

INFORMATIONIST SCIENCE FICTION THEORY
AND INFORMATIONIST SCIENCE FICTION

Master of Philosophy Thesis

Bruce Long ©2008-2009

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Chapter 1 – Informationist Science Fiction Theory

INFORMATIONISM FROM SCIENCE TO SCIENCE FICTION

The titles of this thesis and of this chapter are neologisms with *high information values*. This statement will be fully explained in chapter two, but basically it reflects the fact that, although structured according to the grammatical rules of English, the word *informationist* is not in any normative English vocabulary to date. Thus, out of all of the possible lexical strings that might appear where ‘informationist’ does, it is one of the less probable selections relative to the vocabulary of the English language and an English speaker’s knowledge thereof. Therefore, you as the reader were perhaps surprised to see it, and likewise perhaps to see the phrase ‘science fiction theory’, which is not a semantically normative assemblage of these three words, conveying as it does a nascent concept. Mathematicians have coined another neologism to describe this property of the relative improbability of occurrence of such neologisms or neologised phrases: they refer to it as the *surprisal* value. Its origin is in the 1948 formula devised by mathematician Claude E. Shannon to provide a measure of *information* or *entropy* in a *message*. It applies to, among other things, words, concepts, realities, symbols, phrases, ensembles of functions, messages, and signs. We will have cause to return to the concept of the *surprisal value* or *surprisal* numerous times henceforth¹.

Generally, criticism and literary theory as applied to science fiction are structuralist, poststructuralist or modernist – or some hybridisation of these. What I term *informationist theory* is not properly aligned with any of them. What I have called informationism describes the embracing of information-scientific and information-theoretic imperatives, paradigms, tools and principles across numerous human disciplines and epistemes from the sciences to literature and aesthetics. Attempts were made to demonstrate a link between information theory and aesthetic affect as early as 1958, with Abraham Moles’ *Information Theory and Esthetic Perception*. In science, informationism involves the implicit recognition of information as a natural as well as a man-made *commodity*², and the conception of information as a substantive, quantifiable, empirically verifiable entity in all natural sciences, as well as a conceptual and theoretic abstracta for problem solving and elucidation. Scientific informationism is also signified by the increasingly information-centric nature of scientific practice due to advances in digital computer technology and especially software. As Daniel Cordle has observed, Richard Dawkins’ landmark *The Selfish Gene* sees gene sequences and DNA as coded information³. In *The Blind Watchmaker*, Dawkins has this to say about life itself from a scientific perspective:

What lies at the heart of every living thing...is information, words, instructions...If you want a metaphor...If you want to understand life, don’t think about vibrant, throbbing gels and oozes, think about information technology.⁴

As Cordle discerns, however, Dawkins is not just instancing informational metaphors for explaining biological systems like DNA. He sees genes as actually informational:

On the bank of the Oxford canal at the bottom of my garden is a large willow tree, and it is pumping downy seeds into the air...It is raining instructions...it’s raining programs; it’s raining tree growing, fluff-spreading algorithms. This is not a metaphor, it is the plain truth.⁵

There are similar trends in physics and mathematics. Recent contributions to quantum physics seek to reframe vectors in state space in quantum mechanics as fundamentally about information rather than the unpredictability of the direction and velocity of particles as defined by vectors in state space⁶. Mathematicians like Stephen Wolfram and Edward Fredkin see the material universe as *computational* in a

¹ Especially in chapter two.

² Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 46-7. Dawkins, Richard. *The Selfish Gene*. Oxford: Oxford University Press, 1976, 50, 62, 64, especially 157.

³ Cordle, Daniel. *Postmodern Postures: Literature, Science and the Two Cultures Debate*. Aldershot: Ashgate, 1999, 128-9.

⁴ Dawkins, R. *The Blind Watchmaker*. London: Folio Press, 2007, Quoted in Cordle, 128-9.

⁵ *Ibid.*, Quoted in Cordle, 115.

⁶ Bub, Jeffrey. *Quantum Mechanics is About Information*. <arXiv:quant-ph/0408020v2.> Maryland: University of Maryland, 2004.

very real sense: as what N. Katherine Hayles refers to, implicating the language of computer scientists in describing computer systems, as a *platform for computation*⁷.

The philosophy of information theory proposes that information is universally ubiquitous and exists naturally as well as artefactually⁸. Moreover, the philosophy of information theory recognises a general understanding of the nature of information, and a coherent *metaphysics* of information, as essential to understanding and defining epistemology, cognition and meaning, and how these are encoded as messages and exchanged in artefactual information sources such as texts. I define *artefactual information* as any kind of information created by humans for the purposes of communication. Contemporary philosophers of information correspondingly propose that a unified theory and conception of information may be attainable and would result in unprecedented advances in many fields of science and thought, including aesthetics and literary theory. Contemporary philosopher of information Luciano Floridi believes that such an understanding may even render the distinction between continental and analytic philosophy redundant⁹.

In linguistics, informationism is most readily evidenced in the structuralist practice of applying mathematical information theoretic principles, usually directly or indirectly based on *The Mathematical Theory of Communication*, to linguistic analysis. John Lyons was one of the numerous linguists to thus apply Shannon's theory during the two decades following the publication of his *The Mathematical Theory of Communication*¹⁰. Tendencies towards informationism in linguistics include the non-logocentric conception of language that acknowledges the role of non-verbal components in human language communication - context, situation, habitus, repertoire, gestures, tone, mood and so forth - and an informational impression of semiotics which is, perhaps surprisingly, at least as old as C.S. Peirce's *Logic as Semiotic: The Theory of Signs*¹¹.

Informationist *philosophers* increasingly associate what I term *informationism* with a growing tendency in both science and philosophy to regard natural complex systems and processes as involving information production and exchange. Information is thus regarded as a commodity in numerous different natural and man-made economies. Postmodern informationist *science fiction* authors like William Gibson pursue this theme fictively in multiple contexts. Cordle emphasises the parallel presence of the theme in the work of both Gibson, and biologist and science populariser Richard Dawkins:

Information lies at the heart of the fictional world described by Gibson, because the economy and the lives of the protagonists are driven by exchanges of information; in Dawkins work, it is important because it is at the center of the natural world...¹²

Analytic Philosopher Fred Dretske and his European contemporary Jean-François Lyotard both regard information as a commodity¹³. Lyotard's formulation echoes Jean Baudrillard's:

Knowledge in the form of an informational commodity indispensable to productive power is already, and will continue to be, a major --perhaps the major --stake in the worldwide competition for power.¹⁴

Baudrillard also saw informational *simulation* as a *hyperreal hypercommodity*¹⁵. Dretske sees information as tangible, if not easily quantifiable, and identified *true* information as necessary for knowledge. This

⁷ Hayles, N. Katherine. *My Mother Was a Computer: Digital Subjects and Literary Texts*. 2nd. Chicago: University Of Chicago Press, 2005, 17-18.

⁸ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, . and Long, Bruce. Shannon and Dretske: Information Theory and Philosophy. Honours thesis. Sydney, 2008.

⁹ For this ambitious outlook, refer to Aadrians, Pieter and Johan van Benthem, *Philosophy of Information*. Amsterdam: North Holland, 2008, 4.

¹⁰ Lyons, J. *Introduction to Theoretical Linguistics*. Cambridge: Cambridge University Press, 1968-9.

¹¹ Peirce, C. S. "Logic as Semiotic: The Theory of Signs." in *Philosophical Writings of Peirce* Ed. Justus Buchler. New York: Dover, 1955.

¹² Cordle, Daniel. *Postmodern Postures: Literature, Science and the Two Cultures Debate*. Aldershot: Ashgate, 1999, 110.

¹³ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 45-7. (Note that this book was published in the same year as Baudrillard's '*Simulacra and Simulation*'.) Dretske's connotation includes the naturalistic one that regards a commodity as anything beneficial or of value to an organism (there is also a sense of that which is transferable) and does not necessarily entail the Marxist economic sense of commodity.

¹⁴ Lyotard, F., *The Postmodern Condition: A Report on Knowledge (Theory and History of Literature Volume 10)*, Minnesota: The University of Minnesota Press, 1984.

outlook is associated with the perception of matter and nature as in some significant sense *computational* – an embracing of *metaphysical computationalism*¹⁶. This conception relies on the information theory of mathematician Claude E. Shannon. This computational view of the universe – as literary critic Hayles explains in her *My Mother was a Computer* – is based on both information theory and what Hayles terms the *regime of computation*: those practices and modes of thinking about and interpreting the complexity of the world and human affairs as being ultimately *emergent* from iterative combinatorial processing of simple base elements according to simple logical rules¹⁷. Also related to Hayles' *regime* is what she describes as the *information perspective*¹⁸: an ontological view of information similar to that propounded by philosopher of information Dretske, wherein information is regarded as it is frequently assumed to be in scientific practice – a *fundamental natural* entity, not just a linguistic and computational artefact. I will place all of these conceptions under the descriptor-category of *informationism*, along with numerous popular cultural attitudes, social analyses, and modern and postmodern fictions.

INFORMATIONIST STRUCTURALISM AND POSTSTRUCTURALISM

In *literary theory*, informationism in structuralist – and sometimes in poststructuralist – treatises often results in attempts to appropriate rigorous information theoretic ideas and principles from Shannon's mathematical theory as a basis for drawing conclusions about text processing, reader response and the aesthetic object (Wolfgang Iser and Stanley Fish,) semantics and aesthetic signification (Barthes,) affect, and aesthetic effect (Moles.) In Juri Lotman's *The Structure of the Artistic Text*, the author attempts to adapt the work of Kolmogorov and the Russian formalist school of metrics to poetry, leveraging adaptations of formal information-theoretic posits in analysing verse, and attempting to systematise a notion of “the entropy [information] of a message and the specifically artistic entropy of its expression.”¹⁹ Poststructuralists and two-cultures unifiers like Cordle and Hayles tend to focus on the metaphorical and thematic presence of information theory and science in fiction, although David Porush has identified similar efforts in this direction by structuralist era critics of the cybernetic science fiction works of Thomas Pynchon²⁰. As will be discussed below, many of these attempts at what I call *informationist* literary theory, whilst elucidatory to an extent, tend to falter from an information-theoretic and analytic standpoint.

As Paulson observes, “[t]he theory of information has not gone unnoticed by literary researchers.”²¹ He notes the structuralist work of Roman Jakobson and of Lotman, and cites the contributions from numerous early informationist philosophers researching the informational basis of aesthetics and semantics, including French analytic philosopher Abraham Moles, and philosophers Donald Mackay and Yehoshua Bar-Hillel. In the introduction to the first English translation of Moles' 1958 *Information Theory and Aesthetic Perception*, translator Joel E. Cohen describes information theory as a “young man in a very great hurry, who jumped on his horse and rode off in all directions” and observed that in the decade following Claude E. Shannon's landmark monograph, “standard bearers of information theory were plunging into genetics, neuro-physiology, sociology, experimental psychology, linguistics, and philosophy with great enthusiasm and greater hopes.”²² He then observes, soberingly, that 20 years later “information theory seems to have stimulated a great deal of highly imaginative and occasionally fruitful analysis in fields other than communications engineering.”

Many structuralist and poststructuralist attempts at analysing and understanding texts and text processing or signification from an information-theoretic standpoint ultimately fail, not on deconstructive grounds –

¹⁵ Baudrillard, J. *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994, 67.

¹⁶ Aadrians, Pieter and Johan van Benthem, *Philosophy of Information*. Amsterdam: North Holland, 2008, 12.

¹⁷ Hayles, N. Katherine. *My Mother Was a Computer: Digital Subjects and Literary Texts*. 2nd. Chicago: University Of Chicago Press, 2005, 15, 17, 18.

¹⁸ Hayles, N. Katherine. “Information or Noise? Economy of Explanation in Barthe's S/Z and Shannon's Information Theory.” *One Culture: Essays in Science and Literature*. Ed. George Levine. Madison: University of Wisconsin Press, 1987. 120.

¹⁹ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 62.

²⁰ Porush, D. *The Soft Machine: Cybernetic Fiction*. Methuen, New York & London, 1985, 115.

²¹ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 60.

²² Moles, Abraham A. *Information Theory and Esthetic Perception*. Trans. Joel E Cohen. Illinois: University of Illinois Press, 1966 (Trans.) 1958, Translator's preface.

but because of some kind of faulty phallogocentrically or hierarchically motivated assumption in the principles and theory being investigated (although this can also be the case.) Rather it is because of the flawed assumption that the epistemic and empirical validity of the scientific will somehow transfer to the non-scientific simply through the analogical appropriation and application of discourse, terminology and theoretical premises. Principles from science will not work for literature, culture and the arts by virtue of some hidden functional power of analogy and the appropriated discourse alone, and certainly not without proper recourse to the meaning, analytical rigour and true scope of application implications of the original theories - nor without the isolation and elucidation of the theoretical abstracta and simples necessary to map and validate such adaptations. The theories of Saussure, Iser, Barthes and Derrida all exhibit such problems. Otherwise stated, it is the habit of appropriating terminology and principles from rigorous mathematics and science and employing them for analogical parallels in theorising, whilst simultaneously re-referencing or appealing to the epistemically stronger and demonstrative outcomes of the original science from one's conceptually weaker and less rigorously developed analogical position. Perhaps unintuitively, I think *science fiction* is much *less* prone to exhibit this error than literary theory, since SF²³ focusses on *counterfactual fictive estrangement* of scientific objects, theories and facts, rather than on the appropriation of the latter for application to other disciplines. This pervasive application, in literary theory, of the conceptual and theoretic analogical *non-sequitur*, results in numerous category errors, and an epistemological and semantic *pseudo-isomorphic* mapping of a theory and its attributes from one domain to another. Shannon himself warned against such outcomes for information theory:

While we feel that information theory is indeed a valuable tool for providing fundamental insights into the nature of communication problems ... it is certainly no panacea for the communication engineer or, *a fortiori*, for anyone else...It will be all too easy for our somewhat artificial prosperity to collapse overnight when it is realised that the use of a few exciting words like *information, entropy, redundancy*, do not solve all our problems...[W]orkers in other fields should realise that the basic results of the subject are aimed in a very specific direction, a direction that is not necessarily relevant to such fields as psychology, economics, and other social sciences. Information theory is, essentially, a branch of mathematics, a strictly deductive system. A thorough understanding of this mathematical foundation and its communication application is surely a prerequisite to other applications.²⁴

Many literary and cultural theorists appropriate 'exciting words' from science and mathematics to lend authority to their own arguments, and then simultaneously seek to denigrate the cogency and scientific status of the very scientific discipline or source of authority upon which they have relied. Interdisciplinary literary theorists such as Hayles and Damien Broderick both identify this error. Hayles laments Roland Barthes' misappropriation of mathematical terminology in his informationist *S/Z*:

He appropriates concepts and terminology from information theory to posit it as a putative center of control and communication, and then situates himself...disdainful of – the controlling centre...Barthes's misunderstanding of Shannon's position is fundamentally equivocal, for it repudiates the control over communication that it imputes to information theory, at the same time that it seeks to gain control over the "delectable" noise that it offers for consumption. Repudiation of control in one context is thus inseparable from the strategy of gaining control in another²⁵.

Broderick, who argues convincingly that metaphor and literary language does pervade scientific discourse at least at the descriptive level, expounds at length and with cogency about similar problems with Derrida's appropriation of Kurt Godel's rigorous mathematical principle of *undecidability*, before concluding:

²³ This abbreviation for *science fiction* will be extensively employed henceforth.

²⁴ Shannon, C. "The Bandwagon." *Information Theory, IRE Transactions on* 2.1 (1956): 3-3.

²⁵ Hayles, N. Katherine. "Information or Noise? Economy of Explanation in Barthes's *S/Z* and Shannon's Information Theory." *One Culture: Essays in Science and Literature*. Ed. George Levine. Madison: University of Wisconsin Press, 1987. 134.

Arbitrary codes, complex isomorphisms - it is easy to see the attraction of this domain of undecidables for literary theorists who have become accustomed to Saussurean and Lacanian doctrines. It is also, alas, all too easy to see how strict results borrowed from one domain and introduced into another can lapse into analogies which loiter...unshaved by Ockham's razor, in the blindest of alleys.²⁶

These problems are quite prevalent in informationist literary theory and criticism, and in informationist cultural theory. I am convinced that one of the main reasons for these failings, aside from basic intellectual 'looseness', is that linguists and literary theorists understandably approach information theory and its principles logocentrically by design or by necessity, and usually rely on the assumption that Shannon's theory provides a universally stable *metaphysics* of information. Shannon's information theory is in fact inherently non-logocentric – over half of *The Mathematical Theory of Communication* deals not with linguistic messages, but with messages that are ensembles of mathematical functions modelling signal frequencies for such applications as television image transmission. Theorists who assume the logocentricity of information theory thereby confuse the metaphysics and *ontology* of information, and thus undermine their own theories. It is for these reasons that I, surprisingly perhaps, seek to *avoid* being situated in *literary theory*, and instead attempt to offer an informationist theory of science fiction and science fiction texts on the basis of informational principles and *informationist aesthetics*. This does not mean that I decry or denigrate natural and literary *language*, only that I recognise them as manifestly one very important *type* of information – artefactual information – about which I will say much more in Chapter two. This approach avails me of the theoretical latitude to explore the interaction between science and science fiction on a basis more fundamental than culture or discourse, which are the mainstay of most contemporary theorists professedly working to engage Snow's two cultures. A similar aversion to logocentricity was evident in the work of philosopher Michel Serres, who, as Paulson notes "did not see linguistics, and the fact that literature exists in language, as the foundation of a structural analysis of texts."²⁷ Paulson interprets Serres' early structuralism as involving "an abstraction from specific contents, a formal invariant, structure as defined [by Serres] does not have any particular kinship with linguistics or semiology or anthropology."²⁸ Serres' views are disciplinarily multifarious and esoteric, and often viewed as notoriously obscurantist, but his aversion to logocentrism and his engagement with information theory make him an informationist, if not a philosopher of information theory proper²⁹. Although averse to "seeking global paradigms, universal ways of ordering, that can join the literary and the scientific" because "Serres contends that there are no such paradigms or methods," Paulson himself nevertheless follows the metaphysical views of Serres and Henri Atlan in attempting to develop an approach to criticism based on regarding literature generally and literary texts specifically as *entropic* in the informational sense and as exhibiting traits of systemic self-organisation in structure³⁰. This is supposed to rest on the putatively information-theoretic and mathematical analogy of "passages from one domain to the other," where, both analogically and on Paulson's terms *actually*, "passages between science and literature...are offered by theories of information, self-organisation, and autonomous systems."³¹ The information-theoretic analogy in this is multiple: the *passage* ascribed to information theory involves literature seen as a communication channel³², and simultaneously as cultural noise³³. Curiously, Serres does not engage significantly with science fiction, and Paulson barely mentions it in *The Noise of Culture*.

My own approach seeks to avoid overarching logocentrism and terminological misappropriation by attempting to integrate what I will call *informationist SF theory* into an encompassing information theoretic-framework, wherein the central theoretic isolate is not putative meaning, semantics, culture, knowledge,

²⁶ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994, 115.

²⁷ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 31-2.

²⁸ *Ibid.*, 32.

²⁹ Serres, Michel, Bruno Latour and Roxanne Lapidus. *Conversations on science, culture, and time*. An Arbor: University of Michigan Press, 1995, 1, 125.

³⁰ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 36, 48-9. [Emphasis mine.]

³¹ *Ibid.*, 37.

³² *Ibid.*, 132-4.

³³ *Ibid.*, 180.

psychology, social norms, external narratives, meta narratives, repertoire, or episteme – or one of several other nebulously or multiply defined terms - but is instead information considered in a specific non-logocentric way such that it is the substrate upon which meaning, language, and knowledge all *supervene*³⁴. Although the information ontology and typology I employ is unique, an aversion to logocentricism has been familiar even to some literary theorists for some time. In discussing the veracity and utility of Juri Lotman’s centrally informational distinction between message entropy (information) and artistic entropy (information) in literary texts, an informationist Paulson notes that:

Anyone trained in deconstruction could challenge this distinction with a by now familiar argument: since there is no signified preceding, and exterior to, its production by signifiers, all language is already literary, since no variation in signifiers can be said to leave the “message” expressed unchanged. Theoretically therefore, we are dealing with an ultimately untenable distinction.³⁵

However, Paulson feels that this deconstructive criticism is deceptive and vacuous by its very ease, and that, of his *message* entropy versus *artistic* entropy model, “heuristically, the distinction is both necessary and useful.³⁶” Broderick, in considering the discursive and epistemic difficulties potentially faced by those in the sciences and the humanities working with a contemporary episteme prospectively in crisis, offers a more complex and semiologically attuned analysis which implies one must deal with more than just lexemes and language:

All that can be said with certainty, perhaps, is that our language is always already inadequate to inscribe prescriptions or memorials on a grand scale. There is no *outside-the-text*, because everything used by multi-levelled subjectivity to turn graphemes into meaning is ‘inscribed’ in some text or other, some semiotic system. **Even our apparently direct access to the world arrives through narrow sensory codes and channels, and vast quantities of neural processing.**³⁷

He seems to place these *sensory codes* in the context of a semiotic system along with lexical codes, apparently categorising them similarly to graphemes and regarding them in some way as a text, and perhaps exposing them to deconstructive strategies. It is perhaps not clear what a sensory code actually is, or how it is that such are *narrow*, but at the risk perhaps of producing SF out of context, let us assume Broderick intends to refer to non-linguistic informational elements in sense-perception which contribute information to multiple-levelled subjectivity in cognition. This seems to be borne out by his *computational* approach to cognition. He suggests a cognitive-scientific explanation for the synthesis of rigorous technical and metaphorical narrative expression in scientific expository, identifying the heterogeneity of human cognition and thought – the informational complexity of the human brain – as causal³⁸:

The human brain/mind is primarily a hermeneutic device...Where a computer needs to be told be an explicit algorithm to go to a specific ‘address’...a human mind reaches directly for a desired ‘content’. This information (including codes for feelings, wishes and the rest of what makes us human) is dispersed throughout the brain, each location linked to the others by networks of affinities.

What seems at first to be a thoroughgoing logocentric subsumption of the non-lexical to the linguistic is instead intended to establish Broderick’s notion of epistemic and discursive *synthesis*³⁹, and thus he emphasises the non-lexical nature of perception from the perspective of cognitive science, and more specifically a physicalist representational or computational theory of mind. Although, vis-à-vis Feyerabend and Serres (via Paulson,) Broderick also emphasises the narrative, metaphysical and even mythologised aspects of *scientific* discourse and meta-narratives, his conception of synthesis requires acknowledgement that the scientific episteme, unlike the social sciences, is strongly influenced by raw information attained

³⁴ Long, B. “The Ontology of Information.” (In preparation.)

³⁵ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 65.

³⁶ Ibid.

³⁷ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994, 126-7.

³⁸ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994, 130-31.

³⁹ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994. See especially the final chapter ‘Synthesis’.

from nature *empirically* through channels of sense perception, and methodologically organised by scientists “decoding the objective world⁴⁰”. These conceptions all imply an informal and intuitive awareness of the relevance of what I refer to formally as *different types of information* or *information types*. Broderick articulates no formal metaphysical view of information. However, he intuitively discerns that it is *information* – *distinguished* from language – that is the common metaphysical substrate and term of reference for both science and fiction.⁴¹ I think any semiotic logocentricity he exhibits necessarily arises from a lack of any available cohesive ontological conception of information to draw on for his inferences – a problem shared by all informationist literary critics and theorists to date⁴².

The metaphysical Achilles heel of the *deconstructive* model of the signified is that it essentially depends on an inherently logocentric expression of *idealism* – it conflates the objective existence of external objects or referents with their recognition and attribution by signification, then renders the latter somehow the *cause* of the former. This is partly because of the confusion of *information loss* through *information synthesis* with a conception of insensibility (which terms will be fully explored in chapters two and three.) Mostly, however, it is due to the equivocation⁴³ of what it means for purely imaginary internal objects to be materially non-existent, with the material non-existence of external material objects or events. It does not logically or rationally follow, just because we must use language to communicatively express a correlate with existing real world object or facts, that the existence of those objects or facts *supervenes* on said linguistic expression. This is a *theological* predicate: it requires that lexical language is somehow metaphysically a-priori and causal – that it exists *before* and somehow *causes* the material *sans* human agency. A cogent ontology of information is necessary to correct such errors. That science and scientific discourse are prone to occasional *seemingly* mythic metaphor and a-priori metaphysics in trying to understand nature does not somehow make this error something other than an error: it simply means that the natural world is complex and explaining it is *recondite*. Although *utterances* are analogue, language is *digital* type of information, which means linguistic representation and description of reality *necessarily* involves a significant loss of information from any natural non-lexical information source⁴⁴. If we describe a frog with words, assuming a practicable length of description, we will *necessarily lose* and fail to represent enormous amounts of information about the amphibian in question. *SF* texts are replete with counterfactual and estranging narrative elements, but the modal speculation and estrangement encoded within them are, on Darko Suvin’s theory, extrapolative or analogical in relation to some material scientific or technological object or reality, or to *mathematically* or empirically underwritten scientific principles. Thus *SF* texts, although packed with counterfactuals and *scientific* metaphor, nevertheless *rely*, for their cognitive aesthetic and effects, upon an implied unambiguous distinction between actual scientific, technological, or natural objects and their fictively estranged or counterfactual textual and narrative representation. According to Samuel R. Delany, Suvin, and Stanislaw Lem, *quality* or *competent* *SF* texts achieve the combination of superior aesthetics and style with cognitively intriguing counterfactual extrapolation and estrangement relative to actual fact.

INFORMATIONIST SCIENCE FICTION THEORY PREFIGURED

Leaving aside the question of the *literariness* of science fiction, there have been numerous attempts to distinguish *competent* science fiction writing from pulp and the mediocre or ‘junk.’ Suvin’s original central requirement for ‘competent *SF*’ in *The Metamorphoses of Science Fiction* is partly technical-stylistic and partly idealistic: the author must exhibit prowess in *cognitive estrangement* and integrity in the strict observation of the materialist tenets of the science with which science fiction engages⁴⁵. Delany requires, on an informational basis, that the author exhibit superior style by engaging with estranged themes and concepts in such a way as information is revealed *sententially* to the reader in an elegant, logically tenable and

⁴⁰ *Ibid.*, 129, 131, 127.

⁴¹ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994., 23, 81, 100.

⁴² Addressed in Chapter 3.

⁴³ The philosophical sense of the word.

⁴⁴ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 175, 177, 180, 183, 188, 189, 193, 57, 61, 81-2.

⁴⁵ Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980.

convincing way which preserves a smooth flow of reading and imaginative genesis from encoded information:

The ability to utilise effectively this refinement in **generated information** is what makes Sturgeon a better writer than Heinlen...The illusion of reality, the sense of veracity in all fiction, is controlled by the author's sensitivity to these distinctions⁴⁶.

Delany here reveals himself to be an *informationist SF theorist*. If the first half of Delany's essay leaves any doubt that he is interested in an informational *aesthetic*, then it dissolves with:

When the corrections when we move from word to word produce a muddy picture, when unclear bits of information do not resolve to even greater clarity when we progress, we call the writer a poor stylist.⁴⁷

This is also a striking anticipation of Wolfgang Iser's reader-response theory. Broderick, seeking a comprehensive picture of SF, cites the elegant management of the multifarious attributes espoused by Suvin, Delany and Gary K. Wolf: the stylistically elegant development of SF *novum*, the deft management of the objective mood Delany realises is prevalent in SF, and clever intertextual engagement with the SF *mega-text*⁴⁸. Broderick defines the SF mega-text as an abstract and amorphously bounded and subjectively experienced collective text which provides "behind every item in the syntagm a certified and secure paradigm of reference"⁴⁹ and which is realised for the practised SF reader who is familiar with the common tropes and themes SF and its sub-modes:

Using a strategy of semiological compensation, or redundancy and over-coding...the s-f mega-text works by embedding each new work, seen by Delany as a self-structuring web of non-mundane signifiers and syntagms, in an even vaster web of interpenetrating semantic and tropic givens or vectors.⁵⁰

Tom Shippey recognises, in informational terms, the cognitive and aesthetic value of Suvin's *novum* as an ideation accompanied by words which are both 'high information' or have high surprisal values for the reader, and the necessity of competent management of the SF *mise en scène* which he associates with a closed system or universe⁵¹. Novums are science-inspired modal and counterfactual ideations and their accompanying neologisms identified as special to SF by groundbreaking SF theorist and dialectical materialist Suvin in his *Metamorphoses of Science Fiction*:

I do not see any tenable intrinsic determination of SF which would not hinge on the category of the *novum*, to borrow (and slightly adapt) a term from...Ernst Bloch. A novum of cognitive innovation is a totalising phenomenon or relationship deviating from the author's and implied reader's norm of reality...Clearly the novum is a mediating category whose explicative potency springs from its rare bridging of literary and extra-literary, fictional and empirical, formal and ideological domains, in brief from its unalienable historicity.⁵²

I do not wish to approach quality science fiction – which I will refer to as SF *proper* - as literature in the normative sense, nor as sub-literary, nor necessarily as para-literary. While I am sure that the works of George Orwell, Neal Stephenson, Gibson, Pynchon and Philip K. Dick may be literary on some popular or propounded literary-theoretic interpretation, I am more interested in the *informational* basis of the fictionality, narrative power and cognitive aesthetic effects of SF texts. This is what I mean by *informationist science fiction theory*. This approach has been prefigured by other theorists.

It is not a new idea that science fiction is something nascent in the world of fiction – a new form of writing productive of a new type of text – younger than the modern novel itself as a form in the literary

⁴⁶ Delany, Samuel R. "About 5,750 Words." in *The Jewel-Hinged Jaw* New York: Berkley Windhover, 1978, 23-4. (emphasis mine.)

⁴⁷ Ibid., 28-9.

⁴⁸ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995.

⁴⁹ Ibid., 57.

⁵⁰ Ibid., 59.

⁵¹ Shippey, T. "Hard Reading: The Challenges of Science Fiction." Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005. 11-26.

⁵² Suvin, D. *Metamorphoses of Science Fiction*, Yale: Yale University Press, 1980, 64.

world and not necessarily or adequately describable as a minor form of fiction or as a literary sub-genre. The popular critics and fans of American pulp SF were convinced that SF was an incipient *form* of writing:

Its participants were primarily fans, avid readers - many of whom were active writers - who were encouraged by the influential editors of the period, Hugo Gernsback and John Campbell...They approached SF not as an interesting minor branch of literature, but as a new form of writing altogether.⁵³

Various theoretically sophisticated re-statements of Gernsback and Campbell's view have been forwarded. Carl Freedman, following Suvin, refers to SF and its sibling mode of Utopian fiction as "the critical genre par excellence"⁵⁴ on the basis of its being socially motivated and possessed of an innate capacity for cultural comment and revision, and being simultaneously specially equipped to this latter end with a device for scientifically and materialistically inspired *demythologisation* and cognition in the cognitively estranging *novum*. Tom Moylan, also endeavouring to demonstrate the specialness of SF, cites Suvin's development of *novum* categorisation, wherein the *true novum* is invested with *ideological and political* impetus, and the false-*novum* or pseudo-*novum* is associated with what is tantamount to postmodern depthlessness and simulation arising from commodification and market economics⁵⁵. Broderick sees SF as possessed of distinguishing narratological, linguistic and textual traits by virtue of its naturalistic narrative foregrounding of *object over subject*, and through its intertextual engagement with a greater SF *mega-text* invested with a rich array of *icons* and motifs inspired by both anti-quotidian scientific discourse and worldview, and postmodern uncertainty⁵⁶. He also embraces an assertively *formalist* Delany's thesis of the *subjunctivity* of SF – the tendency for its language to reflect the speculative and anticipatory attitude of scientific futurological positivism⁵⁷:

Of course, Delany was not denying the cognitive novelties of sf. His definition of its singular level of subjunctivity was that it dealt with events that 'have not happened...'⁵⁸

Broderick further cites SF's subjunctivity pursuant to asserting the specialness of the *language* of SF, and seeking a broad categorisation thereof:

My developing case is that sf's special language, clichéd and flattened as many of its routine moves have now become, remains a tongue uniquely shaped for the articulation of the subjunctivity of our current episteme. (Recall my definition of 'episteme': 'the complex of discursive templates within a given space and epoch')⁵⁹

In chapters two and three, I will subsume the *complex of discursive templates* of which Broderick speaks to a definition of a *set of contributing external and internal information sources*, the semantics of Broderick's templates supervening on the information of said sources⁶⁰. The *subjunctivity* proposed by Delany is a functional characteristic of, and narrative outcome associated with, futurological speculation and estrangement rooted in the technologically and scientifically inspired episteme which Broderick identifies. The latter notes that, in an effort to supplant analytic word-object reference mechanisms with Saussurean syntagmatic signification chains, Delany revises the definition of said subjunctivity, incorporating ideas from philosopher Jerry Fodor's representational theory of mind, and Iser's reception theory. There are both modern structuralist and postmodern-poststructuralist aspects to Broderick's theorising, and, largely on the basis of the former, he asserts that:

⁵³ Csicsery-Ronay Jr., I. "Science Fiction/Criticism" *A Companion to Science Fiction*, Ed. David Seed, Malden: Blackwell, 2005, 43-59.

⁵⁴ Freedman, C. "Science Fiction and Utopia" in *Learning from Other Worlds: Estrangement, Cognition, and the Politics of Science Fiction and Utopia*, Liverpool: Duke University Press, 2001, 72-96.

⁵⁵ Moylan, Tom. "Look into the Dark: On Dystopia and the Novum" *Learning from Other Worlds: Estrangement, Cognition, and the Politics of Science Fiction and Utopia*, Liverpool: Duke University Press, 2001, 50-71.

⁵⁶ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995.67-8, 140, 155-6.

⁵⁷ *Ibid.*, 168 note 6.

⁵⁸ *Ibid.*, 66.

⁵⁹ Broderick., *Op. Cit.*, 75.

⁶⁰ *Set* here is used very much according to the mathematical set-theoretic definition.

The major result of such explorations has been a growing recognition, I think, that in SF the impulses of science and fiction do indeed overlap, not as opposed variant forms of human understanding but in sharing deep identity...that deep identity is the discursive unity...at the intersecting knot between the two great fields known...as ‘the two cultures.’⁶¹

In Suvin, Delany and Broderick’s theories, the engagement of SF with the discourse of science and the scientific episteme of modern and postmodern culture is variously implicated. Discursively, the language of authentic SF often appears and functions as much like the language of science as that of literature, and it engages with scientific, post-industrial and post-enlightenment epistemic commitments to cognition, materialism, defeasibility and progressiveness⁶². Both Broderick and Delany himself also variously allude to and cite the *informational density* and properties of SF texts as special, making allusive reference to Shannon’s mathematical theory of communications, and anticipating Shippey:

Certain **codons** manifested in the text, such as the narrative units Gary Wolfe was to identify as SF’s icons, alert the reader to *a special way of actualising the words*. **The text is then received in such a manner that the information density and texture of the discourse is appropriately decoded.** ‘The particular **subjunctive** level of s-f expands the **freedom of the choice of words that can follow another group of words meaningfully.**⁶³

Discourse usually implies semantics. Philosopher Fred Dretske lamented that child prodigy and founding father of cybernetics, Norbert Wiener, conflated information with meaning⁶⁴. This results in equivocating on, or at least failing to distinguish between, the semantic decoding of discourse and the decoding of Shannon information, the latter being something categorically different. Moreover, the definition, usage and semantics of the word *discourse* seems multifarious in literary studies. However, Broderick’s overall premise - that the inclusion of improbable words and vocabulary increases the informational density of a text and that there is an associated distinguishing discursive dynamic or trait - is valid on Shannon’s theory. Moreover, “the semantic aspects of communication have little to do with the engineering aspects...[but] this does not mean that the engineering aspects are necessarily irrelevant to the semantic aspects.”⁶⁵ Meaning-information equivocation is significantly abated by an approach to the *ontology* of information that formally recognises information *types* and semantic *supervenience*, which I will explicate in chapter two. Fred Dretske’s externalist informational epistemology, and even more so my own information ontology, treat information as *multiply realisable*. That is to say, information can exist externally in a text, or internally in something that, ontologically speaking, is unlikely to resemble a text in any way, even if one does accede to the idea of some kind of *lexically* representational syntactic mentalese (which I do not.)

Informationist SF exhibits subjunctive semantic *markers* at the sentential, phrasal and lexemic level, which Broderick, in a conscious act of *apt* informationist scientific analogising, refers to as *codons*: terms which intertextually pick out familiar themes and motifs from the larger repository of all SF texts⁶⁶. Here I will appropriate an informationist Broderick’s DNA-science inspired term *codons* for *informationist SF theory*. I will use it to refer explicitly to a greater range of textual, semantic and narrative markers than could be be categorised as simply narrative units. I will apply it to Suvinian novum and novum neologisms. I classify also as codons: general *scientific* neologisms, scientific neologisms, futurological counterfactuals, speculative or extrapolative scientific modal invention and the SF *mega-text icons* of Broderick.

On my own account SF texts - and especially *informationist* SF texts - are generally information-age SF texts which exhibit a broad *information synthesis* encapsulating marked scientifically ascribable *veridical*

⁶¹ Broderick., Op. Cit., 100.

⁶² This comment may embody a misleading neglect of ancient philosophers such as Aristarchus of Samos 2260 BP - 2180 BP, who, according to Aristotle, may be the earliest proposer of the Heliocentric model of the solar system. I use the term defeasibility in keeping with its usage and connotation in philosophy and science, where a defeasible theory is one that can change – be strengthened or be invalidated - contingent upon the discovery of further information or evidence.

⁶³ *Ibid.*, 66.

⁶⁴ Dretske., Op. Cit., 42.

⁶⁵ Weaver., Op. Cit., 8.

⁶⁶ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 48, 67-8.

information, largely existing as *counterfactual pseudo-information*⁶⁷. Informationist SF texts also frequently exhibit narrative engagement with computational and information-theoretic themes (in numerous guises) narrative engagement with information science and technology proper, and engagement with cyber-culture and other information scientific cultures and their discourses.

INFORMATIONIST SCIENCE FICTION AT THE MULTIVARIATE NEXUS

Mid to late 1990s cultural and interdisciplinary critical studies in science and literature exhibited a trend towards engaging with C.P. Snow's binary of the two cultures and either providing a common discursive, cultural, or interdisciplinary basis for each, or demonstrating commonalities between science and the arts along the lines of shared discursive, linguistic or rhetorical traits in both non-fictional scientific and fictional literary texts. Broderick sees scientific theories as heavily indebted to the use of metaphor and analogy, and as prone to conceptual aporia as literature when indeterminable and indescribable outcomes are encountered. He follows Feyerabend in noting the degree to which armchair metaphysical speculation and opinion often becomes pre-eminent in science when hard data and facts are unavailable⁶⁸. Cordle sees a "late twentieth century reworking of our conceptions of the natural and artificial" stemming from information theory and cybernetics and accompanied by a "shift from a mechanical to an organic vocabulary" in the sciences⁶⁹. In drawing parallels between the discourses of identity employed in the writings of Gibson and Richard Dawkins, Cordle emphasises that he has no intention "to read (or misread) [Richard] Dawkins as a closet postmodernist", but goes on to highlight "the centrality of information (and therefore information technology) to the world views of both writers"⁷⁰. Hayles sees the discourses of science and literature as similarly influenced by informational and computational world views, and that texts have come to be regarded as encapsulating informational and computational characteristics and outcomes⁷¹.

It is science fiction texts which emerge at the median point of the science to fiction spectrum: at the conflux of the metaphoric and fictive extreme of science writing and the empirical and cognitive extreme of fiction writing. However, a binary distinction, even on a continuum, is not realistic. SF is fiction that emerges at what I will refer to as the *multifaceted* or *multivariate nexus*: the simultaneous cultural and disciplinary nexus of science and art, and at the epistemological nexus of the empirical and rational, the counterfactual, and the imaginary that exists for both the imaginative scientist and the scientifically astute author. It supervenes on and exhibits the *information synthesis* that arises at the nexus of the empirical-actual and the imaginary-counterfactual, and the discursive synthesis that supervenes thereupon. I do not think that informationist SF theory will readily yield terms for delineating a science fiction canon, nor for defining the boundaries of SF as a genre, and neither is a pursuit which I find promising or meaningful. However, I do expect some cohesive picture of the informational properties of competent SF to become evident through informationist SF theory, and especially that it will provide a cohesive description of the traits of informationist SF. Information-age informationist SF *narratives*, due to their political, cultural, and ideological non-uniformity draw on perspectives about information and information science and what they mean for the future which are as diverse, and yet convergent, as the treatment of information itself given by continental philosophers like Jean Baudrillard and Anglo-American philosophers like Fred Dretske. This is partly because such texts also appear over a surprisingly long epoch, concomitant with the fact that informationism is older, although perhaps arbitrarily so, than the digital age.

Any question or assertion of the historicity of any cultural or historical era or movement is potentially prone to interminable dispute and revision. I will thus *tentatively* locate the historical inception of the information age no earlier than the mid to late 1940s, which decade saw the construction of Eniac⁷²

⁶⁷ These new terms will be fully expounded in chapter two.

⁶⁸ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994.

⁶⁹ Cordle, Daniel. *Postmodern Postures: Literature, Science and the Two Cultures Debate*. Aldershot: Ashgate, 1999, 131, 130.

⁷⁰ *Ibid.*, 109.

⁷¹ Hayles, N. Katherine. *My Mother Was a Computer: Digital Subjects and Literary Texts*. 2nd. Chicago: University Of Chicago Press, 2005, 30-1, 63.

⁷² The first electrical computer developed by the US military.

(1946⁷³) and thence the development *The Mathematical Theory of Communication* by American Mathematician Claude E. Shannon at Bell Labs in the United States in 1948. I take it also to date *perhaps* no *later* than computer networking visionary Joseph Carl Robnett Licklider's 1960 *Man-Computer Symbiosis*, in which he speculated about the benefits of networking computers, ultimately perpetuating the birth of the Internet at the Defence Advanced Research Projects Agency in the United States in the mid 1960s. I will *defeasibly* take the origin of computational *informationism* in the sciences to coincide with Shannon's paper, and perhaps also with the earlier work of Wiener, Nyquist and Hartley from which Shannon derived impetus. However, it is arguable that, by mathematical lights, one might trace this origin as far back as the origins of modern probability theory in the 17th century with the exchange of letters between Blaise Pascal and Pierre Fermat. Informationism in the media and in broader culture, I tentatively take to coincide with, but not necessarily to be solely determined by, the inception of the cybernetics movement at the hands of Norbert Wiener, with his landmark book *Cybernetics*. The earnest popular onset of *informationism*, whence the global community began to conceive of information as an information technology related commodity, and to perceive information technology as instrumental in globalisation, is seen to coincide with, but again not to be wholly determined by, the subsequent development in 1989 and 1990 by Tim Berners-Lee of the hypertext and distributed multimedia technologies used to implement the World Wide Web upon the substrate of the internet and its component technologies⁷⁴.

Postmodernism has been called a practise of theorising about the failure of structuralism or structuralist positivism, and the ideology of modernism, by questioning modernist assumptions and identifying the ideological and theoretical aporia of modernity and failings of structuralism, and yet to be prefigured in structuralism and modernism⁷⁵. Simultaneously, the maturation of *informationism* corresponds with the rise and wane of postmodernism. Moreover, *informationism* pays homage to scientific modernism and the technological prowess associated with and lauded by it, as well as simultaneously embodying postmodern indifference to and wariness of modernist assertions about the intrinsic value of science and technology, exemplified in Jean-Francois Lyotard's thesis regarding the collapse of metanarratives. Such themes of ambivalence about information science are reflected in the cyberpunk works of Gibson. Gibson's informationally estranged characters and settings extol the power of information technology, and simultaneously present it as a dystopian anticipation of human apocalypse wrought through something similar to the *technological singularity* coined by computer scientist, futurologist, and SF writer Vernor Vinge. *Technological singularity* is a speculative neologism referring to a point in the near future of human history when computing machines will become more intellectually capable than their human inventors⁷⁶. Vinge's anthropologically and sociologically astute informationist space opera, *A Fire Upon The Deep*, engages constantly with information technology as an enabling boon which empowers humanity and other sentient species, and yet simultaneously renders it a threateningly estranged and estranging phenomenon which spawns *daemons*, hordes of super-sentient invaders, and informational god-despots. There is *real* scientific debate about whether the technological singularity will occur, and if so when. Although it has detractors, the idea is regarded not as mysticism, but as scientifically defeasible, and is formally debated as such in actual professional scientific forums⁷⁷.

Information technology *is* a tool for facilitating and accelerating the manipulation and *commoditisation* of what I refer to as human-abstracted⁷⁸ or *artefactual* information: information generated and/or structured by human beings. Information technological developments in computer networking, databases, computer control systems, and data compression and encryption technologies in the 1980s and 1990s brought a dramatic change to the power and speed with which certain types of *artefactual information* could be

⁷³ This is the traditionally accepted date of inception of the information age.

⁷⁴ TCP/IP and datagram-packet based networks

⁷⁵ Connor, S. "Introduction" in *The Cambridge Companion to Postmodernism*, Cambridge: CUP, 2004., 5, 8, 9.

⁷⁶ Vinge's prediction is for the arrival of the singularity by around the year 2030.

⁷⁷ At the time of this writing, Vinge is a keynote contributor to an extensive special report in IEEE Spectrum – the online journal of the Institute of Electrical and Electronics Engineers Vinge, V. "Signs of the Singularity." June 2008. IEEE Spectrum Online. 5 November 2008 <<http://spectrum.ieee.org/jun08/6306>>.

⁷⁸ i.e. Information as encoded by intelligent life possessing abstract lexical-symbolic communication capabilities, as opposed to the naturally evolved emergent signalling systems of biological life forms (chemical signalling, DNA replication, immune system responses etc.) See Long [1] and [2].

manipulated and used⁷⁹. Thus I see the emergence of *informationism*, as a cultural and social dynamic, as motivated by multifarious cultural and environmental factors, but the advance and effects of technology and specifically information technology are seen as embodying its *primary* causal motivator, culturally and otherwise. *Informationism* also embodies a concomitant obsession with information as a *commodity*. It is partly the outworking of a struggle for the control of the commodity of information pursuant to influencing cultural, sociological and sociographic outcomes. Ironically, many of the conceptual difficulties, and theoretic aporia intrinsic to *informationism*, and by extension postmodernism and modernism, may well revolve around the failure to adequately define and understand the ontology of information⁸⁰. A cogent ontology of information is important in the definition or parameterisation of informationism as a cultural phenomenon, since it allows us to differentiate the informationally real, the informationally false, and the *informationally hyperreal*, and to distinguish mythologies from substantive factual discourse within texts and other *persisted information repositories* or *sources* based on the types of information they engage and encapsulate⁸¹. *Informationism* is related to but distinct from both modernism and postmodernism. SF in the information age is as engaged with the social, ideological and cultural impact of science and technology as it was during the scientific revolution, the cold war and modern era. Information age *informationist* SF is also, and again in keeping with traditional SF commitments, centrally interested in the science and technology itself, and thus especially in *information* science and technology, from a *cognitive* and *philosophical* standpoint.

In discussing the origins and definition of SF, semiotician and theorist Broderick cites, among others, Brian Aldiss, Isaac Asimov and John W. Campbell Jr.⁸² as supporting the thesis that SF is motivated by the cultural and practical influence of science and technology on homosapiens during and after the scientific and industrial revolutions⁸³. Broderick emphasises that this critical positioning of SF as specifically a literary adjunct to the technological era renders it a more historically recent form of writing than is often claimed, with some other literary theorists reaching as far back as Plato's *Republic* and the epic of *Gilgamesh* for SF's origins⁸⁴. Broderick himself eventually defers to semiological and other structuralist and poststructuralist theoretic constructs in the pursuit of a quasi-categorisation and definition of SF, but with ample caution and dubiety in regard to the veracity, stability and reliability of structuralism, generic classification and genre theory⁸⁵. He follows the general approach of Suvin and Delany in elucidating the special qualities of SF through the analysis of devices employed by SF writers to engage in their texts with the ideological and cultural commitments and discourses of science, ideological progressivism and scientism. This approach provides an explanation for the correlation of SF with the historical rise and empowerment of science on the world scene, and as a worldview alternative to the supernaturalist and mythologically inspired worldviews that largely prevailed from before the dark ages⁸⁶ to the Western enlightenment and scientific revolution⁸⁷. I agree that SF should be regarded, as suggested by Campbell, as something which embraces or at least engages with the idea of scientifically and technologically inspired change as "the natural order of things,"⁸⁸ and as specially correlated with the ideological penchant for facing and embracing such change identified with later human eras. SF is uniquely influenced by science and its progressive discourses and ideologies. Although I too am wary of purely structuralist codifications of literature, the question of *how* it is so influenced, and what makes it unique, is important. In this chapter and subsequent chapters I seek to provide an answer which uniquely

⁷⁹ In my work on the philosophy and ontology of information and information theory, I distinguish *artefactual information* from *natural incidental information*, the latter associated with natural incidental information sources that exist independent of human agency.

⁸⁰ See Long [1].

⁸¹ See Long [1] and [2] for a full exposition of dynamic and persisted information sources and repositories. Adequate definition and explication for our purposes here is provided in chapters 2 and 3 herein.

⁸² Asimov's editorial successor at *Analogue*.

⁸³ Broderick, Op. Cit., 4,5.

⁸⁴ *Ibid.*, 4.

⁸⁵ *Ibid.*, 38, 39.

⁸⁶ With the possible exception of ancient Greek and later Arabic mathematics and philosophy and the Hellenistic age, the latter ending with the death of the Greek philosopher and intellectual Hypatia in about 415 A.D.

⁸⁷ Of course, many Greek philosophers are known to have been atheistic and materialistic: Diogenes, Protagoras, and Theosophus all incurred ascriptions of disrespecting the Gods. Each of those philosophers, and Hypatia (a pagan) were, arguably, naturalistic philosophers of their time to whom the closed system perspective may be ascribable.

⁸⁸ *Ibid.*, 5. (From an excerpt quoted by Broderick.)

engages *information theoretical* posits and which demonstrates further special informational characteristics of contemporary information-age SF, including the relationship thereof to *informationism* as I have defined it.

READING INFORMATIONIST SCIENCE FICTION TEXTS: META-INFORMATIONAL WRITING

The earliest clearly identifiable information-age *informationist* SF text, on the informationist SF theory being presented herein, is Delany's 1967 *Babel 17*. Lem's 1961 *Solaris* and Arthur C. Clark's *Childhood's End* also contain intriguing prefigurations of *meta-informational* characters and what I will refer to as informationally estranged ontologies. Ursula K Le Guin's 1966 Rocannon's world has an astonishing early example of an informationist novum – *the ansible* – which I will discuss later. Pynchon's 1963 *V.* can probably be considered as a precursor, if not a proper representation of the mode, from the perspective of informationist SF theory. Pynchon's 1977 *Gravity's Rainbow* and Delany's 1984 *Stars In My Pocket Like Grains of Sand* are later landmarks, but as I will demonstrate in chapters three and four, by the late 1970s there were numerous other informationist SF novels. Investigating what I call *meta-informational* writing is a good way to preview informationist SF theory at work prior to rigorously engaging with numerous theoretical constructs and postulates relevant to my theses. It also provides a strong introduction to informationist SF, since meta-informational writing is a motif that was approximately prefigured in theory in the structuralist to poststructuralist era by both Wolfgang Iser and Porush. Iser, working outside of SF, regards Joyce's *Ulysses* as a work wherein the narrative actually represents and reflects the very communication principles which inform reader-response theory, mostly via the French philosopher of information Abraham Moles. Joyce's works were something of a fashion for early informationist literary theorists, since Claude Shannon's original mathematical paper engages with the text of *Finnegan's Wake*.

In developing his reader-response theory, Iser appropriates and extends Abraham Moles' definition of *repertoire* to refer to a kind of sociological, linguistic and cultural *episteme* or field of knowledge outside of the text: that which Moles calls, in relation to human communicators, the *sociocultural field*⁸⁹. Initially Moles defines *repertoire* according to psychophysiological usage and Shannon's theory as the "repertoire of elements associated with a given physical sensation"⁹⁰, but then radically alters the definition of the same term to apply to a *new communication concept*:

The concept of a *social communication matrix* is an important extension to the concept of communication.⁹¹

Iser further appropriates the term analogically to refer to a conception of the general epistemological *elements* which contribute to a text from such nebulous externalities as culture and normative values:

The repertoire of the text is made up of material *selected* from social systems and literary traditions. The *selection* of social norms and literary allusions sets the work in a referential context within which its system of equivalences must be actualised.⁹²

In later writings Iser seems to drop this term, favouring instead *collective referential fields*⁹³. In *The Act of Reading*, however, Iser expounds at great length on various analytic philosophical and epistemological theories and models - including the speech-act theory of J.L Austin, the process philosophy of Alfred North Whitehead, and the empiricist associative-ideation of Locke – in order to construct the functional theoretical abstraction that is *the repertoire*. It is correspondingly notable that the definition of the repertoire that Iser offers, although basically coherent, is ultimately conceptually nebulous and ontologically imprecise. As I will reiterate in Chapter three, such a metaphysical flaw might be interpreted as irrelevant in application to literature and aesthetics, except that Iser implicitly *and* explicitly largely authenticates his theory by reference to the metaphysical and mathematical rigour of both Shannon's mathematical theory and Moles' mathematical theorising. The scope of reference of Iser's *repertoire* is necessarily general, but no general conceptual term or common ontological substrate is offered to validate its coherence as an

⁸⁹ Moles, Abraham A. *Information Theory and Esthetic Perception*. Trans. Joel E Cohen. Illinois: University of Illinois Press, 1966 (Trans.) 1958, 52-3.

⁹⁰ Ibid,12.

⁹¹ Ibid,52.

⁹² Iser, W. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978., 86. (my italics.)

⁹³ Iser, W. "Reception Theory." in *How to Do Theory* Ed. Wolfgang Iser. Malden: Blackwell Publishing, 2006., 59.

explanatory abstraction. This is a result of the scope and complexity of that which Iser is trying to capture with his theory, and of the largely analogical and terminologically appropriative approach he adopts to theorising. Iser's *repertoire* consists of all cultural and social systems, all thought systems and values, all empirical experiences, all knowledge and memories, all symbols and signifieds, all historical and political contingencies, all situations, all information and implications – in short anything and everything related to the author, text and reader - which contributes in some way to the meaning and messages communicated within the text, and thus to the meaning and aesthetic effects produced in reader response. Anything which is part of the external reality of the world which contributes elements of the meaning ultimately derivable from the text by the reader is part of the *repertoire*. It “consists of all of the familiar territory within the text⁹⁴” and results from “a selection of norms and allusions⁹⁵” from external reality. The theory also simultaneously has it that the repertoire is an outcome of the “selective combination of [social and cultural] norms⁹⁶” and that as this apparently functional object it “reshapes familiar schemata to form a background for the process of communication, and it provides a general framework within which the messages or meaning of the text can be organised.⁹⁷” Significantly, Iser's *repertoire* becomes something specifically external to the text, as well as being something specifically internal to it, such that the definition semantically bifurcates at least once, resulting in a confusing polysemy. Critically, although Iser *rejects* language as the mode and medium of the function of the repertoire, he offers no explanation of exactly what it is that *does* enable all of these disparate elements to interrelate and combine to produce the stipulated outcomes of “the innovative character of the repertoire⁹⁸” whereby “the observer will grasp something which has hitherto never been real for him⁹⁹”, through the repertoire's *recursive* self-altering dynamics during text processing. The repertoire is, however, like Broderick's episteme, an attempt to grasp what I will refer to, in chapters two and three, as a *contributing set of information sources*. As I will then explicate, the *supervenience base* which Iser ironically fails to identify to provide ontological clarity is in fact the focus of the very theory which motivates his fundamentally informationist approach to literary theory: *information*.

Iser's pre-figuration of the aesthetic motif of meta-informational writing comes with his view of what happens when the complexity of a text's repertoire causes the repertoire itself to be foregrounded in the text. The repertoire of *Ulysses* as a text is “derived from a great number of different systems, but is also presented in such density that the reader finds himself disoriented.¹⁰⁰” For Iser, “the problem is not so much the unfamiliarity of the elements, for these themselves are not difficult to identify.” It is instead “the intermingling and sheer mass” of elements of the repertoire that cause it to become “increasingly amorphous.” The reference to elements not only confirms Iser's analogical appropriation of Moles' terms, but again indicates ontological ambiguity and conceptual nebulousness. However, Iser continues unperturbed in his literary-theoretical situ, and thus:

Not only are the elements themselves recoded, but they all seem devoid of any identifiable frame of reference. And so, even where the repertoires of **sender** and **recipient** partially overlap, the incoherence and density of realistic details and literary allusion make all points of contact too tenuous to hold onto. If the overlap, however, is diminished, **the repertoire tends to be robbed of one of its usual functions- to provide the framework for the communication of a message-and instead it serves to turn attention to the process of communication itself.**¹⁰¹

As such, Iser asserts that in *Ulysses*, “the communicatory function of the repertoire moves into focus and itself evolves into a theme.¹⁰²” Because of the terminological ambiguity and loose descriptivism that Iser employs, it is unclear how some of the dynamics described above are outworked. It is not clear how

⁹⁴ Iser, W. *The Act of Reading: An Aesthetic Theory of Response*. Baltimore: The Johns Hopkins University Press, 1978., 69.

⁹⁵ *Ibid.*, 70.

⁹⁶ *Ibid.*, 76, 80.

⁹⁷ *Ibid.*, 81.

⁹⁸ *Ibid.*, 78.

⁹⁹ *Ibid.*, 79.

¹⁰⁰ Iser, W. *The Act of Reading: An Aesthetic Theory of Response*. Baltimore: The Johns Hopkins University Press, 1978, 84.

¹⁰¹ *Ibid.*, 84.

¹⁰² *Ibid.*, 84.

something as over-determined and yet conceptually abstract and ambiguous as *repertoire* is able to be seen as that which, on Shannon's mathematical theory, is very specifically and unambiguously modelled and mathematically defined: the communication channel. Problematically, one must ultimately accept, not on the basis of rigorous demonstration or convincing logic, but *on faith*, that the analogical appropriation of scientific terms from information theory and communication theory (elements, channel, sender, receiver etc.) will somehow ensure the cogency of Iser's theory and postulations. However, the main point here is that the observation being made based on these terms is that *the text and the narrative encoded upon or within it begin to refer to and present, pursuant and contributory to their aesthetic and cognitive outcomes, the very communication-theoretic dynamics which Iser is expounding*. I refer to this as only a *partial prefiguration* of a theoretical description of *meta-informational writing* for two reasons. Firstly, it is dissimilar in some significant theoretical aspects, and concomitantly, but perhaps more importantly, it is not clear that what Iser has produced is not simply a theoretical projection *onto* the text. If Joyce intended of *Ulysses* that its structure and narrative would be such that "the repertoire of this novel both reflects and reveals the rules that govern its own communication" - if he did intend for such effects through encoding such self-reference into the 1922 *Ulysses* - then he could not have done so with the same communication-theoretic terms in mind. Shannon's theory and its precursors date from the late 1930s at the earliest. However, Iser's repertoire is loosely enough defined and makes enough reference to general polysemous terms like knowledge, culture and values that it could perhaps be claimed that the author who perfected the complex and experimental *stream of consciousness* narrative was pursuing just such self-referring outcomes. I will seek to demonstrate below that, unlike *Ulysses*, information age informationist SF texts actually exhibit narrative engagement with the very information-theoretic terms and concepts which they self-reflexively represent, and often directly *name* or allude to these principles, sometimes in a way that *recursively* references them, and often simultaneously in an estranged and counterfactual sense.

THE META-INFORMATIONAL WRITING OF PYNCHON

Yet another recognisable theoretical pre-figuring of meta-informational writing in SF specifically, exists in Porush's analyses of Pynchon's novels *The Crying of Lot 49*, *V.* and *Gravity's Rainbow*. Porush focusses on the prevalence therein of complex *self-reflexive prose* and especially *self-reflexive metaphor*. His posits are salient because his interest is in the impact on literature of *cybernetics*, a scientific bedfellow of information theory. His expository of Pynchon along these lines is exemplary enough that I will not need to extend it. Aside from its prescience, the importance of Porush's thesis is that it provides an opportunity to introduce an information-theoretic analysis of *metaphor* using the terms of the metaphysical information theory upon which *my* thesis ultimately depends. Porush isolates some of the prose which makes Pynchon's 1976 *Gravity's Rainbow* a representative of the informationist SF mode. Whilst he does not approach the *ontology* of information per se, he nevertheless notes the ontological shift in the view of information in accordance with its newly perceived role as a commodity whereby it comes to be perceived as a type of substance, to the extent that the addict Slothrop tries to acquire some from the black-marketeer Semyavin as if for a fix:

"What is it you're after...stimulants, depressants, psychomimetics?"

"Uh, Information?"

"Information? What's wrong with dope and women? Is it any wonder that the world's gone insane...It'll get easier. Some day it will all be done by machine. Information machines."¹⁰³

Written at the paranoid height of the cold war, *Gravity's Rainbow* here directly engages with the concept of information as commodity, questioning it on humanistic terms. Porush chooses to link Pynchon's engagement with information theory with Pavlovian behaviourist psychology in the context of cybernetics, asserting that:

¹⁰³ Pynchon as quoted in Porush, David. *The Soft Machine: Cybernetic Fiction*. New York & London: Methuen, 1985, 133.

Pynchon's refinement is to link the raw information with the desire to have meaning. Humans are partly machines that take data and abstract them into knowledge that is never certain or complete.¹⁰⁴

Appropriating the information-theoretic conceptions of uncertainty and information loss (both of which we will meet in the next chapter) and applying them to knowledge instead of information is a strategy familiar from Iser's theory, but here Porush also demonstrates a superior understanding of the distinction between information and meaning proposed by mathematician Shannon and philosophers Moles and Dretske. The above dialogue from the novel is a direct, not a metaphorical, reference to information. Its self-reflexivity is only in the fact that the text itself is a repository of information, and the reader is perhaps the implied information junkie. Of more relevance to the conception of what I am calling *meta-informational writing* is Porush's interpretation and application of the observations of numerous critics who have noted the information-centric self-reflexivity of Pynchon's work:

As many critics have proposed, Pynchon's work is eminently self-reflexive. *V.*, *The Crying of Lot 49*, and *Gravity's Rainbow* inspire in the reader the same compulsive desire to organise a welter of data...¹⁰⁵

Porush astutely situates the epitome of informational self-reflexivity in Pynchon's novels in *V.* where "the most interesting – and one of the most direct – references to cybernetics concerns the distinction between noise and information.¹⁰⁶" In the novel, German engineer Kurt Mondaugen is a familiar example of Pynchon's informational characters: he is information-metaphorical and information-allusive. The primary loci of Mondaugen's actions are information and communications articulated intertextually through the science and discourse of communication theory, and his behaviour and experiences provide a metaphor for the same. The narrative encoded upon the text, which tells of Mondaugen's efforts to record "atmospheric radio disturbances: sferics for short" and his efforts to decode a coded pattern in his recording, stands itself as a metaphor for the manner in which Pynchon's dense, complex text encodes messages to be extracted or decoded by the reader¹⁰⁷. Porush's conclusion about the ultimate implications of such self-reflexivity is that it is conducive to cognitive aesthetic effects and cognitive outcomes for the reader:

Pynchon's fictions employ machinery to expose the very un-machinelike machinery of the reader's consciousness at work. If Pynchon's work is systematically meaningful, it is on the cognitive level: it brings the reader into a hyper-alert state that goes beyond mere self-consciousness. If we read Pynchon's work seriously, we are ultimately forced to observe ourselves as we are compelled...to explain what we are reading. Works like *Gravity's Rainbow*, in particular, punch certain cortical buttons that respond to the stimuli of indeterminacy, incompleteness, paradox, complex metaphors, near crystallizations of sense out of super-saturated solutions of information.¹⁰⁸

Undecodable hyperbole and pleonasms notwithstanding¹⁰⁹, Porush is echoing Suvin and Lem on the cognitive value of science fiction, and ascribing this cognitive effect and affect largely to the informational and specifically information-theoretic self-reflexive metaphor in Pynchon's text.

In *V.* Mondaugen is presented with an information-theoretic problem to solve, when his 'sferics' recorder records a peculiar and ambiguously noisy or encoded message:

“DIGEWOELDTIMESTEALALENSWTASNDEURFUALRLKIST”

¹⁰⁴ Porush, David. "Cybernetic Fiction and Postmodern Science." *New Literary History* 20.2 (1989), 133.

¹⁰⁵ Porush, D. *The Soft Machine: Cybernetic Fiction*. New York & London: Methuen, 1985, 114.

¹⁰⁶ *Ibid.*, 122.

¹⁰⁷ *Ibid.*, 122-3.

¹⁰⁸ *Ibid.*, 117.

¹⁰⁹ I cannot find anything but the barest cogent meaning in the alliterative and descriptivist "near crystallisations of sense out of super-saturated solutions of information", although it perhaps is a nice example of synthesis of scientific and literary discourses. Presumably it refers to Porush's observations about uncertainty of meaning due to complex informational structure of the text, but this is speculative.

It turns out to be compound and nested, like Pynchon's informationist text itself, such that when decoded it reveals two messages – one an anagram of the engineer's own name, the other a "direct quote of Wittgenstein's first principle in the *Tractatus*, "The world is all that the case is".¹¹⁰" The efforts by the engineer to decode the message are a metaphor for the effort required by the reader in processing the text of *V.*, and concomitantly there is the question of whether one or both of the messages revealed is an accident due to noise and the projective scrutiny of the human decoder or reader¹¹¹. This indeterminacy references exactly the question of meaning production and the encoding of knowledge in texts that is posed by Iser's reader response theory, and prefigures philosopher Fred Dretske's suggestion that knowledge attained from a source by a receiving person is affected not only by noise between the source and the receiver, but by what the receiver already knows¹¹². The jumbled encoded message Mondaugen receives is a metaphor for the text the reader is receiving – which is also specifically technically (not analogically) a *message* from a *source* on Shannon's information model. Simultaneously there is the straightforward *and* metaphorical intertextual invocation of the technical problems of channel fidelity, and of interference from noise affecting a message, as presented by Shannon himself. Furthermore, this entire section of the text alludes, in an intuitive way, to the dynamics of *information synthesis*, which I will pursue in earnest later. This style of layered self-reflexive informational writing, has been reprised skilfully by Neal Stephenson in the informationist *Snow Crash* and *Cryptonomicon* (which reprises also the wartime and cold war *mise en scene*), and perhaps in the former with a similar degree of self-reflexivity in metaphor that is ascribable to Pynchon.

The metaphoric device itself is in fact a recursive metaphor for the technical conception of communication processes. This is because *metaphor simply is a message influenced by multiple contributing sources of information and noise*, or else it is a *message exhibiting such ambiguity through information loss and inexact encoding that multiple meanings or decodings are available for its interpretation*. Metaphors work as metaphors because of noise and the loss of information resulting from the impossibility of perfectly representing the author's image to the reader, and the author's *intention* to inject ambiguity and noise into a metaphor to begin with – when encoding it as a message. When an SF text combines metaphor and other devices with narrative references to information theory and communications theory such that the narrative recursively implies the text itself on informational terms, then this is *meta-informational* writing. Much informationist SF, such as the cyberpunk SF of Gibson and Neal Stephenson, simultaneously engages with and foregrounds the use and effects of information technology. As in the case of Pynchon's Mondaugen, such works also exhibit another dynamic special to the informationist mode: the scientific object and human subject become co-focal, and each emphasises the other. This corresponds with the shift of emphases in SF texts generally, as observed by Broderick following Ebert, from the subject to the object, where the object is usually scientific or technological¹¹³. For Broderick, SF texts encapsulate a "comparable positioning towards language which is many ways closer to scientific discourse than to traditional literature" since "both new forms of writing, reference to the world: in a word, the object."¹¹⁴ When the object is information either alone or in conjunction with information and communication science, then meta-informational writing is frequently manifest. Meta-informational writing is a primary contributor to the *informationist SF aesthetic*.

A READING OF A CONTEMPORARY META-INFORMATIONAL SCIENCE FICTION TEXT

Fictional narratives in general involve and supervene upon special artefactual encodings and encapsulations of information. Information-age SF texts encode curious meta-fictional narrative and expository attributes that I have referred to as *meta-informational*. As I have suggested, texts encoding fictions which engage with information scientific and informational themes are themselves open to information theoretic analysis, and often meta-fictionally and *meta-informationally* imply their own informational status and configuration, simultaneously diegetically engaging with communication theory

¹¹⁰ Porush, D. *The Soft Machine: Cybernetic Fiction*. New York & London: Methuen, 1985, 123.

¹¹¹ *Ibid.*

¹¹² Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 82, 84.

¹¹³ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 115, 156.

¹¹⁴ *Ibid.*, 116.

and information theory either directly or counterfactually through the novum and other SF codons, delivering cognitive aesthetic outcomes for readers. Often this meta-informational self-reference is *recursive* and layered, and is sometimes achieved through self-reflexive metaphor. The word *recursive* is often used ambiguously by literary theorists: here I mean that the text and narrative both encode and imply - metafictionally, analogically or otherwise diegetically - informational themes and information-theoretic principles and structures, and that the thus implicated informational principles and structures in turn *apply to and reflect what is happening in the text itself from an informational and information-ontological perspective*. Thus the text references both information theoretic and information ontological principles and thereby indirectly and directly implicates itself, and the mechanism of reference itself as also informational and meta-fictional. To be more precise, in a quasi-axiomatic sense, there is the statement: ‘this text and its encoded narrative and semantics infer or reference information-theoretic and information-ontological principles, dynamics, and structures’; and then there is a second statement: ‘the informational principles, dynamics and structures implied by the narrative and semantics of the text in the first statement *apply to* the text mentioned in the first statement’. There is then a third statement or quasi-axiom: ‘The mechanism of self reference *described* in the second statement exhibits, and is describable in terms of, information theoretic and information ontological principles, dynamics and structure’. The second two statements are established with recourse to the statement(s) preceding them, and thus the meta-informational meta-fictional mechanism is *recursive*. *This recursive meta-informational meta-fictional device is only present in texts which engage the discourse(s) of information science and technology, communication theory¹¹⁵, information theory, or information ontology in a descriptive, analogical, explicative or expository way*. Thus, I suggest that this occurs in few, if any, non-SF texts in which discursive and informational *synthesis* does not centrally involve scientific discourse and information associated with scientific endeavour, or where counterfactual estrangement of the ontology of characters and objects is not directly *informational*. Moreover it is far more likely to occur in informationist SF specifically. It is a metafictional tropic and narratological marker of *informationist* SF. Meta-informational meta-fiction results in a unique and unusual aesthetic experience for the reader, and contributes to what I refer to as the *aesthetic of complexity*, which I will explicate fully in chapter four.

Readers familiar with Broderick’s SF *mega-text*, who are able to decode the icon-codons related to the discursively subjunctive scientific and futurological episteme that he identifies as special to the modern and postmodern world and as important to SF¹¹⁶, are perhaps more likely to be cognisant of the metainformational devices of informationist SF. However, if the reader is not familiar with information-theoretic principles, dynamics and structures, the *cognitive aesthetic* effects of reading such a text are not necessarily nullified, since the informational dynamics can often be gleaned from the narrative and its encoded semantics. Moreover, it is *because* of the oft-maligned expository and quasi-pedagogical narrative characteristics of SF that informationist SF texts *can* deliver cognitive and general aesthetic effects via meta-informational metafictional devices, even for the SF mega-text uninitiated reader. This is because character or world related novum description and construction through expository SF narrative - whether autodiegetic, homodiegetic, heterodiegetic or even hypodiegetic – facilitates the encapsulation within the text of the very semantic explication and decoding required for understanding the novum or other informational codons. The codes for both *informational* and *semantic* decoding of the novum or SF icon can actually be conceptually ‘bootstrapped’ from the text and the narrative encoded upon it. Put simply, if the reader doesn’t possess the requisite internal information and knowledge, the fictive text can supply it at the time of reader text processing. Ergo the effectiveness of Pynchon’s self-reflexive metaphor. The best SF authors can effect this reflexive pedagogical and informative construction subtly, such that although the reader must engage cognitively with the text at an elevated level, their aesthetic enjoyment of the narrative is not disturbed by an awareness of their status as the subject of partly explicative narrative. Alternatively, the exposition can often be foregrounded *as* exposition whilst retaining aesthetic effects, so long as the flow, voice and structure of the narrative are thoughtfully executed in accordance with Delany’s informational stylistic requirements.

¹¹⁵ Of the mathematical variety i.e. Shannon’s Theory.

¹¹⁶ Broderick, D., Op. cit., 59-60, 66, 156.

To pre-theoretically consolidate and exemplify, at this early point in our theory construction, some of principles, ideas and theoretical vocabulary thus far mentioned, we now turn to a close reading of a meta-informational excerpt from Alastair Reynolds' 2000 informationist SF novel *Revelation Space*. The terminology and principles of information theory and information ontology are philosophically and analytically rigorous and exacting, but the intention here is not only to leverage them for investigating the language and semantics of texts, but to address questions of the aesthetics and style of the text as a work of informationist science fiction, and thus pre-theory is adequate. Nevertheless, the philosopher of language will need to delineate between analysis and aesthetics at some points in what follows, and the literary reader allow for some rather structural posits, and some exacting theoretic terminology. This is not a dissimilar set of cognitive demands to those placed on the reader of informationist SF itself. I think that the locale of SF texts and their encoded fictions at the cultural, discursive, ideological, and linguistic multivariate nexus of science, philosophy and fiction naturally – perhaps necessarily – imputes such duality to SF theorising. Such admixture and hybridisation of the analytic and aesthetic – the linguistic and stylistic – is a natural upshot of theorising about texts which hybridise and synthesise scientific, philosophical and fictive discourses and their respective associated information *types*. Such is evidenced in the literary theoretic and critical musings of many SF theorists including Broderick, Delany, Suvin and Parrinder. Even the politically attuned Suvin and the almost constantly heterodox Delany are interested in the analytic and cognitive, to the extent that both pursue analyses which draw significantly, at various distances, on cognitive science, linguistics, and the philosophy of language. As has already been revealed, Delany even engages with information theoretic ideas, and is interested not only in the semiotics of SF but in the processes of cognitive concept-formation associated with reading SF¹¹⁷.

In addition to exhibiting numerous uniquely SF narrative and discursive characteristics including *counterfactually* estranged¹¹⁸ setting and character ontology, *Revelation Space* provides an easily recognisable example of recursively *meta-informational* meta-fiction. Reynolds employs polyphonic third-person narrative which combines heterodiegesis and free indirect discourse to construct, and to explicate the ontologically estranged nuances of, the character-novum of the *Jugglers*: vast ocean-dwelling aqueous bio-informational superorganisms whose life is spent absorbing matter and actually converting it to structured information:

The jugglers...had the ability to mediate the biospheres of the worlds in which they had been seeded, acting like a single, intelligently acting mass of phytoplankton – but no one knew if this was merely secondary to some hidden, higher function. What was known – and again not properly understood – was that the jugglers had the capacity to store and retrieve information, acting like a single, planet-wide neural net. This information was stored on many levels, from the gross connectivity patterns of surface floating tendrils, down to free-floating strands of RNA. It was impossible to say where the oceans began and the Jugglers ended – it was just as impossible to say whether each world contained many Jugglers or merely one arbitrarily extended individual, for the islands themselves were linked by organic bridges.¹¹⁹

The Jugglers are a rendition of an SF mega-text codon which originates with Lem's *Solaris*, wherein is developed the informationally and ontologically estranged and estranging subject-object of *the ocean*: a vast body of liquid on a distant planet which takes information in the form of thoughts and instantiates from it physical objects and realities. Reynold's novel is an example of what I refer to herein as *informationist space opera*. It is a linguistically, discursively and informationally dense space opera with copious hard SF content, which has been lauded by reviewer-readers as exhibiting high ideational complexity, well appointed narrative and convincing characterisation. Not only does the above explicatory excerpt recursively refer to itself meta-informationally, but *almost the entire passage can be read as a meta-informational recursive reference to the SF text, the reader, the author and the acts of writing and text processing*.

¹¹⁷ Delany, Samuel R. "About 5,750 Words." Delany, Samuel R. *The Jewel-Hinged Jaw: Notes on the Language of Science Fiction*. New York: Berkley Windhover, 1978.

¹¹⁸ Rather than fantastically estranged

¹¹⁹ Reynolds, A. *Revelation Space*. New York: Ace/Orion/Victor Gollancz/Penguin, 2000, 96. (emphasis mine.)

A fiction text indeed has “the capacity to store” and the reader in processing the text the capacity to “retrieve information.” Both meaning and information in an SF text is “stored on many levels” through intertextual engagement with the codons of the SF mega-text, and through overlapping and hybrid discourses and what I will refer to later as discursive and *informational* synthesis, the latter being realised through discursive polyphony, reader reception in text processing, novum implementation, semiotic information sources, and especially the combination of information *types*. Information and semantic content in the fiction text are conveyed in both “the gross connectivity patterns of surface floating tendrils” – a ready metaphor for the overall narrative structure, intertextuality, voice and style – and in the “free floating strands of RNA” that are embodied in SF codons, novum and novum neologisms, in discursive polyphony and expository and explicatory narrative and hypodiegesis. All of the latter generally supervene on different types of *artefactual lexical information* from or associated with *artefactual lexical information sources*. Such sources include other texts and any linguistically or lexically encoded man-made data. As a heterodiegetic free indirect discursive and expository narrative which inherits the internal voice of the character Dan Sylveste and that of the normative narrator, the passage itself is and embodies a strand of free floating textual ‘RNA.’ In genetic science, Ribonucleic Acid (RNA) and particularly the messenger variety (mRNA) is responsible for carrying transcribed segments of genomic information between DNA sequences and thus providing genetic information for the synthesis of new DNA strands: in terms of information theory¹²⁰ it is a *message* sent from a *source* to a *destination*, and in information ontological terms RNA is an information source itself, and a natural incidental *emission*¹²¹ of information. This fictive RNA element of the Jugglers construction implements an informational metaphor which recursively implicates the expository passage itself, again according to our three quasi-axiomatic statements. Moreover, the expository excerpt carries ‘genetic’ thematic microtropes or codons¹²² inherited from the SF mega-text in the form of the superorganism icon and the mind-absorption icon, among others, and like RNA embodies the concepts of message transmission and the information source, being as it is an information source itself. The reader, in processing this text, is *informed* by the transmission of a message, and must perform information synthesis internally - via what we will at this point refer to as cognition - to realise encoded semantics in the narrative. On the semiotic level, the syntagms associated with the terms borrowed from scientific discourse are themselves a kind of informational strand, and by information ontology they and the symbols that comprise them are both messages and sources. The actual act of reading this text is an analogy for the informational functions that the narrative is describing: there are functional and ontological parallels between the counterfactually described novum and the reading act.

In addition to being a meta-informational metaphor for the SF novel, and the relationship of the reader to the text in the act of reading, this passage arguably also invokes, in the highly ontologically estranged, fragmented, and information-synthesising character of the Jugglers, an image of the author’s imagination and internal *information sources*: their internal semantic and cognitive structures. Not only does the counterfactual and highly mereologically estranged ontology of the Juggler result in a cognitively challenging and highly affective *extreme otherness*, but it is pervasively *informational*. Jugglers are physical, but also *recursively informational*¹²³, beings: they embody information supervening on other different *types* of information. Like a writer or reader, they absorb and *synthesise* information from multiple sources to gain knowledge¹²⁴. *Like a text, their physical configuration is subsumed to the task of information storage and synthesis*. The estranged *informational* ontology of the Jugglers makes it “impossible to say where the oceans began and the Jugglers ended”: it is concomitantly impossible or very difficult to identify and quantify the boundaries of the *information sources* encapsulated within and absorbed by them. As we will discover in chapter two, this is a metaphor for textual *informational synthesis*: the external and internal information sources involved in the production of an SF text and in the information synthesis associated with text

¹²⁰ On Shannon and Dretske’s models.

¹²¹ Long B. “The Ontology of Information.” (In preparation).

¹²² My adaptation of Broderick’s sense thereof – see chapter one, pages 32-35.

¹²³ Recursion here refers to information supervenience – not the recursive quasi-axiomatic meta-informational mechanism defined in chapter one (p. 33-5).

¹²⁴ Knowledge is not the same thing as information by either Dretske’s information ontology or my own. Knowledge supervenes upon information in the strong sense of supervenience.

processing are only abstractly quantifiable or delineable. This source indeterminacy also implies intertextuality. Accordingly, the entire passage itself exhibits, effects and embodies an actual *information synthesis*. This is *recursively meta-informational*, according to the quasi-axiomatic definition provided above. In a striking simultaneous analogical citing of the theoretic posits of the mega-text, intertextuality, the anxiety of influence and *informational synthesis*, the passage has it that “it was just as impossible to say whether each world contained many Jugglers or merely one arbitrarily extended individual”. The multiplicity and synthesis of identity, voice and information are all implied here. Readers are linked to texts and authors by conceptual ‘bridges’ through common context and knowledge, and the Jugglers are internally structured as linked information repositories: “the islands themselves were linked by organic bridges.” This novum implies an organic data network. The text continues:

They were world-sized repositories of living information; vast informational sponges. Almost anything entering a juggler ocean would be penetrated by microscopic tendrils, partially dissolved, until its structural and chemical properties had been revealed, and that information would then be passed to the biochemical storage of the ocean itself. As Lascaille had intimated, the Jugglers could imprint these patterns as well as decode them. Supposedly those patterns could include the mentalities of other species which had come into contact with the Jugglers – such as the Shrouders.¹²⁵

Just as SF texts, authors and readers are informational insofar as they absorb copious information in storing or processing texts and discourses from multiple internal and external information sources, so the Jugglers are “vast informational sponges.” The Juggler’s organic form *is* informational: dedicated to information storage and processing. At this point we can return to the first sentence of the passage, in which the narrator declares of the Jugglers that they “had the ability to mediate the biospheres of the worlds in which they had been seeded, acting like a single, intelligently acting mass of phytoplankton”, which invokes not only impressions of author and reader through the mention of mediating intelligence, but also further metafictionally establishes an analogical impression of the SF mega-text. The informational Jugglers are not only constitutive of the information associated with the world they inhabit, but also have some mysterious and obscured purpose: “– but no one knew if this was merely secondary to some hidden, higher function.” The information-synthesising, information-absorptive Juggler provides a metafictional analogy for the reader-mediated coupling of the specific SF text with the abstractly conceived but real contributing *set* of texts which is the SF mega-text. Incidentally, the Juggler is concomitantly also emblematic of the informationist commodification of information: everything that is consumed by them is information, and their function is inferred to be one of information storage and production. SF fictions in general implement world-sized settings and represent counterfactual worlds in narrative, and by the lights of information theory, reader reception theory and Bakhtin’s theory of novelistic discourse (through embodying captured utterance) are “repositories of living information¹²⁶”, albeit mostly what I will introduce in chapter two as *counterfactual pseudo-information*. The next line of the passage contains a striking combination of SF novum and meta-informational allusion. In a complex metaphoric invocation of the synthesis of discourses and information sources in an SF novel, the narrator explains that “[a]lmost anything entering a juggler ocean would be penetrated by microscopic tendrils, partially dissolved, until its structural and chemical properties had been revealed, and that information would then be passed to the biochemical storage of the ocean itself.” In other words physical objects, including the physical bodies and brains of sentient beings, are systematically metamorphosed from their initial form into a kind of biochemically encoded stored information, and the structured information supervening upon or *contained within them* is also synthesised and stored¹²⁷. The Jugglers perform a naturalistic kind of reading – natural in the same sense as the decoding performed by DNA transcriptase and reverse transcriptase – but which combines and synthesises information from many disparate and related natural and artefactual sources. They exemplify information transmission,

¹²⁵ Reynolds, A. *Revelation Space*. New York: Ace/Orion/Victor Gollancz/Penguin, 2000, 96.

¹²⁶ Bakhtin does not refer to information as such, but later in this chapter I provide an information ontological interpretation of novelistic discourse.

¹²⁷ Information is not meaning. See the explanation of the informationist SF megatext icon *The Infomorph* in chapter four. Meaning, like knowledge, *supervenes* upon information.

information storage, information synthesis and writerly textuality in this: a (fictive) materially embodied ontologically estranged parallel of the informationist SF novel.

The Juggler's uniquely appointed novum involves the conversion of matter, and the information supervening on it, to differently supervening information. The Jugglers of *Revelation Space* are specifically and uniquely ontologically configured, and the highly counterfactual *naturalistic* mechanism is explicated to reasonable depth in the narrative. The original physical object or body that they absorb, and any information inherent in its form, is effectively *lost*: it is dissolved in its entirety and *lossfully* converted to information. This is a *novum* that *directly* references information theory¹²⁸, and a speculative anticipation of certain aspects of my information ontology which might be surprising, except that Reynolds was a working astrophysicist at the time of writing. By Shannon's theory the process of encoding a message for transmission involves converting the information upon which that message is encoded from one mereological configuration and physical state to another often completely physically distinct mode of material existence¹²⁹, such as what occurs when a page of text is scanned and then transferred as an encoded signal over conducted (cable) or radiated (satellite and radio) transmission media constituting a *channel*. The information ontology I have devised sees any information transmission requiring *information type conversion* as involving a *loss* of information and some change in configuration or mode of existence of the initial information from a source¹³⁰. The next sentence of the passage both consolidates the informationist novum and continues the complex simultaneous recursive meta-informational reference to the text, author and reader, since "the Jugglers could imprint these patterns as well as decode them." It is salient that the sense of the word 'decode' in the context of this passage, by virtue of the aforementioned information-ontological allusions, seems to relate to information rather than meaning: a subtly important, albeit philosophically debatable distinction which I have already mentioned in conjunction with Delany's perspective on style and content, and which will be expanded upon in chapter two.

I propose that one of the primary differences between SF and other modes of fiction writing is the way that SF approaches, encapsulates, presents and - particularly - synthesises *information*. I am not concerned with the question of informationist and information age SF as *literature*, but as modes of fiction writing which can deliver complex and altogether aesthetically *and* cognitively rich fiction. Quality informationist SF *proper* has a commitment to cognitive enrichment through speculation and discursive hybridisation through *information synthesis*. Many of the most famous works of literature are lauded because of their poesy and increased vocabulary – those of Shakespeare and Joyce for example. Quality SF writing exhibits sophisticated prose and psychological insight, whilst expanding its vocabulary not just into philosophical discourses, but also through extensive counterfactual novum neologising and engagement with scientific discourse and scientific neologisms. I will suggest SF inherits the neologising practices of science and scientific discourse, albeit with some important differences with regard to the *types* of information involved in SF's own fictive discourses. I have already ascertained that SF, and especially informationist SF, is unique in its employment of meta-informational tropes and devices, and this is a first push toward the claim that SF is special by virtue of information synthesis. First, I must devote the next chapter to explication and elucidation, and establish a new information theoretic and meta-theoretic framework for analysing information age SF texts. This will require engagement with the philosophy of language, linguistics, metaphysics, information ontology and information theory.

¹²⁸ Dretske [1], Op. cit., 183.

¹²⁹ Shannon, C. E., *The Mathematical Theory of Communication*, Reprinted with corrections from The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948. URL: <http://cm.belllabs.com/cm/ms/what/shannonday/shannon1948.pdf>, 2 (bullet points 2. Transmitter and 3. Channel)

¹³⁰ Long, B. "The Ontology of Information." (In preparation.)

Chapter 2 - Information Theory and the Language of Science Fiction Texts

INFORMATION AND MEANING

Tom Shippey, in his insightful essay *Hard Reading*, refers to Suvin's *novum*, or more precisely to novum neologisms, in the context of the information-theoretic model founded by Claude E. Shannon. Shippey, drawing on the work of Shannon and of linguists who adopted Shannon's theory¹³¹, stipulates that a novum word – the kind of neologism ubiquitous in SF texts by virtue of the need and desire to name the kind of speculative ideas and wondrous objects or principles developed to elicit aesthetic and affective value through cognitive elicitation – embodies *higher information* than words in existing established lexicons¹³². The foundation for this assertion is based on *objective probability* in that the number of possible novum neologisms is vastly greater than the number of words in the natural language lexicon. The SF author can invoke almost any string of letters, even without regard for normative grammar¹³³, to achieve a novum neologism. Arbitrarily combining parts of existing normatively referring terms and verbs into new *permutations* also results in a far greater set of possible novums. The inclusion of neologising in scientific discourse and texts, and the same neologising habit associated with the novum in SF texts, means that the vocabulary associated with each text kind is instantly made arbitrarily much larger. Moreover, scientific neologisms and SF novum neologisms have comparatively much lower probabilities of occurring compared to normative lexical and grammatical words – there is more *uncertainty* associated with neologisms and novum words. This means that, as Shippey observes, a much less likely novum word chosen from a much larger prospective vocabulary, will involve comparatively much higher information. He concludes that:

Science fiction...is an intrinsically high-information genre. Novums, because they are novums, are very hard to predict.¹³⁴

Shippey uses the concise and economical term 'novums' for what I refer to variously as 'novum terms', 'novum neologisms' or 'novum words'. I prefer the latter options because a novum on Bloch and Suvin's definition is technically not just a word, but in Ernst Bloch's case can apply to a metaphor and on Suvin's (re)definition renders it as a *category* which applies to the cognitive ideation associated with cognitive estrangement and speculation in SF, which often involves neologisms¹³⁵. Nowadays, the ultimately mathematical definition of information that Shippey employs, which refers to what is known as *Shannon entropy*¹³⁶, is not the whole story in information theory, although it is pervasive and central in information science, and lately also even in new interpretations of quantum mechanics involving *quantum information*¹³⁷. I seek here to add other information-theoretic insights for the study of texts and especially information age SF, which I will concomitantly determine to be informationally special: to have a special *informational profile*.

SF texts themselves frequently engage with the discourses of science, and often include within their narratives quite technical hard-scientific exposition and explication, frequently incorporating mathematical and logical components. In a similar way, both modern structuralist and postmodern poststructuralist literary theory and criticism often engages with quite recondite philosophical and technical material. Much

¹³¹ Shannon, C. E., *The Mathematical Theory of Communication*, Reprinted with corrections from The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948. URL: <http://cm.belllabs.com/cm/ms/what/shannonday/shannon1948.pdf>, 4-7, 14-15. See also Hockett, C.F. "The Mathematical Theory of Communication by Claude E. Shannon and Warren Weaver Reviewed by Charles F. Hockett," in *Psycholinguistics; A Book of Readings*, Reprinted from Language 29, 69-93 (1953), New York: Holt Reinhart and Winston, 1961. and especially Lyons, J. *Introduction to Theoretical Linguistics*, Cambridge: Cambridge University Press, 1968-9.68, 84-87.

¹³² Shippey, T. "Hard Reading: The Challenges of Science Fiction." Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005. 11-26, 15-17.

¹³³ Recall the name of the central protagonist of Italo Calvino's *Cosmicomics* stories: Qfwfq.

¹³⁴ Shippey, Op. cit., 15.

¹³⁵ Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980, 64.

¹³⁶ Shannon, Op. Cit., 10-15.

¹³⁷ Bubb, Jeffrey. *Quantum Mechanics is About Information*. arXiv:quant-ph/0408020v2. Maryland: University of Maryland, 2004.

of the material that follows will call for this same spirit of broad technical and philosophical adventurism, and will involve a significant vocabulary of technical terms. The most important ideas for the reader to grasp to this end include that of the internal and external *information source*, and the idea of *source type* and *information typology*. The concept of a *discrete* source and the idea of a source *configuration* are also important, as is the definition of a *message*.

It is important to understand the difference between the strictly information-theoretic denotation and definition of the terms ‘message’ and ‘encoding’, and the normative literary-critical meaning of the same terms. On the information-theoretic definition neither *message* nor *encoding* directly involve either semantics or *meaning*. The following is a perfectly valid message in information theoretic terms by Shannon’s *TMTC*: “ARKL FROBBIT SDFHJ ? !@#\\$”. One problem with applying the ideas of information theory to SF theory is that the term *encoding* used in a literary and linguistic context is generally not the same as the sense of encoding by Shannon’s theory, which preserves the distinction between information and meaning¹³⁸. The literary theoretic definition is usually only analogical to the mathematical one. The verbs *encode* and *decode* have become almost as homonymous as the noun-verb *code*. Both essentially indicate that symbols or representational artefacts of some kind are used to encode *something* which can be retrieved, extracted or unpacked from the product of the encoding – a message or text in the case of *discrete* linguistic sources – by a reader or receiver somehow possessed of the requisite mental, linguistic, cultural or sociological *codes*. The linguistic and semiological sense of encoding familiar to Peirce, Saussure and Barthes generally refers to this analogical sense of encoding or *semantic* encoding - the encoding of meaning, denotation or reference. In literary theory the idea of encoding is loosely defined at best and involves semantics and reference and also may encompass, among other things, the cultural and the aesthetic, and other more arbitrary and less analytic impressions and unquantifiable things such as *affect*. Encoding on Shannon and Dretske’s theories is *not* the encoding of meaning¹³⁹. For Dretske, information requires truth, but meaning can exist without truth: one can express a meaningful statement that is not true¹⁴⁰. On the theory of Long[2], the encoding of meaning *supervenes upon* information synthesised from multiple sources. Shannon encoding is the encoding of sequences of selected symbols in the discrete source case, or in the case of a continuous source – the selection of points from a continuous statistical distribution function based on an ensemble of functions determined by mathematically quantising the continuum to produce messages and signals. When approaching structuralist or postmodern-poststructuralist theory, these distinctions between semantics and information must be carefully observed.

Philosopher Fred Dretske echoes Shannon’s colleague Warren Weaver in asserting that, although meaning and information are not the same thing, information does have *something* to do with meaning¹⁴¹. It is possibly Weaver who motivated Roland Barthes’ assertion that semantic noise contributes to information proliferation¹⁴². Dretske asserts that “communication theory does not tell us what information is” since it “ignores questions having to do with the content of signals, what *specific information* they carry, in order to describe *how much* information they carry,” but that nevertheless some aspect of *semantics depend* on information, since “although information, as ordinarily understood, may be a semantic concept, this does not mean that we must assimilate it into the concept of meaning¹⁴³.” Moreover, *meaning* is notoriously ill-defined, and the word information is also unavoidably polysemous in common usage. Shannon’s theory at least provides a rigorous, axiomatic, practically proven base from which to approach the definition of *information*. Thus Dretske is justified in claiming that “the failure of information theory to tell us what meaning is should not be used to discredit it as a theory which can tell us something about

¹³⁸ See also Moles’ discussion in Moles, Abraham A. *Information Theory and Esthetic Perception*. Trans. Joel E Cohen. Illinois: University of Illinois Press, 1966 (Trans.) 1958, 52-3.

¹³⁹ Shannon, C. E. and Warren Weaver. *The Mathematical Theory of Communication*. Chicago: University of Illinois Press, 1998, 8.

¹⁴⁰ Dretske, F. “Epistemology and Information.” Adriaan, P. in *Philosophy of Information* (Handbook of the Philosophy of Science.). Ed. Johan F.A.K van Benthem. Amsterdam: Elsevier B.V., 2008.

¹⁴¹ Shannon, C. E., *The Mathematical Theory of Communication*, Reprinted with corrections from The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948. URL: <http://cm.belllabs.com/cm/ms/what/shannonday/shannon1948.pdf>, 1. See page 10 herein.

¹⁴² Hayles, N. Katherine. “Information or Noise? Economy of Explanation in Barthe’s S/Z and Shannon’s Information Theory.” *One Culture: Essays in Science and Literature*. Ed. George Levine. Madison: University of Wisconsin Press, 1987. 119-142.

¹⁴³ Dretske, F. *Knowledge and the Flow of Information*, London: Basil Blackwell, 1981., 42.

information.” For Dretske, *meaning* and *information* are both intrinsic to semantics, and it is not the case that “meaning is the only semantically relevant concept.”¹⁴⁴ He asserts that “[i]nformation theory should be able to tell us what information is without telling us what the word ‘information’ means,¹⁴⁵” and suggests that its meaning is simply the “commodity that, given the right recipient, is capable of yielding knowledge.”¹⁴⁶

To refine the definition of information, what it is, and how it exists and moves from an ontological and logical perspective is part of the project I pursue in my *The Ontology of Information*. Here I can only present those aspects of that project which are salient to developing the theoretical equipment for analysing texts with a view to then demonstrating the informational and discursive specialness of *SF* texts. The ontological definition of information which I present in Long[2] does not assert the centrality of perceptive agents, but sees it fundamentally as a *source event configured or causally configured effect*. In simpler terms, information is defined by the source which produces it, not according to the way it is perceived by intelligent agents, or expressed by linguistic agents. Information is not anthropocentric nor is it logocentric – it is a natural kind *first* and foremost. Lexical or linguistic information is of a secondary type which supervenes upon the natural kind. The natural kind is a-priori, the lexical *artefactual* type is contingent upon production by intelligent agents. Natural phenomena and intelligent agents are both *different types of sources of information*, but of course intelligent agents are themselves natural phenomena¹⁴⁷. When coupled with the theory of concepts as *internal sources* (information sources ‘in the head’), this is a foundation for a sound definition of *meaning* and *communication*, and a workable basis for an *informational epistemology*. A workable metaphysical theory of information provides a basis for understanding the synthesis of information from disparate information sources, which is key to understanding *SF* as involving special information synthesis and a special *information profile*. The above definition of information is absolutely central to this thesis, but this paraphrasing summary is sufficient for our purposes here.

DISCRETE LEXICAL INFORMATION SOURCES

Information *sources*, by the lights of information theory, are quite familiar to communication theory and information science in general. Information *types* are a more original and nascent postulate¹⁴⁸. As such I will begin with the normative definition of the *information source*. In his landmark 1948 paper *The Mathematical Theory of Communication*, eminent American mathematician Claude E. Shannon developed an applied mathematical theory which marked the beginning of modern machine-based communications as we know it today. Shannon was interested in facilitating efficient human communications over limited bandwidth telecommunications lines. He was interested in the *hi-fidelity* conveyance of teletype messages and human voice over noisy physical lines – cables that were imperfect media for conducting message carrying signals because of magnetic interference, malfunctions, material imperfections, and so on. To solve these problems, Shannon built a model in which the point of origin of any information to be communicated was called a *source*, and the point to which it would be communicated a *destination*. To go from the source to the destination, any *message* must first be encoded into a signal, then passed over a *channel*, then decoded from the signal so conveyed by a receiver, for final delivery at the *destination*. On Shannon’s model, any stochastic (statistically measurable or describable) *process* which produces a sequence of symbols, including a text (writing and parsing,) can be considered as a *source*.

¹⁴⁴ Ibid., 46.

¹⁴⁵ Ibid., 47.

¹⁴⁶ Ibid., 46,47.

¹⁴⁷ Long, B. For a detailed technical explication encompassing the philosophy of language, metaphysics, and the philosophy of information theory, see my monograph essay: Long, B. “The Ontology of Information.” (In preparation.)

¹⁴⁸ Long, [1] and [2].

We can think of a discrete source as generating the message, symbol by symbol. It will choose successive symbols according to certain probabilities depending, in general, on preceding choices as well as the particular symbols in question. A physical system, or a mathematical model of a system which produces such a sequence of symbols governed by a set of probabilities, is known as a stochastic process. We may consider a discrete source, therefore, to be represented by a stochastic process. **Conversely, any stochastic process which produces a discrete sequence of symbols chosen from a finite set may be considered a discrete source. This will include such cases as:**

1. Natural written languages such as English, German, Chinese.
2. Continuous information sources that have been rendered discrete by some quantizing process.¹⁴⁹

Note that although a discrete source is technically considered to be a generative *process*, regarding texts and languages as sources is not necessarily proscribed. A contemporary of Shannon, the Russian formalist Mikhail Mikhailevitch Bakhtin, regarded natural languages as heteroglot multi-discursive *processes* of development¹⁵⁰. This definition has the benefit that it accommodates the very real dynamic and changing nature of a living language – with a shifting, metamorphosing and (in the case of English) growing lexicon and semantic base. Shannon regards words in natural language to be themselves tantamount to symbols, as are letters and other graphemic or morphemic items, since words are defined in and can be chosen from a defined lexicon – a finite set. The model is the epitome of engineering and mathematical elegance, but its outworking is non-trivial, and employs some recondite pure and statistical applied mathematics, which I will elide. As already indicated, a source is any process that produces a sequence of symbols or a message. A text would generally be considered a message or a sequence of messages produced by a source on Shannon's theory:

Stochastic processes can also be defined which produce a text consisting of a sequence of "words." Suppose there are five letters A, B, C, D, E and 16 "words" in the language with associated probabilities¹⁵¹:

.10 A .16 BEBE .11 CABED .04 DEB
 .04 ADEB .04 BED .05 CEED .15 DEED
 .05 ADEE .02 BEED .08 DAB .01 EAB
 .01 BADD .05 CA .04 DAD .05 EE

Suppose successive "words" are chosen independently and are separated by a space. A typical **message** might be: DAB EE A BEBE DEED DEB ADEE ADEE EE DEB BEBE BEBE BEBE ADEE BED DEED DEED CEED ADEE A DEED DEED BEBE CABED BEBE BED DAB DEED ADEB.¹⁵²

As can be seen from the above example, the text or *message* on Shannon's model does not have to have any *meaning* in the normative sense. Semantics are not relevant to the functioning of a machine communication system, only the faithful encoding and transmission of a sequence of symbols, which is effectively the *message* in the discourse of information theory. Briefly, it is supposed that at any source there are a finite number of words to choose from and a finite (although prospectively very large) number of sentences and phrases that can be assembled from those words. Shannon develops a special logarithmic formula based on the mathematical principle of *Markov Chains* to determine what he calls the *entropy* of the source, and the *entropy* associated with each symbol or message *selected* at the source¹⁵³. In a Markov chain, the probability of each successive element (symbol or word) chosen is dependent on the immediately previous element only. Entropy means the amount of uncertainty involved in the outcome of the selection – the more alternatives there are to choose from, the more uncertain we are of what the next selected symbol or word will be. *Selection* here can be considered roughly tantamount to choosing a

¹⁴⁹ Shannon, C. E., *The Mathematical Theory of Communication*, Reprinted with corrections from The Bell System Technical Journal, Vol. 27, pp. 379–423, 623–656, July, October, 1948. URL: <http://cm.belllabs.com/cm/ms/what/shannonday/shannon1948.pdf>, 4-5.

¹⁵⁰ Bakhtin 356-57. It is difficult to read this 1934-5 essay without musing that Bakhtin's theory somehow directly or indirectly influenced Shannon's 1948 nomenclature. See especially the use of transmission, information and source 338-339, 342, 351.

¹⁵¹ This is the lexicon. In probability theory, probabilities add to 1.

¹⁵² Shannon, Op. cit., 6.

¹⁵³ Ibid., 1, 6-8.

word to put into a sentence. On Shannon's theory, if one has a set of only two words to work with, then the *uncertainty* associated with the set is *maximised* if each word has a 'fifty-fifty' chance of occurring. If one word was far more likely to occur than the other, then the more likely word would involve *less uncertainty*, just in the same way as a weighted coin or a loaded dice involves less uncertainty – because *it will be more certain that the more heavily weighted outcome will occur*. Less uncertainty means *less* information in Shannon's theory. Information scientists refer to *entropy* and information on Shannon's model as *Shannon entropy* and *Shannon information* respectively, *and the two terms are largely considered synonymous, or at least interchangeable*. *Shannon entropy*, which corresponds to a quantity arrived at mathematically, is generally considered as the definition of *Shannon information*. The term *entropy* was famously suggested to Shannon by Von Neumann, when the former could not think of an appropriate name for what it was he was dealing with¹⁵⁴. He sought a new term, with similar motivations to many SF authors when they implement a neologism for a novum: it referred to something specific and new, and the word 'information' was already overused. Shannon was seeking to signify ideational and conceptual newness, and to disambiguate terms. Unfortunately, Shannon's use of terms like 'entropy' and 'uncertainty' are ambiguous within the context of his theory, although this does not undermine his machine-mediated communications project¹⁵⁵. In any case, no understanding of the details of Shannon's formula are necessary here, only the understanding that *information* on Shannon's definition has a mathematical and probabilistic foundation, and that the Shannon information associated with a word in a sentence involves the probability and uncertainty that it will be chosen from a set of alternative possible words or terms.

The Shannon entropy (denoted H) of a stochastic process regarded as a source is actually calculated on the basis of the Shannon entropy of an arbitrarily long sequence or message produced by that source:

H is thus approximately the logarithm of the reciprocal probability of a typical long sequence divided by the number of symbols in the sequence... **a series of approximations to H can be obtained by considering only the statistical structure of the sequences extending over 1, 2,..., N symbols.**¹⁵⁶

Basically, a string, sentence, phrase, paragraph, chapter, book etc. can all be regarded as message sequences made up of symbols. There is in fact a time component involved in this definition, which I have elided for conciseness, but the average Shannon information in a long message is still the basis of the approximation used to determine the Shannon information of a source. Although not technically a stochastic process on Shannon's model, I suggest that a text can effectively be regarded as a *latent discrete source* of information, because the sequence of symbols or words generated in the processing of a text by the reader matches the sequence generated when the text is initially produced: the stochastic behaviour of the original source of the text is persisted in the message, and thus the message can be regarded as a source in isolation, and especially in text processing¹⁵⁷. As was noted above, Shannon regards a language as a source. On Shannon's definition of a source as any stochastic dynamic process, a text such as a book is not technically a source. However, Abramson demonstrates that source input alphabets, the set of possibilities for selection at the source as governed by probability laws, have an information/entropy measure, and I correspondingly regard a book or text as a latent information source.

THE TEXT AS MESSAGE AND SOURCE

As a persisted structured repository of a subset of a greater input alphabet, a text is clearly recognisable as very close to a source, as well as being a message or complex of messages. A similar view is propounded by William R. Paulson, who defines texts as information sources on the basis that they contain information generative noise, and with reference to Michel Serres' assertion of texts as sources of knowledge¹⁵⁸. I suggest that it is a latent source or potential source by virtue of its information-causal origins (having been produced by a source or sources) and information-causal potential. A deeper analysis

¹⁵⁴ Scientific American, Vol. 224, 1971, 178-184.

¹⁵⁵ Long, B. *Shannon and Dretske: Information Theory and Philosophy*, 2008.

¹⁵⁶ Shannon., Op. cit., 13-14

¹⁵⁷ Long B. *The Ontology of Information*, (In preparation).

¹⁵⁸ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 155, 32.

which makes reference to the metaphysics of *process philosophy* is necessary for a full explication, which I will not pursue here. Suffice it to say that there is specific information encoded in the text when it is regarded simply as a *persisted repository*¹⁵⁹: it exists as a discrete image of the source that produced it over time¹⁶⁰. This conception fits with Dretske's adaptation of Shannon's theory for specific *signals*, whereby he accommodates *specific* message selection and transmission instances, rather than the average of runs¹⁶¹ of the same which Shannon's own application to efficient machine-mediated communication requires. Dretske is interested in the amount of information from a specific selection event or state of affairs at a source – resulting in a specific message or symbol - that a signal manages to convey to a receiver:

Although the surprisal of a **given event**...and the amount of information carried by a **particular signal** are not significant quantities in engineering applications of information theory...these *are* the important quantities for the study of information as commonly understood, and hence for the kind of cognitive studies that depend on a semantically related concept of information.¹⁶²

Dretske does not explicate what the ontology of this kind of singular signal would be. It can be regarded as a singular representation which captures some, but – due to normative information loss - not all, of the outcome of a specific individual selection event or message generation event. Presumably for discrete sources (those which involve one discrete selection event at a time) it would involve the representation for transmission of the outcome of one symbol or message selection event only. As such, an individual sequence of symbols such as a text, regarded as just the kind of source state 'snapshot' which I have proposed – a persisted repository which stores the message selected by a source – may be regarded also as a signal in the way that Dretske posits above. Dretske's 'particular signal' is, on my information ontology, another source in a *causally related* set of sources. Dretske is cognisant of the consequences of his metaphysically attuned adaptation of Shannon's averaging mechanism:

It should be emphasised (if only for the benefit of those who will accuse me of *mis*representing or *mis*understanding communication theory) that the above formulas [elided] are now being assigned a significance, given an interpretation, that they do not have in standard applications of communication theory. They are now being used to define the amount of information associated with particular events and signals¹⁶³

If we treat this current sentence as a discrete text source, as I am apt to do on the proposed model and theory, then the *Shannon* information associated with the third word in it is a function of the number of possible words that could have been used in that place, and the statistical likelihood of that particular word occurring given the second word¹⁶⁴. Ideally, the grammar and syntax of English also matter in the calculation. Especially if neologisms and other nuances (such as breaking from normal grammar) are allowed, the objective probability of a word decreases, and uncertainty (and therefore entropy) increases, dramatically in accordance with the very large number of possible word-symbols¹⁶⁵. Especially if the neologisms and vocabularies of the sciences are included, the English language does not involve a lexicon of fixed magnitude anyway, being as it is constantly updated with new terms and words. Add to this the propensity for new technology and science to cause the propagation of new discourses and vocabularies associated with related techno-cultural enclaves such as cyber-culture. The *SF mega-text* itself feeds back into this lexical source set and the linguistic milieu associated therewith. Shannon overcame this for discrete sources of lexical symbols by assuming approximate finite lexicons and sets of symbols: relying on *frequentist* objective probabilities in tables derived from actual measurement of texts¹⁶⁶. Tom Shippey's

¹⁵⁹ Ibid. On my information ontology, a *persisted repository* is anything which records, remembers or *persists* information generated by a source. Books and databases are both persisted information repositories. Persisted repositories are also *latent sources* as defined here.

¹⁶⁰ What I refer to more technically as that source's *configuration* over time.

¹⁶¹ Or, statistically speaking, *blocks* of selected messages

¹⁶² —. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981., 52. (emphasis mine.) The selection of a word for inclusion in a sentence is an example of a **given event**.

¹⁶³ Ibid., 52.

¹⁶⁴ Technically, this digram probability can be extended to a trigram probability, and so on.

¹⁶⁵ There is a debate amongst mathematicians and philosophers over the veracity of the idea of a truly objective probability measure in any case.

¹⁶⁶ Shannon, Op. cit., 6 (including footnote 5) Later examples can be found in Lyons, Op.cit., 92-4.

application of Shannon information to Suvin's novum is based on these objective probabilistic results and on the concomitant idea of the *redundancy* of a natural language, and would also seem to intrinsically require something like Dretske's adaptation for particular selection events and signals since a text is a message generated by sources involving processes. *Redundancy* is linked with the ratio of the information actually in a given specific text source of a certain number of symbols/words to the maximum amount of information which that text source *could* contain with the same number of words and using the same lexicon. Shannon explicates this idea quite succinctly:

The ratio of the entropy of a **source** to the maximum value it could have while still restricted to the same symbols will be called its *relative entropy*...**One minus the relative entropy is the redundancy. The redundancy of ordinary English, not considering statistical structure over greater distances than about eight letters, is roughly 50%. This means that when we write English half of what we write is determined by the structure of the language and half is chosen freely.** The figure 50% was found by several independent methods which all gave results in this neighborhood. One is by calculation of the entropy of the approximations to English. A second method is to **delete a certain fraction of the letters from a sample of English text and then let someone attempt to restore them.** If they can be restored when 50% are deleted the redundancy must be greater than 50%. A third method depends on certain known results in cryptography.¹⁶⁷

This description also suggests that natural languages and subsets of the lexicons thereof can be regarded as kinds of latent source.

LINGUISTIC INFORMATION REDUNDANCY AND THE NOVUM

Shippey determines that the novum *diminishes redundancy* in a text¹⁶⁸. If you add more symbols or words to the lexicon, you increase the *number of possible choices*, thereby *increasing* the uncertainty involved with each word choice or selection. This increases the *surprisal* or Shannon-information value of each selected word unit. This in turn *increases* the Shannon entropy of the text and source overall. If one then makes the words in the set all *equally* probable, resulting in a situation like a fair dice or coin in terms of possible outcomes of word selection, this results in the *maximum* possible surprisal value for that lexical set. In an actual natural language lexicon, this ideal scenario does not obtain. If you increase the number of *low probability* words in the genuine (not ideal) lexicon, say by including more novums, such that the probabilities of the words in the set both *vary* greatly *and* are distributed over a greater range of possible values, this *reduces* the *actual* information associated with the lexicon as a source. This will in turn result in an *increase* in relative entropy – the ratio of the ideal maximum possible entropy to the actual entropy. This in turn results in a *decrease* in redundancy (which is 1 minus the relative entropy.) An early coverage by linguist John Lyons explains how redundancy applies to individual words:

Redundancy is therefore a matter of degree...In general, the more probable a unit is, the greater its *degree of redundancy* (and the lower its information content.)¹⁶⁹

Remember that for Shannon information, greater *uncertainty* in the selection of word accompanies a greater number of possible less probable word options, which results in what Shippey refers to as 'high-information': more Shannon information being associated with a given word. Novum neologisms and phrases are low probability messages and therefore have low redundancy and high information. If one removes a novum neologism from an SF text, it will be very difficult for a reader to determine it. Shippey illustrates this by comparing novums in SF texts to words in more normative texts like Orwell's *1984*. Shannon performs a similar analysis in his 1948 paper:

¹⁶⁷ Shannon, op. cit., 14.

¹⁶⁸ Shippey., Op. cit., 15-16.

¹⁶⁹ Lyons, J. *Introduction to Theoretical Linguistics*, Cambridge: Cambridge University Press, 1968-9.68, 85.

Two extremes of redundancy in English prose are represented by Basic English and by James Joyce's book "FinnegansWake". The Basic English vocabulary is limited to 850 words and the redundancy is very high. This is reflected in the expansion that occurs when a passage is translated into Basic English. Joyce on the other hand enlarges the vocabulary and is alleged to achieve a compression of semantic content.¹⁷⁰

Note that the reference to semantic content here is allusive, and does not indicate that Shannon considered his theory to be about meaning. The semantic content arises from the linguistic implications of the vocabulary associated with the symbol sequence or message selected by author James Joyce functioning as a source. In enlarging the vocabulary in his text, Joyce automatically decreases the probability assigned to each symbol in the lexical set, since probabilities always add to 1, and thus increases the uncertainty associated with each word, as well as the overall uncertainty of the text. Moreover, the vocabulary expansion Joyce implements presumably contains a lot of unlikely or surprising words, and correspondingly a greater range of word probabilities. This increases the relative entropy of his text, and decreases its redundancy. Joyce behaves as a high-uncertainty source of information in terms of the words he selects. Increasing vocabulary increases the *overall* uncertainty and entropy of a text as a message and as a source.

Lyons understands and linguistically integrates the concepts of redundancy and the surprisal value of words (as leveraged by Shippey) for statistical language structure, but then goes on to attempt to reconcile and ultimately identify information with meaning by asserting that meaningfulness for words involves 'having meaning' and for phrases or sentences involves significance. 'Having meaning' is asserted to be logically prior to the latter on the basis of the Shannon surprisal value of the lexeme in its syntagmatic context¹⁷¹. For Lyons, "a linguistic unit of whatever level, has no meaning in a given context if it is completely predictable in that context¹⁷²" and "having no meaning is merely the limiting case of complete 'predictability'.¹⁷³" This assertion ultimately rests on the "widely accepted principle that 'meaningfulness implies choice.'¹⁷⁴" This somewhat circular maxim is *petitio principii* and is neither rigorous nor convincing as the foundation of a theoretical identity relation between lexical information and linguistic meaning. It does not convincingly follow that a lexeme is meaningless just because it conveys no information in the syntagmatic context in which it is used. The word *it* in the previous sentence is completely predictable, if only one word is allowed in its place, based on the flanking grammar and lexemes in syntagmatic context, and thus its Shannon surprisal is 0. However, it is hard to see it as meaningless, by an intuitive conception of meaning, on this basis. Moreover, the surprisal value of a symbol or message underlying the measure of Shannon information must be applicable to any sequence of symbols produced by a discrete information source – even nonsense or random strings such as !\$4b%oPH. In the context of an English language syntagm like "it's really very !\$4b%oPH", the string !\$4b%oPH has a very high surprisal value. It is very unexpected in the context of an English syntagm relying on the English lexicon and English grammatical rules, and would be nearly impossible to predict if removed. However, it would be hard to defend the semantic value of !\$4b%oPH as involving the having of meaning. If one asserts that only words in the English lexicon count as valid for selection, as Lyons presumably does, then neologisms of the kind employed in SF texts and scientific theories become instantly problematic. Such words are very unexpected within their contexts, but have little meaning for the uninitiated reader if Lyons' meaning-choice maxim is applied, since they are not available to be chosen from the formal English lexicon. The string "it's really very *fligglemorph*" is perhaps more predictable than !\$4b%oPH since its construction obeys principles which guide phonological structure in English, but still it has a high Shannon information or surprisal value implying lots of statistical choice, whilst having no discernable meaning. It thus can't be the case that unpredictability is the key component of 'having meaning,' since this would result in such gibberish inside and outside of language contexts having meaning. Moreover, source selection of words

¹⁷⁰ Shannon, Op. cit., 15.

¹⁷¹ Lyons, J. *Introduction to Theoretical Linguistics*. Cambridge: Cambridge University Press, 1968-9, 89, 412-414.

¹⁷² *Ibid.*, 89.

¹⁷³ *Ibid.*, 415.

¹⁷⁴ *Ibid.*, 413.

and messages in the case of English utterances and sentences is presumably somehow influenced a-priori by their 'having meaning.' 'Having meaning' thus cannot be as simple as unpredictability in selection, since selection for a language user source seems to require something beyond statistical unpredictability based on statistical possibilities referred to as choice. *Choice* in Shannon's theory and in Bayesian statistics is simply a statistical synonym for the number of different possibilities in a set. No agency is inferred or required for this definition.

As Shannon, Warren Weaver and philosopher Fred Dretske all emphasise, Shannon entropy is not intended to capture or convey any sense or meaning – only to provide a measure of a lexical or analogue 'message' via a physical signal. Because of his project of establishing an informational epistemology, Dretske must ensure clarity on this point:

Shannon has said that the semantic aspects of communication are irrelevant to the engineering problem. So they are... [Warren] Weaver warns the reader that in this theory the word "information" is used in a special sense which must not be confused with its ordinary usage. Other authors caution the reader not to confuse the sense of information appropriate to this theory with the *value* of the received information...The utterance "There is a gnu in my backyard" does not have *more meaning* than "There is a dog in my backyard" because the former is, statistically, less probable. It is not even clear that one can talk sensibly about "amounts of meaning" in this way".¹⁷⁵

This is one reason why Dretske, pursuant to developing an informational externalist epistemology, first attempts to establish a *semantic* theory of information¹⁷⁶. Meaning is not *in* the signal per se, nor the message conveyed using the signal. The *signal* in the case of SF texts, or any text for that matter, is constituted by a number of things including the physically inscribed text – the type on the page. The message or messages are those lexical patterns – letters, words, sentences, phrases etc. - which are grammatically, syntactically and linguistically encoded into the text by virtue of *combination* with information (at the agent-destination) from a variety of other internal (mental) and external sources, including those which encapsulate information about language and grammar. Dretske *locates* meaning at the conflux of the information in the signal from the source and the *background knowledge of the receiving agent*, and that agent's ability to somehow thereby recognise the information that is present at the source¹⁷⁷. Thus, information on Dretske's model, and thus on Shannon's model, *does* have *something* to do with meaning – but not in the way that Lyons suggests. As I will explicate more fully later, what is important on my theory is that meaning, whether defined as reference, or in psychological terms, or some other way, *supervenes* on the structured information that is the text in a *strong sense* of supervenience: a change in the *selected* information – the selected symbols, graphemes, morphemes and phrases - will necessarily result in some change in the encoded meaning – whatever meaning is defined to be - even if the change is very trivial or subtle. Importantly, Dretske's amendments to Shannon's theory for semantics and epistemology implicitly acknowledge the critical place of a well thought-out metaphysics of information, due to the complexities of information exchange and flow in communication, but making the information at a source itself dependent on an independent receiving agent is problematic.

CONCEPTS AND INFORMATION SYNTHESIS

I think the reason Dretske develops a slightly metaphysically and logically convoluted model is because he adheres closely to Shannon's source-transmitter-channel-receiver-destination model for all information transfer cases, and is thus driven to reconcile it with the effect of shared background knowledge without recourse to information from other sources, including internal concept sources:

¹⁷⁵ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 41.

¹⁷⁶ *Ibid.*, 62-3.

¹⁷⁷ *Ibid.*, 80-81.

Information...is a relative quantity...For often enough, a known frame of reference is understood. Every relevant party knows the same thing about the possibilities existing at the source...a receiver's background knowledge is relevant to the information that he receives (both *how much* information and *what* information)¹⁷⁸

It think, however, that every relevant party – every reader, for example - does *not* necessarily possess the *same information about* the possibilities at the source. This frame of reference is an abstraction which I think, in the case of artefactual information and information theory, misleads. However, the receiver's background knowledge *is* relevant to the information which they *combine* with the information they receive, resulting in the *synthesis of nascent information*. Nothing in the agent-receiver-destination's head affects *what happens* at a remote external source – but the information synthesis that occurs in their head will involve different amounts of *veridical* information based on the agent's existing internal information. It's not that what a *reader* knows actually *changes* the information of a specific *text* – it's that there are multiple internal information sources generating information and contributing to *information synthesis*. *Some* of those *internal* sources are in turn informed by external sources of various *types*.

Dretske's theory caters for the acquisition of natural information via *digitalisation*, to effect knowledge through perception. To this end, he posits that all knowledge depends on the *digitalisation* of information – the perceptual *encoding* of analogue information from continuous sources for human cognition. Dretske is referring primarily to information as extracted from an external material analogue source and rendered into internal *semantic structures* and ultimately *cognitive structures* - which he proposes are synonymous with *concepts* - through sense perception¹⁷⁹. In Long[1], I suggest that such cognitive structures should be regarded as combinatory, and that they in fact constitute internal information sources of a certain highly organised type. The process involves a loss of external natural information¹⁸⁰. This model of loss in conversion also applies to lexical *artefactual* information such as texts. These posits bring to mind Suvin's assertion that naturalistic fiction is marked by its tendency to textually represent the author's environment as experienced sensory-empirically¹⁸¹. Thus the process of digitalisation that an author performs against what Wolfgang Iser calls the referential field from which she is drawing her inspiration, facts and ideas for processing and decoding the text, means that the text is broadly produced by a *lossy*¹⁸² coded representation of the information in her referential fields via what I refer to as the author's internal sources¹⁸³. I do not subscribe to the idea that we are possessed of a 'mentalese' – a *lexical* basis for thought (nor, I think, does Dretske.) However, language is the primary mechanism for outputting and encoding *artefactual* information in *external* sources like texts, and as such it clearly abstracts-out significant amounts of information about any real state of affairs.

Numerous literary theorists have posited conceptions of synthesis and meaning construction in texts and text processing. Wolfgang Iser, in his *The Act of Reading: A Theory of Aesthetic Response*, ultimately proposes that it is a synthesis of *knowledge* that occurs during text processing. Australian theorist Richard Harland suggests that it is *meaning* that is synthesised syntagmatically through sentential atomic cohesion¹⁸⁴. Neither suggestion is perhaps ultimately satisfying since neither theorist offers rigorous explication or elucidation of key theoretical terms: knowledge in Iser's case, and meaning for Barthes' and Harland's. SF author and self-taught literary theorist Samuel R Delany, in a feat of perspicacity perhaps twenty years ahead of its time which closely anticipates both Harland and Shippey's efforts of 27 and 38 years later respectively, isolates information as the central component of *his* syntagmatic sentential explanation of how meaning is *estranged* in science fiction, thus making science fiction unique on an informational basis or *informationally*. Although Delany seems to conflate information with the somewhat nebulous conception of *content* as popular with the new wave science fiction writers of the 1960s, his syntagmatic *algorithm*, as Broderick

¹⁷⁸ Ibid., 80.

¹⁷⁹ Dretske, Op. cit., 175, 177, 180, 183, 188, 189, 193, 195, 211, 212, 214, 215, 218.

¹⁸⁰ Dretske, Op. Cit., 183, 215, 217, 230.

¹⁸¹ Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980, 18.

¹⁸² Lossy: *adj.* Involving a loss of information or data (another information age neologism.)

¹⁸³ Iser, W. "Reception Theory." in *How to Do Theory* Ed. Wolfgang Iser. Malden: Blackwell Publishing, 2006., 60.

¹⁸⁴ Harland, Richard. *Beyond Superstructuralism*. London: Routledge, 1993, 61, 63, 93, 187.

describes it, largely holds together on my own analysis, and both superstructuralist Harland and neo-structuralist Tom Shippey provide indirect inadvertent support for it in their much later theses¹⁸⁵.

At this point, the persistent and difficult question of what *meaning* explicitly *is* has still not really been satisfied. If meaning in a fiction (or non-fiction) text is defined as ultimately arising from some kind of ethereal transitory or persistent agglomeration of unidentifiable or undefinable components of an arbitrary socio-cultural, psycho-social, empirical and historical *Zeitgeist*, then any definition thereof becomes something largely inaccessible as either subjectively or objectively coherent in any intellectually satisfying way. If we regard such abstractions as Broderick's mega-text as non-analytic and *ideally* unquantifiable - which assertion would seem errant in the light of Broderick's analytic orientation - then a definition of meaning should remain immutably elusive. Let us posit that the definition of meaning should not only provide some kind of conceptual coherence and exactitude, but also allow us at minimum to speak sensibly of a text encoding or not encoding some particular atomic meaning: to be able to say that it does mean this but it does not mean that, even upon a relativist interpretation. If we define meaning as supervening upon the outcomes of *information synthesis*, meaning is then combinatorial, contingent and temporally determined. On the information synthesis thesis, meaning may be regarded as ideally and (in some cases) practically determinable.

I suggest that *meaning supervenes on internal information synthesis: upon the associative mentally mediated combination of information from multiple internal and external sources*¹⁸⁶. Textual meaning simply *is* the *internal cognitive and epistemological effects or outcomes which arise or emerge during internal information synthesis* of the kind which occurs when an actual text is read by an actual reader - what I will refer to as *read-time* synthesis. The real finite mechanisms of meaning encoding and decoding during *write-time* and *read-time* synthesis are abstracted out of my model: their investigation being the domain of neuroscience and cognitive science. The mechanism whereby meaning and narrative in a text supervene on the information of that text is subsumed to the principle of *supervenience*. Whatever *exactly* is going on at the neural and cognitive level during information synthesis when an actual reader reads a specific actual text - at *read-time* - is currently inaccessible even to neuroscience, but I am asserting that - whatever it is - it does involve *information synthesis*, and *whatever meaning actually is, it does supervene upon the information thus synthesised*.

Thus if a certain meaning, or narrative, or whatever - call it encoding B - supervenes on the latent artefactual information source that is Heinlein's phrase "everything that is of any importance is founded on mathematics"¹⁸⁷ - which phrase we will call 'A' - then any change in the phrase A will result in an encoding somehow different to encoding B. On this theory, even a transposed synonym will result in a difference in what is encoded into or by a message¹⁸⁸, so that if phrase A was instead "everything that is of any importance is **based** on mathematics" or even "everything of any importance is founded on mathematics" then in each case whatever is encoded upon A - meaning, or narrative, or knowledge, or semantics - must be different *in some way* from B¹⁸⁹. If phrase A is included in a larger message, then changing any other part of the selected message - any part of the artefactual information - will have the same effect on the supervening encoded meaning or narrative (or whatever) of the total message including A within it. If meaning arises from and supervenes on the synthesis of information due to the combination of internal and external information sources, as I think it does, then meaning will be determined by the set of sources providing information at the time of perception and interpretation: at the time of text processing in the case of reading. An author may encode a specific meaning during *write-time* information synthesis, which meaning is thus encoded in the text produced, albeit with the effects of information loss. However, that same specific meaning will only be accessible/decodable at *read-time* if the reader synthesises a contributing information source set which significantly intersects with that of the

¹⁸⁵ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 67.

¹⁸⁶ It is the strong sense of supervenience which is required. This will be explicated more fully in the next two paragraphs.

¹⁸⁷ Free indirect thoughts of first person character narrator Juan "Johnnie" Rico in Robert A. Heinlein's *Starship Troopers*

¹⁸⁸ Remember - a message is any selected string of symbols, graphemes, morphemes, phrases, sentences etc. of any length, including an entire 'text'.

¹⁸⁹ In the third re-organisation of the phrase, the meaning is arguably less precise and specific, since 'that is' may preclude past tense or subjunctive stipulation.

writer. This would seem to fit intuitively with Suvin's observation – with apparent disregard for Barthes' *death of the author* - that SF worlds seem to have different meanings based on the intention of the author¹⁹⁰.

An elegant upshot of this information synthesis model is that once the read-time cognitive response has occurred, further cognitive and aesthetic effects can then arise from the further synthesis of the newly synthesised information, and the meaning which supervenes upon it, with other information in pre-existing internal sources. This opens the way also for an informational explanation for the *cognitive aesthetic*, and also for the realisation of the *aesthetic of complexity* in SF, which I will expound upon in chapter four. The ambiguities and “elements of indeterminacy which enable the text to ‘communicate’ with the reader¹⁹¹” in such a way that the “relative indeterminacy of the text allows a spectrum of actualisation” without complete arbitrariness of meaning, arise because of the indeterminacy of the contributing information source set in any given read-time or write-time synthesis. This indeterminacy does not make the source set any less materially real, but is simply a result of the finite mental capacities of the reader and author, and the information loss involved in write-time and read-time syntheses.

The possibilities associated with any given *lexical* source and selections thereat are estimable or knowable for human languages like English. Shared background knowledge supervening on contributing source sets is generally *practically* unquantifiable, but information theory allows for external veridical sources to commonly inform the internal sources of many reader-perceivers. Reductively speaking, Broderick's mega-text operates in just this way: it exists as an external source set, the boundaries of which are abstract and the contents of which not readily or practically quantifiable, and which can inform the internal sources with variation in information content from individual to individual. Thus the mega-text is ultimately a source set which includes external and internal sources contributing arbitrarily to write-time and read-time synthesis. When any number of practised SF readers engage in processing an SF text, and when an author is selecting its constituent symbols in writing it, all agents have differing access to the SF mega-text as a set of external sources. They do not each possess information from the same subset of those SF mega-text sources, nor even the exact same information from any one shared source, nor are any of their internal novums or SF codon concept tokens exactly the same. However, all initiated readers share enough information distributed across internal concept sources to allow them to identify many of the SF codons they encounter, and to assess any novum in an *informed* way – since they have acquired or had transmitted to them similar or the same words or neologisms before in the context of information synthesis across a set of sources containing information associated with SF – SF texts, utterances from remembered SF conversations, and existing internal SF ideas. Moreover, if the author has written hard SF or SF *proper*, many of the terms selected by the author operating as a source will include those drawn from sources associated with science and scientific theory and discourse.

So, at this juncture we have a definition for texts as discrete latent external information sources, and another for concepts as internal sources. The next salient information theoretic postulate is *information typology*, which is due neither to Dretske or Shannon, but is my own offering. Dretske deals informationally with concepts and what he proposes to be their informational and propositional contents, via *digitalisation* of external analogue information to produce internal cognitive digital information.

VERIDICAL INFORMATION AND PSEUDO-INFORMATION IN SCIENCE FICTION TEXTS

One of the most recondite theoretical undertakings that faced Dretske was determining how external analogue information sources inform the knowledge of intelligent agents with different background knowledge¹⁹². It is my conviction that this undertaking is far easier if one recognises not only Dretske's analogue and digital information kinds, and Shannon's *continuous* and *discrete* information, but also many other kinds or *types* of information, and a typology to accompany them. The objective basis for such a typology is that there exist ontologically fundamentally different types of *source*. The type of information is

¹⁹⁰ Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980, 59.

¹⁹¹ Iser, W. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978., 24.

¹⁹² Dretske, Op. Cit., vii, 80-82.

determined by the type of source which encapsulates, emits or generates it¹⁹³. Critically for the application to informationist SF theory, the typology of information is rooted in the relationship of the textual source to a veridical source of some kind – a source which involves materially, mathematically or logically verifiable actual objects or phenomena – a source with a *configuration* which is materially actual or corresponds to a real state of affairs, including those objects which are not physical but mathematically/logically veracious like the number 2. ‘ $2 + 2 = 4$ ’, for example, is an artefactual lexical information source the configuration of which encodes veridical information. An SF reader’s physical body is a veridical information source of a different type, encapsulating a different type of veridical information. Briefly speaking, the information encapsulated within it is non-lexical, natural and incidental. Natural information can be *veridical* only: its source is necessarily something real. Artefactual information is not necessarily veridical. A lexical message which is selected on the basis of *concepts* of unreal things, or of counterfactuals, constitutes *pseudo-information*. Pseudo-information is *necessarily* artefactual information, and does entail the implications of encoded *semantics*.

Artefactual lexical sources – texts for example – often encode information which is not correlated with nor was synthesised from any material source in the real world – no *real* or actual object or information source is associated with them. There are many material inscriptions of descriptions of unicorns – textual sources whose configurations encode the inscribed word ‘unicorn’ in English or some other language – but there is no actual *scientifically* examinable material configuration in the real world which we could rationally map to the semantics encoded by the linguistic lexical artefact ‘unicorn’. The information associated with such words and texts is what I refer to as *pure pseudo-information*¹⁹⁴. It is to specific information types that we now turn to bring informationist SF theory to full fruition.

I refer to information which is true, pace Dretske’s axiom of necessary information-truth coupling, as *veridical* information. Such information can only come from a *veridical* source: something that corresponds with a material state of affairs or logically or empirically adducible fact or facts. Artefactual veridical information is necessarily true information about the actual world which has been produced by humans *for the purpose of communication*. However, for the purposes of analysing fictions and counterfactuals, I introduce the concept of *artefactual pseudo-information*. Information synthesis involves the combining of multiple *types* of information from multiple ontologically or semantically different *types* of sources to produce a new source of another type, such that *novel* information emerges. In the case of write-time and read-time synthesis of fiction texts, *artefactual veridical information* and *artefactual pseudo-information* are most often combined.

Journalistic, historical and biographical writings and texts ideally attempt to represent factual information – what I refer to as *veridical information*¹⁹⁵. *Veridical* information associated with such modes of writing corresponds and refers to actual verifiable material facts or states of affairs in the real world: human affairs, historical events, cultural movements, personal history, and so on. There are sub-types of the veridical information type. They involve information loss due to their dependence on artefactual sources. The problems of determining the facts of history, biographical or otherwise, are well understood. One can’t prove (non-natural) history in the scientific sense, since historical artefacts and artefactual information are open to interpretation. This is precisely because human action and behaviour is rendered unpredictable by human intellect and volition, and is not nomologically predictable. People are cognisant of the arrow of time and can intentionally evidentially obfuscate or ‘rewrite’ history, undermining the historian’s ability to avoid uncertainty in many cases. Scientific theories and texts and the discourses that accompany them are centrally interested in the types of *veridical information* associated, not with human affairs or political events or *sociological* cause and effect, but with material physical states of affairs in nature and the physical world. Thus *veridical information* (materially, logically, or mathematically verifiable) is the type of information with which science is ideally *ultimately* centrally preoccupied, even if it is pursued via

¹⁹³ Long, B. “The Ontology of Information.” (In preparation.)

¹⁹⁴ Long [1], Op. cit.

¹⁹⁵ Long, B. “The Ontology of Information.” (In preparation.)

defeasible scientific theorising established with abstract mathematics or the interpretation of experimental results. With the possible exceptions of abstract mathematics, the statistically based revelations of apparent indeterminism in quantum mechanics, and string theory in physics, science understands nature as involving complex and immutable patterns and laws which are best inscribed and interpreted mathematically or with rigorous, conceptually and symbolically consistent (but defeasible and revisable) methodological tools. The natural physical world is understood by scientists and many non-scientists alike to require a special kind of rigour and exactitude to be explored and understood adequately and convincingly, such that effective, falsifiable, verifiable and accurate concrete knowledge can be acquired about it. Fiction, of course, has no such demands upon it, which is indubitably why supernaturalist and mystical religious texts and dogmas resemble, exist as or incorporate, mythologising fiction - albeit admixed with historical, quasi-historical or material facts in some cases. Such texts encapsulate a different type of information altogether from the sciences: *pure pseudo information*¹⁹⁶. I will refer to the pseudo-information of mythological, fantasy, fairy tale and mystical texts as *pure pseudo-information*. Such information either comes from sources which are not *veridical*, or arises from the *synthesis* of information from sets of information-contributing sources such that the resulting *synthesised* information is not veridical because of the inclusion of non-veridical sources, or the confusion of veridical information from multiple veridical and non-veridical sources¹⁹⁷. Veridical information comes from *veridical sources*: real sources involving possibilities and ontological configurations which are materially and physically falsifiable, empirically and materially verifiable, and/or mathematically or logically consistent and provable¹⁹⁸.

When a large proportion of the artefactual lexical information encapsulated within an artefactual lexical source such as a text does not in actuality *trace back* to material facts and states of affairs in the actual world as would be the case for a *veridical information source*, this is indicative that the textual/lexical source is fictive, and that the type of information therein is therefore largely *pure pseudo-information*, or possibly *counterfactual pseudo-information*. The source set which influences the selection of words to include in pure pseudo-informational artefactual lexical messages includes a large proportion of internal sources or other artefactual pseudo-information sources, such that no reliable synthesis of internal source information with external veridical source information is effected¹⁹⁹. This is because there is either no materially or mathematically real source (object or state of affairs) which *informs* the word selection at all, or if there is, then the information from such a source is so admixed with both pseudo-information and veridical information from other internal and external artefactual and natural sources that the resulting synthesised information is no longer *veridical* with respect to the original veridical source in question. The information from the other sources in the contributing set behaves as *noise* according to Shannon's model. This will be especially so if none of the sources in the contributing *lexical artefactual source set* – the set of texts which contribute information to the synthesised message or text – are veridical. In the case of pure pseudo-information, neither do any of the linguistically encoded semantics *supervening upon the information* in the contributing *lexical artefactual source set* refer to any veridical source.

Fred Dretske's *digitalisation* process *necessarily* involves information loss. Internal sources which contain veridical information are thus imperfect when compared with the external sources from which their information originated: my concept of my bicycle is quite informationally imperfect. It will be missing a lot of information which an actual bicycle encapsulates as a veridical information source²⁰⁰. The internal *concept sources* possessed by an author or speaker are themselves real and veridical, much like pseudo-informational text sources are materially real and veridical as physical objects. However, information received, absorbed or acquired *from* external veridical information sources and then *encoded and encapsulated within* actual existing internal (concept) sources is always *equivocal* and *lossy* due to *digitalisation*. Internal sources (concepts) which encode and encapsulate *pseudo-information* have synthesised that information

¹⁹⁶ Long [1], Op. cit.

¹⁹⁷ Ibid.

¹⁹⁸ Ibid.

¹⁹⁹ Ibid.

²⁰⁰ The paint, pedals, alloy, shape etc. were all selected from a large number of possible options.

from other internal sources with loss, and if there is any information encapsulated and encoded within them from external veridical sources, then the loss of information is so great that any information remaining is no longer veridical. Strictly interpreted on *Shannon's* model, other internal sources contributing to the information synthesis would constitute *noise* sources with respect to any external veridical source considered as *the transmitting source*.

With words or terms associated with veridical lexical artefactual information (texts), *there is always a veridical external source which has somehow contributed veridical information to the word selection/choice*. There is at least one veridical external source included in the *contributing information source set* – a materially, empirically or mathematically verifiable object, event or state of affairs. The author of an SF novel may, or may not, have first-hand experience with a gas laser, a moon of Jupiter, a synaptic firing, the Riemann Zeta function, a fractal compression algorithm, or a space shuttle. However, if they are writing hard SF, then the information associated with the corresponding selection of scientific terms and scientific discourse in the text ultimately comes from actual existing veridical sources corresponding to these existent entities and states of affairs. The encoded semantics of the messages, and the words and terms that comprise them, will supervene on information originating with these objects and states of affairs regarded as sources. Simply put, there exist real gas lasers, moons of Jupiter, fractal compression algorithms and Space Shuttles, and instances of these, and the real states of affairs which such instances are part of, constitutes non-lexical veridical information sources in and of themselves. If such a source ultimately contributes veridical information to the lexical artefactual information of a text, the linguistically encoded narrative and semantics references the source faithfully. Genuine competent SF texts rely on source sets which include artefactual lexical sources such as scientific texts and theories, and natural and incidental sources such as materially and mathematically verifiable states of affairs and objects. Information from these sets is synthesised in such a way as to preserve and re-represent veridical information within the text, even if the text encodes a fiction *overall*, and is thus itself pseudo-information *overall*.

Most fiction is encoded – written - not with any immutable *mandate* for the encapsulation and conveyance of facts, but for fictive narrative purposes: aesthetic, affective, metaphorical, allegorical, etc. Ontologically speaking, a text that *lexically* encodes *pseudo-information* is technically still a source of *veridical information* on a different level, since it exists physically as an inscribed lexically structured source. That is to say, an instance of the text is physically existent, and has grammatically and linguistically ordered symbols inscribed upon, or represented on, it. There is some significant measure of *veridical information* associated with such a source from an ontological and empirical perspective. An uninitiated intelligent alien being could feasibly gain from it *veridical information* associated with grammar, vocabulary, printing techniques, text formatting, human reading practices and so on. Moreover, as has already been demonstrated, fiction texts invariably include *some* veridical information in terms of what is lexically encoded within them, and embodied in the semantics grammatically and linguistically encoded by the text, because they include some references to real objects or states of affairs. If we consider an otherwise pseudo-informational textual source such as J.R.R. Tolkien's *The Hobbit*, any information therein putatively associated with Hobbits as an information source is pseudo-information, but that does not mean that to say the message “the text is about fictional characters called Hobbits” would involve pseudo-information. This would be instead true or veridical information, for which a material instance of the fictive text *The Hobbit* could *itself* be regarded as a *veridical source*. The selection of the message “the text is about fictional characters called Hobbits” is informed by a large set of veridical information sources, including presumably the text itself, its location in the bookstore or library, the marketing text on its cover, the definition of fiction, texts on literary theory, reviews, encyclopaedias, and so on. A text can thus behave as a source of different *types* of information. A textual artefact can behave as more than one *type* of source. In terms of the information ontology being here utilised, this is *not* true of a non-lexical, natural, incidental material configuration like a moon or an atom, which is a *veridical source only*. Human-abstracted artefactual lexical information sources like texts are *multiply realised*. Because of encoding and synthesis, they can encapsulate multiple information types. You *can* get the *veridical information* corresponding to the artefactual lexical source-message “the fictive text *The Hobbit* is about a fictive character called a Hobbit” from the text that is *The Hobbit* itself. So a physical sample of the text *The Hobbit* can also stand as a *veridical source*. However, none of the information *upon which the encoded semantics about the actions and thoughts of Hobbits supervenes* can be regarded as

veridical. For example, “This Hobbit was a very well-to-do Hobbit, and his name was Baggins” encodes little or no meaning associated with or *supervening* upon external veridical information sources - this text message is thus pseudo-information²⁰¹. Moreover, it encodes what I refer to as *pure* pseudo-information. Fantasy and myth texts as information sources are sources of *pure pseudo information*. SF texts contain in the main another kind of information altogether – *counterfactual pseudo-information*.

Science fiction frequently involves the careful merging of veridical and pseudo-information effecting a synthesis of *heterogeneous information types* such that veridical information is preserved for cognition even in highly estranged *counterfactual* futurological settings. In Iain M. Banks’ *The Algebraist*, the former science writer frequently engages veridical science and counterfactual estrangement simultaneously, stimulating the cognitive in the reader who must extrapolate from familiar veridical information – the known:

The gascraft weighed next to nothing in the Third Fury’s miniscule gravity, but it massed over two tonnes and the laws regarding inertia and momentum still applied.²⁰²

This is a rather obvious example of the outcomes of such write-time information synthesis, but is exemplary of this common informational marker of science fiction: counterfactual pseudo-information.

Realist and naturalistic fictions set in the era of their authors, and historical novels, are the result of the write-time synthesis of information from veridical sources such as actual material objects, people, settings and events with pseudo-information from internal source synthesis. *Overall*, such texts as information sources are still *not* veridical by virtue of the fictive encoded semantic *context*. That is to say, even regarded in terms of the *meaning* semantically encoded upon the messages encoded within them, the *overall* information type of a realist or naturalistic fiction text, and even of a historical fiction text, is *still* pseudo-information. The texts of SF, realist or naturalistic novels are still *pseudo-information sources*. *Overall*, they do not encode meaning referring to ontologically material or factual realities or states of affairs, nor synthesise information sourced from the same. Put another way, ontologically speaking such texts would only stand as *veridical sources* if the information *linguistically* and *semantically* encoded in their configurations – supervening on their constituent lexical information - was completely *disregarded*. Information theoretically, on the model I am using, this approach would be errant. All of the information acquired (with loss) from all of the information sources in the set which *inform*²⁰³ the text – not just its physical representation – contribute to the text’s *information synthesis*. In terms of the ontology of information I am presenting, one must account for *all* of the information – and all of the different *types* of information – that *is* encapsulated within a given source and its configuration. No amount of *internal* information possessed by the reader – whether it is veridical or not – when combined with the pseudo-information in an external text source which encodes a *fiction*, can result in rendering the pseudo-information linguistically encoded in the text *veridical*. This may seem to be counter-intuitive. If one knows enough correct information, one can extrapolate from fictive texts and learn something factual. However, such an outcome, on this theory, is because of the other internal sources (concepts) called into service at read-time: because of the reader’s knowledge, which supervenes upon information.

Here some examples should prove elucidatory. Suppose that I have a *concept* which stands as an *internal* information source, and the information encapsulated in the concept is *veridical*, say for example the information conveyed by the English lexical message: *the Sun can warm my skin*. Note that I have not used quotes, but am only interested in what some philosophers of language refer to as the *propositional contents* of, or associated with, the phrase ‘the Sun can warm my skin.’ On Dretske’s theory this proposition has associated with it *informational content*²⁰⁴. On my ontology this content is associated with the *configuration* of the source itself, *which is influenced by the set of any sources that contribute information to it by influencing the word selection*. The contributing sources need not be lexical, nor artefactual. The information as encoded textually in the linguistic sub clause ‘the Sun can warm my skin’ is lexical, but it does not logically follow that the corresponding information in the internal concept – the internal source(s) that I possess -

²⁰¹ The authors internal imaginary concept of a Hobbit at write-time synthesis supervenes on veridical internal sources – real concepts – but there is no external veridical *Hobbit* source object.

²⁰² Banks, Iain M. *The Algebraist*. London: Orbit Time Warner, 2004, 159.

²⁰³ Again – *inform* on the original platonic definition, whereby other sources influence the configuration and content of the source in question.

²⁰⁴ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 47, 48, 60, 173.

supervenes *lexically*. An internal source is unlikely to be lexical in any way that resembles the source constituted by the text *the Sun can warm my skin*. I am proposing that concepts, as internal sources, are - following Stephen Pinker, at bottom *not* realised by a *linguistic* and *lexical* mentalese²⁰⁵. The information which subsists in internal sources, on the best cognitive science and informational epistemological theories, and on the most lucid reasoning, is non-linguistic²⁰⁶. The gaining of knowledge through the acquisition of information is not always associated with language alone, or in some cases at all, even if that knowledge is expressed linguistically. We may encode internal information using our linguistic-grammatical tool set and internally stored language lexicon for the purposes of transmitting it phonetically or lexically as a *message* in an utterance or inscription. However, even though it may possibly have some kind of basic structure and thus possibly something roughly resembling a syntax²⁰⁷, internal information encapsulated in cognitive structure sources is probably *not* fundamentally linguistic or lexical. Like Dretske, I hesitate to be definitive due to the special technical complexity of the problem, but suggest that language – artefactual lexical information as conveyed linguistically - supervenes causally and structurally on complex internal structures constituted of more basic types of information acquired through sensory perception and internal information synthesis, not vice versa²⁰⁸. Returning to the example, that *the Sun can warm my skin* is an example of veridical information, the Sun and my skin are real objects – real veridical information sources – and the state of affairs matching the encoded semantics of this statement actually occurs when I stand exposed to energy from the Sun. This state of affairs is thus an external veridical source of information, its configuration roughly described by the previous sentence. Now – if I select and token (via inscription or utterance) the message “Gandalf is a most magical wizard”, then this lexical message, although a veridical source in terms of being a real inscribed grammatical entity, refers to *no* veridical information sources in its encoded semantics. Moreover, it doesn’t matter how I combine the information encapsulated in the first message-source with the second, neither the thus synthesised lexical artefactual information source, nor the semantics supervening thereupon, will result in the realisation of either Gandalf, magic or wizards as external actual objects or states of affairs which can stand as *veridical* information sources. In fact, the combining of the two sources as one lexical artefactual source – one grammatical phrase – will always result in a *less* veridical lexical artefactual information source, even if correct grammar is employed. The only exception would be if the encoded semantics and grammar of the combined statements resulted in a true proposition, such as “It is the case that the Sun can warm my skin, and in the story of *The Lord of the Rings*, the character Gandalf is a most magical wizard.” However, this requires the synthesis of veridical information from other sources: one’s concept of *The Lord of the Rings*, one’s concepts of fact and fiction, instances of the text of the actual book itself, and so on²⁰⁹. The messages constituted as *the Sun can warm my skin and Gandalf is a most magical wizard*; *the Sun can warm my skin because Gandalf is a most magical wizard*; *Gandalf is a most magical wizard and the Sun can warm my skin* are all proportionally *less* veridical in terms of their total information than the message *the Sun can warm my skin*.

At this point, we should be able to exemplify the *informational* distinction between SF texts and fantasy/myth texts straightforwardly. In Tolkien’s *The Two Towers*, the sorcerer Sauron’s eye can perform feats of remote seeing through the *palantir* of Orthanc, an otherwise inert and amorphous crystal ball. The Hobbit Pippin asks for details about the stone. Gandalf describes their purpose, but their mechanism remains unimportant²¹⁰:

²⁰⁵ Pinker, S. *The Language Instinct*, London: The Folio Society/Penguin Press, 1994-5., 39,40.

²⁰⁶ *Ibid.*, 39, 41-2.

²⁰⁷ Dretske, F. *Op. cit.*, 230.

²⁰⁸ *Ibid.*

²⁰⁹ Concepts here are informational cognitive structures as on Dretske’s model.

²¹⁰ Tolkien, J.R.R., “The Lord of the Rings: The Two Towers: Book Three” in *The Lord of the Rings: One Volume Edition with Index and Appendices*, London: Harper Collins, 2001., 583.

‘What did the men of old use them for?’ asked Pippin...

‘To see far off, and to converse in thought with one another,’ said Gandalf. ‘In that way they long guarded and united the realm of Gondor. They set up the stones at Minas Anor, and Minis Ithil, and at Orthanc in the ring of Isengard.’²¹¹

Aside perhaps from metaphoric references to juvenile psychology through the vehicle of fictional behavioural traits of Hobbits, basic insight into the benefits of long distance communications, and normative invocations of relational and personality dynamics, there is no veridical information associated – counterfactually or otherwise - with the episode involving the operation of the palantíri. The veridical information content of this text is too low for it to be called counterfactual pseudo-information. It is not a possible world but an *alternative* world. The stones function by mysterious supernatural power, presumably invested in them by the magic Elf Fëanor, who ‘wrought’ them²¹². One of the quirks of such fictive magical devices and objects, and the supernaturalised narrative devices that accompany them, is that the physical and natural seem to *arbitrarily restrain* the otherwise unlimited supernatural. This has the permanent effect of requiring a sustained suspension of disbelief on the part of the reader, since even *internal* to the fictive context of the fantasy story and setting, the invocation of the supernatural imputes marked logical inconsistencies. In a fictive world permeated by and causally subsumed to the magical and the supernatural, impedances and limitations due to natural causal relations are barely tenable as plot interventions:

Each palantír replied to each, but all those in Gondor were ever open to the view of Osgiliath. Now it appears that, as the rock of Orthanc has withstood the storms of time, so there the palantír of that tower has remained. But it could do nothing but see small images of things far off and days remote.²¹³

With such powers to completely subvert the natural, it is difficult to see why Sauron, or any other wizard or supernaturally inspired persona, needs a palantír, or any other magical or supernatural object (or spell, or incantation, or prayer) at all. The cognitive aesthetic of Lem is not the one invoked at read-time *The Two Towers*. In fact, there is an additional suspension required: that of cognition. Supernaturalism and magic facilitate causal circumvention: they short-circuit and render redundant natural material causality. None of this, of course, diminishes *The Two Towers* as a work of fiction from an aesthetic perspective. My intention here has been to attempt undo the conflation of SF, fantasy and mythology on an informational basis. The *informational profile* of Tolkien’s text is quite different from that of Reynold’s *Revelation Space*.

In Reynold’s text, the character of Ilya Volyova is preoccupied with learning as much as possible about the Resurgam system from her ship’s databases and from a vast swarm of miniature information gathering sensors called pebbles, which race ahead of the ship and spread out over vast areas of space to capture as much information as possible before the ship’s arrival:

The pebble cloud had whipped past either side of Resurgam so there was data from both its day and night sides. Additionally, the pebble cloud had elongated itself in the line of flight until fifteen hours spaced the passage of its first and last unit through the system, enabling the entire surface of Resurgam to be glimpsed under both illumination and darkness.²¹⁴

The fictional pebble cloud is an informationist novum which employs highly extrapolative estrangement from known technology, but which is nonetheless informed by veridical information associated with real sensor arrays and actual sensor swarms of the kind used for meteorological research. It is not simply analogical, but involves *counterfactual* extrapolation from fact. The pebble cloud is defeasibly *possible* in reality, magical palantíri are not. Reynold’s character casts this surveillance net into space, and the information it provides avails the author of a narrative device for validating further counterfactual invention:

²¹¹ Ibid., 583-4.

²¹² Ibid., 583-4.

²¹³ Ibid., 584.

²¹⁴ Reynolds, A. *Revelation Space*. New York: Ace/Orion/Victor Gollancz/Penguin, 2000, 204.

The Resurgam system was a wide binary. Delta Pavonis was the life giving star, but – as she had known – it possessed a dead twin. The dark companion was a neutron star, separated by ten light hours from Pavonis, far enough for stable planetary orbits to be possible around both stars. And indeed, the neutron star had claimed a planet of its own. The fact of the planet's existence was known to her in advance of the information from the pebbles. All it warranted in the ship's database was a line of comment.²¹⁵

This excerpt contains an admixture of scientific and fictive language supervening on a synthesis of veridical and pseudo-information typical of SF in the sub mode of informationist space opera. Delta Pavonis is a real star identified by astronomers. It, and any real physical state of affairs in which it is causally involved, are natural veridical information sources. Any recorded scientific results, observations and calculations, database entries, textbook entries, empirically informed mathematical theories, encyclopedia entries and so forth, resulting from the detection of such natural veridical information sources, constitute veridical artefactual lexical information sources. Neutron stars and star pairs (binary systems) involving neutron stars are all real, materially verifiable astronomical entities²¹⁶, real instances of which are veridical natural information sources. However, neither the binary system described in the passage nor the neutron star which it incorporates are existent objects and states of affairs constituting information sources. The structure and distances postulated for the fictional binary system *are* veridical – informed by veridical astronomical science. This indicates the significant presence of a special type of pseudo-information. It is not the *pure* pseudo-information of fantasy and myth texts. It is *counterfactual pseudo information*. I suggest that the discursive hybridisation associated with hard informationist SF, or any SF with hard scientific elements, whether it be futurological or not, is generally accompanied by and supervenes upon information synthesis which incorporates *counterfactual* pseudo-information associated with veridical scientific and technological sources.

LINGUISTIC SUBJUNCTIVITY AND COUNTERFACTUAL PSEUDO-INFORMATION IN SCIENCE FICTION

It is veridical information and counterfactual pseudo-information that marks the SF novum, and which distinguishes hard SF from fantasy and myth texts which encapsulate little or no veridical information or *counterfactual* pseudo-information – but instead largely or only pure pseudo-information. On the model of philosophers Saul Kripke and Hilary Putnam, a counterfactual involves a modal speculation about how the actual world – or a given situation in the actual world – might be logically and materially manifest if just one or a few facts about the actual world, and the given situation, were different than they actually are²¹⁷. Other philosophers and logicians, most notably David Lewis, allow for a much more metaphysically radical conception of a possible world – one which can not only deviate from the actual world multifariously and to the point of significant ontological distancing from actual norms and states of affairs²¹⁸, but which is itself also given the status of actuality. Kripke famously rejects such models:

All this talk seems to me to have taken the metaphor of possible worlds much too seriously in some way. It is as if a 'possible world' were like a distant country...What it amounts to is the view that counterfactual situations have to be described purely qualitatively... this seems to me to be wrong.²¹⁹

²¹⁵ Ibid., 205.

²¹⁶ Substantiated by actual X-Ray and optical observations.

²¹⁷ Yagisawa, Takashi. "Possible Objects" in *The Stanford Encyclopedia of Philosophy*, Published Fri Apr 15, 2005; substantive revision Thu Jul 21, 2005. <16 September 2008> <<http://plato.stanford.edu/entries/possible-objects/#5>>, 2. Possible Worlds.

²¹⁸ Not some distance in space-time, but distance in the literary sense of the contrast

²¹⁹ Kripke, S. "Naming and Necessity". Eds. Donald Davidson and Harman. G. Holland: Reidel, 1972, 147.

The inventor of *modern* modal logic, Kripke established a working systematic mathematical logic of modality related to subjunctive speech modes, general modal speech, and modal reasoning. Prior to Kripke's efforts²²⁰, logic had been confused, problematic and inelegantly described since Aristotle. Part of Kripke's system includes the *accessibility relation*: a logical operator which enforces the metaphysical principle that possible worlds so considered should be *minimally* different from the actual real world. Lewis was a *modal realist*, and his perspective on the ontological and logical status of possible worlds – whether or not they can be regarded as actual - differs from that of Kripke:

There are so many ways that a world might be; and one of these many ways is the way the world is. Are there other worlds that are other ways? I say that there are. I advocate a thesis of plurality of worlds, or *modal realism*, which holds that our world is but one among many.²²¹

Modal logic starts, in very real sense, with language. Lewis identifies the connexion:

A counterfactual (or 'subjunctive') conditional is an invitation to consider what goes on in a selected 'counterfactual situation'; which is to say, at some other possible world.²²²

This is the same linguistic subjunctivity Broderick, following Delany, identifies as special to SF texts as compared to other literary genres and modes of writing:

Sf textuality is grounded in a distinctive *subjunctivity* (a useful borrowing from grammar by Samuel Delany). Briefly: 'A distinct level of subjunctivity informs all of the words in an s-f story at a level that is different from that which informs naturalistic fiction, fantasy or reportage...' ²²³

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Delany, a pioneer in informationist SF theory, identifies SF as marked by modal subjunctive language associated with *possibilities* extrapolated from facts, rather than with facts alone, as in reportage, or pervasively with *impossibilities*, as in the case of fantasy²²⁵. The upshot of this is that "the particular subjunctive level of s-f continues to expand the freedom of the choice of words that can follow another group of words meaningfully."²²⁶

Delany stipulates the relative balance of indicative and subjunctive tensions in the words of each mode of writing. For a series of words in reportage, "a blanket indicative tension informs the whole series: *this happened*." Delany also cites the centrality of reference to the real in the discourse and textuality of reportage, asserting that in this mode "every word, even the metaphorical ones, must go straight back to a real object, or a real thought on the part of the reporter." It is probably not the case that every word would refer thus, since even reportage can include such things as aphorisms, jokes, inserted narrative and discourse, and allusive metaphors - not to mention straight errors based on information loss or the supplanting of veridical information with pseudo-information. Moreover, it is difficult to discern what Delany means by 'real thought', since both by information ontology, information theory and cognitive science (both dualist and physicalist), all thoughts are regarded as real – things that really occur and either supervene somehow on mental processes or states, or are realised by some variety of 'spooky stuff'. If one has a thought, it is real – the thought has really occurred. To what extent the information content of the thought – what it is about – is *veridical*, is a separate question. One could interpret 'real thought' as meaning that the thought must be of a real object – but then again this is problematic since thought is again vulnerable to error through information loss and noise. For naturalist or realist writing, Delany suggests that the subjunctive-injunctive balance is weighed in favour of the former, and that the "subjunctivity level for a series of words labelled naturalistic fiction is defined by: *could have happened*."²²⁷ This is closer to the subjunctivity level engaged in SF works such as Rudy Rucker's *Mathematicians in Love*,

²²⁰ At the tender age of 18 years.

²²¹ Lewis, D. *On the Plurality of Worlds*. Massachusetts: Blackwell, (1986), 2.

²²² *Ibid.*, 20.

²²³ Delany, Samuel R. "About 5,750 Words." Delany, Samuel R. *The Jewel-Hinged Jaw: Notes on the Language of Science Fiction*. New York: Berkley Windhover, 1978, 31.

²²⁴ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995.57.

²²⁵ *Ibid.*, 32-3.

²²⁶ *Ibid.*, 32.

²²⁷ Delany., Op. cit. 31.

and the historically attuned *Cryptonomicon* of Neal Stephenson, which I suggest accords with: *may have/could have happened thus*. The information types associated with such SF are veridical and counterfactual-pseudo. In *Cryptonomicon*, when the character-narrator Alan Turing explicates, via narrative hypodiegesis, the basic semantic notions underpinning Kurt Gödel's incompleteness theorem, the text includes significant *veridical* information, since the explication is a notional expository summary of mathematically verifiable truths. As far as mathematicians can discern, the syntactic proof of Gödel's theorem renders it as true as the mathematical statement $2+2=4$. It is interesting that this is one of the moments in Stephenson's text where mathematical discourse is inserted as mathematical notation proper:

"But you can calculate the digits of pi, one at a time, by using certain formulas. And you can write down the formulas like so"

$$\pi = 4 \sum_{n=0}^{\infty} \frac{(-1)^n}{2n+1}$$

"I have used the Leibniz series to placate our friend. See Lawrence? It is a string of symbols" ...Gödel said..."Say!, if you buy into this business about mathematics being just strings of symbols...any string of symbols-such as this very formula, here – can be translated into integers... Formulas can act on numbers, right?...but if *another mathematical formula*, such as the one right here, for calculating pi, *can be encoded as a number*, then you can have another formula *act on it*...Then he showed...that if formulas really can refer to themselves, it's possible to write down one saying 'this statement cannot be proved.'"²²⁸

The situation described by the narrative supervening on the lexical information of the text is wholly counterfactual, but many of the details conveyed regarding the real Kurt Gödel and his real incompleteness theorems are accurate and supervene on *veridical* information. It involves the existence of people in another possible world who didn't exist in the actual world in association with the real Alan Turing: the fictive characters Lawrence and his companion Rudy. Stephenson even captures the important distinction between the semantic and syntactic aspects of a mathematical proof: this constitutes demonstrably verifiable *veridical* information. This passage involves an information synthesis, upon which supervenes a discursive hybridisation and synthesis, wherein the primary sources of veridical information synthesised into the whole are *scientific* and *mathematical* in nature: Gödel's incompleteness theorems, Leibniz formula, and so on. This expands the cognitive aesthetic of the text, and its informational complexity. The only SF element absent is the *novum*, since all of the scientific and mathematical veridical information is non-speculative. The narrative framework of the passage is subjunctive in mode and tone, but the encapsulated hypo-diegetic expository is indicative in tone, and involves mathematically verifiable veridical information. *Cryptonomicon* also synthesises with pure pseudo-information of the impossible variety, bound up in the preternatural to supernatural character of Enoch Root, which synthesis imputes to the text a supernaturalistic aspect. In chapters three and four, I will argue that such manoeuvres normally result in an ideological subsumption of science to mysticism, which undermines the cognitive outcomes of the text's informational and discursive synthesis with science. In the case of *Cryptonomicon*, cognitive aesthetic outcomes at read-time synthesis are little diminished for passages such as the above.

Delany places fantasy at the non-SF extreme of his subjunctivity-injunctivity spectrum, asserting that "[f]antasy takes the subjunctivity of naturalistic fiction and throws it into reverse."²²⁹ He identifies the very crux of the linguistic, semantic and informational difference between fantasy and SF proper:

²²⁸ Stephenson, N. *Cryptonomicon*. United Kingdom: Arrow Books, 2000, 15-16.

²²⁹ Delany, Samuel R. "About 5,750 Words." Delany, Samuel R. *The Jewel-Hinged Jaw: Notes on the Language of Science Fiction*. New York: Berkley Windhover, 1978. 32.

At the appearance of elves, witches or magic in a non metaphorical position, or at some correction of image too bizarre to be explained by other than the supernatural, the level of subjunctivity becomes: *could not have happened*. And immediately it **informs** all of the words in the series.²³⁰

This correlates well with our definition of pure pseudo-information. Moreover, once pure pseudo-informational words and terms become part of the text message which encodes the narrative and its semantics, they cause the entire narrative context to be thus *informed*. Interestingly, Delany here uses the strong original metaphysical Platonic sense of *inform*: the overall configuration of the information source is shaped by the type of information being employed for unreal objects and references – in this case an *anti* type, for pseudo-information is not real or veridical information any more than pseudocode is real computer program code, pseudoscience real science, or a pseudorandom number a truly random number²³¹. None of these pseudo-objects does or is what their real correlates do or are. Textual/lexical artefactual pure pseudo-information looks a lot like veridical information but conveys nothing truly materially possible from any veridical source. It ceases even to be counterfactual on Kripke and Putnam's modal logic, and is only counterfactual at extreme removes with no regard for accessibility relations or closeness even on Lewis' model. It is, however, interesting that Kripke and Lewis as modal logicians both presumably allow for the existence of the supernatural. Lewis does so in a modal or counterfactual sense, and in so doing confirms his commitment to the actual existence of other possible worlds:

The other worlds are of a kind with this world of ours. To be sure, there are differences of kind between things that are part of different worlds – one world has electrons and another has none, one has spirits and the other has none.²³²

Presumably Kripke, being a devout theist, allows for the existence of the supernatural in the actual world to support his beliefs²³³. Ironically, perhaps, it would seem that in a sense the artisan Delany is more of a physicalist and thus more scientific than either logician, which perhaps fits with the former's professed Marxism under the rubric of dialectic materialism.

Significantly, Lewis introduces the controversial theory of counterparts into his modal logic, wherein possible worlds contain actual duplicates of things in the actual world – counterpart objects - for the purposes of modal logic and reasoning²³⁴. This apparatus is needed to retain the consistency of his modal realist metaphysical picture of possible worlds. Of central importance to our thesis of the specialness of SF writing which engages with scientific discourses and theory (and the contingent defeasible facts) is Lewis' stated premise for modal realism:

Why believe in a plurality of worlds? – Because the hypothesis is serviceable, and that is a reason to think that it is true. ...I think it is clear that talk of possibilities that has clarified questions in many parts of the philosophy of logic, of mind, of language and of science – not to mention metaphysics itself.²³⁵

The import of this for theories of SF as cognitively engaging is that on both the original metaphysically weaker conception of possible worlds adhered to by Kripke, and on the more radical modal realism embraced by Lewis, *modal reasoning is pursued by philosophers, mathematicians and logicians because it is seen to be conducive to problem solving and clarification, and to be cognitively rewarding*. Lewis sees it as productive of improved understanding in various applications of analytic philosophy, including those of language and the sciences. I think this lends significant credence to Suvin's conception of SF as embodying an aesthetic of cognitive estrangement.

²³⁰ Ibid., 32 (bold emphasis mine)

²³¹ Veridical information must be true by virtue coming from real material or actual sources.

²³² Lewis, D. *On the Plurality of Worlds*, Massachusetts: Blackwell, (1986,) 2001, 2.

²³³ I think that this belief status is instrumental in the formation of Kripke's causal chain theory of reference for proper names and natural kind terms, since it seems apparent that there is necessarily a reification of kind of third observer abstracta required for the tenability of the theory – a 'god perspective.' However, this is a subject for a different treatise

²³⁴ Ibid, 8.

²³⁵ Ibid.,3.

TRANSREALISM AND COUNTERFACTUAL PSEUDO-INFORMATION

With respect to the ontological, logical, conceptual and *subjunctive* distance from the real world allowed for in possible worlds, both Lewis' and Kripke's models are represented in fiction generally, and especially in SF²³⁶. Space opera and utopian tales estrange the world enormously, and rely on analogical, extrapolated, metaphorical and discursive reference to the real, whereas the 'transrealism' of Rudy Rucker, the historical SF of Neal Stephenson's *Cryptonomicon*, and realist hard SF of the contemporary or very near future setting, pinion themselves in the more ontologically proximate counterfactuals set up more in accordance with Kripke's alternative possible world-situation model with its logical accessibility relation. Rudy Rucker's *Transrealist Manifesto* is especially salient with respect to a general relationship between cognitively-aesthetically rewarding fiction and the closeness of counterfactual worlds to the actual world – as considered on Kripke's accessibility relation or Lewis' metaphysically and logically different similarity and closeness precepts:

The Transrealist writes about **immediate perceptions** in a fantastic way. Any literature which is not about **actual reality** is weak and enervated. But the genre of straight realism is all burnt out. Who needs more straight novels? The tools of fantasy and SF offer a means to thicken and intensify realistic fiction. By using fantastic devices it is actually possible to manipulate subtext. The familiar tools of SF — time travel, antigravity, alternate worlds, telepathy, etc. — are in fact symbolic of archetypal **modes of perception**...This is the "Trans" aspect. The "realism" aspect has to do with the fact that a valid work of art should deal with **the world the way it actually is**.²³⁷

Although his statements regarding the cognitive utility of possible worlds is less exacting than that of the aforementioned modal logicians, the definition put forward by computer scientist and SF writer Rucker for transrealism reads much like Lewis' above quoted justification for modal realism, but with metaphoric allusions. Rucker's propensity to assign realism as *the* nomological determiner of valid art belies an ideologically and philosophically founded commitment to supervenience of the text on *veridical* information: a grounding in actual states of affairs. The explication of what the realist component of Rucker's neologism means is effectively an artistically motivated accessibility relation. Transrealism is, in effect, an approximation of the definition I will introduce in chapter four of what I call *anti-simulacra*: tropes and icons from the SF mega-text which are constructed like *simulacra*, but which point counterfactually to realities in the actual world, rather than obfuscating them. Rucker's definition apparently incorporates the mechanisms of metaphor and analogy for such ends. The transrealist manifesto would thus seem to exclude *futurological* possible worlds outside of the scope of actual experience. This is partly due to Rucker's empiricist emphasis on *immediate perception*, which fits with the empiricist scope of Fred Dretske's informational epistemology:

A third way to deal with the problem...is to restrict one's theory of knowledge to perceptual knowledge or (more generally) to knowledge of contingent (empirical) fact. Since a contingent fact is a fact for which there are possible alternatives, a fact that might not have been a fact, a fact that (because it has a probability less than one) generates information^{238 239}.

It is not clear that one cannot 'deal with the world the way it actually is' at a counterfactual future close enough that the accessibility or closeness to the actual world is preserved. Dealing with the way the world will actually be in the very near future would not seem to be any less a *close* counterfactual than dealing with the way the world actually is with fictive narratives and no futurological setting. If *real* knowledge supervenes only on empirically accessible existent veridical information sources, it is perhaps not

²³⁶ Lewis' modal realist possible worlds model is still not strong enough to give counterfactual objects and states of affairs described in fictions the status of veridical information sources, because such sources need to ultimately *materially* contribute to influencing the selection of words in a text. Lewis' model does not substantiate any actual transference of information from the distant actual possible world to *our* actual world.

²³⁷ Rucker, R. *A Transrealist Manifesto*, <www.rudyrucker.com>, < http://www.cs.sjsu.edu/faculty/rucker/transrealistmanifesto.pdf> accessed 14th November 2008., 1. (emphasis mine.)

²³⁸ This is a direct unambiguous reference to Shannon information.

²³⁹ Dretske, F. "Epistemology and Information." Adriaan, P. in *Philosophy of Information (Handbook of the Philosophy of Science)*. Ed. Johan F.A.K van Benthem. Amsterdam: Elsevier B.V., 2008.

immediately clear how it is that we can gain knowledge and learn from counterfactual pseudo-information sources like SF fictions about concurrent or futurological possible worlds. The reason is that this would be the wrong question to ask. Counterfactual information sources are not materially real. They are implied and constructed by the semantics and narrative encoded upon the text conveying novum concepts: concepts of counterfactual *possibilia*. Counterfactual sources are ultimately concepts which emerge from the selection of words in the SF text as influenced by synthesis of information from sets of *veridical* information sources including internal concept sources – cognitive structures – at write-time. Counterfactual sources cannot themselves contribute any veridical information to anything, since they are simply not, in and of themselves, real.

FUTUROLOGICAL COUNTERFACTUAL PSEUDO-INFORMATION

Many counterfactuals in SF, and especially information technology focussed informationist SF, involve speculation about the *future*: logically and cognitively considering or speculating about how an actual thing might look or exist in the near or distant future, or about what things might exist in the future *based on the evidence of actual things that exist and facts that obtain at write-time*. I will refer to this kind of counterfactual as a *futurological counterfactual* involving a *futurological possible world*. In order for speculation about the future to be regarded as involving counterfactual pseudo-information and not pure pseudo-information, I require that it be *rooted in actual veridical information sources existing in the actual world in the present* – for “in SF there can be no inexplicable marvels, no transcendences, no devils or demons—and the pattern of occurrences must be verisimilar.²⁴⁰” There must be some *logical* accessibility from material truths – veridical information - to the future counterfactual novum or speculation. This corresponds in a futurological sense with the accessibility relation for possible worlds of Kripke and the closeness or similarity principle which Lewis logically problematises thus:

Partly, the world in question is specified by the antecedent of the conditional: ‘If kangaroos had no tails...’ Partly it is specified by a permanent understanding that **there is to be no gratuitous departure from the background of fact**: ignore worlds where kangaroos float around like balloons, since the kangaroos of our world are much too heavy for that. Partly, it is specified by temporary contextual influences that indicate what sorts of departures would be especially gratuitous; for instance, facts just mentioned may have a special claim to be held fixed. Partly, **it is not specified at all**: no telling whether the kangaroos have stumps where their tails should be.²⁴¹

Speculations that a giant supernaturally-supervening magic demon will descend from space and rule the Earth, or that the universe will turn into five kinds of marshmallow due to a witch’s curse: such are not validly *future counterfactuals* with respect to the actual world by Kripke’s accessibility relation or operating out of a scientific worldview²⁴², nor of the characteristically SF subjunctive mode by Delany’s definition, nor the definition of cognitive estrangement propounded by Suvin. Such worlds would be doubly counterfactual – future counterfactuals only to possible worlds considered (f)actual on Lewis’ radical *modal realist* metaphysics. Such counterfactuals are at such a subjunctive, metaphysical, material and logical distance from *our* actual world that they ultimately converge on *pure* pseudo-information.

An ontologically radically different world setting with super advanced technology which still retains human familiars but does not imply the actual world as fictively *historical* – temporally preceding – isn’t necessarily a *futurological possible world*. This is the kind of ontologically estranged counterfactual *mise en scène* frequently encountered in space opera. Such a world is not *necessarily* counterfactual in the sense that the setting is an intentional futurological extrapolation from the actual world, but may be estranged and counterfactual in a larger speculative sense: Kripke’s *accessibility relation* for possible worlds is all but ignored, whilst simultaneously a naturalistic and scientific *précis* suggests the *possible* rather than the purely fantastic and impossible. The result is a possible world setting which fits somewhere between the modal

²⁴⁰ Lem, Stanislaw. “On The Structural Analysis of Science Fiction: *Science Fiction Studies* #1 = Vol 1, Part 1 = Spring 1973.” Spring 1973. *Science Fiction Studies*. February 2009 <<http://www.depauw.edu/sfs/backissues/1/lem1art.htm>>. Paragraph 10.

²⁴¹ Lewis, D. *On the Plurality of Worlds*, Massachusetts: Blackwell, (1986.) 2001,21.

²⁴² i.e. Provided the actual world is not considered to include the supernatural as real, as mystics or realists on supernaturalism believe.

logic of Kripke and Lewis. The world of Neal Stephenson's informationist cyberpunk *Snow Crash* is futurologically counterfactual, estranged and extrapolated (if quite radically) at a certain projected but relatively close historical distance from the actual world at write-time. Contrastingly, although Banks' *The Algebraist* and Vernor Vinge's *A Fire Upon the Deep* each retain the Earth, its solar system, the human species and our galaxy in the narrative, the counterfactual estrangement of setting in these space operas is dramatically increased. Thus in each fictive case the Earth itself is only mentioned in the narrative as vastly temporally and spatially distant and has no role as a setting for action. In both Bank's *Algebraist* and Delany's *Stars In My Pocket Like Grains of Sand*, actual Earth as known to the author at write-time becomes 'Old Earth' in the context of the narrative encoded upon the text. Thus science fiction demonstrates its location in the multivariate nexus: humanity and human settings are commonly retained as somehow central in hard SF and even in much informationist space opera. Delany's *Babel 17* has an Earth-centric setting, and Reynold's *Revelation Space* again reinforces the 'Old Earth' SF mega-text *codon*.

The classificatory and definitional boundaries of counterfactual pseudo-information seem to become slippery here, and the threshold between futurological counterfactual pseudo-information and pure pseudo-information unclear. However, one simply needs to remember that it is the presence or absence of the supervenience base of veridical information in synthesis which delineates the two pseudo-information types. Moreover, such fiction as includes pure pseudo-information can still effect synthesis with information from veridical scientific information sources and the discourses and theoretical semantics supervening thereupon by representing scientifically underpinned veridical information in novum, or by representing information from veridical sources with high informational fidelity, as we saw in the case of *Cryptonomicon*. Space opera which elides any reference to the actual world known to the author in the narrative or setting is not necessarily pure pseudo-informational fantasy, since such fictions can include numerous scientifically inspired novums and other codons extrapolated from scientific fact and material realities revealed by science. Nevertheless, supernatural super-demons and magically invoked marshmallow universes *are* radical pure pseudo-informational counterfactuals which require the setting to be so ontologically and logically *radically* different from *our* actual world that the only representations of information from veridical sources encoded therein exist as ad hoc metaphor – symbolic and semantic pattern representations involving arbitrary or estranged convolutions of vehicle and tenor. Metaphor is an interesting case of semantics supervening on or encoded as information which involves significant information loss and large contributions of information from the internal sources – the cognitive structures - of the reader-agent processing the text.

Text message-sources that encode stories with ontologically radical counterfactual settings which are in no way even defeasible from a veridical informational standpoint involve pure pseudo-information, and their encoded fictions are tantamount to fantasy. Material *possibility* is the delineator. Lewis' floating kangaroos would involve counterfactual pseudo-information if wrought by genetic engineering or cybernetics, since there is a materially possible (if unlikely) path from veridical information about genetic engineering, DNA science and machine augmentation of macro-organisms to floating kangaroos²⁴³. However, artefactual informational text messages or latent sources encoding narrative and semantics involving floating kangaroos wrought by black magic incantations or Elven prayers would be pure pseudo-information, since neither black magic nor Elves are associated with any *veridical* information in the actual world. Such imaginary causes are not associated with any actual *veridical* information sources aside from the pseudo-informational concepts – the imaginary ideas - of the mind which evokes them. Discourses predominantly supervening on, or encoded upon, such extreme counterfactual and pure pseudo-information, are largely fantastical from an informational standpoint.

By way of contrast, the informational specialness of SF is pinioned by veridical information associated with *scientific* commitments to materialism and naturalism, even for counterfactuals associated with possible worlds. In a scientific text, the combination of the veridical information therein with further internal veridical information possessed by the knowledgeable reader results, not only in counterfactual

²⁴³ A hot air balloon with said marsupial in the basket may even provide a realist example. Genetic scientists have produced glow-in-the-dark rabbits and mice with non-functional ears growing from their backs.

information, but further veridical information, depending on the veracity and accuracy of the source text message – the *fidelity* of the signal-source. The primary objective of the sciences is to discern the truths of the actual material world with as much detail and reliability as is physically and lexically possible: science is ideally about veridical information only. On the ontological model on which I rely, information from a source – veridical or otherwise - is conveyed or transmitted by a message encoded as a text when some aspect or aspects of the mappable material, nomological and/or logical²⁴⁴ configuration of that source at a given point in time is reproduced in a lossy way by information type conversion to artefactual lexical message-based text. One might think, then, that the kind of futurological counterfactual speculation present in so many SF stories would preclude any possibility of proper engagement with the discourses of the science of the actual world. Put in terms of Shannon’s original conception of the information/entropy measure at a source and Fred Dretske’s adaptation of Shannon information for the individual signal as representative of the individual message selection event resulting in a specific message: there is nothing existing – no veridical source from which to select any veridical information. It appears to be the same situation as for fantasy. Future information sources are themselves speculative and counterfactual and, unlike a naturalist fiction, *all* of the sources implied in the actual narrative are such. There is no certainty that any material or other type of veridical sources existing in the present will persist in the future. However, the situation is *not* the same as for fantasy and mythology. Delany, again using his thesis of SF subjunctivity, approaches futurological counterfactual fiction thus:

But when spaceships, ray guns, or more accurately any correction of images that indicates the future appear in a series of words and mark it as s-f, the subjunctivity level is changed once more. These objects, these convocations of objects into situations and events, are blankly defined by: *have not happened*. Events that *have not happened* are very different from ... fictional events that *could have happened*, or the fantastic events that *could not have happened*.²⁴⁵

In accordance with the definitions in the previous section, I would prefer the definition, if it can be so named, to be: are materially and defeasibly really possible, or not impossible, based on veridical scientific, mathematical and empirical information sources existent in the actual world, and might thus possibly happen contingent upon the right material circumstances or facts. I will refer to this as the future counterfactual principle. The future counterfactual principle incorporates relevant principles from information ontology, and also contracts and subsumes Delany’s subjunctive hierarchy falling under *events that have not happened*:

Events that have not happened include several subcategories. These subcategories describe the subcategories of s-f. *Events that have not happened* include those events that might happen: these are your technological and sociological predictive tales. Another category includes *events that will not happen*: these are your science fantasy stories.²⁴⁶

Lexically encoded narrative and semantics describing the latter subcategory - events that will not happen - are displaced on my theory into the category which supervenes on pure pseudo-information²⁴⁷. Delany adds other subcategories, the first of which, logically speaking, should collapse into its parent category and fall under the same revision, since no one can speak sensibly *temporally* of “events that have not happened yet” without a modal qualifier such as *may* or *might*, or without acknowledging *contingency* as in *the future counterfactual principle* above:

²⁴⁴ For artefactual lexical sources

²⁴⁵ Delany, Samuel R. “About 5,750 Words.” Delany, Samuel R. *The Jewel-Hinged Jaw: Notes on the Language of Science Fiction*. New York: Berkley Windhover, 1978., 32.

²⁴⁶ Ibid.

²⁴⁷ The category supervenes on the information type in that a different information type will mean a different category, but this does not imply an isomorphic mapping

They include events that *have not happened yet*...cautionary dystopias, *Brave New World* and *1984*. Were English a language with a more detailed tense system, it would be easier to see that *events which have not happened* include past events as well as future ones. *Events that have not happened in the past* compose that s-f speciality the parallel-world story, whose outstanding example is Philip K. Dick's *The Man in the High Castle*.²⁴⁸

Delany's master stroke is to associate his different levels of subjunctivity with different cognitively and aesthetically meaningful choices of words in a text. For aesthetic outcomes, he sees style and content as generally being intrinsically coupled and that "[p]ut in opposition to style, there is no such thing as content"²⁴⁹ where content is tantamount to information. Delany engages here with a central question of language, semantics, texts and information theory, that of the status of information as meaning. I am not comfortable with the equating, albeit transitively, of information with meaning, but for Delany:

The words *content*, *meaning* and *information* are all metaphors for an abstract quality of a word or group of words. The one I would like to concentrate on is: *information*.²⁵⁰

Metaphysically, this is the best definition of these terms he makes available: synonymous metaphors for an abstract quality of what, on Shannon's theory, are textual messages. This abstract quality is the progressive development of ideation and mental images evoked by the syntagm in the reading of a text, Delany's "series of corrected images."²⁵¹ It is notably a prefiguring of reader response theory, and of my own conception of information synthesis:

In naturalistic fiction our corrections in our images must be made in accordance with what we know of the personally observable – this includes our own observations of others that have been reported to us at the subjunctive level of journalism...The subjunctive level of s-f says that we must make our corrections process in accord with what we know of the physically explainable universe.²⁵²

Broderick questions the veracity of the details of Delany's read-time text corrective processing mechanism on conceptual, theoretic and representational grounds, stating that "its assumption that to understand spoken language we use a serial, additive algorithm flies in the face of contemporary linguistics and semiotics"²⁵³ In chapter notes he cites linguists Bronowski and Bruner as asserting that it is the entire message which is central to animal and human communication²⁵⁴. However, Given Delany's preoccupation with information in *About 5,750 Words* I suspect his account is less motivated by semiotics than it is by Shannon's theory – either directly or perhaps through the work of linguist contemporaries. On information theoretic terms, the boundaries of a message are not necessarily determined semantically. Information theoretically speaking, messages are produced (or *selected*) transmitted, and received and decoded serially, and it is difficult to see how the semiotic syntagm can function otherwise at read-time. Moreover, as was alluded to in chapter one, semiotics and information theory have a notoriously uneasy partnership, and this becomes more tenuous if one's ontology of information is not logocentric, since the lexical symbol then becomes secondary (at best) in information theory²⁵⁵. Delany's thesis not only anticipates Tom Shippey's treatment of the novum as high information based on word selection or choice more than thirty years in advance of Shippey's essay, but it fits amicably with Shannon's statistical explication of the association between word choice in a text, its linguistic redundancy and its semantics. Delany's syntagmatic²⁵⁶ algorithm accords with Shannon's definition of sequential algorithmic message selection or formation at a discrete (lexical) information source. It also anticipates significant aspects of reader reception. As I will argue below, semiotic theory of the kind propounded by Saussure is problematic and explanatorily lacking in terms of the representation and processing of information,

²⁴⁸ Ibid.

²⁴⁹ Ibid., 21

²⁵⁰ Ibid.

²⁵¹ Ibid., 25-8, 31.

²⁵² Ibid., 33.

²⁵³ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995., 67.

²⁵⁴ Ibid 168.

²⁵⁵ Pace Hayles' criticism of Barthes use of information theory.

²⁵⁶ Although "Syntagmatic is does not imply sequential" (Lyons, op.cit., 76.)

according to the best available information theories and to sound information ontology. In an echo of the syntagmatic aspect of Delany's approach, Australian theorist Richard Harland posits an almost identical mechanism of sentence-driven ideation as central to literature and text-processing in general. Although, like Wolfgang Iser, Harland refers to the textually guided production of mental images and imaginary objects with reference to Sartre and the Gestalt school, the mechanism of synthesis described by Harland applies only to linguistic and textual synthesis in the sentential syntagm, and is thus logocentric and overall not the same as the sense of general informational synthesis which I propose. Delany's approach is more properly informationist, since it is *ideally* info-centric, not logocentric.

Information represented in the context of counterfactual semantics encoded into a source text is pseudo-informational because no real material or actual veridical sources are involved: only counterfactuals and possibilia. However, such information is not *pure* pseudo-information, because the encoded semantics counterfactually imply information associated with actual veridical information sources. Counterfactual pseudo-information is the primary information type involved in the write-time and read-time information synthesis associated with Rucker's transrealism and Delany's SF subjunctivity. Each involves the representation or re-representation of veridical information via counterfactual semantics supervening on counterfactual sources associated with the possible world encoded in the actual SF source text-message. Counterfactual possible world speculation which retains some sense of Kripke's logical accessibility relation and Lewis' general similarity or closeness, whether futurological or not, involves the imagining of information sources (objects, states of affairs) the ontological configurations of which are partly informed by actual veridical information sources in the actual world. Frequently such imagined sources are not only fictively semantically associated with and modelled on veridical sources, but significant *veridical* information is also associated with their construction. In SF proper, this veridical information is empirical and scientific in origin – it comes from science, its materially veracious theories and associated discourses. The resulting information synthesis, and the discursive and semantic synthesis which supervenes upon it, is effectively what I define SF to be – a special heterogeneous informational and discursive synthesis effected in a mode of fiction writing. Delany poetically alludes to the role of what I have called counterfactual pseudo-information in SF thus:

But anyone who reads or writes s-f seriously knows that its particular excellence is...in all the brouhaha clanging about these unreal worlds, chords are sounded in total sympathy with the real.²⁵⁷

THE NOVUM AS COUNTERFACTUAL PSEUDO-INFORMATION

Novum terms have *high* Shannon information, or a high *surprisal* value²⁵⁸. The interesting thing to note here is that this analysis does not just apply to individual novums, but to the *concepts* encoded into them. The concept which the reader synthesises at read-time, or develops in response to processing the text, will differ to the extent that it is something for which they have an informative context through possession of internal cognitive sources and access to common external referenceable sources (information common with the author). If the conceptual information associated with the text as a source implies many possible alternatives, then it will be high information, and require the reader to do more work – to generate more information from a larger range of speculative possibilities. Not only is a novum neologism a high-information word, but it is correspondingly a source of information. A novum is an information source which combines different *types* of information, from different *types* of source. Looking at texts and at the novum and novum neologisms in this way avails us of an important insight. Scientific texts also include special neologisms and such scientific neologisms are also high-information. The distinction rests in the *type* of information involved: SF novums entail high *veridical* information, but generally they also entail high *counterfactual pseudo-information*. Scientific neologisms and new scientific concepts as represented

²⁵⁷ Delany, Samuel R. "About 5,750 Words." Delany, Samuel R. *The Jewel-Hinged Jaw: Notes on the Language of Science Fiction*. New York: Berkley Windhover, 1978, 29.

²⁵⁸ Shippey, T. "Hard Reading: The Challenges of Science Fiction." Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005. 11-26, 15.

textually in scientific texts generally encapsulate and entail high *veridical information*, with very little if any counterfactual information. Neologisms in both SF texts and scientific texts require elevated cognition in decoding.

Tom Shippey suggests that SF texts also encapsulate what he refers to as *degraded information*. This is presumably an allusion to *information loss* as defined by Shannon, but like the idea that novums constitute ‘high information’, the inference is both insightful and problematic. The stipulation that ‘degraded information’ accompanies what he refers to as “the closed universe story” is probably strained if one takes into account external information sources associated with the SF mega-text. On Shippey’s account, the degraded information does not seem to be based on the normative idea of the surprisal value of words selected for the text as it is with his conception of high information, but on the restricted setting of the fictive universe:

The classic subgenre to illustrate this is the “enclosed universe” story, whose paradigmatic example is H.G. Wells’ 1904 novella, “The Country of the Blind.”...a basic feature inherited from Wells is that the cosmology of the enclosed universe – which we, the readers, are quite sure is false, information seriously degraded – has to be made to seem reasonable, plausible, indeed (given the evidence available) inescapable...[F]or a truly closed system based on degraded information...must have its own methods of ensuring that correct information is not received.²⁵⁹

Shippey seems to have two conceptions of information, and on the terms of the first definition – that associated with novum neologisms – the description of *degraded information* seems largely untenable. A closed-universe story is informed by the external lexical artefactual information sources which comprise the SF mega-text and involves just as large a set of artefactually inscribed and internal sources at write-time and read-time as stories without such closed universe constraints. It is hard to see that any significant reduction in either the set of sources influencing word selection, or any significant reduction of choice at such sources, would result from having a closed universe implemented in the encoded narrative *semantically* encoded upon the information of the text. It seems likely that the common confusion involving the conflation of information with meaning is partly responsible for this difficulty.

I think that distinguishing information types, especially counterfactual pseudo-information, is required to make the degraded information postulate tenable. Shippey refers to *correct information* and this intuition accords with my conception of veridical information. Firstly, as discussed in the previous sections, information associated with the fictional sources in the context of an SF narrative is *in fact* not comprehensively from real sources or veridical at all²⁶⁰. The novum as described by Shippey has either limited or *indirect* referential relation to reality – to the real world or real objects or states of affairs²⁶¹ therein – by virtue of information synthesis. However, novum referents are *not* like those of the word ‘unicorn’, of which Bertrand Russell said, regarding its use in a description:

”A Unicorn” is an indefinite description which describes nothing. It is not an indefinite description which describes something unreal.²⁶²

In his essay *On Denoting*, Russell makes similar assertions about the denotation of the *proposition* “The present King of France.”²⁶³:

But this phrase, though it has a *meaning* provided ‘the King of England’ has a meaning, has certainly no denotation, at least in any obvious sense.²⁶⁴

In the context of the ontology of information which I am presenting, the propositions, descriptive terms, names and phrases included in “A unicorn” and ‘the present King of France’ constitute artefactual lexical

²⁵⁹ Shippey, T. “Hard Reading: The Challenges of Science Fiction.” Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005. 11-26.

²⁶⁰ Any factual state of affairs can be regarded as a source, pace Dretske.

²⁶¹ Or events, people, places etc.

²⁶² Russell, B. “Descriptions.” Sullivan, Arthur. *Logicism and the Philosophy of Language*. Toronto: Broadview, 2003. 279-289.

²⁶³ Russell, B. “On Denoting.” Sullivan, Arthur. *Logicism and the Philosophy of Language*. Toronto: Broadview, 2003. 235-249, 238-9.

²⁶⁴ *Ibid.*, 239.

information *sources*. Their configurations encode information as well as semantics. However, as already mentioned, information and *meaning* are *not* the same thing on Shannon's model, and the textual encoding of information in a message/source²⁶⁵ is only part of the encoding of semantics.

Fred Dretske's conception of *true information* prefigures, but subtly differs from, the definition of *veridical information*. It makes the role of the perceiving agent central in the delineation of true information, based on the premise that this is the only information which can produce real knowledge:

Information is what is capable of yielding knowledge, and since knowledge requires truth, information requires it also²⁶⁶.

Veridical information is likewise productive of knowledge if synthesised by an intelligent agent, but its veridicality conditions can obtain without any intelligent agency and a-priori knowledge conditions. Knowledge requires truth in the sense of correspondence to facts or real states of affairs, but whether reading artefactual lexical information in a fiction text secures it is largely subjectively dependent on read-time information synthesis. Russell cited logician Gottlob Frege's theory of sense and reference as distinguishing reference from meaning, but Frege's theory defines *sense* as an *objective* "mode of representation"²⁶⁷. Mental entities, like images, cognitive structures or concepts, such as are embraced by later theorists like Wolfgang Iser and Samuel R Delany, and by philosophers like Fred Dretske, are rejected as *subjective*. However, as Laurence and Margolis point out, this *objective sense* argument against mental entities and representations "isn't the least bit convincing"²⁶⁸:

To see why, one has to be careful about several distinctions that can get lumped together as a single contrast between the subjective and the objective. One of these concerns the difference between mental representations, thoughts, and experiences, on the one hand, and extra mental entities on the other. In this sense, a stone is objective, but a mental representation of a stone is subjective; it's subjective simply because it's mental. Notice, however, that subjectivity of this kind does not preclude the sharing of a mental representation. What isn't possible is for two people to have the very same *token* representation...Mental representations are subjective in that their tokens are uniquely possessed: they belong to one and only one subject. Their being subjective in this sense, however, doesn't preclude their being shareable in the relevant sense, since, again, two people can have the same representation by each having tokens of the same type. When someone says that two people have the same concept, there is no need to suppose that she is saying that they both possess the same token concept.²⁶⁹

Subjective token representations on my theory correspond to concepts as internal sources. Extra-mental entities are external information sources like texts. I would strengthen the statements about shared concepts. I think it unlikely that two readers can ever have *exactly* the same concept *token*. The set of contributing sources for its synthesis or formation will be at least subtly different for every individual, and probably substantially different. Thus 'shareable in the relevant sense' for tokens of concepts involves instances of internal sources which have significant common informational content, but it is probably extremely unlikely that they will be exactly the same.

The set of contributing sources for any information synthesis in or associated with SF texts includes the SF mega-text, various artefactually informed internal sources and any number of practically unquantifiable external sources including artefactual lexical and natural incidental types. When linguists and philosophers of language talk about context, or objective reference, or *langue* and *parole*, or collective intelligence, or speech communities, or social language and semantics, or causal reference chains, the delineation of the

²⁶⁵ A message, even on Shannon's definition, can be regarded as a source also. A message from a source can itself stand as a source on the ontological model being presented.

²⁶⁶ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 45.

²⁶⁷ Frege, G. "On Sense and Reference." Sullivan, Arthur. in *Logicism and the Philosophy of Language*. Toronto: Broadview, 2003. 175-193, 180.

²⁶⁸ Laurence, S. and Eric Margolis, "Concepts and Cognitive Science" in *Concepts: Core Readings*, Ed. Eric Margolis and Stephen Laurence, Cambridge: MIT/Bradford, 1999., 7.

²⁶⁹ *Ibid.*

external and internal and the subjective-objective distinction are often confused or not well captured by the theoretical framework.

The most that can be said for veridical information in internal sources is that separate readers with concepts informed by the same veridical sources have at least instances of *those* contributing sources in common²⁷⁰. When the reader of an SF text has internal concepts (sources) which are informed by external veridical sources associated with the sciences and the discourses thereof, then the synthesis of those sources with counterfactual pseudo information sources in the SF text, coupled with the similar synthesis implemented intertextually and otherwise by the author at the time of writing, results in a greater proportion of pseudo-information which is *counterfactual*, rather than *pure*. This is what differentiates the information synthesis of SF proper from that of even normative realist and naturalist fiction: scientific theory and discourse has a practical commitment to ensuring high levels of veridical information. When SF texts synthesise scientific discourse and information, the number of contributing veridical sources, and the variety of their veridical information subtypes (mathematical, logical, materially verifiable and so on), is increased in proportion to the overall information in the text. Informationist SF such as *Cryptonomicon* and *Revelation Space*, with their discursive hybridisation and synthesis with physics, mathematics, logic and the machine implemented logic of computer science and information technology, achieves a synthesis which relies on a large proportion of mathematically veridical information, and veridical information associated with real practical computing systems which demonstrably work because of mathematical and logical truths.

I suggest that much of the cognitive aesthetic value of SF on these terms comes from the individual reader's subjective experience of synthesising their own internal information with that of the text. The failure on the part of the reader to distinguish veridical information types results in equivocating on SF proper and fantasy modes of fiction writing. This conflation and confusion of information types results partly from the kinds of logically errant linguistic acculturation which so irked a realist Russell:

But it is of the very essence of fiction that only the thoughts, feelings etc., in Shakespeare and his readers are real, and that there is not, in addition to them, an objective Hamlet...If no one thought about Hamlet, there would be nothing left of him; if no one had thought of Napoleon, he would have soon seen to it that someone did. The sense of reality is vital in logic...A robust sense of reality is very necessary in framing a correct analysis of propositions about unicorn's, golden mountains, round squares, and other such pseudo-objects.²⁷¹

The *type of information* encoded in the selected message "there was a unicorn", upon which the linguistically encoded meaning associated with the linguistic phrase supervenes, is what I call *pure* pseudo-information. Any linguistic definition of *unicorn* presumably ultimately involves a synthesis of information from veridical sources such as instances of horses and instances of horns. However, *there is no real state of affairs standing as a veridical information source* in the source set which influences the selection of the message. There is no truth encapsulated within the message "there was a unicorn" – no material veridical source of information that is a unicorn, or even the bodily combination of a horse and a horn. Critically, such a combination is not possible in the present or past, nor contingent, nor defeasibly so, in the actual world²⁷². The statement "there was a horned horse" is likewise *pure* pseudo information, since although the message is informed by a set of veridical sources including horse instances and horn instances, the state of affairs where they are combined is *impossible* in the past tense: the synthesis of information from veridical sources gives rise to *pure* pseudo information. It isn't just that no-one has ever seen a horned horse *that we know of*. A horse with a horn is demonstrably proscribed by horse fossil morphology, and especially by the genetic code of horses – the DNA and gene sequence of that species - which *is known* to be that which determines what body parts a horse can have, and what body parts they *have* had in the past. Moreover, the normative definition of a Unicorn arguably intrinsically involves not only the conception of a horned horse, but also the conception that such a creature is intrinsically *only* mythical. 'Unicorn', according to its normative definition, is simply *not* a natural kind term, in past or present tense. There is

²⁷⁰ For an in-depth treatment, see Long[2].

²⁷¹ Russell, B. "Descriptions." Sullivan, Arthur. *Logicism and the Philosophy of Language*. Toronto: Broadview, 2003. 279-289.280-1.

²⁷² Genetically, in the *past*.

no actual, incidental, material, mereologically bounded, natural information source which will give us information that can be mapped to the artefactual textual lexical message-source ‘there was a unicorn’ in terms of information source influence over word selection, and in terms of synthesis with information sources which are associated with correct grammar and English language rules – those which implement the supervening linguistic semantics, effected through synthesis with internal sources containing information about grammar and language. In terms of information ontology, the set of all veridical unicorn instance sources will be empty. If we speak in terms of *information flow*, as does philosopher Fred Dretske, then none of ‘upstream’ information flow in the textual artefactual lexical source ‘A unicorn’ has flown from a veridical source configuration at any remove in the real world that would make this set non-empty – there is not now, nor has there ever been, a *real* unicorn in our actual world. ‘There was a unicorn’ could be considered a counterfactual – something possible in another world - on Lewis’ modal realism, but the phrase ‘there was a unicorn’ would still constitute pure pseudo-information, because there is no *real* information flow between the perpetually separate possible worlds and the actual worlds on Lewis’ model. ‘There was a unicorn’ is a source of pure pseudo-information because, although arguably *informed* by the veridical source that is minimally one instance of a real horse, and other veridical sources such as instances of real horns, the selected message itself does not contain true information sourced from the actual world²⁷³.

The informational status of the unicorn might change with a futurological possible world, as long as the *mythological* or magical component of the definition of ‘unicorn’ was elided. The novum associated with the selected message-source “In the year 2021, genetic scientists created a unicorn”, is *still* pure pseudo-information, because of the mythological and supernaturalistic denotations of *unicorn*. It only becomes a future counterfactual involving *counterfactual* pseudo-information, if we combine scientific defeasibility, and material contingency due to real possibility²⁷⁴. A transgenic horse with a horn that *looks like* a unicorn is now defeasibly theoretically possible: the truth of its existence will be contingent on what trans-geneticists do. The mythological element of the definition of *unicorn*, which requires supervenience upon magic or supernatural causes, would not be brought any nearer to fact if this transgenic horned-horse novum was ultimately realised in fact. In order to be *counterfactual* pseudo-information, the message would have to be selected as something like “In the year 2021, genetic scientists created an animal that looked like the unicorn described in myth texts” or simply “in the year 2021, genetic scientists created a transgenic horned horse.”

Novum neologisms and terms do not simply denote reified fantastic objects or phenomena on the Meinongian understanding of real – because they denote *something real* indirectly - but their referents proper *in the counterfactual world setting* are of course counterfactual, and to that extent they are imaginary. Ergo they still involve *pseudo-information*. They map directly to counterfactual objects, and *indirectly* to real objects, because counterfactual pseudo-information relies on a synthesis with veridical information traceable to a real information source. They thus involve *indirect* counterfactual reference to real things/events/phenomena acting as sources of veridical information. This brings us to the following maxim for SF theory: *the greater the counterfactual distance from reality, and the more information sources in the set that informs synthesis, the more estranged the novum*. A similar outcome is achieved by metaphor – the mainstay of poetry - but metaphor has no referential *veridicality* condition, and the lexical message selection upon which metaphor supervenes semantically involves potentially very low fidelity and high information loss. The reader must be very familiar with the sources associated with the vehicle of a metaphor and know enough about the tenor to make a connection – to associate and synthesise the requisite information sources. No veridical information source need be represented in the encoded text of the metaphor itself. A metaphor *vehicle* can operate through implementing a pattern of mimicry or parallel by which the reader can identify the metaphor with something else (its *tenor*), but with no linguistic or informationally encoded

²⁷³ Note that this veridical information may have come via intermediate sources, but it is still veridical by virtue of the existence of instances of the materially verifiable veridical source – an object or state of affairs - in the real world.

²⁷⁴ It is a fact that scientists can alter animals in spectacular ways in the actual world: transgenic GFP (green fluorescence protein) rabbits, fish and cats that glow green in the dark, mice with genetic facsimiles of human ears on their backs, featherless chickens, and so on.

reference, directly or otherwise, to the real world. The vehicle's association with the tenor depends upon the internal information sources of the reader and the knowledge which supervenes thereupon.

Indeed, metaphors can happily implicate imaginary things or fictional situations. There is no material, cognitive or scientific defeasibility with respect to the real world required for metaphor. Puff the Magic Dragon may be a working metaphor in fictional context, but none of the meaning or aesthetic qualities of the metaphor depend on *defeasibility*. The sources associated with scientific discourse need not be referenced for the application of the metaphor. Though perfectly rational, it would be pointless and frivolous, beyond a basic statement of intended mythological and magical fictive status, to argue that Puff The Magic Dragon could never be real. The informational loss involved in such metaphors explains why they are widely misinterpreted or multiply interpreted – hence the long running debate about whether the song *Puff the Magic Dragon* is about illicit drug use, or simply about adults being less innocent and imaginative than children – or somehow both. Arthur C. Clarke's space elevator, Neal Stephenson's metaverse, or Vernor Vinge's group-thinking Tines, on the other hand, both invite, and rely on for their aesthetic appeal, considerations of their specifically scientific and ontological contingency and defeasibility by the reader as they process the text. If straight description and naming involve reference, and metaphor involves allusion through a vehicle, then the novum involves the combining of reference with counterfactual extrapolation, and sometimes with allusion, but even estranged novums involving counterfactual pseudo-information must be materially and defeasibly contingently possible. Novums are uncertain, but necessarily defeasibly materially possible.

Shippey is *right* about the information density of SF on the basis of novum and novum neologisms, but the lack of any mechanism to distinguish what I have called information types²⁷⁵ in his analysis, and the failure to distinguish between informational and semantic *encoding*, renders the strategy less satisfying than it might perhaps otherwise be. However, the measure of information thus attained is probabilistic and not ontologically or semantically informed: just because the lexical symbol sequence that is a novum word is more uncertain and unpredictable with respect to the natural language lexicon, it does not logically follow that its intension or semantic content is even cogent – let alone somehow conducive to greater knowledge or understanding. A random, meaningless string would also be high information on the standard interpretation. The standard information theoretic analysis as applied by Shannon and Shippey obscures the fact that what I refer to as pseudo-information is not necessarily wholly *fantastical*. There is an ontological distinction between *pure* pseudo-information and *counterfactual* pseudo-information. This distinction is based on a simple bivalence: either pseudo-information is sourced from or makes some reference to a veridical information source – or it doesn't. If it doesn't, then it is *pure* pseudo-information. Novums, as Suvin ideally wants them to be understood, potentially have the quality of feasibly being true under some counterfactual material circumstance – they involve, and their neologisms encapsulate *counterfactual pseudo-information*. Fantasy and fantastic ideas – such as magical or supernatural story elements – do not have any possibility of feasibly being true under any real circumstances and are thus *pure pseudo-information*, not *counterfactual pseudo-information*. Novums necessarily include an aspect of scientific defeasibility. Pure pseudo-information is not scientifically or materially defeasible. It is not even meaningful to ask whether *pure* pseudo-information is defeasibly associated with veridical information sources, or if potentially falsifiable on the basis of veridical information. Put simply, there is no cognitive-aesthetic narrative value to be derived from asking whether Puff the Magic Dragon could really exist or if Gandalf's magic is scientifically tenable. This distinction is important in setting apart science fantasy from science fiction as a mode of writing, or mythology from counterfactual speculation. They embody different kinds of authorial purpose and ideology, and combine differently with internal reader sources and external sources of veridical information. *Once pure pseudo-information becomes predominant, any speculative ideological and direct or indirect referential cognitive engagement (metaphorical or otherwise) with real scientific discourse has ceased.*

²⁷⁵ I would not expect Shippey to do this – this metaphysical picture of information is my own – and is to be found in *Shannon and Dretske: Information Theory and Philosophy*

Chapter 3 - The Fiction of Veridical, Counterfactual and Heterogeneous Information

Darkko Suvin has called SF the literature of cognitive estrangement. I would like to give the mode another attribution: *the fiction of veridical, counterfactual, and heterogeneous information synthesis*. On my theory, information synthesis is the combining of numerous types of information from different types of information sources, both internal and external. I suggest that SF texts exhibit the outcomes of write-time information synthesis to an elevated extent, resulting in multiple aesthetic, cognitive and epistemological outcomes for readers at read-time. The actualisation of synthesis is thus *dynamic*. Static synthesised information is exhibited in texts in that they constitute latent sources which contain messages that are output from processes of information synthesis, and which thus constitute and contain synthesised information. Dynamic information synthesis is that which occurs when the writer writes a text, and when the reader processes a text in reading. When writing the author combines information from a set of internal mental information sources and a set of external non-mental information sources constituting a total source set. This is what I call the write-time synthesis. When reading, an actual reader performs *read-time synthesis*, again combining information from internal mental sources and external sources, the latter including the text produced by the author's *write-time* synthesis. We must continue to remember to eschew logocentrism and remain mindful of the temporal aspects of information processing when approaching fiction texts informationally. In order to better understand the informational, aesthetic and epistemological outcomes of both write-time and read-time synthesis involving SF texts, we will turn now to some post-structuralist and informationist literary theorists' conceptions of synthesis in science and literature. Some of these approximately anticipate some aspects of the information theoretic approach I am espousing for analysing SF texts, having attempted to explain the nature of literary texts and text production and processing from an informational or quasi-informational standpoint. Contemporary informationist SF theory²⁷⁶ in turn provides an antidote for theoretic aporia and limitations in some of these theories.

INFORMATION SYNTHESIS AT READ-TIME

Paulson presents an informationist literary and cultural theory which draws on theories of self organisation and systemic autonomy in theoretical biology and cybernetics. He regards reader-response theory as "quite advanced on its own terms, without recourse to disciplines such as cybernetics or theoretical biology" and argues that "drawing attention to the similarities between theories of reader response and those of self-organisation could be of considerable cultural and intellectual import."²⁷⁷ I redefine what Paulson calls "the reader's assimilation of a text," and what reader-response theorist Wolfgang Iser refers to as simply text processing, as *read-time information synthesis*. When Iser speaks of syntheses in the acts of reading and writing, he gives no clear and consistent definition of exactly what is being synthesised. Ultimately Iser settles on *knowledge*. He suggests that the text-processing involves an externalist epistemological mechanism, in contrast to the subjectivist empiricism of philosopher John Locke²⁷⁸. Fred Dretske makes a strong externalist case for knowledge as belief validated by information²⁷⁹, and concepts as specially structured information: semantic and cognitive structures. On his thesis, and mine, knowledge is not information: *knowledge supervenes on information*. I see read-time synthesis as based on the combination of heterogeneous information types from heterogeneous internal and external information sources²⁸⁰. This model provides consistent general terms for negotiating the question of complexity in a text, without the need to engage with questions of 'multiple levels of meaning,' 'multiple

²⁷⁶ I will henceforth refer to an information-theoretic approach to texts and their encoded fictions, and especially science fiction texts encoding science fictions, as informationist SF theory.

²⁷⁷ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 91.

²⁷⁸ Iser, W. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978, 73-5.

²⁷⁹ Dretske., Op. Cit., 86, 88, 89, 90, 175-177.

²⁸⁰ For more detailed explanation, see Long, B., *Shannon and Dretske: Information Theory and Philosophy*, 2008.

levels of structure', or 'interconnecting subsystems' as does Paulson, or with 'social norms', 'referential fields' or 'literary allusions,' as does Iser²⁸¹.

Following Juri Lotman's conception of information productive *noise* in art, Paulson holds that the inexactness of language and communication in literary texts constitutes information loss and noise which is conducive to the production of new information and meaning on a subjective basis:²⁸²

[L]iterary language, by its very failure as a system for the communication of pre-existent information, becomes a vehicle for the production for new information.²⁸³

On Paulson's theory, ambiguity, aporia and undecidability (pace Derrida and Paul De Man) correspond to the noise in a text which results in the production of new information during reader text processing:

The theory of self-organisation from noise suggests that this ambiguity...can be converted into information...by a reader²⁸⁴

Whilst I think that this assessment has significant merit, I feel it is only part of a larger reality which I have referred to as read-time *information synthesis*. Paulson's assertions about literary texts as correspondingly self-organising *systems* is perhaps less convincing, and somewhat at odds with his own assertions about the ontology of a text and the extent to which it is autonomously dynamic:

Self organisation from noise is more than a mechanism for explaining gains, as opposed to losses, of information: it implies the existence of a system that effectively organises itself.²⁸⁵

However, I agree that fiction texts are complex assemblies of what I call *artefactual* information, and that this complexity can cause the reader to generate new information when reading a text - during what I have called *read-time synthesis*:

The disorder, the noise of literary language can become information for us, can bring us to more subtle forms of understanding, because it is the unexpected, the radically different to which we can respond only because we are complex beings capable of yet more complexity.²⁸⁶

In considering the larger picture of what happens in the formation of a text at what I call *write-time synthesis*, Paulson asserts that:

In its production, the literary text is formed by the intersecting action of several systems, which may themselves be autonomous: its author's mind, its language, its society, culture, and genre traditions²⁸⁷

In this he virtually echoes Iser's formulation of the *repertoire* of a text²⁸⁸. Paulson's view of the production of meaning is also very close to Iser's. In regarding literary texts as noisy and inexact in their conveyance of information – as noisy messages which cannot reliably convey immutable information or knowledge from an author - Paulson concomitantly ascribes to them not epistemological vacuity, but the ability to contribute to meaning production, such that "what emerges is not so much the loss of authorial meaning as the production of new meaning by readers."²⁸⁹ In preparing the conceptual ground for the establishment of his theory of aesthetic response, Wolfgang Iser posits that:

²⁸¹ Iser, W. "Reception Theory." in *How to Do Theory* Ed. Wolfgang Iser. Malden: Blackwell Publishing, 2006., 58-60.

²⁸² Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 85, 92-3, 95, 96, 101, 110.

²⁸³ *Ibid.*, 101.

²⁸⁴ *Ibid.*, 95.

²⁸⁵ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 161.

²⁸⁶ *Ibid.*, 99.

²⁸⁷ *Ibid.*, 135.

²⁸⁸ See the discussion in Chapter one.

²⁸⁹ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 171.

[I]t is only by elucidating the processes of meaning production that one can come to understand how meaning can take on so many different forms. Furthermore, such an analysis may lay the foundations for an understanding, and indeed, even a theory of how aesthetic effects are actually processed.²⁹⁰

Importantly, neither theorist *defines* meaning, resulting in significant theoretic aporia and circularity. However, Iser goes on to implement a reader-centric theory for textual meaning and aesthetic response, wherein he eschews logocentricism and linguistic-grammatical approaches in establishing the importance of the mental image developed by the reader in response to processing a text. For Iser, the critic “fails—the work does not offer him a detachable message; meaning cannot be reduced to a ‘thing’,²⁹¹” and meaning and aesthetic outcomes are not encapsulated within the text, but are mental *effects* of the act of text processing. Iser eschews both subjectivism, with its relativistic emphasis on the receiver of a text as the seat of meaning, and objectivism, with its commitment to the meaning-determining text, in favour of seeing meaning and the aesthetic outcomes of a work as effects of reader response in text processing, such that “[t]he effectiveness of the work depends on the participation of the reader²⁹².” This “new reality brought into being by the fictional text²⁹³” does not necessarily correspond or refer to anything external to text processing. On my theory, it may result in the synthesis of *pure pseudo-information*.

INFORMATIONIST LITERARY THEORY: A FLAWED HYBRIDISATION

The contributing information source-set abstraction is a reductive and superior alternative to Iser’s *repertoire*. Both in the conception of a repertoire as realised on the basis of the *selection* of certain components of reality external to a text, and through numerous references to communication theory, Iser comes tantalisingly close to an elegant and terminologically stable information-theoretic explanation for the dynamics of reader response. He quotes Juri Lotman’s observations that:

Apart from its ability to concentrate an enormous amount of information within the ‘space’ of a short text...the literary text...delivers different information to different readers—each in accordance with the capacity of his comprehension; furthermore, it also gives the reader the language to help appropriate the next portion of the data as he reads on.²⁹⁴

Iser then goes on to hybridise the discourse and concepts of communication theory and semiotics, asserting that:

The relation between text and reader as a kind of self-regulating system, we can define the text itself as an array of sign impulses (signifiers) which are received by the reader. As he reads, there is a constant ‘feedback’ of ‘information’ already received.²⁹⁵

This conception of the text as a self-regulating informational system prefigures the analysis of self-reflexivity in Pynchon’s texts as presented by Porush, and my own conception of meta-informational writing and read-time information synthesis²⁹⁶. Iser’s basis for this dynamic is a hybridisation of information theory and semiotics. Unfortunately, Iser’s definitions, ontology and nomenclature subsequently become somewhat baroque and prone to category errors. I think Iser was partly thwarted in his attempt to satisfyingly validate his conception of repertoire by the inevitable difficulties associated with misappropriating Shannon’s mathematical communication theoretic principles and terms for semi-rigorous application, resulting in a vicious circle of definitional and semantic slippage which undermines the very theoretic terms from which his theory is supposed to derive authority. Primarily, however, it is the lack of availability of ontologically cogent definition of *information*²⁹⁷, and of a cohesive *information typology*, which prevents the necessary analytically satisfying definition of repertoire, and thus of meaning and aesthetics in the literary text. The primitive Iser needs to flatten out his model is *information*, and an

²⁹⁰ Iser, W. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978, 23.

²⁹¹ *Ibid.*, 7.

²⁹² *Ibid.*, 10.

²⁹³ *Ibid.*, 10.

²⁹⁴ *Ibid.*, 66.

²⁹⁵ *Ibid.*, 67.

²⁹⁶ See Chapter one.

²⁹⁷ Note that in the above passage, Iser refers to ‘information’ in scare quotes.

ontologically unambiguous definition thereof. The distinction between veridical information and counterfactual pseudo-information which I have presented, and the conception of information as the common, uniform substrate upon which all language, perception, communication and knowledge supervenes, eliminate the need for the kind of terminological involutions that arise in the explication of the repertoire, and for arbitrary abstractions like the *implied reader*.

In non-information theoretic language, Iser asserts that “there is no doubt that processing a text results in changes in the recipient, and these changes are not a matter of grammatical rules, but of experience.²⁹⁸” This is because what is produced in the reader during text processing is a part linguistic, or even a non-linguistic *image*.

The instructions provided [in the text] stimulate mental images, which animate what is linguistically implied, though not said. A sequence of mental images is bound to arise during the reading process, as new instructions have continually to be accommodated, resulting not only in the placement of images formed but also in a shifting position of the vantage point, which differentiates the attitudes to be adopted in the process of image building.²⁹⁹

Note the similarity of the above description to Delany’s earlier analysis of the corrective syntagmatic processing of SF texts³⁰⁰. Again, however, Iser’s terminology and expression are convoluted and ambiguous. It is indiscernible what exactly is meant by the second half of the last sentence: “placement of images”, “shifting position of the vantage point” and “differentiates the attitudes” are all obscure. Iser was of course aware at least of the *terminology* of Shannon’s theory, even if his use of its nomenclature is typically appropriative and given over to shifting signification.

This drifting signification and nomenclatural-semantic slippage which occurs when rigorous scientific theoretic terms are appropriated by literary theorists and passed from one to the other in the manner resembling artistic intertext rather than science, is itself an example of the synthesis of pseudo-information and veridical information with information loss, which results in pseudo-information where there should be veridical information. In attempting explication of *strategies* in a text, Iser chooses to draw on terminologies and models from various psychological, aesthetic and literary theories and theorists. One of Iser’s theoretical objectives is to identify the dynamic interaction between text and reader at text processing time as the genus of the work and its meaning³⁰¹. Thus the concretisation of the work “cannot be reduced to the reality of the text or to the subjectivity of the reader.³⁰²” In explicating the need to identify *structures* in the text which will activate reader responses during text processing, Iser asserts of text and reader that:

[S]eparate analysis would only be conclusive if the relationship were that of *transmitter* and *receiver*, for this would presuppose a common *code*, ensuring accurate communication, since the *message* would only be travelling one way. In literary works, however, the message is transmitted in two ways, in that the reader receives it by ‘composing’ it. There is no common code-at best one could say that a common code may arise in the course of the process.³⁰³

Describing a text as simultaneously a message and a transmitter is problematic, especially given the nature and function of a real transmitter in mathematical communication theory. Iser *is* ultimately relying on Shannon’s theory to provide authority for his model. Thus it behoves him to interpret the abstracta and other elements of the theory correctly. Describing the reader as a receiver is less irksome and matches Dretske’s adaptation. Iser refers to Posner’s formulation of the text as a first code and the “aesthetic object as the second code, which the reader himself must produce,³⁰⁴” which provides an example of the semantic confusion or alteration of the term code when this rigorous mathematical concept is loosely or analogically applied but with only the pretence of an appeal to rigour. Shannon’s transmitter and receiver

²⁹⁸ Iser, W. *The Act of Reading: An Aesthetic Theory of Response*. Baltimore: The Johns Hopkins University Press, 1978, 32.

²⁹⁹ *Ibid.*, 36.

³⁰⁰ (See Chapter One pp. 15-16.)

³⁰¹ *Ibid.*, 21.

³⁰² *Ibid.*

³⁰³ *Ibid.* (Emphasis mine.)

³⁰⁴ Iser, W. *The Act of Reading: An Aesthetic Theory of Response*. Baltimore: The Johns Hopkins University Press, 1978., 92.

are machine devices for which *coding* and *decoding* are defined consistently according to fixed mathematical rules. When Iser suggests that “there is no common code between the transmitter and receiver governing the way in which the text is to be processed,” he uses these terms in a far looser sense than either Shannon, Dretske or Moles intended, but his insight is principally sound. However, Iser then subtly alters the conception of *code* such that “at best such a code is to be established in the reading process itself,” suggesting that it is in fact a quasi-stable set of rules for interpretation that he is referring to, and that importantly the reader may alter the code itself during reading. Problematically for this interpretation, there must obviously *always* be a common *linguistic code* between the author, text and reader. I prefer recourse instead to information synthesis, wherein the code itself is regarded as a source of information, whether incipient at read-time, or a-priori.

Nevertheless, Iser demonstrates theoretical prescience in that he posits that there are structures in the text which give rise to the reader’s internal images and which “must be complex in nature, for although they are contained in the text, they do not fulfil their function until they have affected the reader.³⁰⁵” Iser clearly demonstrates an understanding, or at least intuition, that information plays a significant role in the entire reader-response process. He provides a near perfect approximation of read-time information synthesis using informationist terms:

In literature, where the reader is constantly feeding back reactions as he obtains new *information*, there is...a continual process of realisation, and so reading itself ‘happens’ like an event...³⁰⁶

Incidentally, it is information synthesis itself, and the inability, in most cases, to quantify and enumerate – or even empirically identify - all contributing information sources in a read-time or write-time synthesis event, which ensures the aesthetic qualities of the SF text. Interestingly, Iser’s theses of progressive temporally sequential reader-enacted composition, concretisation during text processing and consistency building in novel reading, which I see as corresponding to dynamic read-time information synthesis, again parallels semiotician Delany’s much earlier progressive syntagmatic algorithmic analysis of sentential information building during reading.

WORDS FAIL: CATEGORY ERRORS, EQUIVOCATION, AND GENERAL NOUNS

Approaches like those of Iser and Paulson must identify arbitrary boundaries of, and causes for, the different structural and semantic *levels* postulated, different contributing or associated disciplines in Paulson’s case³⁰⁷. Iser’s *strategies* in particular are numerous ascribed with various psychological, structural and aesthetic effects and outcomes, but are never really defined: Iser never says exactly what a strategy is or what it consists of. *Strategies* can apparently be “discerned through the techniques employed in the text,” including narrative and poetic techniques. However, the “concern is not with the techniques, but with the structure underlying them.³⁰⁸” They are said to be structures which “organise the references of the repertoire, together with the possibilities of their comprehension”, which assertion is of limited use when the definition of the repertoire itself, as I have suggested, is unstable. In explicating strategies, Iser makes reference to communication theory by emphasising the role of *selection* in determining the experience of the reader and the “emergence of the aesthetic object.³⁰⁹” Again, however, it is persistently unclear just what is being selected from what, and how. Such approaches also lead to ontological confusion between dynamic information processes and static persisted information repositories, and a reliance on unstable terms such as meaning.

Henri Atlan, from whose work Paulson adopts his view of a text as a *self-organising system*, seems to conflate time-based communication systems with relationships between static texts or messages. In his library analogy, cited by Paulson, Atlan speaks of “information...which is transmitted from one book to another, in the form of diverse forms of citation, from literal quotation to summary allusion.³¹⁰” With

³⁰⁵ Ibid.

³⁰⁶ Ibid, 68.

³⁰⁷ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 109.

³⁰⁸ Iser, W. *The Act of Reading: An Aesthetic Theory of Response*. Baltimore: The Johns Hopkins University Press, 1978., 87.

³⁰⁹ Ibid, 95.

³¹⁰ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 77.

intertextuality and citation, it is the case that information *has been* transmitted between one book and another – from one latent source to another during write-time processing - but this is not a process that a reader can *observe*. The reader can only process and *synthesise* information from the latent sources that are the *persisted repositories* of artefactual lexical information – the texts – in the library. Such texts are *latent* sources: they will not emit or transmit any information until such time as they are read. Any intersection between the information contained in each text is the result of prior transmission where one of the texts has been a contributing source and the other the destination or output message, or because both texts share another text as a common source in their respective contributing source sets. Paulson reflects on the error of regarding texts in isolation as somehow dynamic in the sense of a process, considering the Romantics on poetic text:

Poems are relational structures with words, but poems do not make the words. Nothing really justifies calling the text a living organism, though perhaps Varela's very choice of the term autopoiesis gives us an idea why the metaphor has been so seductive and powerful: **it seemed intuitively fitting to the romantics to identify the *autonomy* of literary works with their production or creation**, their poesis. But to call the text an organism is based on a **category mistake**... The literary text would appear to be an autonomous object whose specificity arises out of the use it makes of its medium, language, insofar as the latter is also an autonomous system.³¹¹

It is not that, as Paulson himself then inconsistently has it, a *text* “creates its own codes beyond all other codes,³¹²” but that *when a text is read* (the process of read-time information synthesis) new codes emerge. Paulson concludes, via reader response theory, that “to be considered a possible autonomous system, the text must be understood dynamically and not statically.³¹³” He decides, correctly in my estimation, that the text only exhibits the behaviour of an autonomous *system* when it is being written or read: the point at which what I refer to as synthesis – the process of *information synthesis* – occurs. It is also at this point in his theory, however, that Paulson himself falls victim to another far more subtle logical and category error common to literary theory – that of equivocating the abstract general conception of a text and the general idea of its assimilation by anyone, with the hypothetical conception of a specific instance of an actual text as being read by some real reader:

When it is coming into being in a dynamic interaction of the author, language and tradition, when it is being assimilated by the mind of its reader *or by the collective mind of its culture*, then *the literary text* is a possible autonomous system.³¹⁴

Firstly, “assimilated by the mind of its reader” is analytically unambiguous, but only if it is *a text*, and not ‘*the text*’, being so assimilated³¹⁵. To achieve consistency, one must read both the pronoun *it* and the nouns *author*, *mind* and *reader* in the above passage all as general nouns. This propensity for massing general nouns in place of countable nouns in explication is typical of literary theory and cultural studies, and it undermines the clarity of dealing with ideal specific, isolable, quantifiable and individual entities. It leaves the way open for loose quasi-explicative metaphor, which is also prolific in such theorising. Simply put, it serves to promote pretentious generalisation over disambiguation. Another associated habit in literary theory is that of using the definite article with a *general sense* of the noun *text*. This is not grammatically impermissible, but Paulson is undeniably trying to articulate a mapping of concepts and principles from scientific theories³¹⁶, where a duality of general and specific noun with a specific predicate is frequently problematic and gives rise to ontological confusion, the latter being largely incompatible with the aims of science. The rather nebulous conception of *culture* and the artificial, tenuous, and perhaps vacuous abstraction that is *cultural collective mind* exacerbates this problem in explication. If this phrase is intended to be metaphorically synonymous with something like “all readers (from a given culture) who

³¹¹ Ibid, 131.

³¹² Ibid, 145.

³¹³ Ibid, 132.

³¹⁴ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 132. (my italics)

³¹⁵ Grammatically, the definite article is used to refer to specific or particular nouns; the indefinite article is used to modify non-specific or non-particular nouns.

³¹⁶ Information theory, the theory of autonomous systems, and the theory of biological emergence and emergent systems.

process a particular text”, then it is analytically consistent, otherwise the *collective mind of culture* is a very queer and ambiguous object, and unsuited to analytic predication with explicit scientific descriptors such as ‘autonomous system’. The two conceptions of a text here – the general abstractive and the abstract individual – are combined in such an arbitrary and equivocal way as to make it impossible to discern what exactly is supposed to be attributed the analytic property of being an autonomous system. Given that Paulson’s thesis assertively relies for its cogency and intellectual authority on the *scientifically underwritten* rigorously ontologically explicit conception of an autonomous system, this polysemy by equivocation is deleterious. It is thus no intellectual out to fall back on the fact that such theorising is aimed at literature, does not claim to be scientific and eschews reductive approaches³¹⁷. This is a similar problem as that exhibited in the writings of Barthes and Derrida, as discussed in chapter one³¹⁸. The indefinite article denoting a specific example of a specific type is the logically consistent approach in the context. Why “pursue the idea that *the literary text* may have formal characteristics in some way comparable to those of living organisms³¹⁹” when what is required is to apply this idea, not to the ambiguous ‘the literary text’, but to arbitrarily selected but real instances of *literary texts* such that *literary texts* maps to *living organisms*? The former usage opens the way for a further confusion, whereby the term *literature* is treated as a partial synonym of *literary text* operating as a general noun, such that literature is then similarly specifically and analytically predicated.

The information theoretic view I am presenting regards each and every material and mental instantiation of any text as a separate source of artefactual or incidental information³²⁰ according to an ontologically motivated typology. There is no use for or valid mapping from the abstract conception of a text as an abstract shared and distributed entity, and the idea of a source, except that the reader’s community could certainly be regarded as a heterogeneous *compound source* made up of many other individual sources or *sub sources*³²¹.

INFORMATIONIST SCIENCE FICTION THEORY, TEXTS, AND THE MEGA-TEXT

Paulson, citing Richard Rorty’s scepticism about attempts to formulate systematic terminologies for dealing with literature, asserts that any attempt to develop a formulaic or scientific approach to literary texts will falter, since:

[T]he literary text cannot be described at a single level; it can be reduced neither to linguistic phenomena nor to rhetorical figures nor to global structures ... Attempts to make such reductions, to account for the whole in terms of a single set of parts or a single procedure for organising the parts, have never obtained general assent, precisely because they are always incomplete. Nor is such a reductive understanding what we really want out of literature³²².

We may not want a reductive understanding *from* literature or literary texts, but the best way *to understand* fiction texts and their read-time cognitive and aesthetic outcomes may well be reductive. I suggest that this is precisely why theorists like Iser, Barthes and Paulson have constantly deferred to Shannon’s theory for authority. Moreover, it is difficult not to regard Paulson’s own approach, on his own terms, as being of this systematic and analytic variety, which requires some sense of reduction to ontologically unambiguous terms both terminologically and theoretically:

³¹⁷ Ibid., 114.

³¹⁸ § Informationist Structuralism and Poststructuralism in Chapter one.

³¹⁹ Ibid., 131.

³²⁰ This includes information that results in affect or and to what are stylistically described as the aesthetic qualities of the text.

³²¹ Long B. The Ontology of Information, (In Preparation).

³²² Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 114.

Lotman's use of information theoretic concepts should not mask the fact that he is producing a formalist projection of the romantic divinization of literature as literary form, that he is describing how this cultural concept of the work of art actually operates as an organisational principle of reading. The same must be said a-forteriori of my own argument...**I have proposed the formalism of self organisation from noise as an explanation for the production of meaning out of the polysystemic complexity of the text.**³²³

Paulson and Iser both pursue a formalist and analytic description of texts and their properties, but then contradict and undermine these evident analytic objectives by conflation and equivocation with nebulous, loosely defined concepts of culture, values, literature, the ideal or abstract reader and text, and such arbitrariness as social norms.

Paulson encounters further ontological equivocations when he comes to analyse the degree to which a text can be considered an autonomous system and "entirely self determined, turned back on itself so as to take up and assume within its autonomous organisation any initial, allonomous intention of meaning."³²⁴ He concludes that "it is most unlikely that this process ever attains organisational closure, unlikely that the composition of a text can ever be determined entirely by the laws arising within its own composition."³²⁵ In turning to his assertion that the "literary text is a locus of self organisation from noise," he then oscillates between references to what is ambiguously either a specific or general conception of 'the text' and ambiguous generalisations of culture and literature:

The initial shift...was not directly toward consideration of the text as autonomous object, but rather toward taking the text, with its unreliable transmission of information, to be a component of a larger system, that of cultural circulation...In this sense we are still considering literature as a transmission channel and thus as an allonomous system³²⁶

'Text' can feasibly be read as a general noun here, but 'culture' and 'literature' cannot, given the use of *transmission channel*. It is never clear in Paulson's theory how literature can be considered to be something so specific as a communications channel, an unexpected aporia in the light of his assertions of formalism, and no less so by virtue of his disclaimer against reductionism. This random interlacing of metaphoric allusions to the principles and schemata of communication and information theory with direct reference to the same in the exposition of theory is not cognitively and logically innocuous. It rests upon ontological confusion and category errors, and results in obfuscation. 'Literature' is itself a polysemous and semantically slippery term, and can be taken to refer to an arbitrary body of written texts, or to writing conceived generally as praxis, or to an abstract conception of the output of that praxis, or be some combination of these. Other definitions exist, all of which would be hard to invalidate on ontological, logical or semantic grounds.

Iser rejects the notion of the *informed reader* as posited by Stanley Fish, since it relies on a logocentric generative-transformational grammatical model which renders the effect of the text on the reader only a linguistic metaphor³²⁷. He refers to the *superreader* of theorist and linguist Michael Riffaterre, which term denotes an abstraction for a kind of democratic agreement between an abstract "group of informants" (readers) as demonstrative that "stylistic fact can only be discerned by a perceiving subject."³²⁸ Iser's careful comparison of the various *abstract* reader type constructs in these various theoretical models reveals his commitment to avoiding logocentricism in theorising about meaning and aesthetics: he concludes that "we can see even more clearly from the concept of the informed reader than from that of the superreader that an analysis of text processing requires more than just a linguistic model."³²⁹ Iser is in interdisciplinary company, for philosopher Michael Devitt joins naturalist-philosopher Stephen Stich in the assertion that ontology cannot be explained by theories of linguistic reference, and admonishes

³²³ Ibid, 120.

³²⁴ Ibid., 132.

³²⁵ Ibid., 133.

³²⁶ Ibid., 134.

³²⁷ Iser, W. *The Act of Reading: An Aesthetic Theory of Response*. Baltimore: The Johns Hopkins University Press, 1978, 32.

³²⁸ Ibid., 31.

³²⁹ Ibid., 32.

philosophers to “put metaphysics first.”³³⁰ Nevertheless, in identifying the importance of the actual or ‘contemporary’ reader, Iser devises the *implied reader* as a theoretic abstraction. He struggles with the consistency and coherence of that abstraction. He claims that the “concept of the implied reader is therefore a textual structure anticipating the presence of a recipient without defining him”³³¹ and yet that “the ideal reader, unlike the contemporary reader, is a purely fictional being; he has *no basis in reality*.”³³² Even in identifying the work as a virtual upshot of the dynamic interaction between the reader and the text, and even whilst establishing the abstract nature of the implied reader, Iser gravitates to the necessity of identifying the implied reader in the context of structures in the form, which framework was a mainstay of structuralist theory. Iser is perhaps simply unable to be radical enough in his re-assessment out of his historical and theoretical context. My standpoint, some 31 years later and on the other side of the postmodernist revolution, is perhaps a somewhat easier place from which to re-formulate or radicalise such frameworks. I think that the various competing abstract representations of the reader arose in the late structuralist period precisely because such a construct is ultimately inadequate to capture the dynamics of meaning production or for understanding the respective contributions of the text and reader to the realisation of meaning. I suggest that it is not in fact the *reader* that is the requisite *central* abstraction, but the *information source*.

Readers are clearly important to the production of meaning during text-processing. However, no abstraction which bottoms out in some kind of unreality is going to help any analytic theorist to establish a cogent basis for a theoretical framework. If we supplant the implied reader and other manifestations of the abstract reader with abstractions which are firmly rooted in reality and not anthropocentric – namely the contributing information source set and read-time synthesis – then the ontological and conceptual difficulties associated with trying to determine the role and parameters of the former are eliminated. The information source set is a mathematical abstraction of a similar functional profile to the universal quantifier of classical logic: it refers to something real in a readily conceivable and conceptually cogent way, even if what is referred to is not quantifiable or *practically* enumerable, it is *denumerable*. The set theoretic universal and existential quantifiers of classical logic are perfectly analytically cogent. No logician of merit ever expects anyone to ever actually enumerate all of the hydrogen atoms in the universe, but the set of all hydrogen atoms at time *t* is perfectly real. Likewise, one need not be able to identify and enumerate (nor, in most cases, could one) all of the contributing information sources in a given read-time or write-time synthesis event, in order to make mathematical sense of such a conception. In contrast, it is impossible to give the same analytic credence to an abstraction like the implied reader, which construct is multifariously definable at best. Biologists and other scientists may employ description, metaphor and analogy in explication, but the referents are always discrete or determinable material objects, systemic actualities, or reproducible mathematically, experimentally, or methodologically determined results which are ontologically unambiguous. They may counterfactually estrange known facts by analogy and extrapolation, but in each case the information being attenuated or synthesised with noise is *veridical* information. Incompleteness in a reductive theory is problematic, *but linguistic and ontological incoherence in any theory is more so*.

Information theoretic terms like *communication channel* simply don’t apply to such loosely defined terms as *literature*. This analogical mapping incurs an ontological category error which *does* matter. It is difficult to avoid a parallel with Broderick’s critique of Derridean deconstruction’s appropriation of the term *undecidability* from Godel’s incompleteness theorems, where “it is arguable that to step out of the purely formal is to turn undecidability from a well defined phenomenon into a sloppy figure of speech.”³³³ Regarding ontological confusion due to appropriated terminology, Broderick makes the following deft observation:

³³⁰ Devitt, Michael. “On Determining What There Isn’t.” *Stich and His Critics*. Chichester: Wiley-Blackwell, 2009. 46-61, 5, 48.

³³¹ Iser, W. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978, 34.

³³² *Ibid.*, 29. (my italics.)

³³³ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994, 112.

This is not to scorn Derridean attacks upon the corrosive of certain phallogocentric and essentialist practices, though we should note that these excel in revealing the contrary effect: namely: **rhetorical figures falsely construed as well-defined phenomena**. It is to point out that significant aspects of the deconstructive programme seem to be based on a poorly understood set of analogies drawn...from meta-mathematical discoveries...**And if this critical remark in turn is thought vulnerable to a deconstructive decentring of ‘expert opinion’...it must be asked why numerology...or lunatic word-play are not used as a basis instead for transgressive theory.**³³⁴

From the perspective of ontological clarity and consistency, a far better approach overall to information theoretically inspired analysis of fiction texts is accessible through a reductive-abstractive adaptation of Broderick’s constructs for science fiction, wherein the collection of SF texts which contain instances and tokens of various SF novums and *icons* is referred to as the *mega-text*³³⁵. I will regard the concept of the mega-text, by the terms of the information theoretic SF theory that I am presenting, as simply an example of an *information source set* – an ideally quantifiable but practically inaccessible *real* set of actual sources which contribute information into the process of information synthesis which occurs at both read-time and write-time, resulting in an agglomeration of messages – an incipient *persisted repository* of information. This synthesised *latent* or *static artefactual information source* is a new text. Note that all of the terms of this vocabulary, if somewhat reductive, are systematic and consistently defined. Artefactual information is simply that which is produced by intelligent agents for the purpose of communication. A source we have already defined rigorously, and a latent source is simply a persisted repository of information such as a message or text which will yield some proportion of its information for synthesis at read-time: when read by a human reader. A persisted repository is simply any repository of information produced by some source and captured such that it effectively stores or persists information for later potential synthesis, transmission or consumption. Synthesis is explicitly the combining of information from one or more sources, which sources may have produced information of different types.

For all fiction texts, the author’s write-time information synthesis is arguably more cognitively demanding than the reader’s read-time synthesis, since the latter does not need to rigorously configure a new message – a newly synthesised latent source. However, science fiction proper requires of the reader that they interpret the ontologically estranged and complex references encoded into the text during write-time synthesis. *Informationist* science fiction texts may elevate the reader’s experience of aesthetic and cognitive outcome in read-time synthesis, by requiring that the reader does this and simultaneously discerns the meta-informational components of the text and its encoded narrative. I use the term *encoded* here in the very specific sense described in chapter two. The mechanism of semantic, affective and aesthetic encoding – of how meaning or narrative comes to supervene on the artefactual information that is the text – is *abstracted* out. What matters is that there is a *strong supervenience relationship* between whatever is held to be encoded in a persisted repository such as a text and the information of that text. It is information types which play a significant role in semantic outcomes at read-time synthesis.

INFORMATION TYPES, SYNTHESIS, AND THE NOVUM

In challenging the explanatory sufficiency and veracity of the *computational regime*³³⁶ – which is how she refers to the *computationalist* world view – and that of *digital philosophy* in general, literary critic Hayles investigates the interplay between digital and analogue information in spoken, written, and computer-mediated human discourse and language. We have met this information type distinction, and the conception of a conversion between one type and the other, in Fred Dretske’s *digitalisation* thesis. Hayles suggests that the locus of complexity of the world and human affairs involves a combination of digital and analogue information, and an interplay and feedback between natural and artificial information, the latter supervening on what she refers to as *code*³³⁷. This dynamic, which she refers to as *intermediation*, is motivated by what she perceives as the “urgent task to understand in nuanced and theoretically

³³⁴ Ibid.

³³⁵ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 37, 57-8, 59-60.

³³⁶ See Chapter one.

³³⁷ Hayles, N. Katherine. *My Mother Was a Computer: Digital Subjects and Literary Texts*. 2nd. Chicago: University Of Chicago Press, 2005, 15-16.

sophisticated...interactions between code and language.³³⁸ In Hayles' thesis, the usage of this word encapsulates the meaning familiar to software developers and computer scientists, and refers generally to all of the program code associated with a computer and the software on it. Although she does not fully develop an accompanying ontological framework, Hayles views speech, writing and computer code as three different "systems for creating signification"³³⁹. This indicates an intuitive tendency to an almost typological view of information, whilst *intermediation* would rely on what I refer to as *information synthesis*. Perhaps less than convincing are Hayles' assertions that Saussure's conception of signifier and signified apply to the relationship between binary code and the higher level lexical codes which supervene upon it, and that the Saussurean conception of difference of signifiers applies to bit values³⁴⁰. I think that the latter is demonstrably more akin to logical bivalence. The appropriate distinction is perhaps that it is *function* that is associated with bit values, rather than difference and meaning³⁴¹.

Hayles goes on to address the insertion of mathematical and computational language, signifiers and symbols – especially with regard to computer program code - into fiction texts³⁴². In an investigation of the motif of *figurative language* "as the dialectic complement of" *performative code* in Neal Stephenson's *Cryptonomicon*, Hayles paraphrases reader-response principles in terms of reader-computer and text-code analogies which are present throughout the narrative of *Cryptonomicon*, thereby echoing Porush's analysis of Pynchon's *V.* as imbued with self-reflexive cybernetic metaphor:

In this context, the reader's activity is implicitly imagined as burying the memory of one section in order to cope with new information offered by the next plot thread; later when the thread resurfaces again, the reader must disinter that information and link it with the new developments...In effect then, the reader functions like a digital computer...³⁴³.

On my information typology, program code and natural language are *both* lexical artefactual information. These meta-informational motifs in *Cryptonomicon*, which Hayles identifies as the "interpenetration of technology and text", and the use of information technology discourse in the fiction text, both exemplify the kind of *information synthesis* which I propose is a mark of information age *informationist* science fiction. The outcome of write-time synthesis of science and technology discourse with fictional narrative discourse involves the synthesis of different types of artefactual information.

Broderick introduces a cognitive and computational conception of discursive and epistemological synthesis in scientific and literary texts and writing. He concludes that scientists combine and present findings and data based on "esoteric but starkly elementary models far removed from the domain we inhabit," with various figurative, analogical, metaphorical and literary devices and in conjunction with metaphysical intuitions that circumvent methodological rigour. For Broderick, this is an upshot of the way in which the human brain copes with the chaos of the world and the various imponderable and "defiantly unknown or uninscribable" facts therein³⁴⁴. As we saw in chapter one, although Broderick defines aspects of cognition semiotically, giving an impression of logocentricity pertaining to a kind of mentalese, it seems he is nevertheless interested in what I refer to as *internal information synthesis* at read-time and write-time. Notwithstanding the echo of Locke's archaic associative model for ideation, the strength of Broderick's view is that it recognises significance in the *heterogeneity* of the 'content' assembled during reader cognition³⁴⁵. In *Reading By Starlight*, Broderick notes that some criticisms of Suvin's thesis, which involve the application of the meaning by difference principle of semiotic theory, fail on the basis of ignoring the subtleties of Suvin's reference to the novum as different and differentiated in terms of its narrative world, and that it is the *way* that novum terms differ from other signs that makes them interesting³⁴⁶. The way that novum terms differ as signifiers can be investigated on the basis of the *types of*

³³⁸ Ibid, 15.

³³⁹ Ibid, 39.

³⁴⁰ Ibid, 44.

³⁴¹ Although perhaps we should allow for the implication of Grice's *natural* meaning.

³⁴² Ibid., 119.

³⁴³ Ibid., 140.

³⁴⁴ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994, 131.

³⁴⁵ Ibid., 130. See my analysis in chapter one.

³⁴⁶ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995,32-33.

information involved; and the extent to which the attenuation or degradation of any messages in the text affects their read-time outcome for the reader will depend on the amount of information lost in textual transmission as well as the ‘noise’ imposed by the reader’s internal information sources.

INFORMATIONIST SF THEORY AND SEMIOTICS

Broderick is one of numerous theorists who have attempted combining semiotics and information theory, resulting in an interesting if problematic information synthesis in theory: information theory vis-à-vis communication theory is rigorous mathematical science, whilst semiotics is not³⁴⁷. The central postulates of the “coherent deformation” of the “data of the world” as giving rise to meaning - which Iser borrows from Merleau Ponty - and the former theorist’s reformulation thereof as a system of equivalences in the *repertoire* which are supposedly “identical to...aesthetic value”, which “initiates the process whereby the reader assembles the meaning of the text³⁴⁸” through the “recodification of familiar norms³⁴⁹” all of these are inferentially putatively underpinned by communication theory in that “[t]his whole process is governed along the lines of all forms of communication.” The lines of governance Iser cites are based on a *hybridisation of semiotic theory and communication theory provided by Moles*:

The basic process of communication between a sender and a recipient...consists...of the following: taking recognisable signs from the repertoire of the sender, putting them together, and transmitting them along a channel of communication; the recipient then has to identify the signs received with those which he has stored in his own repertoire. Ideas can only be communicated in so far as both repertoires have elements in common...But to the extent to which such a process takes place within systems equipped, like human intelligence, with memory and statistical perception...the observation of similar signs gradually alters the recipient’s repertoire and leads ultimately to a complete fusion with that of the sender...Thus acts of communication, in their totality³⁵⁰

The critical distinction upon my theory is that there isn’t really any *signification* occurring in the sense of the instantiation of common signifieds or referents at write-time and read-time. Whatever is signified to the reader at read-time will emerge only through read-time synthesis of the information of the text with the information available in the reader’s internal information sources: these are the ‘elements in common’, not lexical signs. *It is synthesis, not signification, which is occurring*. The only way to strictly determine whether any of the information the reader synthesises at read time refers in the same way as that synthesised by the author at write-time would be to bring the two agents together to make an internal comparison.

Hayles’ asserts that Shannon’s scientific information theory, Saussurean semiotics, and Derridean deconstruction are linked by common theoretic concepts and principles, and that each is based on a similar conception of difference: the difference between symbols or ensembles (continuous) in Shannon’s theory, and difference between signifiers in semiotics³⁵¹. For Shannon’s theory in its intended application, meaning is irrelevant to message and in semiotics and deconstruction the signifier is divorced from the signified such that meaning arises from chains of the former only. However, it is not clear that Shannon’s system is centrally concerned with *difference*, or with any conception of difference at all. Hayles cites Norman Abramson’s introductory text *Information Theory and Coding* in asserting that Shannon information is determined by a series of *differences* between the selected symbols or messages (or the ensemble of functions in the continuous case) at the source³⁵². However it is not difference that forms the basis of Shannon’s theory (nor does Abramson say as much) but the probability that one symbol will be selected after another, whether different or not: this is the principle of the *Markov chain* for determining

³⁴⁷ The earliest serious efforts are probably those of Moles, although Peirce could be said to have prefigured the entire project before the advent of 20th century mathematical communications theory with his *Logic as Semiotic*

³⁴⁸ *Ibid.*, 82.

³⁴⁹ *Ibid.*, 82.

³⁵⁰ Iser, W.. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978, 82 from (Moles.)

³⁵¹ Hayles, N. Katherine. “Information or Noise? Economy of Explanation in Barthe’s S/Z and Shannon’s Information Theory.” *One Culture: Essays in Science and Literature*. Ed. George Levine. Madison: University of Wisconsin Press, 1987. 119-142.

³⁵² *Ibid.*,

informational entropy. A sense of difference is only important in Shannon's theory in terms of the *equivocation*, which is a measure of the mismatch between the message produced by selection at the source to be sent, and that same message assembled for the destination by the receiver. This equivocation is about loss of information and the fidelity of the channel: it does not determine anything about the meaning of either the source-selected message or the received message, and nor does it reflect that "the information content of a message can be calculated only with reference to the ensemble from which the message elements are drawn, that is not absolutely but through a series of differences."³⁵³ Difference on Saussure's theory involves signifieds and meaning. Shannon's theory is not about meaning at all. Shannon was interested in the maximal *fidelity* of the message received at the destination as compared to that which was produced at the source.

In his essay *Logic as Semiotic: The Theory of Signs*, C.S. Peirce does not define information explicitly, but his definitions relating to signs reveal that he regards information as conveyed by combinations of what I have been referring to as natural and artefactual information, and in so doing he not only anticipates structural elements of Shannon's theory, but also anticipates and foreshadows work done on natural and non-natural meaning by philosophers Grice and Dretske as much as a century later³⁵⁴. There is also a striking and important parallel between Peirce's description of sentences as information carrying and Shannon's conception of a message³⁵⁵. Peirce anticipates Dretske's much later postulate that the knowledge gained by a human agent receiving information in a message depends upon the information already available to that agent³⁵⁶. Peirce's trichotomic typology of *signs* is also an anticipation of Grice's conception of natural meaning, and in some sense parallels the typology which I have developed for information. For Broderick, semiotics provides an insight into how SF texts achieve cognitive and aesthetic innovation:

Above all, science fiction textuality escapes the truly formulaic in its capacity – indeed, its dynamic need – for linguistic play and innovation. Agenot stresses that **sf's lexicon constitutes a body of novel signifiers lacking actual signifieds outside their intertextual 'absent paradigms.'** Sf uses 'fictive words'...using paradigm here in the linguistic rather than the Khunian history-of-science sense to mean a list of interchangeable words with a common real world reference.³⁵⁷

If we regard these novel signifiers with absent paradigms as exemplified by novum terms with counterfactual pseudo-informational 'referents' in possible worlds, then a meaningful link between semiotics and information theory becomes apparent for SF theory.

Ferdinand de Saussure's logocentric semiotic model operates at a lexical and semantic level insofar as its central syntagmatic and paradigmatic chaining relationships exist between lexemes and what he describes as their (mental) meanings, and the role of what I am referring to as non-lexical information is minimised. Saussure has no real concept correlating to Peirce's empirical dicent signisign, and focuses comprehensively on lexemes and symbols and their internal mental-ideational correlates:

[T]here is no linguistic entity possible which would be directly accessible through the senses, because none exists apart from the idea which can be attached to it.³⁵⁸

On Saussure's model, the meaning of a lexical sign is determined through difference established in a chain of signifiers - which by information ontology constitute a chain of artefactual lexical information sources. Moreover, Saussure makes very limited mention of information. For Saussure, sensory perception plays a

³⁵³ Ibid., 119-14, 126.

³⁵⁴ Peirce, C. S. "Logic as Semiotic: The Theory of Signs." in *The Philosophical Writings of Peirce* Ed. Justus Buchler. New York: Dover, 1955, Rhematic Indexical Sinisign, Dicent Sinisign 115, 118. Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981, 205, 242.

³⁵⁵ Peirce, C. S. "Logic as Semiotic: The Theory of Signs." in *The Philosophical Writings of Peirce* Ed. Justus Buchler. New York: Dover, 1955, 101.

³⁵⁶ Ibid.

³⁵⁷ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 40.

³⁵⁸ Saussure, F. *Writings in General Linguistics*, Ed. Simon Bouquet and Rudolf Engler, Trans. Carol Sanders and Matthew Pires, Oxford:Oxford University Press, 2006., 5.

role in – else the sign could not be perceived – but I suggest the ‘linguistic entity’ on Saussure’s thesis really requires information synthesised from multiple internal and external information sources of different types, upon which information the semantic codes supervene. A lexical signifier is an artefactual lexical information source. It corresponds itself to an arbitrary selection event on Shannon’s theory, and picks out or selects a particular signified – an object which is also a source of information. It is an information source by Shannon’s statistical definition in so far as it represents the outcome of a selection from many *possibilities* at a given point in the text. The ‘message’ encoded therein on this entropy definition of information is just the lexical symbol itself. The *meaning* encoded in/by the message that is the symbol/signifier is not captured by Shannon’s model. However, Delany’s and Iser’s emphasis on the formation of non-lexical mental *images* must be accommodated. Saussure himself emphasised that there was no linguistic conceptually atomic *simple* available for language theorising:

...there is no linguistic entity available to us which is simple, since even when reduced to its simplest expression it requires that account be taken simultaneously of sign and meaning...³⁵⁹

The only components addressed in Saussure’s model are external physical realities, external grammatical and symbolic representation, internal representation and the meaning intrinsic to the latter: he fails to acknowledge a role for *information*³⁶⁰. In this I think Saussure missed the subtlety which Peirce, before him, captures by allowing information an intuitive and substantive place in semiotic pre-theory and theory. The combinatorial synthesis of information underpins both the process described as the instancing of an *interpretant* by Peirce’s theory and that of the realisation of a mental sign-meaning by Saussure’s lights³⁶¹. SF texts employ a wider range of lexical signs in terms of the *heterogeneity* of their corresponding contributing information source types, and involve more cognitively demanding veridical information synthesis through synthesis of information from scientific information sources which refer to ontologically complex objects. The ratio of signs in an SF text informed by *veridical* information is also significantly increased. The cognitive aesthetic of Lem and Suvin, and the aesthetic of complexity, both correlate with increased veridically informed sign-sources which select informationally complex signifieds by synthesis.

Using the strong sense of supervenience, *signification supervenes upon synthesis*. Read-time information synthesis is what makes the signifier ‘slippery’. *Any* change to the contributing source set will alter the outcome of synthesis in some way. The only way to strictly determine whether any of the information a reader synthesises at read time matches that synthesised by an author at write-time would be to bring the two agents together to make an ideal comparison. An intersection of the set of the *identifiable* contributing sources of the author and the reader should indicate *some* conjunction. However, determining the degree to which what Delany and Iser refer to as the *mental images* formed during read-time and write-time are in any way similar between percipients would be, in accordance with John Locke’s theory of mind, impossible – until perhaps neuroscience provides a solution.

INFORMATIONAL HETEROGENEITY: THE HETEROGENEOUS INFORMATION PROFILE

Read-time synthesis gives rise to incipient and potentially highly unpredictable information: what Iser referred to under the rubric of ‘new codes’. Thus, when the text of Banks’ informationist space opera *The Algebraist* presents scientific veridical information synthesised with futurological counterfactual pseudo-information including novum and mega-text codons, the reader must respond cognitively - ideating and extrapolating from whatever information and knowledge they may internally possess which seems relevant - to accommodate both terminological and ontological estrangement:

³⁵⁹ Saussure, F. “Writings in General Linguistics.” Ed. Simon Bouquet and Rudolf Engler. Trans. Carol Sanders and Matthew Pires. Oxford: Oxford University Press, 2006, 6.

³⁶⁰ Ibid.

³⁶¹ Peirce, C. S. “Logic as Semiotic: The Theory of Signs.” in *The Philosophical Writings of Peirce* Ed. Justus Buchler. New York: Dover, 1955, 100.

We Dwellers...encompass as much of the spectrum of chronosense as we are able, covering most of it. I exclude the machine-Quick.³⁶²

When the ontologically estranged counterfactual character that is the Dweller sage Jundriance discusses the attributes of his species, the reader must employ extrapolative reasoning from knowledge supervening on existing veridical information (internal veridical sources) to understand the diegesis and attain the available cognitive and aesthetic effects. ‘Chronosense’ is a superb scientific neologism (from biological science) for use in an SF text, because even if the reader is unaware of its scientific usage – involving the way that the human metabolism and certain computerised sensor-based systems respond to the stimulus of natural light - then if they have some knowledge of the more commonly encountered morphemes ‘chrono’ and ‘sense’, they can still attempt to perform a satisfying cognitively enacted internal synthesis of information. The information profile of Banks’ informationist space opera thus involves a certain combination of information types in what, I suggest, may be demonstrably statistically typical ratios and proportions. Different SF sub modes evidently do employ subtly or distinctively different information type combinations.

What is generally referred to as Hard SF is regarded by theorists like Suvin as possessed of an aesthetic arising from the cognitive-imaginative application and effort involved in encoding and decoding novum centred around both possibilia and what Suvin himself calls *extrapolative* cognitive estrangement:

The consistency of extrapolation, precision of analogy, and width of reference in such a cognitive discussion turn into aesthetic factors...Once the elastic criteria of literary structure have been met, a cognitive - in most cases strictly scientific - element becomes a measure of aesthetic quality, of the specific pleasure to be sought in SF. In other words, the cognitive nucleus of the plot codetermines the fictional estrangement itself.³⁶³

Thus a primary component of SF’s aesthetic appeal resides in counterfactually extending known material, technological or scientific facts to anticipate or speculate about new possibilities.

The text of astrophysicist Fred Hoyle’s speculative hard-SF classic *The Black Cloud* exhibits counterfactual pseudo-information synthesised with scientific veridical information:

“...But look at the heliocentric distance, 21.3 astronomical units, only 21.3 times the Earth’s distance from the Sun. It’s impossible.”

“I don’t see why.”

“At that distance it must be easily visible to the naked eye...”³⁶⁴

At read-time, this text builds narrative suspense as the fictional astronomer Kingsley is expressing doubt about the fictional data relating to the distance to the fictional black cloud with the fictional astronomer royal. The setting is counterfactual, but not futurological. The narrative is first person memoir. The dialogue employs correct astronomical terminology and the reader’s read-time processing can further synthesise the scientific veridical information encoded into the text at write-time synthesis. The setting is counterfactual by minimal ontological estrangement (the cloud.) The characters and events are, of course, counterfactuals. There is no *futurological* counterfactual pseudo-information in the excerpt from Hoyle’s text, but the proportion of veridical information is quite high in both of the above excerpts, each of which is both a message and a latent source. Significantly, it is Banks’ space opera which employs a greater range of information types by including veridical information, futurological counterfactual pseudo-information and *pure* pseudo-information synthesised with counterfactual pseudo-information (the Dweller.) Its *informational heterogeneity* is greater. Notably absent from the excerpt from *The Black Cloud* are any novum neologisms, although the black cloud is itself certainly a variation on existing mega-text icons and a novum in its own right. Read-time synthesis of what has been encoded into Hoyle’s text during write-time synthesis does not require the reader to consider as many naturalistic estranged ontological *possibilities* to understand the narrative. It would seem that greater ontological estrangement in a counterfactual sense (rather than a purely fantastical sense,) as with the novum, involves a higher

³⁶² Banks, Iain M. *The Algebraist*. London: Orbit Time Warner, 2004.

³⁶³ Suvin, D. *Metamorphoses of Science Fiction*, Yale: Yale University Press, 1980., 17.

³⁶⁴ Hoyle, Fred. *The Black Cloud*. London: Heinman Educational, 1957, 36.

surprisal value: it is accompanied by greater informational entropy across different information types. This fits with our conception of the novum, whereby it is often intrinsically ontologically estranging: SF novums usually involve the *naturalistic* counterfactual extrapolative or augmentative alteration of some material reality, natural kind or real object.

The high *counterfactual pseudo-information* value of the novum is conducive to cognitive aesthetic outcomes at read-time. I propose that SF is not only a special discursive synthesis, which uniquely combines scientific, humanistic and philosophical discourse(s) via Suvin's centrally *cognitive* estrangement, but that it simultaneously involves a *heterogeneous information synthesis* by virtue of the range of information types with which it engages, and especially a *high degree of veridical information* because of the key role played by natural and especially scientific veridical information in write-time and read-time synthesis. This characteristic of information type synthesis, resulting in a typologically heterogeneous information is an indicator of SF's situ at the multivariate nexus. Importantly, the primary indicator of a text's status as SF, and the primary marker of SF texts, is in fact evidenced by a combination of a wider range of lexically and textually implemented information types than is typical of other modes of fiction. The novum indicates the presence of counterfactual pseudo-information, and future possible-worlds codons indicate futurological counterfactual information.

INFORMATIONIST SPACE OPERA

Space opera has been traditionally regarded as the poor cousin to hard SF, and historically has commonly suffered pulp-fictional categorisation. However, when information age SF writers like Ian M Banks and Venor Vinge write, the quasi-normative, fuzzy-logical³⁶⁵ distinction between Hard SF and Space Opera as sub modes becomes significantly blurred. Jonathan Strahan and Gardner Dozois observe that, sometime during the late 1970s and early 1980s, space opera began a metamorphosis from its traditional adventure thematic and aesthetic oeuvre involving astronomically large-scale settings, into a darker, more serious and more sophisticated mode of SF still incorporating these traits, but with a broader intertextual base and wider ranging cognitive and scientific commitments³⁶⁶. In their brief history of the space opera, Strahan and Dozois cite the rise and influence of hard SF, new wave and cyberpunk, respectively, with periodic marked lulls in enthusiasm for adventure-based space opera, culminating in declarations of its expiration as an SF sub genre or form³⁶⁷. However, space opera survived through the absorption of aspects of each one of these sub modes by intertextual 'genetic' borrowing and adaptation. The 1980s saw the determined emergence of the new space opera, and by the early 1990s space opera had acquired the gritty anti-authoritarian ideological and socio-political mood and posthuman characterisation of cyberpunk, as well as the scientifically astute and sometimes technocratic informationism embedded in information age hard SF. New space opera texts are generally more philosophically astute, scientifically informed, and aesthetically clever than their forerunners.

Informationist space opera texts provide some of the most striking examples of both heterogeneous discursive and informational synthesis, as well as starkly contrasting authorial ideologies and knowledge, in any SF mode to date. Many writers of information-age space opera - like Vinge, Egan, Reynolds and Benford - come from mathematical or computer scientific backgrounds, whilst others like Dan Simmons, Stephen R. Donaldson, Greg Bear and Gwyneth Jones are trained solely (professionally) in literature or the humanities. Authors of space opera from professional arts backgrounds often do significant scientific research to produce SF texts: Greg Bear, whose earned his BA from San Diego State University, has worked with the FBI in a serious capacity consulting on homeland security, an upshot of which was his recent techno-thriller *Quantico*, which Bear asserts contains the fruit of serious scientific research into the genetic engineering of viruses for bio-warfare³⁶⁸. This curious role wherein SF authors influence reality in a practical forum was originally primarily within the purview of hard SF. Under the Reagan

³⁶⁵ I mean precisely that sometimes a work will fall into one set of texts, and sometimes into the other, depending on critical contingencies.

³⁶⁶ Strahan, J. and Gardner Dozois, *The New Space Opera*, Ed. Jonathan Strahan and Gardner Dozois, Australia: Voyager, 2007., 4-5.

³⁶⁷ *Ibid.*

³⁶⁸ Bear, G. *The Daily Show with Jon Stewart Interview with Jon Stewart on The Daily Show*, Date Aired June 21 2007. Available at: < <http://www.thedailyshow.com/video/index.jhtml?videoId=88999&title=greg-bear> > Accessed Sunday, 9 November 2008.

administration, a group of writers including Isaac Asimov, Arthur C. Clarke, Gregory Benford, and Robert Heinlen were assembled as a serious team consulting on the 'Star Wars' Strategic Defence Initiative³⁶⁹. Scientifically trained authors like Vernor Vinge and Benford write works which often exhibit highly unusual narrative structures and superior style and construction of character and *mise en scène*. Vinge worked as a computer science lecturer during the writing of his first few novels, and at the time of this writing, Benford is still a tenured professor of physics at The University of California Irvine and publishes physics papers regularly. Australian Greg Egan, author of perhaps the best known Australian example of informationist SF, *Permutation City*, still works as a computer programmer and mathematician.

The text of Vernor Vinge's *A Fire Upon the Deep* is dense with naturalistic, scientific and technology object-centric ontological estrangement. It is even evident in the ontology of the identities of most of the characters. Some have physical forms which make of them meta-informational metaphors for information systems: biological counterfactual *character-novum*³⁷⁰. They are at once object and subject. Other characters are meta-informational devices due to their explicit understanding and use of what are often very extrapolated counterfactual communications and computing science technologies, which exist in the fictive settings encoded by the text as synthesised counterfactual pseudo-information. The inclusion of information that is sourced from science and scientific discourses as sources makes the SF text itself a different kind of *persisted information repository* and source from a fantasy or myth text which is largely or homogeneously *pure* pseudo-information with respect to scientific discourse and information. Fantasy and myth texts might certainly carry extensive analogical references to the habitus of the author and reader, but few or none that are *scientifically* inspired and few if any engage and synthesise with the veridical information and discourses of modern science proper.

Vinge's inclusion of information theoretical precepts and principles and other related textbook tenets of communications and computing science are often not metaphorically or analogically rendered, but injected into the text of the narrative in accordance with the SF codon of the didactic and expository narrative agent, if more subtly so than in the pulp SF of the 1930s. Frequently, lay-friendly re-statements of real scientific information theory find their way into the counterfactual context of the narrative with limited or obvious extrapolative enhancements, or no fictive extrapolation at all. In *A Fire Upon the Deep*, when technician-heroine Ravna reads an intergalactic email post on a forum on the galactic *Known Net*, she observes loosely, but in accordance with actual real-world communication theory, that the original intended message sent by a very alien being with difficult to translate language is badly obscured by textual noise, and that a lot of bandwidth was expended ineffectually in its transmission:

In this part of the galaxy, a significant fraction of all message traffic belonged to the news group. More bits were sent analysing poor Ovn Nilsndot's mouthing than had been in the original. Judging from the flames and contradictions, the signal to noise ratio was very low.³⁷¹

This elegant interleaving of narrative and world construction with meta-fictional *meta-informational* counterfactual pseudo-informational reference to veridical information sources is executed throughout the text. The increased heterogeneity of information types introduced by futurological and ontological counterfactual estrangement differentiates informationist space opera texts from fantasy texts cognitively and aesthetically. The presence of ontologically estranged and counterfactual *veridical* information about scientific, technological and natural objects further differentiates SF from thoroughgoing fantasy, and diminishes within it what Suvin calls mythologisation. This latter attribute is effectively the basis of *anti-simulacra* in informationist SF, which I will discuss in the final chapter.

ONTOLOGICALLY OBJECT-CENTRIC MATERIALIST FICTIONALITY

The informational profile of SF texts means that read-time processing of such texts is cognitively stimulating in the aesthetically pleasing manner in which numerous theorists from Suvin and Lem to Delany and Broderick have observed. I doubt that this is a theoretical chimera. As science has

³⁶⁹ Cramer, K. "Hard Science Fiction" in *The Cambridge Companion to Science Fiction*, Cambridge: CUP, 2003, 186-208., 192-193.

³⁷⁰ The reader will note that I have adopted *novum* as the plural of *novum*, as preferable to *novums*.

³⁷¹ Vinge, V. *A Fire Upon the Deep*. New York: Tor, 1992, 224.

demonstrated, thinking about the natural world and trying to understand and interpret it can be a recondite process full of material obstacles. There is supreme cognitive effort involved in comprehending the ontology and physical dynamics of physical systems and phenomena. Modelling them with axiomatic mathematical systems requires intellectual and mental application that is largely absent in an undertaking such as fictive storytelling. I submit that modern neuroscience currently bears out that mental tasks such as reading and mathematics require different degrees and types of neurological functions and responses³⁷². However, the real differentiator is that science and mathematics necessarily require rigorous attention to finite detail and the necessity of exacting consistency across wide ranging ontological variable data and findings using sophisticated rigorous methods and systems for cross-checking and correlating evidence. Inconsistencies and aporia matter a great deal and must be eliminated through axiomatic proofs, falsifiability and repeatability: not something that is true of storytelling or fictionalisation. Linguistic play and narrative of the kind encountered in most fiction texts – even those considered technically superb on literary terms – may require internal narrative consistency and cohesion, but there are no rigorous demands of ontological consistency, mathematical accuracy or correspondence to fact. Joyce’s *Finnegan’s Wake* and Pynchon’s *The Crying of Lot 49* are elaborate and linguistically complex – but there is no real penalty if they fail heuristically or ontologically in terms of denoting material realities, and *all* metaphor is intrinsically ambiguous. It is arguably for this reason that mythology has always been with us, whilst the scientific revolution came so late in human history – so long after the great observationally and geometrically inspired thought of Aristarchus of Stamos, Archimedes and Pythagoras. With deference to Dawkins’ meme theory, there is simply far more work required to attain a reward in terms of survival benefit from science than from mythology³⁷³. Compared to competent scientific theories, religious narrative and mythology are comparatively effortless to produce, and are simultaneously obscure and determinedly arcane, or – like metaphor - at least ambiguous enough by virtue of the slipperiness of logocentric signification to elide any veridical information.

Peter Lamarque’s assertion of *literary* value as necessarily partly underwritten by what he refers to as moral seriousness marks his short treatise on the aesthetics in literature as strongly influenced by moral criticism. Science fiction authors such as Banks, Gibson and Delany, as well as many non-SF writers, frequently engage with or allude to one or another flavour of relativistic moral non-cognitivism or objectivist moral anti-realism, and I feel that this reflects the destabilising of the moral seriousness claim for the classification of *literature* on the basis of the open question argument, Nietzsche’s nihilism and Russell’s qualms about moral claims - at minimum. That *literature* is necessarily underpinned by some pursuit of an objective moral realism is clearly contentious, but I will not pursue this point further here. However, the prevalence of estranged and normative veridical scientific information in much SF indicates that most competent SF writers are unlikely to be nihilists about truth, and are interested in a scientific materialist definition of truth as correlated with veridical material facts. SF texts can be postmodern and morally ambiguous in the conventional sense, but not when it comes to a materialist-naturalist worldview. Of more interest in Lamarque’s essay is his attempt at a *distinction* between literature and fiction: not because of the classification of the former term, but for the properties he ascribes to the latter. He asserts that the “concepts of literature and fiction are not identical” and that, for many “the imaginative component of literature...implies fictionality.”³⁷⁴ Like Iser, Lamarque has no non-linguistic or non-logocentric terms upon which to base his analyses. Posing the question of whether literary works are thus *essentially* fictional, Lamarque notes that:

³⁷² Mangina, Constantine A, et al. “Modulation of specific brain activity by the perceptual analysis of very subtle geometrical relationships of the {Mangina-Test} stimuli: A functional magnetic resonance imaging {(fMRI)} investigation in young healthy adults.” *International Journal of Psychophysiology* 73.2 (2009). See especially the discussion and 3.2.1-3.

³⁷³ Dawkins, Richard. *The Selfish Gene*. London: Oxford University Press, 1976, 189-91.

³⁷⁴ LaMarque, Peter. “Literature.” *The Routledge Companion to Aesthetics*. New York: Routledge, 2008 (orig 2001.) 571-584.

No satisfactory answer can be given without an adequate conception of fiction, yet that concept has proved remarkably elusive to definition. It can mean ‘false,’ or ‘unreal,’ or ‘invented,’ or product of the imagination.³⁷⁵

Turning to psychologism and cognitivist epistemology, he implicates Nelson Goodman’s thesis of aesthetics as *cognitively* delineated, since “works of fiction encourage a certain kind of ‘cognitive detachment’, in the sense that readers are invited not to believe in the literal truth of what they read, but only to ‘make-believe’.”³⁷⁶ Again fiction is said to have something to do with cognitive outcomes at read-time which involve imaginative production.

Ignoring the question of the literariness of science fiction, and focussing on the aesthetic and cognitive qualities associated with its fictionality, I suggest that fictionality in SF texts and writing generally is definable on a reductive non-logocentric *informationist* basis: the unreality and falseness of fiction writing supervene upon the synthesis of artefactual counterfactual and pure *pseudo-information*. It is important to emphasise that this is not intended as a nominalist relabelling of *linguistically* inscribed conceptions of meaning and truth, but relies on the novel typologically imbued ontology of information which I have presented to provide an alternative and completely different metaphysical and reductive basis for the discussion of fiction texts and writing. Information types are the best delineator of fictionality, and information synthesis involving counterfactual pseudo-information the hallmark of fiction texts. According to Delany and Iser, it is the production of incipient information – of new codes - that is essential to fiction. Broderick cites Beer in support of a view that:

What links both scientific and fictional writing...is more important than what separates them. Both prize information, formal elegance, and surprise.³⁷⁷

SF texts and writing stand apart as that mode of fiction which implements significant synthesis of both types of pseudo-information with scientific veridical information, the latter being specifically associated with naturalistic and physicalist scientific endeavour, its methodology, discipline, and purpose. Informationist science fiction exhibits the aforementioned quality and specifically engages thus with information science and technology, mathematics and the computational sciences.

Paulson notes Michael Serres’ interpretation of a heuristic shift in French philosophy from the nineteenth to twentieth centuries:

[C]an be understood as a displacement of the second law of thermodynamics from physical to informational systems – the shift, one might say, from Boltzmann to Shannon. Bergson’s philosophical system...is one of heat engines, of reservoirs, differences, circulation of energy. If one replaces energy reservoirs by informational reservoirs, this system can be translated into one of textual dissemination³⁷⁸

I suggest that a similar shift is a major marker of the inception of informationist science fiction. The simultaneous application of information theory to literary theory and linguistics from the early 1950s onwards meant that texts by polymath authors such as Delany engaged intertextually and thematically with information theoretic concepts across multiple disciplines from the sciences to the humanities. The multiple informationist themes and icons of novels such as *Babel 17* and *Stars In My Pocket* demonstrate this broad disciplinarily heterogeneous engagement with information theory and information science, and I suggest that the stylistic and aesthetic superiority of such works are largely due to the aesthetic and affective outcomes associated with the resulting informational heterogeneity. In these two novels, Delany merges computational themes with informational character ontologies so that the cognitive estrangement experienced by the reader becomes tangibly self-reflexive with respect to the text: it can be negotiated on informational terms, reflecting what is depicted in the narrative.

The inclusion of such scientifically underwritten veridical information is, like the natural sciences, necessarily always materialistic. Scientifically speaking, information always supervenes on the physical.

³⁷⁵ Ibid., 576.

³⁷⁶ Ibid.

³⁷⁷ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994, 100.

³⁷⁸ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 93.

There exists *artefactual information*, but *there is no such thing as supernatural information*: such would be a complete anathema to science³⁷⁹. Thus science fiction texts which exhibit such synthesis must necessarily inherit this materialism *at least to the extent that this synthesis ensures it*. On this basis, informationist science fiction theory *partly* supports Suvin's assertions that *competent* science fiction is unavoidably materialistic and anti-supernaturalistic³⁸⁰. However, the strongest informationist proposition that one can make about science fiction is that at *minimum* it must *engage* with the materialist principles and determinations of science *through synthesis of some established or verifiable veridical scientific information*. This engagement can be in the form of novums constructed around counterfactual pseudo-information and futurological counterfactual pseudo-information. The informational delineation is of a different form than Suvin's, but is not necessarily ideologically weaker in the positive sense. His (original) requirement is that texts and their encoded narratives belong to the literature of cognitive estrangement only when wholly ideologically committed to materialism in a holistic and thoroughgoing way. My classification of science *fiction* on the basis of the necessary inclusion in SF texts of synthesis with scientifically secured veridical information *can* in fact support this strong position. A text which exhibits the requisite scientific veridical information synthesis may also exhibit a significant amount of *pure* pseudo-information. *If* said pure pseudo-information encodes the semantics of supernaturalism or implements what Suvin refers to as mythologisation, then one should question the status of the text as science fiction proper. I will argue this point further in the next section. Informationist SF theory also delivers a strong negative assertion: a text which exhibits no or negligible engagement with science and scientific discourse, such that there is negligible synthesis of scientifically validated veridical information – even in futurological counterfactuals and novums - is probably not SF proper *on an informational basis*. A text which exhibits only in small part synthesis with scientifically verified veridical information, in the absence of SF icons and the scientific novum, is one which has science fictive *elements*. A stronger statement about what constitutes SF proper requires information-theoretically addressing the distinction between two mutually exclusive worldviews.

INFORMATION AND THE OPEN-SYSTEM *MISE EN SCÈNE*

I suggest that many difficulties in establishing a characteristic definition of SF as a mode of writing and a set of texts arise largely due to SF's place at the multivariate nexus, and especially the nexus of science and fiction, and precisely because this situ ultimately places it also at the nexus of two ontologically mutually exclusive and oppositional sets of *world views*: the supernaturalist and the materialist. The materialist view holds that reality and the universe are encapsulated within a comprehensively physical *closed system*. Supernaturalism regards the universe as an *open system* where the supernatural and supernatural causality (and, in some fiction, magic and magical causality) are also somehow *actual*. The tension arising from this opposition – which I will refer to here as the ontology-causality opposition - is reflected in or influences almost all SF writing and criticism to varying degrees. I think that to a large extent, the impact of this worldview dichotomy or binary on SF is resistant to deconstruction because of the essential ideological commitments of science and the scientific discourses with which SF engages and which it often exploits in synthesis. Moreover, it is arguable that deconstructive theory, with its core of logocentric idealism, depends itself upon this ontology-causality opposition for its effectiveness. Amongst other things, deconstruction seeks to challenge and potentially undermine the Aristotelian law of non-contradiction, primarily in its doxastic and semantic versions wherein conflicting beliefs or linguistic statements are of concern, and to destabilise or invalidate the binary opposition of putative essential properties: male/female, acceptable/unacceptable, good/evil, normal/abnormal. However, the deconstructive approach breaks down for the open system versus closed system *ontology-causality opposition*, because the materialist closed system alternative is explicitly defined with the unreality of supernaturalism *as its contingent assumption*.

Firstly, the law of non-contradiction at work here is the *ontological* version: either the supernatural is real and supernatural things are real or it is not and they are not. If the materialist closed system view turns

³⁷⁹ Even pure pseudo-information ultimately supervenes on the physical text in which it is materially encoded. There is no actual platonic text 'out there' in a metaphysically dualistic sense. A physical text is itself a veridical source.

³⁸⁰ Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980.

out somehow to be contingently false, then it will simply cease to exist as a worldview, and supernaturalism will be the only game in town, because the exclusion of the latter is part of the necessary normative propositional basis of the former. Put simply, one can suggest that something may be both good and evil or that the distinction is meaningless, or that normal and abnormal are only linguistic-semantic constructs; but if the supernaturalist open system is actual, then materialism cannot be true at all, and vice versa. It is an ontological and epistemological question – not a linguistic or doxastic one. Even if one maintains a belief in the magical or supernatural and also that science has access to the material mechanisms of cause and effect, materialism on its scientific definition would not be true, because ultimate causality would be efficient and final and *supernatural* teleology, and its associated unlimited causal potential, would be *the* reality. The simultaneous co-existence of both closed and open systems with some kind of perpetual separation of concerns and ontologies doesn't logically work either, because science *necessarily assumes the universal uniformity of a materialist reality*. Modern pure and applied sciences rely on the assumption of a closed system for their explanatory power and exigency: science *is* foundationally materialistic, because the supernatural has never been scientifically provable or demonstrable.

Another reason for this necessary wholesale contingent trumping of one system by the other is that supernatural and magical causes are theoretically *limitless* in their causal scope and power: by their very definition they effectively completely circumvent and nullify any and all material limits and impedances. The counterfactual pseudo-informational *novum* is meaningless and cognitively uninspiring in such a setting. Scientific explanations in an open system reality would be nothing more than descriptions of mechanism, and frequently unreliable descriptions at that, since all processes and systems in nature would be subject to unpredictable and inconsistent causal impetus vis-à-vis David Hume's scepticism regarding cause and effect³⁸¹. From a cognitive perspective, and thus from a cognitive aesthetic and counterfactual standpoint, there is no point engaging with scientific discourse if The White Wizard can simply yammer 'abracadabra' and render scientific postulation and inquiry moot. The sciences, properly materialistically defined, and by extension the heroic physicalist scientist, are necessarily an anathema to the mythologising and supernaturalist worldview.

Some authors and critics, such as Stephen R. L. Clark, designate SF as a *primarily mythologising* mode with *centrally* religious motivations and outcomes³⁸². I suggest that informationist SF theory reveals this assertion to be errant by the arguments above. SF sometimes subversively engages pseudo-*mythemes* but is generally inspired by or engages with science and scientific precepts: closed system materialism, theoretical defeasibility and scientific methodology. The presence of counterfactuals and metaphor is only to be expected of a fictional text. There is no immutable or inviolable mandate or imperative for a writer of even realist fiction to obey any worldly norm, nor to observe naturalism or indeed to respect normality in any fixed fashion, let alone adhere to anything so restrictive as falsifiability or materialism, with which it is difficult to see how the allegorical could function meaningfully. Ergo the existence of magic-realism as a much loved literary genre, and the popularity of what is commonly referred to as science-fantasy. In novelistic fiction generally, there is no meaningful, nor even desirable, proscription of the fantastic, the mythological, the supernatural or the surreal – just to name a few prospective common departures from naturalism. One can't have the novelistic enterprise, with its expressive power and authenticity rooted in polyphony, allegory and intertext, without having a truly open form and mode. SF itself relies on the novelistic admission of imaginative and truly alien discourses which are only related to human discourses by allegory or extrapolation, and which accompany estranged and counterfactual alien or estranged character ontology. However, if the ontologically attuned object-centric synthesis of scientific veridical information from scientific and material sources is, as I have argued, a necessary minimal component of SF texts, and if the ontology-causality opposition is substantive (and I don't see how it cannot be,) then it is difficult to see how Clark's dictum succeeds. It simply does not logically follow that *necessarily* SF is religious and mythologising just because *some* SF texts engage with supernaturalist themes allegorically or

³⁸¹ One can never know beyond any doubt that a certain causal event will produce the same effect it has always been observed to produce. One day, your fire may produce no heat, or the angle of incidence may not equal the angle of reflection *Ceteris Paribus*.

³⁸² Clark, S.R.L. "Science Fiction and Religion." Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005, 95-109.

otherwise, although such engagement is likely to increase the influence of the closed-system worldview resulting in increased pure pseudo-information.

Metaphysical dualist critics and philosophers like Clark, who subscribe to the open-system model of reality tend to use conflation, co-option and equivocation to attempt to undermine naturalist and materialist definitions of SF. Since SF engages with science, the logical problem with what I will call the open-system model for SF is that it relies on an ontological contradiction. H.G. Wells may have classified his own writings as scientific romance, but he was a committed socialist with Marxist-materialist leanings in life and in his writings. The conflation of romance with dualistic and supernaturalist themes is a natural upshot of its association with the magical and supernaturalist heritage that many classic romance texts engage. Csicsery-Ronay Jr. reflects on the tension in historical terms:

The Wellsian model of scientific romance enjoyed great success. For the literary establishment, it represented a new poetry that fused knowledge of science and character. It brought the undisciplined fantasy of popular adventure fiction under control by grounding it in the useful and realistic scientific worldview...Conservatives believed that science fatally narrowed the scope of the fiction...scientific enlighteners objected to the way romance elements corrupted the truth of facts into pseudoscience.³⁸³

However, as Fred Botting explains, although SF resembles gothic fiction through frequent engagement with the monstrous and with horror elements and because of its persistent partial status as romance, the distinguishing property of SF is embodied in H.G. Well's *War of the Worlds*, wherein the basis for horror becomes "not metaphysics, but physics."³⁸⁴ A closed-system setting enforces Clarke's third law which ensures "gods and demons alike turn out to be no more than alien intelligences"³⁸⁵. Co-opting SF to romance and fantasy on the basis of similar motifs relies on equivocation. Informationally speaking, the open system is corrosive to SF's informational heterogeneity and scientific veridical synthesis. As soon as it is invoked, and the unlimited causal power of supernatural agents or forces are released into the counterfactual *mise en scène*, and the novum and the veridical and counterfactual information synthesis upon which it relies are markedly eroded or nullified commensurate with the presence of open-system semantics. Informational heterogeneity is reduced in the text, because veridical information is diminished and counterfactual pseudo-information tends to be supplanted by pure pseudo-information. This mitigation of *counterfactual* pseudo-information in fantasy arguably corresponds to a more ideologically conservative setting, whereas SF, as Edward James suggests, embraces dynamism and change in the relationship of persons to their world³⁸⁶. Supernaturalism and the 'open system' world view ultimately undermine the cognitive aesthetic associated with SF novum and megatext icons and motifs because the latter rely on mechanism and naturalism, which are cognitively uninteresting and diminished in a supernaturalistically inspired *mise en scène*.

Information age writers of science fiction often seemingly exhibit the open-system equivocation on SF and religion. The prolific and mystical Philip K. Dick regarded SF not only as escapist and fantastic – but as magical:

I was twelve...when I read my first sf magazine ... I was most amazed. Stories about science? At once I recognized the magic which I had found, in earlier times, in the Oz books - this magic now coupled not with magic wands but with science...In any case my view became magic equals science...and science (of the future) equals magic.³⁸⁷

However, Dick uses the term *magic* as an expression for his enthusiasm for the mode, and thus defers to Arthur C. Clarke's dictum that "[a]ny sufficiently advanced technology is indistinguishable from magic"³⁸⁸.

³⁸³ Csicsery-Ronay Jr., I. "Science Fiction/Criticism." Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005, 44.

³⁸⁴ Botting, F. "Monsters of the Imagination" in *A Companion to Science Fiction*, Ed. David Seed, Malden: Blackwell, 2005, 95-111.

³⁸⁵ Clark, S.R.L. "Science Fiction and Religion." Seed, David. *A Companion to Science Fiction*. Malden: Blackwell, 2005. 100.

³⁸⁶ James, E. "Utopias and Anti-Utopias". Ed. Edward James. *The Cambridge Companion to Science Fiction*, Cambridge: Cambridge University Press, 2003, 219-240.

³⁸⁷ Excerpt from quotation in Sutin, L. "Biography:Philip K. Dick: 1928-1982." - - 2003. Philip K. Dick: The Official Site. Philip K. Dick trust. 28 August 2008 <<http://www.philipkdick.com>>.

³⁸⁸ James, E. "Utopias and Anti-Utopias". Ed. Edward James. *The Cambridge Companion to Science Fiction* Cambridge: Cambridge University Press, 2003, 227. (From Clarke, A.C., Profiles of the Future: An Enquiry into the Limits of the Possible, 1962.

Lutin has it that the early Dick (1968, "Self Portrait") was apparently convinced of the anti-realist quality of science fiction:

I want to write about people I love, and put them into a fictional world spun out of my own mind, not the world we actually have, because the world we actually have does not meet my standards...I have never yielded to reality. That's what SF is all about...This is why I love SF....**The SF writer sees not just possibilities but wild possibilities.**³⁸⁹

It seems apparent from the last sentence, however, that Dick's apparent commitments to unreality can probably be accounted for on the basis of a predilection for counterfactual estrangement, which can be achieved with a materialist closed-system narrative setting. He mentions wild *possibilities*, not *impossibilities*. Many of his journal entries are crammed with copious references to religious icons. However, they are also replete with references to analytic philosophical metaphysical concepts including determinism and teleology, and Dick believed himself committed to investigating truth and reality in his works on a perceptive and cognitive basis:

I am a fictionalizing philosopher, not a novelist; my novel & story-writing ability is employed as a means to formulate my **perception**. The core of my writing is not art but **truth**. Thus what I tell is the truth, yet I can do nothing to alleviate it, either by deed or explanation... my corpus is one long **rationation** regarding...inexplicable reality...³⁹⁰

Although his works contain quasi-mystical (or perhaps pseudo-mystical) motifs, like many hard SF writers, Dick seems committed to what I will refer to in the final chapter as *anti-simulacra*.

ARTEFACTUAL SYNTHESIS: THE DISCOURSES AND NOTATIONS OF THE SCIENCES IN SF

Hard science fiction authors cannot assume the desire nor the ability of the reader to execute the conceptual and cognitive fulfilments required by actual scientific writing, nor would a reader of hard SF necessarily want to interrupt the flow of reading with research. However, as Broderick aptly suggests, SF can facilitate the enjoyment of a reader and stimulate their interest even if they are not well versed with the veridical scientific discourse and signifiers included in the fictive text³⁹¹. A reader not possessed of an internal source containing the requisite veridical information will not necessarily be deterred, so long as they are able to grasp the story and gain some insight from the contextual placement of the unfamiliar content within the SF text. In fact, as Suvin suggested, there is a cognitively centred aesthetic involved in the reader's personal extrapolation or speculation regarding the unfamiliar component³⁹². They may not have an internal source which can provide veridical information to support their access to the semantics encoded upon the veridical information synthesised into the unfamiliar textual source from write-time, but they may be able to discern something of the veridical information involved by reference to the information with which it has been synthesised, or for which they may have a related internal veridical source (concept.) This is what delivers the cognitive aesthetic outcome intrinsic to read-time synthesis associated with a novum. Speculation about whether fairies might exist in an alternative universe involves pure pseudo-information, but speculation that makes the alternative universe – the counterfactual world or world situation - accessible from the real world, adds an aesthetic which is bound up in *possibility* and cognition. This manoeuvre integrates into the experience of an SF reader the read-time outcome of ontologically orientated conceptual and ideational pioneering and invention. It requires write-time encapsulation of a large specialised and complex scientific discursive field within a much more general and less technically specific fictive one. Novum neologisms and SF mega-text codons both help to achieve this, as does the synthesis of heterogeneous artefactual information, the combining of scientific notations and diagrams with prose.

³⁸⁹ As quoted by Sutin in Sutin, L. "Biography:Philip K. Dick: 1928-1982." - - 2003. Philip K. Dick: The Official Site. Philip K. Dick trust. 28 August 2008 <<http://www.philipkdick.com>>.

³⁹⁰ Ibid., (emphasis mine.)

³⁹¹ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 25-26.

³⁹² Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980.

Science needs more than prose with which to encode its outcomes and theories. Mathematical and diagrammatic languages are critical in the sciences and engineering to provide a greater set of tools for abstraction and the symbolic conveyance of material facts. Broderick is simultaneously perspicacious on two key ontologically grounded points: that the knowledge of scientists is *not* just linguistic or textual, and correspondingly, that scientific language and discourse are informed by the material natural world empirically through interactions *other* than the linguistic and textual alone³⁹³. He recognises that when scientists use narrative, metaphor and discourse in ideating about and linguistically expressing theories of the material world, they are using such literary devices fundamentally differently to fiction writers: with common veridical referents in mind and on the basis of the assumption of shared professional scientific understanding of those referents and pursuant to the development of systematic definitions *de rigueur*³⁹⁴. SF texts mimic this in their references to the SF mega-text, and gravitate towards scientific writing in that they tend to exhibit *heterogeneous information synthesis* with a greater proportion of sources in the contributing source set supplying *scientific veridical information*. Broderick also sees that Snow's conception of two cultures is a journalistic simplification of reality³⁹⁵. Of all modes of fiction writing, competent SF texts best engage with that reality, as evidenced by these same informational properties.

Science and engineering engage the physical through semi-linguistic and super-linguistic tools like mathematics, spatial and diagrammatic nomological representations³⁹⁶, special notations, nuanced technologically and experimentally-driven methodological expression and exposition. Such tools and techniques, and the super-lexical or mathematical notations associated with them, are hallmarks of theoretical and applied science, where they arise out of the need to represent as rigorously and accurately as possible – with high *informational fidelity* – the ontology and facts of material and natural states of affairs and processes. Diagrammatic depictions, mathematical notations, and hybridisations of the two, are an indication in a text of its mandate to engage with scientific *veridical information sources*. Such source types – which include the kind of biological and/or physical natural objects and processes which are the focus of hard scientific study – are frequently complex and not easily accessible to human intuition, perception or common understanding. Natural language alone is not adequate to their analysis and interpretation. Hence the need for complex mathematical and visual abstractions in scientific and mathematical theorising. Nobel Laureate and physicist Richard P. Feynman is famous for promoting the use of diagrams as an alternative to pure mathematics in explicating quantum physics and relativity theory, and his Feynman diagrams revolutionised the field in the late twentieth century³⁹⁷. One sometimes encounters directed graphs or tables in literary *theoretic* treatises³⁹⁸. Certainly node graphs and special ontologically informed lexical notations are plentiful in linguistics, where phonemes must be symbolised, anthropology accounted for, and physical mouth parts depicted, but then linguistics, like psychology, often aspires to the status of a hard science. When veridical information must be captured and represented for scientific purposes, natural language is either heavily augmented by other notational techniques, or becomes adjunct to the latter, as a labelling system or for augmentative natural language explication.

The discourse in most genres of adult *fictional texts* hardly ever admits mathematical or diagrammatic notations, although there are historical and contemporary exceptions. Exceptions are mostly found in SF³⁹⁹. However, an approximation of the practice, and perhaps its fictive origins, are evident in fantasy writing and other older literary forms. Novels from realist, romantic and historical generic traditions sometimes incorporate diagrammatic or diagram-like objects within their texts, although they are generally closer to artistic illustration than scientific or mathematical explication. It is hard to see how Tolkien's – albeit rather more artistic than cartographic – fantastical maps of Middle Earth, are not diagrammatic. Such are not lexical, although typically annotated. Robert Louis Stevenson's *Treasure Island* includes a

³⁹³ Broderick, D. *The Architecture of Babel: Discourses of Literature and Science*. Carlton: Melbourne University Press, 1994.

³⁹⁴ *Ibid.*, 101, 131.

³⁹⁵ *Ibid.*, 125.

³⁹⁶ Cheng, P. C.-H, "Scientific discovery with law encoding diagrams" in *Creativity Research Journal*, Vol. 9, Nos. 2 & 3, 145-162 Routledge Informaworld 1996 <<http://www.informaworld.com/smpp/title~content=t775653635>>, accessed 5th November 2008., 145, 148.

³⁹⁷ Davies, P. "Introduction" in *Six Easy Pieces Massachusetts*: Addison Wesley, 1996 (California Institute of Technology, 1963.), xi.

³⁹⁸ Examples exist in Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980, 155, 236, 237.

³⁹⁹ Children's literature is another exception.

map⁴⁰⁰, although Defoe's 1779 *Robinson Crusoe* had no map added until its fourth edition. A much later Ursula K. Le Guin, following Tolkien in the fantasy mode, includes five maps, four interlinear, in *A Wizard of Earthsea* (1968.⁴⁰¹) Henry Rider Haggard included a stylised fictive map intra-text in *King Solomon's Mines* (1885.) John Rieder sees Haggard's map as inspired by Stevenson's example and expounds at length on its political, cultural, sexual, colonial and social signification⁴⁰². These greater fictive signifieds, rooted in the context of the author's episteme and *habitus*, are exemplary of alternative semantic and *informational* encodings. Rieder cites the illustration of a central fictive object in Haggard's *She* (1887), a pottery fragment depicted with Uncial Greek inscriptions called the "sherd of Amenartas", as exemplary of the text's fictive engagement with the sciences of anthropology and linguistics⁴⁰³. These early examples of novels which engage with alternative non-lexical artefactual information types, to the extent that some small part of their informational content is *non-lexical*⁴⁰⁴, and yet not manifest as simply artistic illustration, but formed and encoded according to nomologically attuned depictive and representational rules drawn from the sciences associated with navigation and geography⁴⁰⁵. They are exemplary of the aesthetic appeal of information heterogeneity over and above *discursive* genre insertion.

To the extent that they are not required to obey grammatical rules, nor reflect *linguistic* dynamics, maps and diagrams are very *uncertain* representations. In terms of Shannon-entropy and the ontology of *artefactual* information types, as symbolic depictions they are very *high information* sources. They are *more* uncertain if fictive – because they need not reflect the veridical information of any real world information source configuration. Such pseudo-informational representations have no intended direct real-world reference, and thus the possibilities for their configuration are not restricted by real contingencies or nomological limitations. Included in a fictive text, they constitute very high counterfactual or pure pseudo-information. This same technique of employing maps for world construction and narrative authenticity is rarely employed in information age and informationist SF. Of the map-bearing texts cited in the previous paragraph, only Le Guin's is information age. A notable exception is Vernor Vinge's *A Fire Upon the Deep*, which includes a stylised fictive cosmological map of the galaxy complete with light year scale, exploded region and two perspective views by faux orthographic projection.

The inclusion of actual mathematical notation or formulas in SF is not common, even in information age SF, but texts of the SF mode arguably include this type of information more than those of any non-SF mode. Mathematics has a natural language discourse associated with it, but discourse on Bakhtin's model of speech genres is centrally something social and uttered using natural language, or derived from the same⁴⁰⁶. Mathematical notations are perhaps as discursive as they are utterable. Neal Stephenson and Vernor Vinge often insert technological and especially information-technological language or 'computerese' within their SF texts as inserted discursive genres, for narrative aesthetic effect and fictive authenticity. A pioneer of this approach is Fred Hoyle: *The Black Cloud* includes numerous examples of both artefactual veridical information and artefactual counterfactual pseudo-information in the form of mathematical notation and diagrams⁴⁰⁷. Vinge's *A Fire Upon the Deep* includes numerous examples of inserted *techno-epistolary*. Stephenson's novels exhibit a predilection for pedagogical explication in narrative which invests his *Snow Crash* with frequent intertextual forays into topics as diverse as ancient Sumerian mythology and contemporary computing programming practice. *Cryptonomicon* is perhaps the most striking example of well written informationist SF to date. As such, it engages heavily with scientific

⁴⁰⁰ Stevenson, R.L. *Treasure Island*. London: Puffin Books, 2008. (orig 1883.)

⁴⁰¹ Le Guin, U.K. *A Wizard of Earthsea*. London: Penguin, 1968, 8, 9, 19, 41, 99, 171.

⁴⁰² Rieder, J. *Colonialism and the Emergence of Science Fiction*. Middletown: Wesleyan, 2008, 23.

⁴⁰³ *Ibid.*, 54-5.

⁴⁰⁴ In the sense that mathematical formulae are not designed for discursive utterance on either the Bakhtinian or traditional definition, which generally implies the use of what is termed *natural* language. Mathematical expressions may be more readily regarded as discourse on the archaic sense of the word, the definition of which is the process or power of reasoning.

⁴⁰⁵ Laurence Sterne's *The Life and Opinions of Tristram Shandy* contains numerous meta-fictional graphical line-drawing depictions of the story line itself, which are largely whimsical, but non-lexical nonetheless.

⁴⁰⁶ Bakhtin, M. M., "Discourse in the Novel" in *The Dialogic of Imagination*, Ed. Michael Holquist, Trans. Caryl Emerson and Michael Holquist., 259-423.

⁴⁰⁷ Hoyle, Fred. *The Black Cloud*. London: Heinman Educational, 1957, 19-20, 31, 50-51.

discourse, and, moreover, it is replete with both scientific diagrams and computing notation. It is one of the few SF texts aside from *The Black Cloud* to include non-discursive mathematical notation intra-linearly. Arthur C. Clarke's Space Trilogy has no such inclusions. A few pages into chapter 1 of *Cryptonomicon*, the text includes the complex Reimann Zeta function:

“This fellow was trying to build...a machine to calculate certain values of the Riemann Zeta function

$$\zeta(s) = \sum_{n=1}^{\infty} \frac{1}{n^s} = 1 + \frac{1}{2^s} + \frac{1}{3^s} + \dots$$

where s is a complex number.⁴⁰⁸”

The fictive context is the development of the eccentric savant character Lawrence Pritchard Waterhouse, and the aesthetic upshot involves cognition and complexity pursuant to fictive authenticity. The text of *Cryptonomicon* is dense with heteroglossia: authorial, narrative, character, epistemic, scientific and cultural voices clamour for reception and recognition therein. The insertion of mathematical notation, carefully placed for cognitive effect and narrative authenticity, adds entirely new voices which are raw and informational – voices that break from discursive normality and by doing so effect estrangement and yet enhance authenticity. The Shannon entropy of the text as a source of information increases with the inclusion of mathematical notation, which move expands dramatically the set of word-symbols and other symbols which are available for selection. Joyce increased the information in *Finnegan's Wake* by using a dramatically inflated English vocabulary. Haggard, Tolkien and Le Guin increase information by including non-lexical encodings of information and meaning, and, in Tolkien's case, an entirely new fictive language. Stephenson combines most of these with technological discourse, scientific and mathematical diagrams and mathematical notation, and realist historical fictive elements. The informational profile of *Cryptonomicon* correspondingly exhibits high levels of *counterfactual* pseudo-information and veridical information, and is very informationally heterogenous.

It is not only non-lexical diagrams and non-linguistic notations, but also comprehensive *neologising* which stands out as a distinguishing characteristic of scientific and SF texts, and the practice of neologising in SF is mimetic on that which occurs in science. The information age has only seen an increase in the strain that the sciences place on natural language vocabularies. There are now myriad new computer software applications for scientific and mathematical analysis, modelling, data collection, real time processing and computer control of experimental processes. In addition to the iconic and symbolic lexicons associated with the diagrammatic and mathematical notations they are designed to support, such software applications are themselves frequently associated with their own vocabulary of technical terms which augment and hybridise the scientific and technical vocabulary of the underlying scientific discipline, and result in a further conflux of the terminology of that discipline with the language of information science and technology. Importantly, there is a parallel between what occurs terminologically in science in the form of scientific neologising, and the SF practice of generating novel terms and novums. Suvin acknowledges his adaptation of the concept of the *novum* from Ernst Bloch's original conception in poetics, augmenting it based upon its narrative consequences being in accordance with Bertolt Brecht's concept of *estrangement*.⁴⁰⁹

⁴⁰⁸ Stephenson, N. *Cryptonomicon*. United Kingdom: Arrow Books, 2000, 9-10.

⁴⁰⁹ Suvin, D. *Metamorphoses of Science Fiction*. Yale: Yale University Press, 1980, 64.

Or perhaps-since, as differentiated from fantasy tale or mythological tale, SF does not posit another superordinated and “more real” reality but a alternative on the same ontological level as the author’s empirical reality...an alternate reality. The new reality overtly or tacitly presupposes the existence of the author’s empirical reality...[SFs] specific modality of existence is a feedback oscillation that moves now from the author’s and implied reader’s norm of reality to the narratively actualised novum...This oscillation, called estrangement by Shklovsky and Brecht, is no doubt a consequence of very poetic, dramatic, scientific, in brief *semantic novum*.⁴¹⁰

However, Suvin’s neologistic adaptation also owes something to the scientific practice of developing new technical terms to empower the scientist descriptively and avail them of an adequately powerful nomenclature for theorising and experimentation. The novum is thus central to Suvin’s project of seeing SF as especially cognitively orientated:

My axiomatic premise...is that SF is distinguished by the narrative dominance or hegemony of a fictional "novum" (novelty, innovation) validated by cognitive logic.⁴¹¹

Novums (or *the novum* as singular in Suvin’s terms) instantiate a conceptual newness or estrangement, pursuant to cognitive synthesis and anticipation at read-time, via what I have called counterfactual pseudo-information. The practice of novum neologising is founded on and influenced by a well known practise of terminological hybridisation and neologising in the sciences: a practice which centres on what I have called *veridical information*. Computerised scientific tools are full of hybrid terminology which facilitates the labelling and understanding of aspects of the computerisation of experimental techniques and analytic processes. Information theory and mathematical sciences like physics, which deal with copious abstract concepts, are especially prone to generate new scientific theoretical and natural kind terms, many of which eventually fall into common usage. Such scientific neologisms are not intended to estrange, but to assist the reader in cognising new facts and incipient scientific principles and objects. All of the information encapsulated in the various scientific neologisms and incipient natural kind terms is of the *veridical* type, because the sources of the information are factual and material or at least mathematically verifiable or scientifically-theoretically defeasible.

If we follow Shippey’s terminological application of probabilistic Shannon entropy and describe a novum neologism as ‘high information’, then it is, according to my ontology of information, high *counterfactual pseudo-information* only. *Scientific* neologisms which require the reader to combine referents and semantics associated with actual material and theoretic (scientific) facts yield, if we apply and embellish Shippey’s approach again, encapsulations of *high veridical information*. Neologisms in fantasy and mythology that have *no* grounding in verifiable material or theoretic fact – wherein there is no factual state of affairs involved in the information source – employ or encapsulate only *pure pseudo-information*. No amount of pure-pseudo information adds up to any veridical information, unless metaphor or allegory is thereby instantiated to reference actual non-fictive facts, and thence the synthesis of the information involves indirection and is unpredictable in terms of a veridical outcome. In this case, the textual/lexical pseudo-information source (the fantasy or myth text) requires the veridical information being indirectly referenced to obtain/subsist in an internal source, a concept possessed by a reader. The outcome depends on the veridicality of a reader’s internal source, and is thus accidental to read-time synthesis. There is still only pure pseudo information encoded upon the fantasy or mythologising text itself as a source. If the reader cannot grasp the allegory or metaphor no veridical information has been synthesised. When SF writers like Arthur C. Clarke and Isaac Asimov engage with the themes of science and technology, the novums that they implement textually and fictively involve counterfactual possibilities and extrapolative and analogical estrangement with a basis in scientific fact and theory. Even if the reader does not know enough science – does not possess internally a source of requisite veridical information embodied in concepts – the information encoded in the texts of these writers is still *counterfactual* pseudo-information, but it is simply *lost*. It does not become pure pseudo-information just because it is not understood in the absence of

⁴¹⁰ Ibid., 71.

⁴¹¹ Ibid., 63.

internal supporting sources of veridical information, although the information synthesised by the reader at read-time *will* be pseudo-information due to the loss.

Chapter 4-Informationist Science Fiction Aesthetics and Motifs

Any aesthetic outcome or affect associated with read-time synthesis of SF texts is arguably largely due to the well executed implementation and stylisation of cognitive estrangement therein, and to well implemented novums, SF icons and futurological counterfactuals. I have argued that these fictive devices supervene on texts which contain elevated information type heterogeneity and elevated veridical information from write-time synthesis. Components such as ontologically estranged characters and *mise en scène*, the subjugation of the subject to the object and the hybridisation of the two through estranged character ontologies, and meta-informational writing: all of these contribute to cognitive and affective read-time outcomes. For Delany, who is one of the pre-eminent SF aestheticians writing today, such informationally heightened writing must be accompanied by superior style and authorial competency to sustain aesthetic palatability. Delany was the first theorist to specifically associate what Suvin later termed *novum* with increased information⁴¹². A novum thus evinces a heightened read-time experience of what Suvin called *cognitive estrangement*. Tom Shippey explicitly identifies the *novum* words as informationally unique, echoing assertions of an informational cognitive aesthetic. The novum and all of the SF codons mentioned contribute to the informational complexity of the text and its encoded fiction. Because they are located at the multivariate-multifaceted nexus, and exhibit counterfactual admixture of scientific fact and discourse with fictive narrative, information synthesis in science fiction texts and in the processing thereof results in a heightened cognitive estrangement as well as an *aesthetic of complexity*.

THE COGNITIVE AESTHETIC AND THE INFORMATIONAL AESTHETIC OF COMPLEXITY

Katherine Hayles asserts that Shannon's central distinction between information and noise was that the former was useful and the latter not so. Shannon does make this distinction, but it is the achievement of fidelity between the message at the source and the message at the receiver for the purposes of minimising information *loss* in the *channel* which is the crux of his theory and its application. This dynamic is more akin to what David Davies, drawing on information theoretic terminology for literary studies, calls the *fidelity constraint*: the rigidly purposed observance of which indicates that a writer intends a narrative *not* to be considered fictional, as it is intended to be the faithful representation of actual material events or facts and their temporal sequence in a text narrative⁴¹³. This corresponds to using artefactual information to represent veridical information from a real world veridical information source, whilst minimising noise and information loss due to information type conversion. SF stands apart from fiction in general, because the cognitive detachment required for normative fictionality – which Davies refers to in terms of the author's intention that the reader *make believe* rather than believe – is mitigated by the cognitive response associated with ontological estrangement and novum at read-time⁴¹⁴. Lem sees make-believe as based on “a convention, a tacit agreement between writer and reader-in a word, the specific rule of literary games that allows the use of nonrealistic means (e.g., thought-reading) for the presentation of realistic happenings.⁴¹⁵” Make-believe is partly overridden or corrected by the cognitive outcomes of SF at read-time, as implied or claimed by Suvin⁴¹⁶, Paulson, and again, Lem:

⁴¹² Delany, Samuel R. “About 5,750 Words.” in *The Jewel-Hinged Jaw* New York: Berkley Windhover, 1978.

⁴¹³ Davies, David. “Fiction.” *The Routledge Companion to Aesthetics*. New York: Routledge, 2008 (orig 2001). 347-358.

⁴¹⁴ Davies, David. “Fiction.” *The Routledge Companion to Aesthetics*. New York: Routledge, 2008 (orig 2001). 347-358.

⁴¹⁵ Lem, Stanislaw. “On The Structural Analysis of Science Fiction.” Spring 1973. *Science Fiction Studies*. February 2009 <<http://www.depauw.edu/sfs/backissues/1/lem1art.htm>>

⁴¹⁶ Barnouw, Dagmar. “Science Fiction as a Model for Probabilistic Worlds: Lem's Fantastic Empiricism” July 1979. *Science Fiction Studies*. March 2009 <<http://www.depauw.edu/SFs/backissues/18/barnouw18art.htm>>. 1.1 paragraph 5.

[I]t is the premise of SF that anything shown shall in principle be interpretable empirically and rationally.⁴¹⁷

Ontologically complex *counterfactuals* in SF require imaginative cognitive estrangement from facts – not thoroughgoing make-believe with no information whatsoever from scientific, natural and ontologically real phenomena and objects. Wolfgang Iser held that “referential meaning could not be of an aesthetic nature⁴¹⁸,” because the aesthetic effect requires a *gap in cognitive comprehension*, and that it is not until “the aesthetic nature of meaning constantly threatens to transmute itself into discursive determinacy⁴¹⁹,” that reference and cognition take over. According to informationist SF theory, such an ‘aesthetic gap’ in cognitive comprehension is preserved through sheer magnitude of the number of contributing information sources, veridical and otherwise, and of the unfamiliarity of many of them to the reader, necessitating synthesis of incipient pseudo-information at read-time for counterfactual fulfilment. The cognitive aesthetic of SF *hybridises the fidelity constraint and make-believe through heterogeneous information synthesis*.

Paulson quotes Michel Serres on the intrinsic relation between reality and complexity:

“If we wish to truly know the real...or to escape the hell of political and military violence...we must shift to ways of knowing that negotiate with complexity⁴²⁰.”

Veridical information in a text, and especially in an informationally heterogeneous text, begets complexity which requires cognitive responses. Paulson sees cognitive demands on the reader of literature or poetry as a consequence of the lack of any discernible pre-established external rules and laws for determining the meaning of the text, such that the reader must employ “considerable knowledge of linguistic and cultural codes to aid her in her task, but who must literally discover the autonomous codes by which a given text is itself organised.⁴²¹” It is this requirement to overcome the informational *indeterminacy* which arises from the fact that a fiction text is *noisy* – does not communicate information without significant loss due to noise – which necessitates cognitive effort.

Competent informationist SF texts exhibit informational and semantic *complexity* to a greater degree than texts of any other mode of fiction writing. The term complexity here is used in accordance with the meaning from the new science of complexity, wherein a system is complex if it has many intricately interoperating and unrelated parts in structured and unstructured configurations. It implies heterogeneity of structure. Lem thought SF uniquely adept at engaging with the complexities of society and complex technology through complex textual “literary games” and narrative sophistication^{422 423}. SF texts are *informationally complex* by virtue of heterogeneous information synthesis and the aesthetic of informational complexity in SF texts is intrinsically related to a cognitively realised aesthetic at read-time. The encoding of meaning in *realist* fiction involves a straightforward, analogical, metaphoric or implied reference from the text to the real in a counterfactual setting with an intended or implied ontological invariance from the actual world of readers and author: realist writing converges on the fidelity constraint of non-fiction. Counterfactually freed from the familiar constraints of the real, the SF author can employ ontological estrangement in character construction at or beyond the level attainable in fantasy and myth literature without semantically encoding the unrealities of magic or the supernatural⁴²⁴. SF texts can thus exhibit heteroglossia or polyphony to a greater extent and with more estranged effects than those of the realist

⁴¹⁷ Lem, Stanislaw. “On The Structural Analysis of Science Fiction” Spring 1973. *Science Fiction Studies*. February 2009 <<http://www.depauw.edu/sfs/backissues/1/lem1art.htm>>. Paragraph 10.

⁴¹⁸ Iser, W. *The Act of Reading: An Theory of Aesthetic Response*. Baltimore: The Johns Hopkins University Press, 1978, 22.

⁴¹⁹ *Ibid*, 22.

⁴²⁰ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 33, 36.

⁴²¹ Paulson, William. *The Noise of Culture: Literary Texts in a World of Information*. New York: Cornell University Press, 1988, 114.

⁴²² Barnouw, Dagmar. “Science Fiction as a Model for Probabilistic Worlds: Lem's Fantastic Empiricism” July 1979. *Science Fiction Studies*. March 2009 <<http://www.depauw.edu/SFs/backissues/18/barnouw18art.htm>>, Section 2.1 Paragraph 3.

⁴²³ Lem, S. “On The Structural Analysis of Science Fiction” Spring 1973. *Science Fiction Studies*. February 2009 <<http://www.depauw.edu/sfs/backissues/1/lem1art.htm>>. Paragraphs 16, 17.

⁴²⁴ Lem, S. “On The Structural Analysis of Science Fiction” Spring 1973. *Science Fiction Studies*. February 2009 <<http://www.depauw.edu/sfs/backissues/1/lem1art.htm>>, Paragraph 30.

novel, but still naturalistically. Moreover, the SF text encapsulates symbols and signification that are instantiated across multiple logical and informational planes: the real, the counterfactual, the futurological counterfactual and the imaginary. A reader of such a text must respond cognitively to counterfactual speculative invention based on counterfactual pseudo-information because the novum of an SF story relies on these for the conveyance of meaning and cognitive-aesthetic fulfilment.

That Lem's cognitive aesthetic⁴²⁵ is heightened by the informational aesthetic of complexity is evidenced in SF texts from Fred Hoyle's *Black Cloud* to Neal Stephenson's *Cryptonomicon*. In Banks *The Algebraist*, Banks admixes counterfactual ontologically estranged settings and objects with veridical information - known physical principles - in a highly emotively charged scene where human protagonist Fassin's whole clan has been annihilated, leaving him as a kind of omega man:

It had been quick, instantaneous, but so What? They had felt no pain but they were dead, gone, beyond recall. Only they were not beyond recall...He could not cease bringing them back to life in his head...He thought of just letting the craft tip further ...plummeting down into the great sucking breath of the gas-giant gravity, the gillfluid wrenched from him, perhaps taking some of his lungs with it...tearing him apart and letting him fill the bloody ragged remains with alien gas for his last scream - falsetto, like the voice you got when you sucked helium from a party balloon...⁴²⁶

The aesthetic of complexity arises with informational complexity, where there are multiple information types from right across the spectrum of veridical to counterfactual and pure pseudo-information. Lem's cognitive aesthetic is here implemented through the combination of psychological and identity themes with physics-informed futurological counterfactual novums.

INFORMATIONIST SPACE OPERA AND THE AESTHETIC OF COMPLEXITY

The new informationist space opera and the futurological informationist SF text are SF sub-modes *possessed of a higher level of informational, semiotic, discursive and textual variety and complexity than other (sub) modes of SF*. Information-age space opera written by science and technology savvy authors such as Banks, and especially those written by working scientists like Vernor Vinge and Alistair Reynolds, tend to exhibit such informational complexity. In Alistair Reynold's *Revelation Space*, when the fictional characters Hegazi and Sylveste call up fictional navigational star maps from the future counterfactual fictive supercomputer on their fictive spacecraft, the result is informational complexity:

The image had the form of an orrery, the orbits of the system's eleven planets and largest minor planets and comets denoted by elegant coloured tracks...Because the scale was so large, the terrestrial planets - Resurgam included - were crammed into the middle; a tight scribble of concentric orbits banded around the star Delta Pavonis. The minor planets came next, followed by the gas giants and comets, occupying the system's middle ground. Then came two smaller sub-Jovian gas worlds, hardly giants at all, then a Plutonian world - not much more than a captured cometary husk, with two attendant moons. The system's Kuiper belt of primordial cometary matter was visible in the infrared as a curiously distorted shoal - one nubby end pointing out from the star. And then there was nothing at all for a further twenty AU⁴²⁷...⁴²⁸

The setting and time frame is fictive, as are all the planets mentioned, including Resurgam, the etymology of which is the ecclesiastical latin for 'I shall rise again'⁴²⁹. Delta Pavonis and the Kuiper belt are real, and

⁴²⁵ So dubbed by Dagmar Barnouw in Barnouw, Dagmar. "Science Fiction as a Model for Probabilistic Worlds: Lem's Fantastic Empiricism" *Science Fiction Studies*. # 18 = Volume 6, Part 2 = July 1979. March 2009 <<http://www.depauw.edu/SFs/backissues/18/barnouw18art.htm>>.

⁴²⁶ Banks, Iain M. *The Algebraist*. London: Orbit Time Warner, 2004, 281.

⁴²⁷ Astronomical units

⁴²⁸ Reynolds, A. *Revelation Space*. New York: Ace/Orion/Victor Gollancz/Penguin, 2000, 345.

⁴²⁹ OED, *Resurgam*. At the time of Reynold's writing, Pluto was still classified as a planet. The change in the status of Pluto is exemplary of scientific defeasibility and theory change.

the description of the effects of scale on the presentation of the visual information is also based on veridical scientific information. Reynold's writing style has been criticised along similar lines to that of many scientist-authors, who are often associated with the derogatory sense of the phrase 'science imitating art'. However, from the perspective of fictional discourse, this passage is not only exemplary of *informational complexity*, but arguably exhibits an associated poesy and mastery of description which captures the awe and ontological largeness of its counterfactually portrayed cosmological subject matter with aesthetic adeptness. It continues:

"The protective caul of the star's magnetic field did not extend this far out, and objects here were buffeted by the ceaseless squall of the galactic magnetosphere; the great wind in which the magnetic fields of all the stars were embedded, like tiny eddies within a vaster cyclone.⁴³⁰"

Reynolds uses the explication of the veridical galactic magnetosphere as an opportunity for further aesthetically pleasing description. This aesthetic quality is strengthened by the cognitive aesthetic stemming from the text's capacity to simultaneously elegantly introduce and expound cosmological concepts. The discursive hybridisation of astronomical language, with its accompanying documentarian, scientific and analytic voices, and fictive description with its artistically inclined narratologically attuned voice, result in a special interlaced content wherein the exactitude of specificity of the descriptive prose merges elegantly with its aesthetic and narratological mandates. Such interlinear cognitive-aesthetic assemblies require more attention from the reader, but need not break the *flow of reading* since they can be 'background processed' at read-time. The introduction of the acronym AU has a high surprisal value, and there is a cognitive satisfaction for the uninitiated reader who can synthesise from the information and semantics of the passage to arrive at *astronomical unit*. The effect of the technological viewing apparatus on the counterfactual Kuiper belt results in distorted information: a "curiously distorted shoal": an example of *meta-informational writing*.

META-INFORMATIONAL SF WRITING

Following Pynchon's *V.* and Delany's *Babel 17*, meta-informational writing proliferated in information age SF texts of the 1970s and 1980s. Lem's 1970 *Solaris* contains the meta-informational ontologically estranged character referred to as *the ocean(s)* – the origin of a mega-text codon reprised either intertextually or inadvertently by the Jugglers of Reynold's *Revelation Space*. Ursula K. Le Guin's 1974 *The Dispossessed* refers to a novum mega-text codon - *the ansible* - introduced in the author's earlier *Rocannon's World* (1966). The ansible is a device which can "permit communication without any time interval between two points in space."⁴³¹ Le Guin's devising of the ansible is perhaps one of the best existing examples of *subjunctive* informationist novum:

"The device will not transmit messages of course; simultaneity is identity. But to our perceptions, that simultaneity will function as a transmission, a sending. So we will be able to use it to talk between worlds, without the long waiting for the message to go and the reply to return that electromagnetic impulses require."⁴³²

It is hardly necessary to expound upon the references to information and communications theory. It also invokes mega-text codons of quantum entanglement⁴³³ and alludes to the communicative deficits of time-dependent information transmission methods including the written text. Philip K. Dick's 1976 semi-autobiographical *Radio Free Albemuth* is replete with meta-informational writing. Eccentric record store employee Nicholas regularly receives telepathic communications from alien superbeing *Valis*, which leads

⁴³⁰ Reynolds, A. *Revelation Space*. New York: Ace/Orion/Victor Gollancz/Penguin, 2000, 345.

⁴³¹ Le Guin, Ursula K. *The Dispossessed: A Novel*. New York: Harper Perennial Modern Classics, 1974.

⁴³² Ibid.

⁴³³ Physics, veridical: where the spin of one particle somehow instantaneously affects the direction of spin of another spatially remote particle.

his friends to believe him insane until one communication turns out, to their surprise, to demonstrably contain very specific veridical information which saves his sick unborn child⁴³⁴.

Estranged communication techniques and languages are ubiquitous meta-informational novum codons in informationist SF. The central novum of Delany's *Babel 17* involves an alien language so complex that it confounds all attempts to understand it, giving unprecedented superiority to its hidden alien native speakers – *The Invaders* - who have enslaved humanity. Central character *Ryda Wong* is an informational savant and the only human who is able to perceive the strange signals of *The Invaders*, which her colleagues think to be an encrypted military code, as a natural language. The counterfactual language in question itself is very informationally dense, a clear inferential citation of Delany's own convictions about the language of science fiction texts themselves:

“For now it's called Babel 17. From what little I know about it already, most of its words carry more information about the things that they refer to than any four of five languages put together, and in less space.” She gave a brief translation for Mollya.

“Who Speak?” Mollya asked...

I don't know. But I wish I did. That's what the main reason for this trip is – to find out.⁴³⁵”

This fictive passage provides a parallel statement of one of the central posits of this thesis: *Babel 17*, like informational SF texts, is informationally heterogeneous and dense. The closing reference to inquiry is significant – a meta-fictional and metainformational reference to science fiction itself, a mode of writing which engages the ideological and methodological commitments of science. The cognitive aesthetic is often thus recursively meta-informationally nested in such works. I think these cognitive and aesthetic qualities signify *Babel 17*'s status as the first serious informationist science fiction novel of the twentieth century, and a strong candidate to mark the beginning of the informationist mode of science fiction. The passage refers implicitly and recursively to Shannon's 'surprisal' value for words, messages and texts: the logarithmic statistical entropy function introduced in chapter two. The principles alluded to apply to the text itself recursively. As a language, Babel-17 is highly estranged, but not impossible. Its native speakers – *The Invaders* – are themselves informationally estranged by it.

THE INFORMATIONAL ONTOLOGICALLY ESTRANGED CHARACTER-NOVUM

Characters constructed as ontologically very informational are prone to ample estrangement and often constitute sophisticated informationist novums. Vernor Vinge is adept at the construction of counterfactual character-novum with curious informational identities and mentalities. This avails him of a unique ways of synthesising texts which achieve the cognitive aesthetic in accordance with Lem's definition of the same as engaging with social and technological complexity through “the art of putting hypothetical premises into the very complicated stream of socio-psychological occurrences.”⁴³⁶ *A Fire Upon the Deep* contains many such estranged character-novums, the most interesting example being the multipart, collectively-conscious dog-like *Tines*, a hybridisation of alternative ideas of psychological and physical identity with concepts from data-communications and supercomputing science, which simultaneously invokes metaphorical impressions of the Egyptian mythological dog-being *Anubis*. This invokes a de-supernaturalising reference to another familiar SF mega-text codon of Egyptian god myths as originating with visits from extraterrestrials.

To achieve full personal identity, the *Tines* employ a form of group-think telepathy which functions like a noise-affected broadcast computer network. Counterfactually furthering the informational synthesis between fiction, the SF mega-text, and information science, the more individual members each *Tine* assimilates into their person, the smarter they potentially are: like a multi-processing computer wherein the addition of more CPU modules results in increased processing power. The overall character and

⁴³⁴ Dick, Philip K. *Radio Free Albemuth*. Film Tie-in Ed. London: Harper Voyager, 2008 (1976), 57-8.

⁴³⁵ Delany, Samuel R.. *Babel 17*. London: Gollancz (Ace), 1987 (1966), 60.

⁴³⁶ Lem, S. “On The Structural Analysis of Science Fiction” *Science Fiction Studies* #1 = Vol 1, Part 1 = Spring 1973. February 2009 <<http://www.depauw.edu/sfs/backissues/1/lem1art.htm>>. Paragraph 32.

personality of a Tine ‘pack-person’ are also dictated by the strengths and weaknesses of their individual members, and by the way in which they are physically organised, which affects the efficiency of thought signal transmission. Both principles are not only analogically similar to, but *ontologically* consistent with multi-processing computer systems theory and mathematical communications theory:

Take a group of ordinary people and train them to string out, not in packs but as individual members. If each member stayed just a few yards from its nearest neighbours, they could maintain something like the mentality of a trio. The group as a whole was scarcely brighter – you can’t have much in the way of deep thoughts when it takes *seconds* for an idea to percolate across your mind.⁴³⁷

This novum-dense passage also makes allusions to contemporary mathematical *network* theory, and to the philosophy of mind. In another unmistakable reference to foundational computer networking and data communications principles, a lot of signal *noise* affects the Tine’s ability to think. Tine *Lord Steel* finds that the materials and shape of the visiting human’s ship’s cargo hold amplify his own thoughts to the point of barely endurable pain and confusion⁴³⁸:

He stuck his head through the hatch-and jerked back abruptly. The acoustics were deadly...How could the aliens bear it?...Echoes screamed at him-worse than from unpadded quartz.⁴³⁹

The noise versus information and signal-to-noise ratio themes are engaged throughout the novel. In the aftermath of battle with the adult custodians of the human spacecraft, packs that are wounded and have lost members exist as pairs and individuals. Their mental capacities reduce to sub-linguistic levels, and their thought signals become chaotic, confusing noise:

A mob of frags and wounded is a terrifying, mind numbing thing. Singletons, duos, trios, a few quads...A few yards from the mob and Peregrine WickWrackRum could feel consciousness slipping from him. If he concentrated really hard, he could remember who he was and that he must get to the other side of the meadow without attracting attention. Other thoughts, loud and unguarded, pummelled him.⁴⁴⁰

It is a central tenet of (mathematical) communication theory that noise results in the degradation and loss of information transmitted from a source. These estranged character-novums, enrich the narrative by virtue of encoded counterfactual pseudo-informational references to scientifically and mathematically verifiable veridical information sources. They also result in interesting meta-informational effects in the language of the text which can avail the author of the opportunity for (or even necessitate) linguistic experimentation. When the ontology of the characters and setting is constructed with such extreme counterfactual estrangement, English can come under significant grammatical and functional strain as an artefactual tool for encoding semantics. Realising that English has no normative sentential or grammatical conventions for dealing with multipart individual subjects with physically and mentally swappable identity components, and demonstrating innovation in typographic experimentation, Vinge employs a morphemic textual device to make the experience of the character more palpable and assimilable through a special grammatic-linguistic association. As the four-member Perigrine WickWrackRum approaches the centre of the chaos of the post-battle milieu, his name begins to split in the text just as his consciousness is splitting in the story because of the thought noise cacophony assailing him:

⁴³⁷ Vinge, V., *A Fire Upon the Deep*, New York: Tor, 1992., 39.

⁴³⁸ The text here is also informed by synthesised scientific veridical information about ultra-sonic echo-location in bats.

⁴³⁹ Ibid., 134.

⁴⁴⁰ Ibid., 31-32

Wik and Kwk and Rac and Rum tried to remember just why **they was** here and where **they was** going. *Concentrate on direct sensation; what is really here:* the sooty smell of the flamer's liquid fire...⁴⁴¹

In addition to the morphemic device employed here in the text, which has a high surprisal value, the format and ontology of the character leads Vinge to alter the normal use of pronouns in conjunction with verbs and adverbs, thereby highlighting the stress that counterfactual pseudo-information, cognitive estrangement and the novum can place on the mechanisms for linguistic and grammatical encoding of meaning in English. The text as an artefactual source with lexical configuration must bend to the semantic imperatives of encoded counterfactual pseudo-information which extrapolates from veridical information: the rules for configuration of the lexeme, grapheme and morpheme are driven by the configuration of the veridical or counterfactual pseudo-informational source. The above passage also offers a reference to the contrast between veridical and pseudo-information which can be addressed using the ontology of information: the character lays hold of the natural veridical information available to him empirically in order to overcome the noise and pseudo-information⁴⁴² arising from the din of the wounded, thus favouring verifiably veridical information sources over other types of source⁴⁴³. Emerging from the battle's aftermath, his consciousness stabilises and coalesces again, which event is meta-informationally signified by the syllabic/morphemic contraction of his name in the actual text:

An awfully long time passed. Minutes. **Wic-Kwk-Rac-Rum** looked ahead. He was almost out of it...He dragged himself to a patch of clean ground...Sanity slowly returned. **Wickwackrum** looked up.⁴⁴⁴

This grammatical fragmenting and contracting of the proper name in accordance with its referent – the being and ontological identity of the counterfactual character – also reflects the overall *object centric* ontological concerns of SF. In keeping with the application of Clarke's 'third law' to character construction, there is an undeniable familiarity to be found here in relation to mythological and fantasy genres and their texts, but the counterfactual is extrapolated within the bounds of the materialist closed system universe. In narratives encoded in fantasy texts, underlings approaching wizards possessed of magical powers of mind control may experience similar confusion to Tine Peregrin Wickwackrum, but only in a supernaturalistic open-system context. In Vinge's SF text, the causality of the confusion is analytically explained and established with metaphorical/analogical and direct counterfactually seated general references to veridical sources of scientific information which describe the actual signal noise dynamics of communications systems. Such analysis and explication would be pointless, aesthetically dysfunctional and probably confusing where a fictive phenomenon was supposedly magically or supernaturally implemented.

Tines can live for hundreds of years by adopting and assimilating 'pups' into their packs. This delivers naturalistic informational estrangement of identity, and the aesthetic of complexity. The identity of a Tine is a communication-theoretic novum built upon a philosophical logical thought experiment: an informational and biological *ship of Theseus*. The pups inherit the information - and the knowledge and identity which supervene upon it - of the pack person as a whole, thereby *perpetuating* the pack personality and knowledge – its information - beyond the lifespan of its individual members. The mortal thus attains potential immortality not via supernatural or magical intervention, *nor* through scientific prowess, but naturalistically - simply as a result of very unusual evolutionary outcomes, and *informationally*. Thus are engaged the discourses of the social, evolutionary and psychological sciences. Correspondingly, further cognitively stimulating fictional outcomes ensue, as commensurate with Lem's socio-technological matrix. The ominous *Flenser* is internally conflicted through a clever twist accorded by the character's estranged

⁴⁴¹ Ibid., 32. (Emphasis mine. 'they was' is not a grammatical error, but intentional on the part of the author.)

⁴⁴² I am applying the term pseudo-information here to the lexical and non-lexical information types in the situation depicted in the story, although it also applies to the (lexical) information type of the story text itself.

⁴⁴³ As in the above footnote. This kind of textual meta-informationism is also what makes Vinge's fiction informationist.

⁴⁴⁴ Ibid., 32.

ontology. *Flenser* is injured in a political uprising and some of his members are separated from him. He eugenically repopulates his pack with members from a follower named Tyratlect. Initially willing, Tyratlect not only comes to resent the imposition on her person, which requires some of her members to be slain, but is of an altogether different personality type to the long-lived tyrant *Flenser*, and secretly plots the downfall of the regime:

She knew now, from the inside, the evil that she had given herself to...Lord Steel was a killer; worse, a manipulator. But since the landing, Tyratlect knew that he was something else: deathly afraid...Even though the folk he feared might ultimately kill them all, in her secret soul she wished them well...⁴⁴⁵

Her strength comes from the ontological configuration of the Tines as compound information sources. The Tines provide a superb, although unintentional, meta-informational picture of the principles of internal-external information source combination and synthesis as modelled by the ontology of information:

Two of Tyratlect were of Flenser. The Master had miscalculated in thinking they could dominate the other three. Instead the conscience of the three had come to own the brilliance of the two. **She had remembered almost everything the great Flenser had known**, all the tricks and the betrayals. The two had given her an intensity that she had never had before...⁴⁴⁶

Tyratlect's internal information sources are augmented and altered by synthesis with the internal information sources of the Flenser members with whom she is eugenically merged, and the troubled Tine becomes enormously internally conflicted because of the contrasting intentional and ideological concepts and convictions that come with assimilating new members, their information and their knowledge. The amount of *cognitively* facilitated imagination required on the part of the reader in read-time processing of the science fictive text, and by the author in the construction and interpretation of such intrigue, is arguably significantly more than would be required for similar plot devices outworked in familiar human characters. Vinge must pay careful attention to the systematic and internally consistent construction of the Tines, with all of their estranged ontology or identity, so that the reader can both follow the narrative and benefit aesthetically from the inventiveness inherent in the resulting character-novum. The read-time cognitive aesthetic outcome is a satisfaction at the intricacy of the device itself, as well as the reader's own success in semantically decoding the requisite structure and symbols, and thus exploiting the underlying synthesis of counterfactual pseudo-information and scientific veridical information in the text.

SCIENCE FICTION TEXTS AS *ANTI*-SIMULACRA

Broderick cites cognitive scientist Howard Gardner as suggesting that SF has little or limited value for actual science education because it proliferates ideas rooted in unscientific 'lay-dynamics' which are "superficial, not rooted in experience, and of little practical use."⁴⁴⁷ He deferentially suggests that "[p]erhaps the pleasure of SF provides from its simulacrum of canonical dynamics – so delightful, compared with the grey drone of rote learned data and algorithms – offsets the errors it supports"⁴⁴⁸. Indeed, Broderick goes on to suggest that semiologically and in terms of its investment in a scientifically inspired and intertextually referenced SF mega-text, there may be even more to SF than that⁴⁴⁹. The combination of heterogeneous information types and disparate discourses from differently motivated sources in science and the SF text does not necessarily simply result in a confusing or obfuscating conflation of fact and fiction. SF heavily engages with thought experiment and extrapolative cognitive estrangement across multiple external and internal information sources and discursive fields, and this necessitates the referential inclusion of veridical information.

⁴⁴⁵ Ibid., 131-132

⁴⁴⁶ Ibid., 132.

⁴⁴⁷ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 164.15.

⁴⁴⁸ Ibid.

⁴⁴⁹ Ibid.

Unlike SF theorists Lem and Suvin, Jean Baudrillard was not convinced of the cognitively liberating and expanding potential of SF. In *Simulacra and Science Fiction*, he classifies modern science fiction as belonging to the *second order of simulacra*, those “productive, productivist” types of simulacra motivated by the desire for the advantages of technologically enabled production, which embraces a “promethean aim of continuous globalisation and expansion.⁴⁵⁰” There is also a *third order* of simulacra defined thus:

[S]imulacra of simulation, founded on information, the model, the cybernetic game – total operationality, hyperreality, aim of total control⁴⁵¹

These are the *informational* type of simulacra which Baudrillard believed that SF was becoming subsumed to and which was rendering it redundant as a referential mode of fiction writing: simulacra arising out of the information based simulation, rather than the product of simple imaginative dissimulation, or of the materialist productive base of second order simulacra⁴⁵². In terms of information ontology, such fictions have become based on *pure pseudo-information* which mimics and supplants veridical information but which bears no cogent or determinable cause-effect relationship to veridical information sources.

Baudrillard defined *hyperrealism* in his 1981 *Simulacra and Simulation*. Baudrillard’s own notorious prolixity and obfuscating language notwithstanding, informationally speaking his theory is effectively about the re-representation and obfuscation of veridical sources of information: the loss of veridical information due to information type conversion. Baudrillard regarded SF texts as simulacra and as speaking of simulacra, and SF as a whole a *simulacrum*⁴⁵³. Hyperreality and simulacra arise when the abstractions and allegories begin to supplant the reality and meaning of those things and states of affairs they are intended to represent or simulate:

Today abstraction is no longer that of the map...Simulation is no longer that of a territory, a referential being, or a substance. **It is the generation by models of a real without origin or reality: a hyperreal.** The territory no longer precedes the map, nor does it survive it. It is nevertheless the map that precedes the territory – *precession of simulacra* – that engenders the territory...⁴⁵⁴

The term *map* here refers to the illustrative allegory of the map and territory in Borges’ fable⁴⁵⁵ wherein cartographers of a fictive empire construct a map that has the same extent as their actual empire⁴⁵⁶. A map is an abstraction of something real which is intended to encode and convey, with information loss, information about something real – about something embodying far more information, and usually different types of information, than does the artefactual information of the map itself. If a real cartographic map is regarded as an information source, then it is veridical to the extent that it accurately depicts the real territory of which it is an abstract representation, and is thus a source in its own right on the same terms as I have stipulated for a text. It is an artefactual information source which exhibits the information loss associated with *information type conversion and synthesis*. Information loss and pseudo-information hides the absence of veridical information: simulacra suppress the knowledge of the *absence* of any underlying reality. On Baudrillard’s theory, the map simulacra become more robust than the reality which they have supplanted. It is *reality* that decays and “[i]t is the real, and not the map, whose vestiges persist here and there in the deserts.⁴⁵⁷”

⁴⁵⁰ Baudrillard, J. "Simulacra and Science Fiction." in *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981),121.

⁴⁵¹ Ibid.

⁴⁵² Ibid.

⁴⁵³ Baudrillard, J. "Simulacra and Science Fiction." in *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981),125. (see discussion of Dick’s *Simulacra*)

⁴⁵⁴ Baudrillard, J., “The Precession of Simulacra” in *Simulacra and Simulation*, Trans. Sheila Faria Glaser, Ann Arbor: the University of Michigan Press, 1994., 1.

⁴⁵⁵ “Exactitude in Science,” 1960.

⁴⁵⁶ Baudrillard, J., Op, cit.,

⁴⁵⁷ Ibid.

For Baudrillard, SF is rendered impotent by the diminution and vanishing of the discernible *distance between the real and the imaginary*^{458 459}. The collapsing of the distance between the imaginary and the real in SF, and the “implosion of meaning” thus achieved, is “*where simulation begins*.”⁴⁶⁰ In utopian fiction “dissociation from the real world is maximised.”⁴⁶¹ Thus *counterfactual* pseudo-information is maximally leveraged for the purpose of indirect reference to the real world through anticipation and critical projection. For Baudrillard, third order simulacrum SF cannot achieve this critical projection because of the collapsing of the imaginary with the real – the conflation of the real and the illusory. Simulations and models of the real (other than SF) are “themselves an anticipation of the real” and thus their counterfactual re-representation is pointless: they “leave no room for any sort of imaginary transcendence.”⁴⁶² SF texts become recursive simulacra; recursively non-referential simulations of simulations which are effectively pure pseudo-information⁴⁶³. However, I think the view that SF is a thoroughgoing simulacrum is based on a limiting and ultimately flawed generalisation. *Some* SF of the postmodern era *is* co-opted to both the third and second order of simulacra. However, not all information age SF is like this, and much informationist SF, such as Philip K. Dick’s *The Simulacra* and Gibson’s Bridge Trilogy (*Virtual Light, Idoru, All Tomorrow’s Parties*), is clearly metafictional and *metainformational* with regard to informational simulation and even (in the case of The Trilogy) Baudrillard’s *hyperreal* simulacra⁴⁶⁴.

The themes of information and simulation addressed in the narrative encoded upon these texts reflexively represent the informational structure and dynamics of the SF texts themselves, and their intertextual relationship to the SF mega-text. I posit that it is an *inversion* of the simulacrum that occurs with the meta-informational narrative resources of possible worlds presented by much information age science fiction, and especially sub-modes like cyberpunk and informationist SF that engages communication theory and information science. I think this kind of information age SF, and especially informationist SF, operate cognitively as *anti-simulacra*. Such SF fictively depict simulacra and simulations as corrosive to the representation of reality and the reliable hi-fidelity conveyance or transmission of veridical information. Information age SF texts of this type openly engage the themes of information inundation and the psychological and cultural effects of immersive, delusive simulation: the counterfactual extrapolation of the known experience of the overload and wash of *hyperreal pseudo-information*. In an anti-simulacral text, the real is ‘referenced’ via fictive speculation about counterfactual worlds, which are then set at a certain discursive and factual ‘distance’⁴⁶⁵ from the real world, so the real is twice removed from the impression, model or simulation of it, but the objective is thus to highlight the deficiencies or problems of the real, thereby foregrounding it rather than obscuring it.

For Baudrillard, technologically and scientifically facilitated space exploration leaves no room for the imaginary narratives of expansion of classic SF, because with it extra-terrestrial space has consequently become normalised to the quotidian and pedestrian levels of terrestrial human existence, and the hyperreal has thus expanded into the entire universe – the expansive domain of the SF imaginary⁴⁶⁶. Thus is brought about “the end of metaphysics, the end of the phantasm, the end of science fiction,” and concomitantly “the era of hyperreality begins.”⁴⁶⁷ However, this assumption of universal hyperreality embraces some fallacies. Baudrillard *starts* with a flawed model of SF, one which excludes or minimises the cognitive aesthetic and cognitive estrangement. His *a priori* view of SF proper seems largely to

⁴⁵⁸ Baudrillard, J. “The Precession of Simulacra.” *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 31.

⁴⁵⁹ *Ibid.*, 2.

⁴⁶⁰ *Ibid.*

⁴⁶¹ *Ibid.*, 122.

⁴⁶² *Ibid.*, 122.

⁴⁶³ *Ibid.*, 125.

⁴⁶⁴ Dick’s novel pre-dates *Simulation and Simulacra* by

⁴⁶⁵ The question of how this distance is described is addressed loosely by Baudrillard in the continental tradition, and analytically and logically by Kripke and Lewis in the Anglo-American philosophical tradition.

⁴⁶⁶ *Ibid.*, 124.

⁴⁶⁷ *Ibid.*, 124.

equivocate on fantasy: to wholly conflate SF with the thoroughgoing fantastical, open-system and mythologising text. Furthermore, Baudrillard employs a convoluted metaphoric illustration which uses the popular big bang model of the universe as a basis for the contrast between classic SF and later modes⁴⁶⁸. He analogises the expansion of generic systems – presumably including human systems - in history to the theoretical posits of the big bang-big crunch theory of the universe and the collapse of spent stars, wherein “[w]hen a system reaches its own limits and becomes saturated, a reversal is produced.⁴⁶⁹” To pose a countering analogy: although the big bang theory is favoured, there are other models which cannot yet be ruled out – some of which do not involve expansion. Similarly, theories about SF are contentious and debateable. The boundaries of the counterfactual are less simply inscribable than the perceived boundaries putatively breached by the ‘conquest’ of space. Counterfactual estrangement in SF relies in large part on the expanding capabilities of science and technology themselves. It is simply not clear, when one considers the counterfactual, that there is no more “virgin territory,” nor that any artefactual map or fiction could cover the entire territory of the explored or unexplored cosmos. Baudrillard misses the true significance of the scientific enterprise, and thus misses the significance of discursive engagement with said enterprise. He posits that:

Perhaps science fiction from the cybernetic and hyperreal era can only exhaust itself, in its artificial resurrection of “historical” worlds...in which fiction will never again be a mirror held toward the future, but a desperate rehallucination of the past.⁴⁷⁰

That the language of this is subjunctive makes it a clever piece of dialogic Devil’s advocacy: Baudrillard has it that SF and science have become seamlessly integrated as part of the same homogeneous simulacrum, and that “science fiction is no longer anywhere, and it is everywhere, in the circulation of models, here and now, and in the very principle surrounding simulation.⁴⁷¹”

Baudrillard’s position on SF is hardly surprising, since he believed that science itself had become subsumed, like the media, to controlling social simulacra, and the subjects and objects of science to “have become referential simulacra, and science itself has become pure simulation.⁴⁷²” Science seconded or co-opted to political or ideological ends may result in a hyperreal, but true science, with its principles of mathematical rigour and evidentiary empiricism, is prone rather to provide cognitive tools to subvert pure pseudo-information: it is an *anti*-simulacrum. Although Baudrillard does not directly engage with information theory, the information available to and acquired by people as a basis for knowledge is a central concern of his theory. The delusiveness of simulacra is ultimately detrimental to the individual. The Bridge Trilogy is illustrative of just these very ideas and thus promotes Lem’s cognitive aesthetic. This cultural-philosophical and psychological outlook on informational simulation and simulacra is important in much informationist SF.

Gibson’s texts subvert, challenge, and *invert* the simulacrum. At the end of the trilogy the avaricious and vicious Harwood achieves a kind of digital transcendence:

“Your friends aren’t the only ones who learned how to secede...Harwood is going now, inverting himself into an informational wormhole...⁴⁷³”

Harwood ‘secedes’ by choice, but Laney must do so to survive the final effects of an illness:

⁴⁶⁸ The big bang theory holds sway because data from cosmic background radiation is seen to support it, but even today, other models are not written off. Fred Hoyle’s steady state theory, and new hybrid theories such as chaotic inflation theory. At the time of writing of *Simulacra and Simulation*, these latter alternatives were strong contenders. The expansion-collapse system model also applies to the evolution of stars and to certain chemical reactions.

⁴⁶⁹ Ibid., 123.

⁴⁷⁰ Ibid., 123.

⁴⁷¹ Ibid., 126.

⁴⁷² Ibid.,

⁴⁷³ Gibson, W. *All Tomorrow’s Parties*. Victoria: Viking/Penguin, 1999, 252.

And Laney is going too, though not with Harwood...And finds himself in Florida sunlight, upon the broad concrete steps leading up to the bland entrance to a federal orphanage...⁴⁷⁴

Rationalist naturalistic metaphor here implicates as tenor the supernaturalistic resurrection and transcendence themes of various myth narratives implied at read-time for the reader familiar with them: transcendence is achieved naturally and technologically, that is, *informationally*. The simulacrum of mythologisation is subverted in the encoded semantics of the narrative by realism and materialism - via *informationism*. The passage is also *meta-informational*. The *informational wormhole* is a reference to information type conversion and to what is referred to as a *sink* or *destination* in electronic communication theory. It is more than metaphor: it is a cognitive component of the novum. Harwood and Laney actually undergo a physical metamorphosis from the material to the digital, from electrical matter to electricity, from material veridical information to artefactual veridical information⁴⁷⁵. They effectively convert themselves into a signal and transmit themselves to the sink that is the wormhole. Harwood and Laney are encoded into the narrative which supervenes on the selected message that is the SF text, the information from which message – behaving also as an information source – the reader synthesises with their internal concept sources whilst processing it. The supervenience of the narrative and characters on artefactual information - as informationally encoded upon and semantically encoded within the message of the text - mirrors the encoding of Laney and Harwood in the artefactual substrate of DatAmerica. DatAmerica itself is a counterfactual fictive informational analogue to the text, as are the Jugglers of Reynold's *Revelation Space*, but DataAmerica is pointedly artefactual and so the metainformational implication of the text is perhaps even stronger. A reader of Gibson's text is now challenged with the same metaphysical uncertainty which afflicts Laney: faced with the spectre of the hyperreal. With fantasy, there would be no need for the reader to wonder about metaphysical nuances, to engage the ideation of causality and mechanism. With Gibson's text, as culturally orientated and scientifically approximate as it is, such futurological counterfactual and naturalistically inclined cognition is intrinsic to the reading experience. Harwood and Laney are a tokening of an informationist SF mega-text novum that an SF author might refer to with the neologism *infomorph*.

THE INFOMORPH AND INFORMATIONAL GHOSTS

Informationist SF frequently exhibits two aesthetically-charged character-novums or icons which I refer to as the *infomorph* and the *natural informational ghost* respectively. The infomorph is an ontologically estranged character who metamorphoses from informational to material existence or vice versa. Arthur C. Clarke's 1973 *Rendezvous with Rama* contains an early example of information-to-matter metamorphosis as just one of a number of examples of *meta-informational* writing:

“If we accept Dr Pererra's very plausible theory, which certainly fits all the facts, the creatures who have been observed inside Rama did not exist until a short time ago. Their patterns, or templates, were stored in some central information bank, and when the time was ripe they were manufactured from organic raw materials-presumably the organometallic soup of the cylindrical sea.⁴⁷⁶”

This information-to-matter metamorphosis in character construction is a repeated *codon* in the informationist SF mega-text. In discussing Gibson's *Neuromancer* trilogy, Cordle identifies the intrigue of the AI character Wintermute as being associated with its ascension from an artificial intelligence limited in power by programmatically imposed laws, to a true super-sentient being with virtually unlimited capacities for knowledge and thought⁴⁷⁷. In Gibson's later Bridge Trilogy, the next step in the fictive evolution of the sentience coveting Wintermute is represented by the artificial intelligence named *Rei Toei* or *The Idoru*.

⁴⁷⁴ Gibson, W. *All Tomorrow's Parties*. Victoria: Viking/Penguin, 1999, 260.

⁴⁷⁵ As humans, their information supervenes on organic material embodiment. Once they 'secede' their information supervenes on electrically actualised computer software running on computer hardware.

⁴⁷⁶ Clarke, A.C. *Rendezvous with Rama*. New York: Spectra, 1973, 203.

⁴⁷⁷ Cordle, Daniel. *Postmodern Postures: Literature, Science and the Two Cultures Debate*. Aldershot: Ashgate, 1999.

Rei Toei is introduced in *Idoru* as an AI singing idol, a digital simulacrum of a generic non-person: a hyperreal entity *embodied* as real *in fiction*⁴⁷⁸. She (it) is an artificial pseudo-person supervening on software. The technological and metaphysical significations of these two character-novum intersect: each yearns for an ontological transformation to a different form of existence, and both must effect their own transformation by leveraging their processing power – their artificial intellects – to overcome the material obstacles placed before them by human design and inadequacy in human design. The infomorph is frequently, but not always, an AI.

In *All Tomorrow's Parties*, protagonist Laney had his mind altered in childhood as the subject of clinical trials of an experimental drug⁴⁷⁹:

The American's peculiar talents with data are a result of experimental trials, in a Federal orphanage in Florida, of a substance known as 5-SB. Laney has seen what Laney can do with data, and what data can do to Laney⁴⁸⁰.

His material existence dwindles as his physical body becomes weaker due to the degenerative syndrome 5-SB causes as a side effect. He himself becomes unsure as to his own ontology because of resulting memory loss, and there is persistent ambiguity throughout *All Tomorrow's Parties* as to whether he started as a real physical person, or as artefactual information:

Something has happened to him...He has started to see that he previously had, in some unthinkably literal way, no self...what was there, he wonders, before? Sub routines: mal-adaptive software behaviours desperately conspiring to approximate a presence that would be, and never quite be, Laney.⁴⁸¹

This ambiguity and uncertainty surrounding Laney's being makes him unsure of his own informational truth status: whether he is real – embodying mostly veridical information – or something else. Information loss and synthesis have resulted in greater *uncertainty*. In this recursive metafictional and meta-informational sense, Laney is thus a *character-novum* embodying copious cognitive estrangement, through whom the text delivers the cognitive aesthetic *and* the aesthetic of informational complexity. Laney follows a trajectory from material existence to the informational, his persona ultimately absorbed into the informational milieu of the virtual world of DatAmerica. Simultaneously, Rei Toei follows an opposite ontological trajectory. Non-conformist security man and action anti-hero of the first two novels, Berry Rydell, and his offsider Sublett – a chronically allergic escapee from Reverend Lowell's puritanical sect of television obsessed god-seekers - first encounter Rei Toei as a mischievously projected anonymous hologram on a roadway⁴⁸². Rydell and Sublett are ignorant of the technology behind the image, prompting nonsensical superstitious perorations from the supernaturalist Sublett and perplexed infatuation on the part of the rationalist Rydell:

One full moon night Rydell had slung gunhead around a curve and frozen a naked woman in the headlights...long enough for Rydell to think ... she might've been Japanese, which struck him right then as the weirdest thing about any of it. Then she saw him...and smiled. Then she was gone. Sublett had seen her, but it only kicked him into some motormouthed ecstasy of religious dread...⁴⁸³

In a meta-informational symbolic emphasis of the surprisal value bound up with the *Idoru* novum, the 'woman' is not only naked and Japanese, but "hadn't it looked like the shadowed darkness of her bush had been shaved into something like an exclamation point"⁴⁸⁴." The surprisal value associated with this

⁴⁷⁸ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 45.

⁴⁷⁹ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996.133.

⁴⁸⁰ Gibson, W., *All Tomorrow's Parties*, Victoria: Viking/Penguin, 1999., 6.

⁴⁸¹ Gibson, W., *Op. cit.*, 71.

⁴⁸² Gibson, W. *Virtual Light*. New York: Bantam Doubleday Dell, 1993-4., 26, 202.

⁴⁸³ *Ibid.*, 26

⁴⁸⁴ *Ibid.*, 27

novum is meta-fictionally *signified* in sexual and racial context. The estrangement of the Idoru's identity and ontology is achieved meta-informationally.

Rei Toei itself learns through the acquisition of true information: veridical information. As Laney realises when he is parsing its *nodal points*, both he, the Idoru's human partner Rez, and the rest of humanity are veridical sources from which Rei Toei synthesises knowledge from new information:

The Idoru's data began somewhere after that, and it began as something smoothly formed, deliberate, lacking complexity. But at the points where it had swerved closest to Rez's data, he saw that it had begun to acquire a sort of complexity. Or randomness, he thought. The human thing. That's how she learns.⁴⁸⁵

Meta-fictional references to informational complexity abound. Not content with one human from whom to learn, Rei Toei seeks to experience as many human sources as possible, and interacts with many of the characters in the book to this end: Berry Rydell, Fontaine the watch-man and Fontaine's autistic charge, the encyclopaedic savant Silencio. As she begins to discern Rez' shallowness, the idoru turns to Laney:

[A]s her growing complexity continued to widen the distance she already knew she felt towards Rez, she had come to [Laney] and asked him to interpret the data as it flowed around herself and Rez.⁴⁸⁶

Again, the text engages here meta-fictionally and meta-informationally with its own complexity.

At the end of the novel, Laney's physical body dies from the syndrome to which all of the other inhabitants of the orphanage who were exposed to 5-SB have succumbed, while Rei Toei becomes a physically embodied individual through newly devised matter-copying technology. The Lucky Dragon Nanofax is installed throughout the real world in the chain stores of the Lucky Dragon franchise for the purpose of enabling customers to have exact duplicates of purchased items instantaneously manufactured for recipients at remote stores. Technology and science are co-opted by the simulated informational person of Rei Toei to allow her to become multiply instantiated as *multiple* real living organisms. In a deft stylistic manoeuvre, Gibson enlists the character of streetwise street-kid Boomzilla for the hybrid first-person free-indirect discursive narrative coverage of Rei Toei's emergence from the Nanofax as a sentient physical organism. Discursive synthesis and complexity are elevated at this nodal point in the SF text:

Light over the hatch turns green, and the hatch slides up and out crawls...this butt naked girl, black hair, maybe Chinese...she's smiling, and everybody...they jaw hang, eyes popped...But the crazy thing is, and he really doesn't get this, standing looking out through the vast doors at the video pylon...he sees her on every last screen, **walking out of every Lucky Dragon in the world...**⁴⁸⁷

Character-novum Rei Toei's transformation has a high surprisal value as a counterfactual estranged outcome. Concomitantly, the linguistic phrase which describes it is *high information*: individuals don't walk out of multiple disparate locations simultaneously, and the selection of a sentence upon which such meaning supervenes is thus statistically unlikely.

Laney and *Rei Toei* are examples of both the *infomorph* and the *informational ghost*. The significant metafictional, intertextual and thematic reference to Baudrillard's theory within many information age SF texts and narratives serves to increase the presence of cognitively engaging philosophical discourse through discursive hybridisation and synthesis. In his *Philip K Dick: Exbilaration and Terror in the Postmodern*, Christopher Palmer – again confirming Lem's thesis of SF for social complexity - describes Dick's writing as an engagement with “popular culture's staging of the claims of the group against those of the individual,” and as explorative of the balance of the human and the social in the context of postmodern

⁴⁸⁵ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 251.

⁴⁸⁶ *Ibid.*, 166.

⁴⁸⁷ Gibson, W., *All Tomorrow's Parties*, Victoria: Viking/Penguin, 1999., 268-9.

consumerism⁴⁸⁸. Palmer views as extreme Baudrillard's thesis that the subject is subsumed to the object through the consumption of commodities, but acknowledges its semblance in Dick's preoccupation with the uneasy balance in the relationship between individual and a control-orientated consumer society⁴⁸⁹. Broderick recognises, as a further marker of SF, the shift in narrative focus from *subject* to *object* in conjunction with the foregrounding of cosmological, natural, scientific and technological novum⁴⁹⁰. This fits with Baudrillard's view of the effect that hyper-commoditisation and social simulacra have on the individual subject. In informationist SF, something interesting happens in the subject-object balance: post-human informational characters – infomorphs and AIs – *are or become part of the novum*. Being more cognitively sophisticated than the cyborg, and not nearly so mechanical as the robotic android of the classic SF mega-text, infomorphs and other character-novums with complex informational ontologies embody the fluidity and complexity of information. The object and subject informationally *merge* in the narrative. Infomorph character-novums are informational subject-object hybrids. For Baudrillard the hyperreal and the simulacrum are the adopted tools of ruling power for the implementation of models for social control, wherein the individual is culturally and psychologically subjected and subsumed to the simulacra, circumventing their agency, self-realisation, and ability to resist:

Such is the watershed of hyperreal sociality, in which the real is confused with the model...Such is the last stage of the social relation, ours, which is no longer one of persuasion...but one of deterrence. "YOU are information, you are the social, you are the event, you are involved, you have the word...it becomes impossible to locate one instance of the model..."⁴⁹¹

The deterrence of the real is the blocking of veridical information. From the perspective of an externalist informational epistemology, this translates to a concern about the amount of veridical information associated with the knowledge of the individual perceiving agent. Gibson's Laney as *subject* in the narrative becomes less substantive by virtue of the imposition of the informational novum on the narrative space, but simultaneously grows in complexity *as* part of a novum object. Laney's convergence on a total informational identity has the overall effect of diminishing him as human subject. The hypercommodity that is Rei Toei presents a further estranging challenge to normative subject-centricity in the text. The identities of Laney and Rei Toei are hybridisations of the data and the physical: of artefactual and natural veridical information. Laney's informational metamorphosis, together with the growing *reality hole* in his identity, make him a kind of *informational ghost*. Because of his informational lightness of being, his internal voice becomes doubly ghostly:

Laney is in drift...It is a matter, he knows, of letting go. He admits the random. The danger of admitting the random is that the random may admit the hole. The hole is that which Laney's being is constructed around...The hole is that into which he has always stuffed things: drugs, career, women, information.
Mainly - lately – information.
Information. This flow. This ... corrosion.
Drift.⁴⁹²

Laney stares into the abyss, and the abyss doesn't just stare back, but it threatens to merge with him such that the hole overtakes him due to the syndrome and he converges on an informational reality. He is threatened with *becoming* the hole of the real: a hole where his person once was. His self-realisation as intimately entwined with artefactual information results in the potential vacuity of the real in his person: hyperreality in the form of third order informational simulacra. As a character, Laney serves to make the text *anti-simulacral*. Laney is in this sense hyperreality personified; hence perhaps a hyperreality pervades his internal voice. His identity is eroded by the loss of veridical information through the conversion of *natural* veridical information (his physical being) to *artefactually* supervening veridical information (data and

⁴⁸⁸ Palmer, C. *Philip K. Dick: Exhilaration and Terror of the Postmodern*, Liverpool: Liverpool University Press, 2003., 133-4.

⁴⁸⁹ *Ibid.*, 134.

⁴⁹⁰ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 155-156.

⁴⁹¹ *Ibid.*, 29.

⁴⁹² Gibson, W., *All Tomorrow's Parties*, Victoria: Viking/Penguin, 1999., 40.

software.) There remains the ambiguity of Laney's origin: he may have been an informational ghost to being with. Thus are engaged the themes of personal identity at root: the question of how human identity supervenes on the information in genetic codes combined with the digitalised information stored as electrical impulses in the brain. What seems like metaphysical dualism is *suggested* by the infomorphs in the Bridge trilogy, but as with most informationist SF, there is always a *material* substrate required for the sustenance of information in either organismic form or in artefactual computing systems: ultimately informationism is physicalist. In fact, the mechanism of a self-aware informational being as realised by computer systems suggests that the actualisation of organismic sentience is similarly achieved: an engagement with the philosophical conception of thought and consciousness as multiply-realizable. The informational metaphorphosis that is deleterious to Laney as natural veridical information, but which promotes him into artefactual information, has the effect of implicating the text itself, the counterfactual pseudo-information source upon which the entire narrative supervenes. Furthering the physicalist theme, Rei Toei the artificial persona *begins* as an informational ghost *supervening on enormously powerful computer hardware*. As he struggles to come to terms with the idoru, Berry Rydell puzzles about her pseudo-ghostly ontology and prospective apperception:

What, he wondered, did the projector slung over his shoulder mean to her? ...did the programs that generated her somehow provide some greater illusion of being there? But if you weren't real in the first place, what did you have to compare not being there too.⁴⁹³

Rei Toei is determined to assert her own realness and when questioned by Rydell asserts that "this is a hologram, ... but I am real⁴⁹⁴." Information sources on Shannon's theory are any stochastic processes, and thus deterrence (hindering, arresting, checking) of every *real* process - "detering every real process by its operational double⁴⁹⁵" - involves the loss of information from veridical sources. Rei Toei supervenes on computer processes, but becomes otherwise real. In *All Tomorrow's Parties*, Laney is the quintessential process philosopher. For him "everything is process...but the process is all a lot stranger than he ever bargained for..."⁴⁹⁶ Laney is rendered more wraithlike by both his own estranging hyperreal informational status, but simultaneously becomes especially empowered by it - freed from material constraints.

THE INFORMATIONAL NATURAL GOD AND 'GODSHATTER'

Another icon of informationist SF is embodied in an extension of the informational natural ghost codon which I will refer to as *the informational natural god*. Its distinguishing feature, aside from informational ontology, is an intrinsic reference to specifically informational epistemology. Metaphorical godhood or godlikeness is attained through extreme superiority via informational metamorphoses, usually achieved through corresponding technological and transhumanist or trans-sapient manifestations thereof. The Invaders of Delany's *Babel 17* are empowered by the super-language Babel 17 which renders them almost god-like to their adversaries. In Banks' *The Algebraist*, the *Dwellers* are conventional in terms of being accessible to the other races, but hide the extreme otherness of which they are suspected of burying evidence of the existence of their super-advanced technologies deep within the magnitudinally intimidating temporally transcendent information archives of which they are masters. The *Jugglers* of Reynolds' *Revelation Space* are almost informationally empowered enough to be representative of this motif, but it is the ancient genocidal infomorphs the *Sbrouders* who are archetypally representative of the codon⁴⁹⁷. One stereotypical meta-informational facet of such characters is their communicative and creative abilities. They communicate telepathically and multi-vocally, and control the dissemination of information. They create objects, and change matter to and from information, and control outcomes for lesser sentient beings with information. These are all metaphors for an author's informationally

⁴⁹³ Gibson, W. *All Tomorrow's Parties*. Victoria: Viking/Penguin, 1999, 247.

⁴⁹⁴ *Ibid.*, 153.

⁴⁹⁵ Baudrillard, J. "The Precession of Simulacra." *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 2.

⁴⁹⁶ Gibson, W. *All Tomorrow's Parties*. Victoria: Viking/Penguin, 1999, 13.

⁴⁹⁷ Reynolds, A. *Revelation Space*. New York: Ace/Orion/Victor Gollancz/Penguin, 2000, 511-12.

supervening creative power at write-time synthesis, and a reader's cognitive engagement at read-time synthesis.

The informational god codon is exemplified in the context of the counterfactually estranged *mise en scène* of Vinge's *A Fire Upon the Deep*, wherein the galaxy is partitioned into *zones* such that the speed of information processing and thought varies depending on one's location relative to the core of the galactic disk. Primitive sentients inhabit the *slow zone* in the matter dense region near the galactic disk, the intellectually and technologically superior *Beyonders* inhabit the more outward regions of *The Beyond* and *High Beyond*, and the god-like *Transcended Powers* have managed to move out and inhabit the far reaches of the galactic halo, *The High Transcend*. *The Powers* have long since accelerated their evolutionary process by leveraging science and technology to accelerate their development to the point where their thought is superluminal and they are regarded as god-like by lesser species⁴⁹⁸. Subsequent to becoming emotionally and sexually involved with archetypal space adventurer Pham Nuwen – whom Vinge, his metafictional tongue in his cheek, has the narrator recognise as such⁴⁹⁹ – human protagonist Ravna Bergsdot discovers that her human lover is not a natural human at all, but constructed from ancient human physical and mental debris by the transcended being *Old One*⁵⁰⁰. Pham's personality is the product of informational source synthesis: he's a meta-informational character-novum. Using *Relay*, *Old One* communicates with Ravna, her AI supervisor Grondr, and *The Vrinimi Org*⁵⁰¹, the information and bandwidth trading super-company for which Ravna works as a consultant human information specialist. *Relay* is a *hub node* of the vast galactic high-bandwidth data network referred to by the protagonists as *The Known Net*⁵⁰². Subsequent to her discovery of Pham's informationally and ontologically estranged identity, Ravna uses a device provided by Grondr which tells her when *Old One* is using Pham as a close-controlled bidirectional conduit for surveillance and influence, which interactions alter Pham's personality:

“You have a pipeline to god Mister, but let me tell you a little secret: I can tell whether it's open or closed...
 ...“Oh? How is that?”
 “Pham Nuwen—left on his own—is a bright, egotistical guy, and about as subtle as a kick in the head...but I've got a little help from my boss. He's cleared me to monitor transceiver usage.”...“Right now, your *Old One* is getting less than 10 kilobits per second from all of *Relay*...which means...you are not being tele-operated.”⁵⁰³

Ravna refers to *Old One* as ‘god’ in accordance with the character-novum adaptation of Clarke's law: any being technologically advanced enough will appear as a god. This interaction between a human character and another human character with a high bandwidth internal link to a transcendent – but not supernatural – being continues the theme of explication and analytic engagement with the details of ontological mechanism underlying the action, which would not generally be cogent in a magical or supernaturalist fictional scenario. When Pham Nuwen changes his facial expression, Ravna suspects ‘close-control’:

The lazy smile faded from his face. She checked her dataset. No, Pham Nuwen was not **possessed**.⁵⁰⁴

Again, supernaturalistic terminology is used to invoke Clarke's third law aphorism in relation to the character *Old One* and his technologically facilitated capabilities, resulting in an almost meta-fictional

⁴⁹⁸ At faster than light speed. FTL travel and the kind of technology that might facilitate it are a favourite trope in space opera, and involve significant counterfactual license, since Einstein's Theory of General Relativity prohibits FTL travel (except perhaps over the event horizon of a black hole.)

⁴⁹⁹ Vinge, V. *A Fire Upon the Deep*. New York: Tor, 1992, 259.

⁵⁰⁰ *Ibid.*, 99-100.

⁵⁰¹ *Ibid.*, 63.

⁵⁰² *Hub node* is a scientific neologism used in mathematical network theory and in data communications science.

⁵⁰³ Vinge, V. *A Fire Upon the Deep*. New York: Tor, 1992, 174.

⁵⁰⁴ *Ibid.*, 175. (emphasis mine.)

reference to the parity and disparity between SF and fantasy writing, and their associated discourses. The cognitive aesthetic of SF is thus attained through discursive engagement with information science across different scientific disciplines. At no point do the characters of Vinge's *A Fire Upon the Deep* or Banks' *The Algebraist* embody the supernatural. All the informational god characters myriad abilities are associated with massive computational prowess and a total mastery of the material universe to the extent that they have virtually unlimited power over their existence. Mythological and fantasy literature is rarely interested with the *how* of a supernaturalism – magic just happens and it is its role in the narrative that is important. As with most religious writ, it is not the *how* or *what* of a thing that is of interest – only the who, and how much power and authority they have. There is no sense of *mechanism*. In *A Fire Upon The Deep* and *Revelation Space*, the characters are empowered by their mastery of technology and thereby the material universe. Such abilities are facilitated by scientific investigation and advancement, even if the science is counterfactually extrapolated in the extreme. One of the drawbacks of Pham's informational ontology and identity is that he is exposed to what Vinge terms *godshatter*: the propensity for massive information injections from Old One to cause him mental and physical damage⁵⁰⁵. Herein is a meta-informational and metaphorical reference to the deleterious effects of information overload and the *hyperreal*.

HYPERREAL PSEUDO-INFORMATION AND THE SIMULATED UNIVERSE SETTING

Jean Baudrillard's thesis of science as a simulacrum is partly motivated by the co-option of technology for the implementation of social control systems. On the hyperreality thesis, the former not only facilitates the latter, but technology is also itself an analogical model of the mechanism of the social – the socialising apparatus of state and power, and the engineering of the social. Social control systems both analogise and are augmented by computer control systems:

Now it is the same model of programmatic infallibility, of maximum security and deterrence that today controls the spread of the social...the meticulous operation of technology serves as a model for the meticulous operation of the social.⁵⁰⁶

In Banks' *The Algebraist*, the chief protagonist Fassin, and the novel's maleficent Luseferous, both muse on the prevailing religious viewpoint referred to as *The Truth*: centring on the belief that life and the universe are simply an enormous simulation being run by hyper-intelligent sentient gamers:

The Truth...It arose from the belief that what appeared to be real life must in fact-according to some piously invoked statistical certitudes - be a simulation being run within some prodigious computational substrate in a greater and more encompassing reality beyond.⁵⁰⁷

Estranging engagement with N Katherine Hayles' *computational regimen* through this ontologically sophisticated meta-informational codon of comprehensive simulation is a common informationist SF mega-text codon. In Douglas Adams' Informationist SF parody *The Hitch Hiker's Guide to the Galaxy*, humanity and the planet Earth itself are a hyperreal material simulation, a gigantic teleological computer system designed and built by supercomputer AI *Deep Thought*, who explains to its pan-dimensional super-being commissioners that Earth will be a "computer of such infinite and subtle complexity that organic life itself shall form part of its operational matrix"⁵⁰⁸. All of Earth's inhabitants are cast as informational 'punks' who are really just part of this program, and the commissioners of the project see them and the physical brain of the hapless protagonist Arthur Dent – which they attempt to excise from him for information gathering purposes - as simply elements of a giant material computer simulation: as informational commodities. In *The Hitch-Hiker's Guide to the Galaxy* even dolphins have access to more veridical information than humanity, being as they are aware of the fact that Earth is a computer

⁵⁰⁵ Ibid., 416, 417, 418, 422, 424, 436, 495. This codon is probably originally due to Gibson's *Neuromancer* and *Johnny Mnemonic*. In the latter, character Johnny Mnemonic uses his brain to smuggle massive amounts of uploaded data, which practice is potentially deadly.

⁵⁰⁶ Baudrillard, J. "The Precession of Simulacra." *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 34.

⁵⁰⁷ Banks, Iain M. *The Algebraist*. London: Orbit Time Warner, 2004, 247.

⁵⁰⁸ Adams, D. Six Stories By Douglas Adams: The Ultimate Hitchhiker's Guide. New York: Wing Books/Random House,, 1996, 122.

simulation, and so humanity is doubly ‘punked’. Human beings are informational punks, but so are all of the other races in the galaxy. The narrow-minded bureaucratic Vogons and the fickle Galactic president *Zaphod Beeblebrox* are all lost in a hyperreal galactic simulacrum-society wherein no-one, even the philosopher-like planet-designing technician Slartibartfast and his pan-dimensional employers, have any idea what is *really* going on. Indeed, the platform for the absurdist comic denouement of the series is the super-beings’ discovery that they must first determine the correct *question* of life, the universe and everything before they can find the *answer*. Slartibartfast is pessimistic in his existential angst:

“The chance of finding out what is really going on in the universe is so absurdly remote that the best thing to do is hang the sense of it and keep yourself occupied.⁵⁰⁹”

For Baudrillard, dissimulating is pretending that something is other than it is, whilst remaining cognisant of the real referent⁵¹⁰ However, *the third order of simulacra*, of which Baudrillard thought emerging SF was an example, arise from simulations which have *supplanted* the real referent and occluded it, or *hidden the fact of its absence*, thus effecting *hyperreality*⁵¹¹. We will extend the information typology for counterfactuals and fictions to include Baudrillard’s hyperreality, adding *hyperreal* artefactual pseudo-information. Hyperreal pseudo-information sources are artefactual pseudo-information sources which have been synthesised with the *intention of obscuring or normalising information from veridical sources*.

Such settings provide scope for cognitive character-novum development. 5-SB makes The Bridge Trilogy’s Laney an informational super-human, a living data-search engine^{512 513}. He can parse and filter vast amounts of data in the novel’s instantiation of the hyperreal simulated universe codon, named DatAmerica. The narrative of The Bridge Trilogy simultaneously instantiates the SF codon of Clarke’s third law, because Laney’s capabilities are so mysterious as to give the character a seemingly preternatural superhero quality. However, the narrative also stipulates that these abilities are rationally accessible and naturalistically grounded, and that there is no magic or preternatural causality at work:

But Laney isn’t psychic in any non-rational sense; rather he is able, through the organic changes wrought long ago by 5-SB, this drug, to somehow perceive changes emerging from vast flows of data.⁵¹⁴

This character-novum also meta-fictionally implicates Baudrillard’s conception of science and technology as productive of simulacra, since “determination itself is aleatory in a non-linear world where it is impossible to chart causal mechanisms in a situation in which individuals are confronted with an overwhelming flux of images, codes, and models, any of which may shape an individual’s thought or behavior.⁵¹⁵” Laney is an informationally estranged denizen of the informational simulated universe that is DatAmerica.

SCIENCE FICTION NODAL POINTS

Laney’s occupation involves mining for, interpreting and synthesising the information from *nodal points* in the data flow of DatAmerica, points of informational change and causality. They are a simultaneous intertextual reference to Riffatarre’s literary critical device and to the geometric property of photographic lenses. They indicate nexuses of intersecting information. Rei Toei’s nodal points reflect her informational strangeness. They indicate information which will have a marked effect on the real world:

⁵⁰⁹ Adams, D. *Six Stories By Douglas Adams: The Ultimate Hitchhiker’s Guide*. New York: Wing Books/Random House, 1996, 127.

⁵¹⁰ Baudrillard, J. “The Precession of Simulacra.” *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 3.

⁵¹¹—. “Simulacra and Science Fiction.” #55 = Volume 18, Part 3 = November 1991, Trans. Arthur B Evans, *Science Fiction Studies*. November 2008 <<http://www.depauw.edu/SFs/backissues/>>.

⁵¹² Gibson, W. *All Tomorrow’s Parties*. Victoria: Viking/Penguin, 1999, 6.

⁵¹³ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 25.

⁵¹⁴ Gibson, W. *All Tomorrow’s Parties*. Victoria: Viking/Penguin, 1999, 56.

⁵¹⁵Kellner, D. “Jean Baudrillard” in *The Stanford Encyclopedia of Philosophy*, 2007, Accessed 27 January 2009, <<http://stanford.library.usyd.edu.au/entries/ baudrillard/>> (section 2 para 17.)

[H]e was an intuitive fisher of information...He'd spent his time skimming vast floes of undifferentiated data, looking for "nodal points" he'd been trained to recognise by a team of French scientists...⁵¹⁶

The implication is that nodal points involve confluxes of causal influence and informational causal power within a sea of random artefactual information and noise. Note the ontological implications of the word *floe*: Laney is a character-novum built upon an informational ontological phenomena – his ability to interpret information flow. This sense of information flow is familiar from the work of informationist philosopher Dretske, and from computer science, wherein *data flow modelling* is a mainstay technique for networked systems design⁵¹⁷. Laney is employed by a media production company to use his skills for trivial and predictable commercial purposes – informational commodification - but Laney suspects that nodal points might be the key to much greater knowledge:

Perhaps the whole of DatAmerica possessed its own nodal points, infofaults that might be followed down to some other kind of truth, another mode of knowing...⁵¹⁸

This strikingly informationist passage addresses Dretske's axiom of information as necessarily true and suggests the supervenience relationship between information and knowledge, as well as my own distinction of true versus false or pseudo information. The fictive framing of nodal points is highly meta-informational: there are points in an SF text where veridical information is implied or bound up in the counterfactual pseudo-information upon which the fiction supervenes. I suggest that the 'nodal points' of an SF text, rather than being associated with the Riffatarré's abstract superreader perspective, instead correlate with phrases, novums and novum neologisms which are the product of write-time information synthesis involving scientific theory and fact. At read-time and in the text as a latent source, nodal points in an SF text are messages which exhibit informational heterogeneity, high information and elevated veridical information: these properties are due to the information source set which contributed to their write-time synthesis. The fiction and narrative encoded upon them invoke the epiphanic 'aha' moments of cognitive estrangement and the cognitive aesthetic in read-time text processing. In Gibson's Bridge trilogy these informationist SF theoretic nodal points often indicate sites of meta-informational prose. For example, there exists the following astonishingly prescient self-conscious reference to information ontology in *Idoru*, where further complexity is being added to the character-novum that is Laney:

Laney's ability to locate key data in apparently random wastes of **incidental information** earned him the envy and grudging admiration of more experienced researchers.⁵¹⁹

Gibson's metafictional reference to and implied definition of *incidental information* is presumably intuitively motivated, and yet it conceptually anticipates almost perfectly the definition of incidental information in the information typology of Long[2]⁵²⁰. Moreover, there is a strong meta-informational parallel between Laney and the stereotypical reader familiar with the SF mega-text capable of mining the data of an SF text for counterfactual pseudo-informational novums, and other SF codons. At SF nodal points, the reader can synthesise the counterfactual pseudo-information in an SF text source with that residing within their internal concept sources and generate incipient veridical or counterfactual information. The general reader who is not necessarily initiated into the SF mega-text, but is able to see the significance of the embedded semantic keys in the text - to decode the meaning of the novum and icons in the text by way of the information sources therein which provide the means to decode them - this reader perhaps benefits the most from *anti-simulacra*. I suggest that the mechanism of decoding is not dissimilar to the syntagmatic algorithm suggested by Delany: each sign and message, as sources of information with certain surprisal

⁵¹⁶ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 25.

⁵¹⁷ Dretske, F. *Knowledge and the Flow of Information*. London: Basil Blackwell, 1981.

⁵¹⁸ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 39.

⁵¹⁹ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 38. Emphasis mine.

⁵²⁰ I did not encounter Gibson's reference, which predates Long[2] by more than a decade, until over a year after developing the information typology introduced in that paper. Although Gibson is an erudite writer, I was nevertheless extremely *surprised* to find this intuition in his novel.

values, are combined with information already encountered in the text. This progressive synthesis allows for semantic ‘bootstrapping’ to facilitate decoding and understanding of counterfactual cognitively estranged novums and SF icons, and any veridical scientific information thus referenced. SF readers, like SF texts proper, are *expected* to circumvent the delusion of simulacra through synthesis at nodal points. Gibson’s character-novum Laney provides a meta-informational model of such behaviour. They are anti-simulacra personified, supervening upon counterfactual pseudo-information within an SF text.

CHARACTER ANTI-SIMULACRA

Gibson’s Laney, by virtue of his conversion to one type of information – artefactual information - is a *normalised* simulacrum⁵²¹. He is an anti-heroic technician-savant and a noble, vicissitudinous, tragic cyberpunk: the epitome of the flawed but valorous social underling, he uses his ability to discern nodal points (Gibson’s usage) to help others despite persistent attacks upon him by greedy corporate stooges and their henchmen. Thus, although he is an informorph who ultimately becomes a simulation to survive the effects of the 5-SB syndrome – a personification of a third order simulacra – he is simultaneously a personification of *anti-simulacra*. As a tool and operative for surveillance he is tasked to acquire, and becomes exposed to, *veridical* information. In *Virtual Light* and *Idoru*, postmodern foot-soldier Berry Rydell personifies an anti-simulacrum through raw determined rationalist non-conformity. The unfortunate Alison Shires is also a character anti-simulacrum. She suicides because something allows her to discern her existence as subject to simulacra:

“Because she knows. She can feel me watching.”
 “That’s impossible, Laney...She can’t know that.”
 “She does.”...”How could you possibly know that she is aware of your attention?”
 The nodal point, he wanted to say. But didn’t.^{522”}

Both Shires and Berry Rydell have a sense for the real and for veridical information. Both are subject to the simulacrum of social control but seek to numerously evade and escape it - Rydell by his unpredictable and nonconformist behaviour and Shires through suicide. Each character is arguably a reflection of the SF reader’s use of the SF text to escape or subvert the hyperreal pseudo-information of social simulacra. Like Rei Toei, they seek to subvert the simulacra.

For Baudrillard, the medium is “no longer a medium in the literal sense: it is now intangible, diffused and diffracted in the real, and one can no longer say that the medium is altered by it.^{523”} It is not a reliable high fidelity information channel but is instead a kind of dissimulation pump⁵²⁴. It is a set of mutative sources of artefactual pseudo-information such that instead of expecting veridical artefactual information through the television and written reportage, “[o]ne must think of the media as if they were, in outer orbit, a kind of genetic code that mutates the real into the hyperreal.^{525”} In *All Tomorrow’s Parties*, when the bridge which is the home of many of the primary characters, including the pawn shop vendor Fontaine, is burned down by Harwood, the media arrive in force:

It’s strange out there, very much the post disaster scenario...Media vehicles outnumber emergency...Probably...he’ll never know what all of this was about, in terms of causality, though he has sure been witness to something.⁵²⁶

In what may be a direct reference to Baudrillard’s thesis of the loss of the cause-effect distinction under simulacra, the causality of Harwood’s act of violence is inaccessible to Fontaine, but he knows that he is going to get numerous different equally uninformative re-representations of the *effect* through the media.

⁵²¹ Baudrillard, J. *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981). ‘the maximal norm’ 34-5.

⁵²² Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 49.

⁵²³ Baudrillard, J. *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 30.

⁵²⁴ *Ibid.*, 6.

⁵²⁵ *Ibid.*, 30.

⁵²⁶ *Ibid.*, 275.

His understanding will still be lacking for the absence of veridical information, even though he experienced the disaster first hand. In Baudrillard's thesis, violence becomes like entertainment through the softening and occlusion of the real via informational simulacra and there is "[n]o more violence or surveillance: only "information"⁵²⁷" However, hyperreality implemented thus ultimately and irrevocably undoes the power that wields it for social control and the implementation of the social control system facilitated by technology⁵²⁸. Rei Toei is a metaphysically and technologically estranged novum. 'She' is an image without referent, an AI persona *sui generis* existing as "a personality construct, a congeries of software agents, the creation of information designers."⁵²⁹ This computer simulation marketed as a human singing superstar is an informational *hypercommodity* subsisting on artefactual information: computer code. Her emergence is a meta-informational reference to the information synthesis that occurs in the read-time processing of the SF text. Just as a reader or writer synthesises information from various internal and external sources, thus reifying a narrative supervening upon artefactual information, so "Rei Toei, The Idoru, was an emergent system, a self continually being iterated from experiential input."⁵³⁰ Rei Toei becomes the embodiment and realisation of simulacra thereby outmoding and overriding the media power which synthesised her. Laney and Rei Toei are meta-fictional instantiations of SF character-novum anti-simulacra: their struggle against the hyperreal in the story is a reflexive representation of Gibson's text as an informational anti-simulacrum.

POSTMODERNISM, INFORMATIONISM, ESTRANGEMENT, AND UNCERTAINTY

It is perhaps significant that Baudrillard associates *uncertainty* with informational third order simulacra⁵³¹, since uncertainty of symbol selection in the syntagm or message – which reflects statistical uncertainty at the information source state at write-time – is intrinsic to the definition of Shannon information, a high value of which we have seen is a textual indicator of novums and their neologisms, and thus of SF proper. Information theory, with its rigorous mathematical foundations, might seem generally antithetical to the deconstructionist poststructuralist tenets of postmodernist thought. This is true when postmodern SF texts and postmodern theorists analogically misappropriate and co-opt scientific terminology for fictive or theoretic ends. To complicate matters further, verbs, nouns and natural kind terms often take on subtly different meanings when seconded to the task of the mathematician. The word *uncertainty*, for example, is notoriously polysemous, even within Shannon's mathematical theory of communication, wherein it refers to both the uncertainty of symbol selection at a source and the uncertainty of a transmitted message reaching a destination intact – giving rise to a semantic bifurcation in the very definition of entropy pursued therein⁵³². *Choice* in Bayesian statistics is not about human agency, but refers only to possible outcomes⁵³³. Baudrillard uses the term *uncertainty* more normatively and in multiple contexts. It is evidently related to the empirical and psychological uncertainty of the individual about the real – or about whether a real state of affairs exists to correspond to the putative veridical information they are presented with. For SF it is also uncertainty about whether the preponderance of the hyperreal leaves anything to imagine in the text – any basis of the real from which to cognitively extrapolate or imaginatively speculate⁵³⁴. I have suggested that informationist SF codons such as novums, and associated SF text *nodal points*, correspond to elevated surprisal values in the syntagm at read-time, and contribute to *anti-simulacra*. A normalised fictional simulacrum reduces Shannon uncertainty by *eliminating* possibilities – reducing the

⁵²⁷ Baudrillard, J., "The Precession of Simulacra" in *Simulacra and Simulation*, Trans. Sheila Faria Glaser, Ann Arbor: the University of Michigan Press, 1994.,, 29-30.

⁵²⁸ *Ibid.*, 22.

⁵²⁹ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996, 92.

⁵³⁰ Gibson, W., *All Tomorrow's Parties*, Victoria: Viking/Penguin, 1999., 163.

⁵³¹ Baudrillard, J. "Simulacra and Science Fiction." *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 126.

⁵³² See Long[1.] following Coles.

⁵³³ Hayek, Alan. "Interpretations of Probability." 2007. *Stanford Encyclopedia of Philosophy*. November 2008 <<http://plato.stanford.edu/entries/probability-interpret/>>.

⁵³⁴ Baudrillard, J. "Simulacra and Science Fiction." *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981).121-2, 125.

paradigmatic set of possible messages or symbols in the syntagm. However, when anti-simulacra exist within the text, the set of possibilities not only expands, but the type of information associated with the surprisal is no longer pure pseudo-information: it is counterfactual pseudo-information which implies veridical information. Thus Baudrillard in fact seems to almost stumble across information typology in his distinction between the real and the hyperreal and the application of this distinction to SF: ergo my earlier move to co-opt the term hyperreal to the typology of pseudo-information.

I propose that this logical and conceptual intersection of postmodern theory with rigorous and mathematically underwritten information theory, on the basis of uncertainty, possibility and hyperreality, underlies the propensity for postmodern writers such as Delany and Gibson to embrace informational themes across scientific and socio-cultural epistemes, combining and hybridising the conception of information as mathematical and computational with the conception of information as human and social, resulting in the emergence of such SF codons as the infomorph. There is perhaps a parallel to this postmodern-structuralist hybridisation in the duality that Broderick tantalisingly reveals as the merging of structuralist and poststructuralist stylistic and semiotic commitments in Delany's novels *Stars in My Pocket Like Grain of Sand*, *Babel 17*, *The Einstein Intersection* and *Empire Star*.

So while Delany is a declared poststructuralist, his fiction is articulated about a semiotic programme which seems, at its limit, to merge with humanist, albeit highly relativist, liberal pluralism. Even in his most strenuous efforts to attain the transgressive, to treat the human subject as an object of cultural manufacture, he seems to be writing his own life and his apologia for it from a position of extreme and admirable wilfulness.⁵³⁵

This duality is reflected meta-fictionally and meta-informationally in informationist SF. We might associate a structuralist approach to literature with the original logical positivistic purview of mathematicians Frege, Whitehead and Russell, and thence with Wittgenstein's logical analyses of *Tractatus Logico Philosophicus* and the rise of the scientific method as championed by Popper. Perhaps, then, the emergence of new modal (subjunctive) logics during the 1960s and 1970s at the hands of Kripke, Lewis and Putnam is more theoretically commensurate with the postmodernist episteme than philosophers are generally prone to consider. Certainly the relatively new information-scientifically inspired *fuzzy* logic of computer scientist Dr. Lofti Zadeh, with its undecidability feature, relies on principles of contextually determined or uncertain set membership, making it prone to reference in postmodernist-informationist SF as early as Delany's *Stars in My Pocket Like Grains of Sand*:

In a universe of c. six thousand two hundred worlds with human populations over two hundred and under five billion "population" itself becomes a **fuzzy edged concept**... the hallways I walked down to ground level through were an allegory for the **informational complexities** that free Kantor both was and was made for...⁵³⁶

This is another metainformational SF nodal point, since the conception of undecidability in fuzzy logic certainly fits the stylistic and de-centered characteristics of postmodern fiction. Fuzzy sets allow elements with degrees of set membership – rather than elements that are simply members of a set or not members⁵³⁷. The aesthetic value of *most* fiction relies in large part on suspense, mystery, plot twists, shocks, and so on, which arise from the uncertainty or ambiguity surrounding events in the narrative. Postmodern informationist SF, however, is further marked by this kind of 'fuzziness' with regard to meaning, subject and the distinction between subject and object. We can get a feel for this informationist SF trait by considering at what point in the Bridge Trilogy Laney becomes more informational than human. The objective Bayesian statistical mathematics behind information theory involve similar set theoretic foundations to both classical, modal and fuzzy logics, but statistics employs different

⁵³⁵ Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995, 138.

⁵³⁶ *Ibid.*, 137.

⁵³⁷ The term undecidability also applies to the property of fuzzy logic wherein it is not possible to determine if some formula's/theorems are neither provable or disprovable in a theory which employs such logic.

mathematical, heuristic, and axiomatic machinery. Nevertheless, probability theory and logic are axiomatically related⁵³⁸.

The themes of uncertainty and fuzzy undecidability are often reprised in informationist SF. However, the terminology of fuzzy logic in the hands of non-mathematicians is just as prone to involve whimsical, loose and basically inaccurate semantics, as that of information theory. The mathematical term *fractal* is often used loosely by SF authors seeking to leverage yet another mathematically spawned icon of uncertainty and indeterminism. However, in the text of *Idoru* Gibson applies it with reference to its use in computer graphics science to simulate natural or coarse surfaces like dirty walls:

Fractal filth, bit rot, the corridor of their passage tented with crazy swoops of faintly flickering lines of some kind.⁵³⁹

The language is highly stylised, but the selection of the message “Fractal filth” is influenced by veridical sources relating to the use of fractal algorithms in computer graphics. Bit rot has been applied somewhat out of context, but is another term from computer science⁵⁴⁰. In *All Tomorrow's Parties* the fractal is put to more scientific, meta-informational and discursively synthesising use in the narrative:

All his life Laney had heard talk of the death of history, but confronted with the living shape of all human knowledge, all human memory, he begins to see the way in which there has never been any such thing...Only the shape, and it comprised of lesser shapes, in squirming fractal descent, on down to the infinitely finest of resolutions.⁵⁴¹

Gibson thus implements a novum involving information synthesis with sources associated with mathematics and chaos theory. It is a true scientific novum, because it is not metaphorical, but suggests a defeasible yet defensible real application of the theory. Modelled mathematically, human history may well appear fractal.

CONCLUSION

Modal logic lends itself to the formal consideration of counterfactual worlds, subjunctive language and speculation prevalent in science fiction. Information theory, and the ontology of information that I have leveraged herein, also provides a formal way of analysing SF texts and the SF codons encoded upon them. Between modal logic and information theory we have tools to help develop a formal framework for approaching both counterfactuals and syntagmatic uncertainty respectively. Novum in an SF text imbue the text with greater linguistic and narrative uncertainty, which leads to increased information. The counterfactual fictive nature of the semantics, settings and narrative encoded upon the SF text mean the information supervening upon it is *pseudo-information* of the counterfactual type, resulting in a text which constitutes a high counterfactual pseudo-information source. This highly formal and structured approach yields, perhaps somewhat surprisingly, outcomes that are recognisably affirming of some deconstructionist, or at least poststructuralist, theoretical tenets, as well as affirming of some structuralist formalisms. Texts that increase uncertainty and thus challenge and undermine – by their information profile and through counterfactual estrangement – favour the unknown and the cognitively motivated over what Broderick calls the “comfortingly quotidian, the known.”⁵⁴² Informationist SF theory provides a formal way of identifying the textual and fictive properties of modern and postmodern, structuralist and poststructuralist SF texts by their informational profiles. Moreover, it seems that *informationist* SF texts constitute and semantically encode *anti-simulacra* which draw on a broad range of complex scientific, social-scientific, philosophical and psychological epistemes: such texts synthesise information from many

⁵³⁸ Although fuzzy logic and Bayesian statistics are very different mathematical tools.

⁵³⁹ Gibson, W. *Idoru*. London: Penguin-Putnam, 1996.

⁵⁴⁰ Bit rot usually refers to the loss of bit values stored on magnetic media over a long period of time, contributing to information loss.

⁵⁴¹ Gibson, W. *All Tomorrow's Parties*. Victoria: Viking/Penguin, 1999, 107.

⁵⁴² Broderick, D. *Reading By Starlight: Postmodern Science Fiction*. London: Routledge, 1995., 156.

types of contributing internal and external information sources, including a high proportion of veridical information sources.

Many SF texts, or perhaps *purported* SF texts, in the information age have undoubtedly taken on the properties of both second and third order simulacra⁵⁴³. However, in necessarily engaging with the discourse of information science, information theory and the philosophy surrounding both, informationist SF has attained a special meta-informational and meta-fictional character, and its texts and narratives have become *anti-simulacral* through engagement with technology, science, logic and philosophy. I have argued that these properties can be discerned by analysing the information age SF text information theoretically, observing a sound metaphysics of information. The narratives, semantics and codons of informationist SF texts supervene upon elevated veridical and counterfactual pseudo-information and information type-heterogeneity, and the syntagms where such codons are implemented in such texts involve high *surprisal* values both in terms of language used and counterfactual concepts communicated through neologisms and other linguistic representations of such codons in a text.

Information age science fiction proper, and especially informationist science fiction, is a mode of fiction writing that is situated at a linguistic, cultural, epistemological, discursive and metaphysical multivariate nexus. It stands apart from other modes of fiction due to the presence of special informational properties. I have suggested that there is a correlation between the information profile of competent SF and the 'observance' of materialism and even physicalism, and that the latter is critical to the cogency and cognitive-aesthetic interest of the SF naturalistic *mise en scène* and *novum*, which would arguably be largely robbed of their cognitive fascination – estranged or otherwise – in a supernaturalist or mythologised setting. Fantasy and its supernaturalism and mythologisation (Suvín's sense thereof) are generally not predominantly encoded upon what I call veridical information and counterfactual pseudo-information. Science fiction proper, like science itself, is interested in, and interesting because of, the importance of material mechanism, which is largely either absent or moot in a fantasy. Informationist SF theory can arguably be applied to any fiction text, and I think that doing so will demonstrate further that science fiction proper, and especially informationist science fiction, employs and exhibits a kind of information synthesis that is special to it, which synthesis results in the potential for dramatically different and unique aesthetic and cognitive effects at read-time. SF proper and the sub-mode of informationist SF are more than just literatures of cognitive estrangement. Informationist science fictions supervene upon texts exhibiting elevated veridical and counterfactual pseudo-information, and upon corresponding heterogeneous information synthesis. Sf is the fiction of veridical information, counterfactual pseudo-information, and information type heterogeneity. It can intertextually, meta-informationally and meta-fictionally engage with, and simultaneously provide a *foil* to, *hyperreal* pseudo-information. The *read-time* and *write-time* synthesis associated with an informationist SF text, and with any text upon which is encoded the cognitive aesthetics, semantics and codons of SF proper, involves an increased proportion of contributing *veridical* information sources, and a preservation of veridical information through the promotion of counterfactual pseudo-information over pure and hyperreal pseudo-information. Sf proper and informationist SF are modes of fiction writing designed to *subvert* and undermine hyperreal narrative modes through read-time cognitive aesthetics and outcomes associated with elevated counterfactual and veridical information. Even in its postmodern manifestations, information age SF proper synthesises high levels of veridical information from the sciences, and inherits the de-mythologising paradigm of true materialist science as commensurate with Suvín's thesis, and as instantiative of Lem's aesthetic of social and technological complexity.

⁵⁴³ Baudrillard, J. "Simulacra and Science Fiction." *Simulacra and Simulation*. Trans. Sheila Faria Glaser. Ann Arbor: The University of Michigan Press, 1994 (orig. 1981), 121.

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