
- Pattison, Reitha. *Cosmology and Capitalism in the Writings of Edward Dorn*. Forthcoming dissertation, University of Cambridge, 2010.
- Prokhovnik, S.J. *The Logic of Special Relativity*. Cambridge University Press, 1967.
- Prynne, J.H. *An Introductory Sketch of American Literature: Six Double Lectures*. Guangzhou University, Spring 2005.
- “Of Sanguine Fire.” *Georgia Straight: Writing 8 Supplement*. Vancouver: [York Street], 27th July 1971 (pp 7-9).
- “The ‘PLANT TIME MANIFOLD’ Transcripts.” *Grosseteste Review*, Volume 7, Numbers 1-3. Edited by Tim Longville. Pensnett, England: Summer 1974 (pp 80-88).
- “The *Plant Time Manifold* Transcripts.” *Poems*. Fremantle and Northumberland: Fremantle Arts Centre Press and Bloodaxe Books Ltd, 1999/2005 (pp 233-242).
- “The *Plant Time Manifold* Transcripts.” *Wound Response*. Cambridge: Street Editions, 1974 (pp 23-32).
- [pseud. Erasmus “Willbeen” Darwin]. “& Hoc Genus Omne” [14th March 1972]. *Bean News* [No. 1]. [Edited by Edward Dorn.] San Francisco: Hermes Free Press and Zephyrus Image, [1972; p 2]. Reprinted in *Sagetrieb*, Vol. 15, No. 3. Orono: National Poetry Foundation, Winter 1996. Online: plantarchy.us/dorn/bean-news-reconstructed.pdf.

- [pseud. Erasmus “Willbeen” Darwin]. “Full Tilt Botany: Ideal Weapons for Suicide Pacts” [25th March 1972]. *Bean News* [No. 1]. [Edited by Edward Dorn.] San Francisco: Hermes Free Press and Zephyrus Image, [1972; p 8]. Reprinted in *Sagetrieb*, Vol. 15, No. 3. Orono: National Poetry Foundation, Winter 1996 Online: plantarchy.us/dorn/bean-news-reconstructed.pdf.
- [pseud. Erasmus “Willbeen” Darwin]. “When Is Now” [1st July 1972]. *Bean News* [No. 1]. [Edited by Edward Dorn.] San Francisco: Hermes Free Press and Zephyrus Image, [1972; p 4]. Reprinted in *Sagetrieb*, Vol. 15, No. 3. Orono: National Poetry Foundation, Winter 1996. Online: plantarchy.us/dorn/bean-news-reconstructed.pdf.
- Reinhart, Bruce L. “Foliated Manifolds with Bundle-Like Metrics” (1958). *Annals of Mathematics*, Vol. 69, No. 1. Edited by Atle Selberg, et al. Princeton University and the Institute for Advanced Studies, January 1959.
- Richardson, Michael. *Translocation in Plants*. The Institute of Biology’s *Studies in Biology No. 10*. London: Edward Arnold (Publishers) Ltd, 1968.
- Rindler, W. “Visual Horizons in World Models.” *Monthly Notices of the Royal Astronomical Society*, Number 116, 1956 (pp 662-667). Reprinted: *General Relativity and Gravitation*, Vol. 34, No. 1. January 2002 (pp 133-153).
- Sheldrake, Rupert. *A New Science of Life: The Hypothesis of Formative Causation* (1981). London: Paladin, 1986.
- Spitzer, Leo. “Language—The Basis of Science, Philosophy and Poetry.” *Studies in Intellectual History*. The Johns Hopkins Press, 1953 (pp 67-93).
- Sutherland, Keston. *J.H. Prynne and Philology*. Unpublished dissertation, University of Cambridge, 2004.
- Thom, René. “Topological Models in Biology” (1969). *Towards a Theoretical Biology, Vol. 3: Drafts*. Edinburgh University Press, 1970 (pp 89-116).
- Tuma, Keith. “Ed Dorn and England.” *The Gig*, No. 6. Edited by Nate Dorward. Willowdale, Ontario: The Gig, July 2000 (pp 41-54).
- Tupper, Sir James Perchard. *An Essay on the Probability of Sensation in Vegetables; with Additional Observations on Instinct, Sensation, Irritability, &c.* London: Richard Taylor and Co., 1811.

- Waddington, C.H., editor. *Biology and the History of the Future*. An IUBS/UNESCO Symposium with John Cage, Carl-Goeran Heden, Margaret Mead, John Papaioannou, John Platt, Ruth Sager, and Gunther Stent (1969). Edinburgh University Press, 1972.
- “Heterogony and the Chemical Ground-Plan of Animal Growth” (2nd January 1933). *Nature*, No. 3300, Vol. 131. London: 28 January 1933 (p 134).
- editor. *Towards a Theoretical Biology, Vol. 1: Prolegomena*. Edinburgh University Press, 1968.
- Wells, Jr., R.O. *Differential Analysis on Complex Manifolds*. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1973.
- Wen-Tsun, Wen and Georges Reeb. *Sur les espaces fibrés et les variétés feuilletées*. Actualities scientifiques et industrielles, 1183. Publications de l’Institut de Mathématique de l’Université de Strasbourg, XI. Paris: Hermann & Cie, Éditeurs, 1952.
- Whitehead, Alfred North. *Process and Reality: An Essay in Cosmology* (1929). Edited by David Ray Griffin and Donald W. Sherburne. New York: The Free Press, 1978.
- Whitrow, G.J. *The Natural Philosophy of Time* (1961). Oxford University Press, 1980.
- Zel’dovich, Ya. B. and I.D. Novikov. *Relativistic Astrophysics. Volume II: The Structure and Evolution of the Universe* (1975). Translated by Leslie Fishbone. Edited by Gary Steigman. University of Chicago Press, 1983.

