Fractured science: Edward O. Wilson's philosophy of consilience and the quantum paradigm in Kim Stanley Robinson's Mars trilogy

by

Christopher Michael Sutch

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Christopher Michael Sutch

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". . . [T]he whole project of science is *backwards*, the more you *understand* something the less it *moves* you, my goal now is to reverse that, to do antiscience, to *know less*, to *understand less* and thus *feel it all more*. . . ." (Spiff, an astronomer; Robinson, Antarctica 220; original emphasis)

CHAPTER 1: INTRODUCTION

A major articulation point for scientific discourses within public spaces is the "popular" scientific text, usually written by professional scientists and intended for consumption by a non-scientific audience. Some of these scientific discourses make their way into science fiction texts which expand and elaborate upon them, speculating about their possible effects in society through the use of individual characters.

Edward O. Wilson, founder of sociobiology (the study of how genetic factors cause and influence social behavior), has recently written a popular science text, Consilience: The Unity of Knowledge, in which he argues for a return to the tenets of an Enlightenment epistemology and the values of a materialist/mechanist scientific paradigm. Wilson's articulation of this specific brand of scientific philosophy demonstrates a deep anxiety and antipathy towards chaos (entropy and nonlinear chaotic systems) and quantum indeterminacy, two major sets of discourses endorsed by scientists who advocate a non-mechanist scientific paradigm. Wilson's text also perpetuates traditional scientific epistemological metaphors, originating in the writings of Francis Bacon, which emphasize the distance between the scientific observer and the object observed, the negative relationship between the two, and the violent, hierarchical nature of scientific objectification. Other scientists writing popular texts, particularly those interested in quantum mechanics and chaos theory, have moved away from such traditional notions of scientific philosophy and epistemology based on the construction of new discourses rooted in twentieth century physics.

This particular set of contested scientific discourses has been taken up and examined in the Mars trilogy of science fiction writer Kim Stanley Robinson. I intend to examine how speculation involving quantum mechanical discourses influences Robinson's characterization of the subjectivities of two primary figures within his trilogy. I will also

examine how those quantum discourses, with their implications about acausality in linear time and indeterminacy, affect the linear narrative of the trilogy and the body of the text itself.

I will also use Robinson's text, and the conclusions it appears to suggest concerning a scientific paradigm such as that proposed by Wilson, to speculate about the possible consequences to individuals' lived experiences of a rigidly deterministic and self-declared "all-(epistemologically)-powerful" mechanist scientific paradigm. Robinson's text explores the implications of Wilson's ideas through two primary characters: Sax Russell, a scientist in the Wilsonian mode, and Maya Toitovna, a scientist whose experiential reality and attempts to order it through her memories vividly highlight the shortcomings of Wilson's arguments from the point of view of real persons who are comfortable with a chaotic and non-empiricist reality. Robinson's text creates a discursive space within which the implications of Wilson's ideas can be explored through comparisons of the experiences of various subjects and their positions regarding the socially constructed discourses of science.

Very little has been published about the writings of Kim Stanley Robinson, and what has been published concerning his work focuses primarily upon the utopian themes of many of his novels and stories (see, for example, the articles of Moylan, and Franko). . Robert Markley's is the only article I have come across which deals with Robinson's Mars trilogy, but he chooses to focus on Robinson's concept of the "future primitive" (mixing contemporary technology with sociobiologically determined Paleolithic behaviors in human life) and its use as a strategy for an ecologically-friendly human social order. I have not been able to discover any articles or other sources concerning Robinson's use of scientific discourses within his work.

Many of the arguments I use in this paper arise out of various critiques of scientific methodology, philosophy, and epistemology made by two major (often overlapping) communities of thinkers, namely poststructuralists and feminists. These two communities,

while having some theoretical suppositions in common, also have major differences. My thoughts and attitudes concerning the utility of poststructuralist theory have been strongly influenced by feminist and postcolonial critiques of the extreme forms of poststructuralism. Chief among these critiques is the strong silencing effect poststructuralist theory has upon certain groups of individuals marked as "different" by the power structure in Western cultures (for example, African-Americans, women, "Third World" citizens). Once a coherent self capable of speaking on its own behalf has been erased, as extreme poststructuralist theories of identity would have it, it becomes impossible for these disadvantaged groups to lay claim to a coherent identity which can voice their concerns. Identity politics recedes as a concern in conditions where there is no identity, and oppressive power effects are still felt by individuals marked as different.

Chela Sandoval, for this very reason, argues for a "theory and method of oppositional consciousness." This theory would allow individuals and groups to selectively lay claim to certain definitions and characteristics of fluid identities depending on the tactical necessity of the context and opponents within and against which the individual or group is struggling. Other critics, such as Linda Martin Alcoff, argue, along similar lines, that context has an impact on the validity of truth claims and that certain claims must be taken as "true" in certain localities (social and physical). Finally, many critics emphasize the role power structures play in creating "truths" in local contexts (though these local truths are often defined by the power structures as global truths). In such contexts it is important to be able to argue within or manipulate the truth claims set forward by the power structure (see, for example, Ó Tuathail's introduction for a detailed discussion of the construction of "geographical" truths by imperialist power structures).

I intend to make an argument concerning Edward O. Wilson's philosophy and epistemology of science using the truth claims of the discipline of quantum mechanics as well as its modes and terms of discourse as espoused by physicists in texts intended for a

general readership. What authors like Paul Davies and John Gribbin attempt to do is describe the "truth" of reality to the general public, as revealed in the local context of our planetary environment through mathematical and scientific discourses. Similarly, Wilson's text is meant for a general readership and claims to be revealing local truth (though Wilson would claim it to be global truth). While I am familiar with the epistemological problems related to truth claims, I wish to enter into a dialogue with Wilson on what he considers to be his own discursive turf, with the assumption that the scientific establishment is a major power structure which determines local truth (and argues convincingly for that truth's validity) and must be engaged at least partially on its own terms.

I have been heavily influenced in my attitudes on this method of scientific critique by feminist criticisms of scientific methodology and epistemology. An excellent overview of such criticism is Evelyn Fox Keller's "Feminism and Science" (originally published in 1982) in which she examines the wide range of feminist critiques, attempts to classify them on a spectrum from "moderate" to "radical," and argues for the benefit to science if it attended to these critiques and modified its praxis and philosophy accordingly. The validity (and value) of such critiques of science from the epistemological positions of "different" subjectivities, both from within and without the discursive framework of the "mechanistic" paradigm, is asserted by Robinson's text. Sax Russell's scientific praxis is improved upon, and his "model" of reality made more accurate when he fully integrates what he learns concerning indeterminacy and chaos into them. Keller, however, understands that there is danger involved in critiquing science, and she lays out what is at stake for her personally in the very beginning of the article. "As both a feminist and a scientist, I am more familiar than I might wish with the nervousness and defensiveness that . . . [the] potential conflict [between feminism and science] evokes. As scientists we have very real difficulties in thinking about the kinds of issues that, as feminists, we have been raising" (Keller, "Feminism and Science" 28). This admission of unease reveals what is at stake for those who wish to critique the

dominant discursive definitions of truth, but who also desire to continue working within those discursive frameworks

Donna J. Haraway's articles critiquing the assumptions of various forms of twentieth century biology and primate studies also fit into this genre of feminist critiques of science undertaken by scientists. Of primary influence to the arguments I make in this paper are the first two parts of her book Simians, Cyborgs, and Women: The Reinvention of Nature, especially chapter 2, "The Past is the Contested Zone: Human Nature and Theories of Production and Reproduction in Primate Behaviour Studies," in which Haraway examines how cultural attitudes held by primatologists in the middle decades of this century influenced the conclusions they drew from field research into primate reproduction. This line of inquiry is important because it demonstrates how "experience," whether in "culture" or "nature," tends to influence supposedly "objective" scientific research and thinking. Edward O. Wilson, as I will describe in the next chapter, seems to be blissfully unaware of how cultural assumptions make their way unexamined into his scientific philosophy and epistemology. This characteristic of Wilson's past work is a favorite theme of research by feminist critics of science, especially Haraway's chapter 3, "The Biological Enterprise: Sex, Mind, and Profit from Human Engineering to Sociobiology." In this chapter, Haraway studies how the discipline of biology has attempted to control its subjects (human organisms in particular) by imposing differing sets of metaphorical characteristics onto those subjects. In the latter half of this chapter, Haraway examines sociobiology (Wilson's brainchild) and how its metaphors adhere closely to advanced capitalist strategies for controlling information and profit. This desire for "control" on the part of science, which necessitates the denial of agency to human subjects (and the denial, on the part of mechanists such as Wilson, of the existence of indeterminacy and chaos in "reality"), is one of the areas most severely criticized by Robinson's Mars trilogy.

Critiquing the metaphors scientists use has been an especially fruitful occupation for feminist critics. I have been especially influenced by Genevieve Lloyd's "Reason, Science and the Domination of Matter," in which she describes the long tradition in Western philosophy of seeing human Culture (gendered male) in opposition to Nature (gendered female) and, especially in the writings and metaphors of Francis Bacon, of desiring the control and subjugation of the female in the name of knowledge. Mary Jacobus's article, "In Parenthesis: Immaculate Conceptions and Feminine Desire," examines how cultural assumptions influence the expectations scientists bring into the lab and the metaphors they use in describing their results (in this particular article Jacobus examines accounts of conception in human reproduction).

Particularly influential to my thoughts about how late twentieth century scientific discourse has organized itself through metaphorical structures shared in common with other areas of Western culture is Evelyn Fox Keller's book Refiguring Life: Metaphors of Twentieth-Century Biology. Especially enlightening is the third section of Keller's book, "The Body of a New Machine: Situating the Organism Between Telegraphs and Computers," in which she examines the impact of cybernetics and information theory on scientific metaphors of networks, genetics as information flow, and organisms conceived as cybernetic systems.

Finally, I have been influenced to a smaller extent by nonpoststructuralist and nonfeminist critiques of science originating from scientific practitioners. Two volumes have been critical in demonstrating the usefulness of scientific critiques of science: Lyall Watson's The Dreams of Dragons: Riddles of Natural History, and Danah Zohar and Ian Marshall's The Quantum Society: Mind, Physics, and a New Social Vision. Watson's volume describes several puzzles that numerous scientific experiments and discoveries have uncovered which have never been followed up by later scientists and thus remain "unsolved." Some of these discoveries have been ignored because the dominant paradigm of the time could not account

for them and they were deemed "anomalous," "impossible" or "irrelevant." Watson argues convincingly that these experiments should be pursued to a conclusion in the interests of increasing scientific knowledge about reality. By highlighting some shortcomings of the scientific process (especially how it deals with "strange" or "unknown" phenomena) Watson shows that it is possible to develop a more realistic and comprehensive scientific paradigm which takes into account the indeterminacy inherent in the "natural" world. Furthermore, Watson, by making this critique from within the discourses of science, shows the possibility of creating (and critiquing) the dominant scientific discourses from within. Especially relevant to the present study are Watson's chapters 4, 5 and 9. Chapter 4, "The Nature of Crowds," concerns crowd behavior and its evident emergent properties which are separate and greater than the properties of the individuals composing the crowd. In chapter 5, "The Source of Concern," Watson describes the spontaneous appearance of crystallized glycerin when all attempts to manufacture this form of the substance had failed, and the glycerin crystals' apparent ability to crystallize entirely separate and sealed samples of glycerin at great distances. Chapter 9, "The Wonder of Water," describes several mysterious physical properties of water which have never been explained or followed up by science.

Zohar and Marshall focus to a large extent on the reluctance many neurologists display toward considering the phenomenon of mind as an emergent quantum system. They argue that this tendency is a remnant of the mechanistic paradigm of mind and nature (the paradigm I would argue Wilson subscribes to) which has come under increasing attack in the sciences over the past several decades thanks to the influence of findings in the discipline of quantum mechanics. Their work has demonstrated to me the sharp divide still existing between "mechanists" and adherents to the "quantum" paradigm, both groups considering themselves to be "scientists."

Many of the critiques I have discussed above focus on the biological sciences as it is easier to locate and understand cultural influences upon scientific praxis in biological

disciplines than in the "harder" sciences such as chemistry and physics. Keller's work is an exception to this rule, as she tackles concepts from physics, such as entropy and "Maxwell's demon," in Refiguring Life. In this project, I do not criticize quantum mechanics as a culturally-produced set of discourses. However, I do think some future work could be done in this direction as I feel that the appearance of quantum mechanics as a discipline smack in the middle of the set of cultural anxieties about subjectivity, truth and progress we have labeled "modernism," is quite intriguing, especially as quantum mechanics is vitally interested in these same issues. However, in this paper I am primarily interested in critiquing how scientists of Wilson's stripe choose to deal with the indeterminacy and uncertainty of the "hard science" of quantum physics by simply ignoring their implications in the name of science in general.

Kim Stanley Robinson's Mars trilogy explores the effects of such a move by depicting the struggles of Sax Russell, a very Wilsonian type of scientist, to first deny indeterminacy and chaos in reality as he interacts with it, and then to come to grips with quantum phenomena after he is forced by his research and his experiences to accept such phenomena as integral to human lives. Robinson's text also explores the lack of relevance of an epistemology, such as Wilson's, which denies chaos and indeterminacy in favor of an overly-ordered conception of reality. Maya Toitovna's thoughts and experiences in the many realms of her subjectivities allow Robinson's text to discover the problems inherent in either a too-orderly or too-indeterminate conceptualization of reality, and to argue instead for a full acceptance of the implications of the quantum paradigm for human life and political agency.

CHAPTER 2: THE "UNPREDICTABILITY OF NATURE:" SCIENCE AS A TECHNOLOGY FOR ORDERING REALITY

"Science," far from being a monolithic entity, is a discursively constructed set of beliefs and practices whose meaning(s) depend heavily on the context(s) (spatial, temporal, discursive, and combinations of any and all of these) within which its articulators operate. It follows that if "science" is constructed by individuals or groups of individuals operating in various contexts with differing goals and notions of "truth," then "science" becomes the site (essentially, considering its size, a metadiscursive site containing many branches of discourse) for a contest between these competing individuals and groups for the power to impose truth-claims on the site as a whole.

In a very general way, some of these conflicts can be understood in their temporal and discursive contexts using Thomas Kuhn's model of scientific paradigms (see Kuhn). According to this model, as time goes on, science acquires more and more knowledge. At certain periods some of the knowledge acquired begins to contradict assumptions of the current scientific discourses causing a re-evaluation of those discourses and the eventual emergence of a new "truth," a new paradigm which exists until the situation (called a "paradigm-shift") occurs again and another paradigm assumes the authority of "truth." During historical moments of "paradigm-shift," Kuhn observes that the scientific community as a whole is generally split into two groups, those who wish to continue to hold onto the old paradigm and those who wish to embrace the new. Eventually as scientifically acceptable evidence in favor of the new paradigm continues to grow, the number of scientists holding to the older paradigm diminishes until the new paradigm is essentially universally held to be "true." This process often takes several decades to run its course.

The twentieth century has been the temporal site for just such a discursive paradigm shift arising in physics. The influence of physics as a discipline over the whole scientific discursive hierarchy is acknowledged by many scientists, including non-physicists, based on

the effectiveness of the mathematical models used in physics to describe reality (see Wilson 66-71). The paradigm-shift in physics began with the publication of Albert Einstein's Special Theory of Relativity in 1905 which, among other things, eliminated the need for "ether" as a medium for the transmission of light and other forces through space. The catalyst for a complete shift from Newtonian mechanistic conceptions of the interaction of objects and the effects of gravity came with Einstein's General Theory of Relativity in 1915, in which Einstein declared that there is no such thing as the absolute space required in Newton's paradigm within which objects are placed and which serves as a frame for the objects' interactions with each other. Einstein "proved" that space is in fact curved by gravity, that space itself is acted upon by the objects which constitute it.

A few years later, beginning in the 1920s, a group of physicists delivered another blow to the old comfortable Newtonian mechanistic paradigm by demonstrating through laboratory experiments that at subatomic levels of reality objects do not behave in the ways predicted by Newton. More disturbing to those scientists who wished to retain the mechanistic paradigm's dominance was the causative role played by the observer in quantum-level experiments. Newtonian rules for simple cause-and-effect did not, in fact, appear to have any truth value at the most basic levels of reality.

Despite the many decades that have elapsed since the publication of the data from the first relativistic and quantum experiments, and the growing amount of further evidence supporting the new paradigm in physics, the full paradigm-shift has yet to work itself out. Part of the difficulty of this particular paradigm-shift is in the inability of most scientists to stomach the philosophical implications of quantum mechanics. If the vast portion of reality is affected and shaped by the subjectivity of the observer, how is it possible to construct a scientifically "objective" model of reality which incorporates the totality of that reality? The added problem of multiple subjectivities inserts a disturbing amount of indeterminacy into scientific discourses which previous scientific paradigms did not have to account for. The

temptation for most scientists is to resist the implications of indeterminacy (and the separate but related problem of nonlinear, or chaotic, systems) in the name of having some sort of common space and determined order within which to continue to articulate discourses of objectivity.

I am primarily interested in a subgenre (perhaps even a sub-subgenre) of scientific discourse, namely scientific texts written by scientists for a nonscientific audience. Within scientific circles (as Robinson's character Sax Russell notes; Blue Mars 580) this subgenre is not considered as accurate as literature published in peer-reviewed journals, primarily because popular texts resort to "linguistic" descriptions of phenomena (i.e., words) instead of the more precise linguistic system of mathematics. However, scientists who write popular accounts of scientific work seem to do so with the primary intention of educating the general public about the state of scientific knowledge at the moment of publication. Thus I believe most scientists would admit that these texts form a bridge between scientists, with their arcane mathematical terminology, and the general public which is not conversant with that terminology. In other words, popular scientific texts articulate scientific discourses within a more public space than the "sciences."

In this chapter I intend to examine and briefly critique Edward O. Wilson's conception of science and its function, tenets of which are shared in common with Wilson by one of Robinson's scientist-protagonists Sax Russell. This scientific philosophy is elaborated in Wilson's book Consilience: The Unity of Knowledge (1998), a text intended for a general readership interested in learning how the sciences can be used to bring all disciplines, from the social sciences to religion and ethics, into a fully comprehensive and coherent ("consilient" in Wilson's terminology) mechanistic-scientific paradigm. As a part of my critique of Wilson's text, I will occasionally draw upon two other scientific texts intended for popular consumption: The Matter Myth: Dramatic Discoveries That Challenge Our Understanding of Physical Reality (1992) by physicists Paul Davies and John Gribbin, and

The Quantum Society: Mind, Physics, and a New Social Vision (1994) by Danah Zohar and Ian Marshall (Marshall is a psychiatrist who has done research on a possible quantum basis for human consciousness; Zohar, Marshall's wife, is a sort of "quantum philosopher" who specializes in theorizing how quantum mechanical principles might be applied to individual and social life). The latter two texts enthusiastically embrace the quantum paradigm of reality and, in their respective idiosyncratic ways, explore the implications of quantum and related phenomena in the authors' particular areas of interest (physics and neurology), areas which Robinson's character Sax Russell becomes interested in and is therefore forced to wrestle with these same issues of quantum indeterminacy and chaotic systems. Wilson's text, although not explicitly stating his allegiance to the mechanistic paradigm, refuses to deal with quantum mechanics and chaos theory at all, with a few exceptions which I will discuss in a moment. I intend to speculate about this omission in Wilson's text, specifically what that omission says about Wilson's desire to construct and maintain a hyperordered reality. I shall then briefly address the implications of some of Wilson's descriptive metaphors concerning science.

A quick glance through Wilson's index goes a long way toward identifying his attitudes toward quantum indeterminacy and chaos. There is no entry for "quantum mechanics," although there are two textual references listed for "quantum electrodynamics (Q.E.D.)" (Wilson 330), the branch of quantum mechanics which aims at unifying all the forces in nature into one grand theory. There is also no listing for "indeterminacy," and the only listing for "chance" has the additional label "in history" (Wilson 324). The index's entry for "chaos theory" directs the reader to "see complexity theory," which Wilson spends a relatively large amount of space critiquing. The odd thing about his conflation of "chaos theory" and "complexity theory" is that, while chaos theory is generally applicable to complexity theory, the two are by no means the same thing. According to Wilson, the scientists working the most strenuously on complexity theory apparently believe that the

complex, nonlinear systems they study can one day be reduced to several interlocking, comprehensive rules (see Wilson 87-95), while scientists and mathematicians working on chaos theory are generally skeptical that science will ever be able to generalize laws that apply to strictly nonlinear systems (see Davies and Gribbin passim, but especially 30-62).

In short, Wilson essentially ignores quantum indeterminacy and chaotic systems in his index and text, much as Sax Russell does in his scientific work and theorizing. The one exception in Wilson's case, "quantum electrodynamics," becomes, in Wilson's text, an example of how successful contemporary scientists are at fitting the universe into their paradigm. While Wilson acknowledges that "Q.E.D. treats the position and momentum of each electron as both a wave function and a discrete particle in space," and further that electrons "randomly emit . . . and reabsorb . . . photons" (Wilson 49), neither the inherent indeterminacy of the electrons, nor the randomness of their photon emission and reabsorption figure in his text at all. Wilson instead emphasizes that "[i]n one property of the electron, the magnetic moment, theory and experiment have been matched to the most extreme degree ever achieved in the physical sciences" (Wilson, 49). In other words the first two properties he gives for the electron and all the methodological problems they raise are ignored in favor of the one property which fits most snugly into the pre-existing scientific paradigm of reality (though he does note that the results of this quantum theory have "small deviations from the [results] previously predicted by classical atomic theory" [Wilson 50]). Wilson even invokes the "scientist as hero" narrative (a narrative often referenced in Robinson's text) through a metaphoric analogy in order to demonstrate how impressive an achievement this prediction is. "Their [the experimenters] data matched the theoretical prediction to one part in a hundred billion. Together the theoretical and experimental physicists accomplished the equivalent of launching a needle due east from San Francisco and correctly calling in advance where it would strike (near Washington D.C.) to within the width of a human hair" (Wilson 50).

This pattern of thought (shared by Sax Russell through most of the Mars trilogy), explicit mention of indeterminacy and then the immediate repression of it, also mark the one point in Wilson's text where "quantum mechanics" is mentioned (while being repressed in the index). Wilson writes, "The ruling talismans of twentieth-century science, relativity and quantum mechanics, have become the ultimate in strangeness to the human mind. . . . The cost of scientific advance is the humbling recognition that reality was not constructed to be easily grasped by the human mind" (Wilson 31). Having brought up the "strangeness" of these branches of science, Wilson immediately dismisses them from the text and never mentions them again. As I will describe in the next chapter Sax Russell, when he realizes he will be forced to deal with quantum phenomena in his work, also admits the basic "strangeness" of those phenomena, and succeeds in repressing that strangeness for a short time. Wilson, in reaction to quantum strangeness, insists in contradictory ways on the essential orderliness of reality (order either "natural" or "created by science" depending on what his argument calls for at the particular moment) and the capability of science to correct the problems with human perception and epistemology that make relativistic and quantum phenomena so "strange." Sax Russell is also vitally concerned with proving the solidity of scientific techniques for ordering a seemingly random and indeterminate reality.

Wilson's project of "consilience," the linking of all branches of human knowledge by fact-based scientific laws, depends on science's ability to build a rigid, ordered model of reality. "[The enterprise of consilience] promises that order, not chaos, lies beyond the horizon" (Wilson 13). With this statement, early in his argument, Wilson declares science's antagonism to chaos. Yet Wilson seems unable to articulate just what is chaotic, or where the chaos is created and where it exists. For the most part, he chooses to blame the apparent chaotic nature of reality on two sources, a human sensory system and brain that were not evolved to understand how the universe works, and on "postmodernists" who, by their insistence upon the inherent fractured and subjective nature of reality, foment chaos where

none previously existed. Wilson describes the concerns of contemporary scientific epistemology: "Can we devise a universal litmus test for scientific statements and with it eventually obtain the grail of objective truth? Current opinion holds that we cannot and never will. Scientists and philosophers have largely abandoned the search for absolute objectivity and are content to ply their trade elsewhere." Wilson continues, "I think otherwise and will risk heresy: The answer could well be yes" (Wilson 60).

Wilson surmises that the "alignment of outer existence with its inner representation has been distorted by the idiosyncrasies of human evolution" (Wilson, 61); that is, the human brain cannot fully experience reality as it really is and thus has a false or incomplete representation of this reality. Up to this point, Wilson would be in partial agreement with his dreaded "postmodernists" on the idea that reality, as humans experience it, is a heavily subjective affair (although he would still insist that everyone experiences that reality in the same way because we are all humans with human brains and thus have consciousnesses controlled by sensory functions hardwired into the brain). He quickly parts company with "postmodernists" one sentence later by declaring, "*[t]he proper task of scientists is to diagnose and correct the misalignment* [of outer existence with its inner representation]. . . . No one should suppose that objective truth is impossible to attain, even when the most committed philosophers urge us to acknowledge that incapacity. In particular it is too early for scientists, the foot soldiers of epistemology, to yield ground so vital to their mission" (Wilson 61, his emphasis) (the last sentence is typical of the hyperbole Wilson engages in while describing the scientific "mission;" I will discuss his particular fondness for violent and colonialist analogies in a moment).

Sax Russell differs slightly from Wilson on this particular subject, a difference that allows Russell to expand his theoretical and experiential frameworks to encompass the implications of indeterminacy and chaos in life in ways which Wilson never could. Where Wilson takes great pains to separate scientific epistemology from subjective experiential

reality. Sax Russell gradually becomes more and more immersed in his own present experience throughout the course of the trilogy. After observing how people (mostly women) around him integrate the indeterminacy of experience into their conceptual paradigms, he becomes able to do so himself. He comes to recognize that "science" is merely a model of reality which should not necessarily always be given primacy over an epistemology grounded in lived experience.

Wilson proposes that "objective truth might be obtainable through empirical investigation" (Wilson 60); however by arguing this, in light of his belief in the false "inner representation" of reality, he ends up not proposing any solution at all to the problem of human subjectivity and epistemology. Since all of "outer existence," including any "empirical investigation" undertaken, must be filtered through the human sensory apparatus and brain, the same misalignment Wilson sees between "outer" and "inner" applies just as much to scientific experiments, mathematics, and peer reviewed journals as it does to the "strangeness" of quantum indeterminacy or the apparent chaos the human brain perceives in the universe. Yet the text, to benefit the broad argument being made, must fight, like the "foot soldiers of epistemology," for the scientist's ability to find an orderly "objective truth," in spite of human intelligence.

Concerning "postmodernists" and their philosophies, Wilson summarily declares, "[t]he ongoing fragmentation of knowledge and resulting chaos in philosophy are not reflections of the real world but artifacts of scholarship" (Wilson 8). Thus, the real world is quite orderly and determinate, while the chaos arises out of "scholarship" (Wilson does not reveal whether this scholarship is influenced by the misalignment caused by the human brain, but considering his professed views of "postmodernists," their epistemological problems would not seem to be of the same nature or caliber as those experienced by scientists). He explains, "[T]here have always been two kinds of original thinkers, those who upon viewing disorder try to create order, and those who upon encountering order try to protest it by creating

disorder. . . . And in the Darwinian contest of ideas, order always wins, because--simply--that is the way the real world works" (Wilson 43-44). Note that the last sentence asserts, first, the metaphor, taken literally, of an evolutionary drive inherent in information; and, second, simply ignores, or represses, the scientifically validated concept of entropy, that is, the always increasing amount of randomness in the universe. In Wilson's view scientists, creating "order" from "disorder," will inevitably triumph against the "postmodernists" who create chaos. They will "win" because the world is an orderly place, thus ensuring that those who most rigidly and mimetically determine "reality" will come out on top in the "survival of the fittest" battle Wilson posits as the state of scholarship in the world today. As I will describe in the chapter concerned with Maya Toitovna, however, Robinson's text integrates quantum discourses with poststructuralist discourses concerning human identity to give greater depth to the latter. Robinson's text, far from scorning "postmodernists" and their concerns, and separating those concerns from "science," views the two discursive frameworks as deeply interconnected.

"Postmodernists," Wilson declares fervently, are a "rebel crew milling beneath the black flag of anarchy, challeng[ing] the very foundations of science and traditional [i.e., Enlightenment] philosophy" (Wilson 40). What makes Wilson's demonization of "postmodernists" ironic is his unconscious reliance upon the quintessential postmodernist metaphor, that of the "network" (see Keller, Refiguring Life). The primary example of this metaphor within Wilson's text is his enthusiastic description of the "state of the art approach" to biological systems "conceived as genetic networks" (Wilson 92). His example of this line of thought is a quote from William Loomis and Paul Sternberg filled with examples of the metaphor of "networks" as applied to genetics ("The nodes of such networks are genes. . . . The connections are the regulatory and physical interactions among the RNAs, proteins, and cis-regulatory DNA sequences of each gene" [quoted in Wilson 92]), and the further metaphorical assertion that the network functions as a way to control, process

and transmit information (the geneticist should "link the genes and their products into functional pathways, circuits, and networks" that "implement . . . digital logic, analog-digital conversions, cross-talk and insulation, and signal integration" [quoted in Wilson 92]). This obsession with networks and information is a characteristic, according to Haraway, of postmodern science (see Haraway). It seems likely that Wilson is not aware of the metaphors he uses in his scientific work (metaphors which, as feminist critics of science point out, many other scientists use as well) and/or he is not informed enough on the subject of postmodernism/poststructuralism to comment knowledgeably on it in relation to science.

Wilson's determined adherence to order causes his text to contradict itself in a puzzling way about the "orderly" nature of reality. Late in his book, Wilson writes, "The flaw [in the predictions of population geneticists] is not in the internal logic of the theory but in the unpredictability of nature itself" (Wilson 201). Is nature "orderly" or is it "unpredictable?" Are humans' inner representations ("theories") of outer nature "misaligned" or not? This point in the text reveals a leakage of the "scientist as hero" metaphor, in which the scientist must "create order" so as to make sense of an "unpredictable" universe. The text has repressed any epistemological problems it might have expressed earlier in favor of the inherent "orderliness" of the scientific project in the face of a terrifying, deeply repressed "unpredictable" reality. This avoidance of "chaos" and "indeterminacy" also leads to overgeneralizations in the text. For instance, "The dominating influence that spawned the arts was the need to impose order on the confusion caused by intelligence" (Wilson 225). Evidently Wilson would not characterize as "art" the products of composers such as John Cage, visual artists such as Jackson Pollack, or writers such as William S. Burroughs, who all enthusiastically embraced a certain amount of indeterminacy and/or chaos in the creation of their work.

Another move toward order which Wilson makes in his text is his faith in the mechanistic paradigm and its ability, through reductionism, to explain and recreate complex and/or nonlinear systems in a linear manner.

> [Biologists] have refined reductionism into a high art and begun to achieve partial syntheses at the level of the molecule and organelle [i.e., used the knowledge gained through reductionism to reconstruct the objects under study]. Even if complete cells and organisms are still beyond them, they know they can reconstruct *some* of the elements one at a time. . . . An organism is a machine [and thus capable of synthesis as the sum of its parts]. (Wilson 91, my emphasis)

Thus, even the creation of living organisms, the most complex systems in the universe, can be accomplished by science once it knows how to construct all of the parts that make up those organisms. However, in order to argue this point, in order to "order" scientific knowledge about complex systems, Wilson must ignore the temporal in his model of those systems, a problem Sax faces in his work on quantum memory in human beings. Scientists must literally "freeze" each part of the system in time, take it out of its context, in order to treat it as a "part" in a "machine." If complex systems such as organisms were truly mechanical this would possibly work; however, one of the factors contributing to the complexity (and chaos) of living organisms, is their tendency to operate, and change, within time. Many of these operations and changes occur on a quantum (and possibly smaller) level within the system and are thus subject to indeterminacy and random effects which a simple knowledge of the "parts" will never be able to adequately account for or reproduce. This is especially significant if, as Zohar and Marshall argue, the brain is an emergent quantum system whose whole is greater than the sum of its parts (see Zohar and Marshall 68-77). Of mechanism in general, Zohar and Marshall write, "In science, . . . mechanism has long since had its day. Newton's strict determinist laws still apply within a narrow spectrum of physical reality but they are no longer at the cutting edge of physical thinking" (Zohar and Marshall

27-28). Mechanism, while not capable of accounting for quantum levels of reality, has to be used by Wilson in order to uphold his faith in the orderly nature of reality and of science.

Other scientists, in contrast to Wilson and the Sax Russell portrayed through the majority of Robinson's trilogy, are enthusiastic about, and fully accept the implications of, quantum indeterminacy and chaos. Physicists Paul Davies and John Gribbin write that "[mechanism] . . . is [a] myth . . . that is being laid [to rest] as we move into the twenty-first century" (Davies and Gribbin 8). They also assert that at the subatomic level there are no "parts" for science to use to take apart or build objects and systems.

> The founders of quantum mechanics . . . argued that when we talk of atoms, electrons, and so on we must not fall into the trap of imagining them as little "things," existing independently in their own right. . . . Use of the word "atom" is just an informal way of talking about [a mathematical] algorithm. It is a helpful means of encapsulating that abstract concept in physical language, but that does not mean that the atom is actually *there* as a well defined entity with a complete set of physical attributes of its own, such as a definite location in space and a definite velocity through space.
>
> Heisenberg's own words are revealing in this context: "In the experiments about atomic events we have to do with things and facts, phenomena which are just as real as any phenomena in daily life. But the atoms or the elementary particles themselves are not as real; they form a world of potentialities or possibilities rather than one of things or facts." (Davies and Gribbin 27, original emphasis)

Davies and Gribbin are not frightened of chaos or indeterminacy. They are excited about the potential for chaos to "liberate matter" and enthusiastically describe the implications of quantum mechanics and the conditions of reality on the smallest level possible, the Planck level of reality (I will rely heavily upon Davies and Gribbin in explaining these concepts in Chapter 3). Perhaps Wilson's unwillingness to deal with or understand these concepts comes down to the matter of disciplinary boundaries: Davies and Gribbin are physicists, Wilson is a

biologist. Yet it seems a crippling blow to Wilson's dream of "consilience" among the sciences that he is unwilling or incapable of accepting, or even acknowledging, the paradigms and concepts of his declared "foundational" science of physics.

I would now like to comment briefly on Wilson's metaphor and hyperbole and the implications of his use of these devices in a text representing a philosophy of science to the general public. While Sax Russell does not explicitly use metaphors as such as Wilson's, his praxis of objectification of the phenomenon under observation, and his conceptualization of science as a rigid, deterministic and controlled (authoritarian) space, reveal the influence of the sort of metaphoric conceptualization of science displayed by Wilson's text. For despite Wilson's assertion that "[h]uman beings are innately disposed to avoid violent physical contact" (Wilson 105) (never mind wars, physical abuse, or even the primate dominance hierarchies he has claimed are a major factor in determining human behavior), his metaphors concerning science are at best violent, and at worst racist and colonialist. I will give two examples.

First, in discussing Francis Bacon's contribution to the creation of modern science, Wilson approves of, and enjoys, Bacon's description of himself as "*buccinator novi temporis*, the trumpeter of new times who summoned men 'to make peace between themselves, and turning with united forces against the Nature of things, to storm and occupy her castles and strongholds, and extend the bounds of human empire'" (Wilson 23-24) (for a critique of Bacon's metaphors see Lloyd). The perpetuation, through quotation of Bacon, of this sort of scientific rhetoric underlines the enmity between scientists (or humans in general) and the universe or reality they experience. The horrible unknown is out there and we must conquer and destroy it in the name of order.

Second, Wilson compares scientists

> with explorers of the sixteenth century, who, having discovered a new coastline, worked rivers up to the fall line, drew crude maps, and commuted home to beg for

> more expeditionary funds. And governmental and private patrons of [scientists], like royal geographic commissions of past centuries, are generous. They know that history can be made by a single sighting of coastland, where inland lies virgin land and the future lineaments of empire.
>
> Call the impulse Western if you wish, call it androcentric, and by all means dismiss it as colonialist if you feel you must. I think it instead basic to human nature. (Wilson 100)

Despite Wilson's flip dismissal of the critiques he knows will be leveled against him, his metaphors contain chilling implications. Their unabashed greed for power (and "funding"), their sexualization of the territory being "explored," and their refusal to mention what goes along with the charting of "lineaments of empire," i.e., genocide, reveal what Wilson and scientists like him think about the objects (and people-as-objects) which they study. Science as Wilson desires it to be practiced will have the tendency to destroy whatever it objectifies in the name of power, money and a repressive "empire" of objective truth. These problems with scientific praxis trouble Sax Russell through much of Robinson's Mars trilogy, until he is forced into an understanding of quantum phenomena and their implications. When, in quantum mechanics, the experimenter's subjectivity is involved and intertwined with the phenomena being observed, the Wilsonian sort of scientific attitude could be interpreted as a self-destructive act, especially if human consciousness is a quantum phenomenon (the majority of Zohar and Marshall's book grapples with just this issue of human interconnectedness through quantum nonlocality and acausality).

For the remainder of this paper I will examine how the philosophy and epistemology espoused and articulated by Wilson are taken up and examined in the Mars trilogy of science fiction writer Kim Stanley Robinson. Science fiction as a genre, among its other discursive purposes, is a locus for speculation concerning scientific discourses circulating in public spaces. Robinson's work grapples with the implications of the application of a theory of

science similar to Wilson's in the experiential reality of the characters within the text. Robinson's scientist character, Sax Russell, wrestles with Wilson's ideas and their failure to adequately account for, and guide, several of Sax's experiences. Foremost among these experiences is his search for an "anamnestic" (literally "loss of forgetting" drug; Robinson, Blue Mars 587) that will renew portions of human memory subject to quantum collapse and chaotic (entropic) decay. Sax's search, like Wilson's, is a search for order in the universe, a search which he is reluctant to give up.

The character Maya Toitovna, in contrast, has many problems with her memory (like Sax) but through an arduous internal process of exploring how her memories affect her interaction with external physical reality, she accepts the chaotic and indeterminate nature of her everyday existence, and her past, and comes to a rich and satisfying appreciation for the reality she experiences. Sax (and, judging from his text, Wilson as well) would have a very difficult time accepting such a rich and rewarding set of experiences while chaos and indeterminacy played such an integral role in those experiences. Order, constructed by science, is just too comfortable.

Before moving on to my analysis of Robinson's text I would like to give a brief synopsis of the Mars trilogy. Because of the depth and complex layering (as well as the sheer length) of Robinson's trilogy, this synopsis will necessarily focus only on the very general outline of events while omitting descriptions of most of the specific subplots. The only exceptions to this will be subplots which bear directly on my analysis.

As the title might indicate, Kim Stanley Robinson's Mars trilogy centers upon the establishment of a human colony on the planet Mars, and that colony's efforts to change ("terraform") the environment of Mars to make it more amenable to supporting life from Earth. The narrative focus is concerned with the experiences of the first scientists and engineers sent to Mars in order to set up the basic infrastructure of the colonial endeavor, as well as to explore the planet. This group of scientists is known as the First Hundred (because

they number one hundred people) and, because of their fame and expertise, the text places them as a sort of technocratic elite class within Martian colonial society.

The main narrative tension within the trilogy is the conflict between the Martian colonists and Terran transnational (and later metanational) corporate interests who are concerned only with exploiting Mars's resources and labor (colonists) for their own profit. The climax of each volume of the trilogy comes with the resolution of separate conflicts (mostly violent uprisings) between the colonists and the corporate interests of Earth. In the first volume, Red Mars, tensions are heightened between Earth and Mars after the assassination of John Boone, the first person to land on Mars and one of the First Hundred. Another of the First Hundred, Frank Chalmers, John's friend and rival for the affections of Maya Toitovna, orchestrated John's assassination out of jealousy, and with the aim of solidifying his own power to construct treaties between Mars and Earth. However, after these treaties are enacted it becomes clear that the corporate interests have no intention of abiding by them, and war breaks out on Mars (coincidental with a world war on Earth fought between countries beholden to corporate interests against rival corporations' countries). Because of the corporate control of communications and the only means of access to the surface of Mars, the "space elevator" (a device which connects an asteroid spacestation to the surface of the planet), the corporations easily quash the "Rebellion" and the surviving First Hundred, who were leaders of the conflict, are forced to go into hiding.

A major scientific discovery is also made in the first volume of the trilogy. Members of the First Hundred develop a "gerontological treatment," a drug which, when administered to an individual, repairs damage and replication errors to that person's DNA, thus lengthening the span of the individual's life. This "gerontological treatment" not only serves as a source of scientific speculation within the novel, but also acts as a plot device which lengthens the lifespans of the protagonists and allows the narrative focus of the trilogy to remain on the First Hundred over 200 years of narrative plotline.

Another conflict which arises in the first volume is the conflict between those scientists and colonists who favor terraforming Mars (the "Greens") and those who desire the surface of the planet to remain in its pristine form (the "Reds"). Chief representatives of these groups are, respectively, Sax Russell and Ann Clayborne. Sax, a Wilsonian-type "scientist-hero," begins to experiment with various terraforming techniques immediately upon his arrival on Mars, in violation of the UN treaty on the subject. Ann Clayborne remains violently opposed to any alteration of the planetary environment throughout the trilogy. Their differences on this issue create an antagonistic relationship between Ann and Sax.

In the second volume, Green Mars, the corporate powers are firmly in control of affairs on the planet and are engaged in radical terraforming of Mars's surface, using techniques which make even the Greens uneasy. Sax, who has been bored since being forced to go into hiding to escape the corporations, assumes a dual identity, Stephen Lindholm, and re-enters the Martian scientific community in order to continue his work on terraforming and the creation of a transplanted Earthly biome onto Mars. He is discovered by Phyllis, a member of the First Hundred in collusion with the corporations, and is tortured and nearly killed, an experience which profoundly affects his thoughts about what the human race is doing to Mars.

Green Mars ends with a second "Rebellion" against the corporations, this one much more successful, resulting in a Free Mars which, in the next volume of the trilogy, Blue Mars, will become the dominant power in the Solar System. That third volume is mostly concerned with the progression of the transplanted biome and the terraforming project, along with speculations about a utopian economic and social order which has sprung up in the context of Martian social practices. For purposes of this paper, the important events of this volume center around the degeneration of the memory of most people who have undergone repeated gerontological treatments, a phenomenon often accompanied by the "swift decline," a

sudden failure of the body followed by death. Maya Toitovna, one of the First Hundred, is the main protagonist who displays the range of the memory problems, and the text is very interested in what these problems do to her subjectivity. Sax Russell, in an effort to make progress in the matter of the "swift decline" focuses his research on developing a drug to alleviate the memory problems. This research brings him face to face with quantum indeterminacy and chaos, as I will describe in the next chapter.

CHAPTER 3: "SLEEP, MEMORY:" LEARNING TO LIVE WITH INDETERMINACY

1. "Quantum Weirdness"

When Kim Stanley Robinson's scientist "hero" Sax Russell begins having insomnia from the strain of maintaining his double identity as Stephen Lindholm, his thoughts turn to the frustrating non-scientific fields of the humanities. Sax realizes he must understand the history of the preceding decades in order to comprehend the present situation on Mars and what the future may hold. He runs into a very basic problem.

> The scientific method could not be applied to human beings in any way that yielded *useful* information. . . . [H]uman reality could only be explained in terms of values. And values were very resistant to scientific analysis. . . . Values drove history, which was whole, nonrepeatable, and contingent. It might be characterized as Lamarckian, or as a chaotic system, but even those were guesses. . . . (Robinson, Green Mars 189; original emphasis; cited hereafter as GM)

Sax finally concludes that "[p]eople [are] not rational systems" (Robinson, GM 193).

Earlier in the novel, Sax had phrased his difficulties with the humanities in a slightly different way. He believes that the humanities, unlike the sciences, construct their systems as analogies rather than homologies. The humanities "added up to a huge compendium of meaningless analogies which did not help to explain things, but only distorted perception of them" (Robinson, GM 159). What Sax thinks he has discovered is the power of non-scientific disciplinary master-narratives to "distort the perception" of the person engaged with those narratives. He conveniently overlooks his own engagement with the master-narrative of Enlightenment epistemology and its tale of perpetual progress and eventual unification, through scientific method, of all human knowledges. Edward O.

Wilson (one of the creators of sociobiology, which Sax Russell sees as a "promising" field: Robinson, GM 189) calls this vision of unity "consilience." "[C]onsilience [is] literally a 'jumping together' of knowledge by the linking of facts and fact-based theory to create a common groundwork of explanation" (Wilson 8). The metaphor of "jumping together" influences Sax throughout the entire trilogy, finally giving him the means to be reconciled with his colleague/nemesis Ann Clayborne. They "jump" their differing viewpoints together, each speaking for the other, and thus avert the impending third crisis with the Terran metanational corporations.

But even more significantly, Wilson's vision of "consilience" informs Sax's attempts to make progress in solving the problem of the failed gerontological treatments which have successfully extended the lifespans of those people able to afford them. The key to his (possible) success is his ability to bridge disciplinary boundaries in order to provide a common "groundwork" for all areas of knowledge. However, where Wilson, in the best tradition of Enlightenment optimism, is hostile to chaos ("[O]rder, not chaos, lies beyond the horizon;" Wilson 13), Sax finds the situation to be a bit more complex.

Sax has already decided that the humanities "distort the perception" and that their subjects might be described as "chaotic systems." The main difference between nonchaotic and chaotic systems is that the former are quite predictable, while the latter are unpredictable. Nonchaotic systems accumulate errors in a slow, linear progression in time which is easily predicted and corrected. Chaotic systems, in contrast, accumulate errors exponentially in time and are therefore highly unpredictable (for an illuminating description of the difference between nonchaotic and chaotic systems, see Davies and Gribbin 33-38).

Sax wishes to find a pattern in human history that will allow him to predict, however roughly, the future of humans on Mars.

The little reading he did in historiography was not encouraging; it was either a sad

> imitation of the scientific method, or art pure and simple. . . . Sociobiology and bioethics were more promising, but they tended to explain things best when working on evolutionary time scales, and he wanted something for the past hundred years, and the next hundred. Or even the past fifty and the next five (Robinson, GM 189)

Sax finds history to be chaotic, unpredictable, and useless to him because of a lack of scientifically grounded discourse in the field. Much later in the fictional chronology of the trilogy, this particular problem is solved for Sax by the Martian historian Charlotte Dorsa Brevia, who lives and works in the matriarchal Dorsa Brevia culture.

The theory of history Dorsa Brevia articulates is a sort of indeterminate telos of socioeconomic periods of history.

> [Charlotte Dorsa Brevia] described what she called a "residual/emergent complex of overlapping paradigms," in which each great socioeconomic era was comprised of roughly equal parts of the systems immediately adjacent to it in past and future. The periods immediately before and after were not the only ones involved, however; they formed the bulk of a system, and composed its most contradictory components, but additional important features came from particularly persistent aspects of more archaic systems, and also faint hesitant intuitions of developments that would not flower until much later. (Robinson, Blue Mars 429-430; hereafter cited as BM)

Dorsa Brevia asserts that this telos is working progressively from the "dominance hierarchies of our primate ancestors on the savanna, toward the . . . undetermined, free emergence of a pure harmony and equality which would then characterize the very truest democracy" (Robinson, BM 430). She justifies this speculative statement by examining past periods of history and noting that, in general, the move of history has always been a swing between two poles, those of dominance hierarchies on the one hand, and democracy on the other. Thus, in one stroke, she ties history into a large paradigm/pattern, firmly rooted in sociobiology's

assessment of primate power structures, and from which, despite the repeated stress on its "undetermined" nature, it is possible to make tentative predictions.

When Sax finally gets around to reading Dorsa Brevia's work he is "in an excited state at finding a general paradigm that might clarify history for him at last" (Robinson, BM 431). Although the reasons for his excitement are not stated explicitly in the text at this point, the subtext is easy to recognize: history is not, after all, a "chaotic system" rife with unpredictability, but instead a patterned system with its own rules. In spite of the basic indeterminacy of her theory, Dorsa Brevia even attempts a tentative prediction about the next phase of human history (after the "democratic" phase which she believes to have emerged on Mars from the previous capitalist system), which she calls "Harmony, or General Goodwill" (Robinson, BM 430). Robinson's text describes the methodology Dorsa Brevia uses in making this prediction as being rooted in a combination of observations of which entities had been accorded status as "equals" in previous socioeconomic eras, and observations of her contemporary socioeconomic system which is based in "cooperative economics" (as opposed to hierarchical capitalism) and in which "the circle of equal citizens had bloomed wider. . . until now not only were all humans (in theory, anyway) equal, but consideration was being given to other animals, and even to plants, ecosystems, and the elements" (Robinson, BM 430, 431).

Sax approves of Dorsa Brevia's theory (with one significant reservation) because it is in the first stages of becoming a "true" science. Edward O. Wilson describes the scientific process as being primarily concerned with reductionism, "[t]he cutting edge of science . . . , the breaking apart of nature into its natural constituents" (Wilson 54). (In line with Wilson's enthusiasm for the Baconian and Enlightenment emphasis on the basic violent nature of the scientific project, he again reproduces this in his metaphors. Thus the "cutting edge" of science, reductionism, is described as a "scalpel or catheter" which will "[break] apart. . .

nature" [Wilson 54]). While reductionism, in Wilson's scheme of science, is the most important tool, he also stresses "synthesis and integration." Not only must science break things apart, it must also be able to put them back together again. Scientific progress hinges on "meditat[ing] on the networks of cause and effect across adjacent levels of organization--from subatomic particles to atoms, say, or organisms to species--and [scientists] must think on the hidden design and forces of the networks of causation" (Wilson 54, 55). As I will describe, this particular concept seems difficult for Sax to realize in his lived experience.

Dorsa Brevia's work is reductionist, ultimately tracing human historical processes back to the sociobiological concept of primate dominance hierarchies, one of several basic genetic principles governing human behavior which Wilson terms "epigenetic rules" (see Wilson 164 and passim). From this basic unit Dorsa Brevia synthesizes and recombines upwards to greater and greater levels of historical process and organization, ultimately developing a theory of causality across those levels of organization. Ideally, of course, the aim of any science is predictability. Dorsa Brevia is able to make some guesses, but ultimately her scheme is still "undetermined," or indeterminate. Indeterminacy is not as problematic for predictability as chaos is; it is possible to make statistical guesses about probable outcomes. Only statistical probabilities are possible, however, not hard predictions.

While Sax seems to appreciate Dorsa Brevia's work as scientific progress in the field of history, even being "excited" about it, he cannot accept it as a valid scientific theory. In the passage where Sax reads her work, Dorsa Brevia's predictions of Harmony are characterized as "faint" "glimmerings" and "a vague hypothesis" (Robinson, BM 431). Sax finally decides Dorsa Brevia's prediction of future "Harmony" is too idealistic.

> [H]e wondered if the putative age of universal harmony and goodwill would ever actually come about; it seemed to him possible or even likely that there was some sort

> of asymptotic curve [a line that constantly approaches, but never reaches, an end point] in the human story--the ballast of the body, perhaps--which would keep civilization struggling there in the age of democracy, struggling always upward, also away from relapse, and never getting much further along . . . . (Robinson, BM 431)

So while Dorsa Brevia's paradigm is reductionist, synthetic, useful and enlightening, Sax ultimately rejects the conclusions she draws from her paradigm as being "vague" and idealistic (perhaps idealism is yet another product of the humanities' tendency to "distort" the "perceptions"). History is still too indeterminate and Dorsa Brevia's predictions not probable enough for Sax to accept them unhesitatingly as science.

Yet Sax's foray into the humanities is significantly placed in the chronology of the trilogy. It is described in the introductory section of Part 11 ("Viriditas") of Blue Mars. This section takes place after Sax has had time to contemplate the attempts of the Da Vinci group of scientific researchers to discover a unified quantum/superstring theory of gravity, and before his own work begins on a quantum theory of memory storage in the human brain. Quantum phenomena, much like Dorsa Brevia's metahistorical telos, are indeterminate and, unlike the historian's paradigm, often seem to lack commonsense causalities. Sax goes on to bring consilience between neurology and quantum physics in his quest for a solution to the problematic gerontological treatments. By doing so he is demonstrating Wilson's scientific method in exemplary fashion, positing the basic memory units in the brain as quantum units and theorizing a web of causal effects from the quantum level of organization up to the complex level of neural cells. But by basing his theory in quantum discourse he is grounding his work in a field that is unpredictable (or indeterminate), lacks firm causation and is very close to the "chaos" which makes Wilson so uncomfortable. It may be argued that the paradoxical effects of the quantum realm have negligible impact on the level of living organisms, yet Sax's whole argument, and the basis for his later experience, rests on the

assumption that quantum effects *do* impact living organisms. I would like to look a bit closer at the sections of Blue Mars where Sax's thoughts on quantum phenomena are described so that I can examine how his theory progresses from "vague hypothesis" to acceptable scientific paradigm, how those "quantum" thoughts impinge on his lived experience, and what these sections of text do to the novel as a whole. But first, I need to lay out some basic concepts about quantum phenomena. For this discussion, I have relied heavily on the discussion of quantum mechanics (or "quantum weirdness" as Davies and Gribbin term it in a chapter title) in The Matter Myth, a text by two physicists, Paul Davies and John Gribbin, intended for a general audience interested in science. I chose this text for its comprehensiveness and clarity compared with other such texts I have read. While I am providing this information in order to make my discussion of Robinson's text more comprehensible for a non-scientific audience, I am not overly concerned with establishing the "truth" or "validity" of this discourse. As I stated in chapter 2, it is these scientific ideas and how they affect and circulate within culture, not necessarily the mathematical or methodological grounds of the research, that I am interested in examining.

Perhaps the most important characteristic of quantum phenomena in terms of my discussion of Robinson's Mars trilogy is the implication of the observer in the quantum events being observed. This effect was first noticed in experiments into the wave/particle duality of subatomic components during the middle decades of the twentieth century. The experiments were inspired by a phenomenon first observed by Thomas Young in the early nineteenth century. Young shone a light source (essentially a stream or wave of photons) through two separate but adjacent slits in an opaque screen, and observed the resulting pattern of light on a second screen behind the first. The light from the two slits formed a pattern of light and dark strips known as an "interference fringe," and the formation of this pattern can be attributed to the "wave" nature of the light source used. In the twentieth

century the same experiment was carried out using electrons, instead of photons, as the source while a television screen sensitive to the impact of electrons served as the second screen. The electrons in such an experiment also form an interference fringe, attesting to their "wave" nature, a rather surprising result at the time, since it was thought that electrons manifested themselves solely as discrete particles.

A further experiment was carried out in which a single electron at a time was fired through the slit system of the first screen and the emerging pattern was observed as it built up over time. One of the basic rules of quantum mechanics, the discipline concerned with describing and explaining quantum phenomena, is Heisenberg's uncertainty principle, which describes the basic indeterminate nature of subatomic phenomena. One of the forms this principle takes concerning quantum particles is that an observer can measure either the position of the particle, or its momentum, but never both at once. It follows that a given particle (or wave) does not exist as a discrete entity while it is in motion (and conversely does not move while it exists as a discrete entity). Instead, it is more accurate to conceive of it as existing as a statistical probability while it is in motion. Because of this property, it is impossible to be certain through which slit any given electron will pass when fired singly in an experiment like the one described above. An electron only gained a determinate existence when its impact was measured on the second screen. The "commonsense" expectation might be that when fired singly through the slit system the patterns the electrons would make on the second screen would be entirely random. Instead, the single electrons formed the interference fringe associated with the previous "wave" experiments.

The moment chosen to determine where a particle is turns out to be critical to the experiment. In a thought experiment, quantum physicist Niels Bohr, who helped create the field of quantum mechanics in the 1920s, predicted that if the experimenter chose to determine through which slit the electrons were passing (for example, by placing a counter at

each slit: because the counters measure position they would act as "observers"), the added uncertainty introduced into the system by the counters themselves would smear out the interference fringe, leaving two randomly formed smudges of impacts on the second screen. The very act of determining the position of the particles as they passed through the slits was the deciding factor in what sort of pattern would appear on the screen. This was later confirmed in physical laboratory experiments.

In the 1960s John Wheeler proposed a further thought experiment, later confirmed in laboratory experiments, in which the experimenter waits until after the particle has passed through the first screen before deciding to discover which slit it passed through. "The decision of the experimenter about whether or not to look back *at the time the particles arrive at the screen* determines whether or not the light *was* behaving in the manner of particles or waves at an earlier moment, at the time when it passed through the slit system in the first screen" (Davies and Gribbin 213; original emphasis). So even after the fact it is the experimenter's decision about what to look for that determines the behavior and constitution of what is being observed on a subatomic level. There do not appear to be spatial or temporal limits to this effect. Davies and Gribbin write that "the quantum nature of reality involves nonlocal effects that could in principle reach right across the Universe and stretch back eons in time" (Davies and Gribbin 214). At the quantum level, the universe is a holistic, if indeterminate and uncertain, system.

The scientific ideal of "objectivity" becomes meaningless on a quantum level. Moreover when these quantum principles are extended beyond the subatomic, "objectivity," and to a certain degree "predictability," become problematic even at the macroscopic levels of living organisms, planets, stars, and the universe itself. When the decision is made to determine where a particle is, what the observer is doing is removing the "particle" from its nature as a statistical probability (uncertainty as to where it might be), and demanding to know the

actual results for that individual particle: that is, not where the particle is *likely* to be, but where it *is*. This process is known as "collapsing the wave function" of the particle. The problem is that macroscopic objects have wave lengths and, therefore, wave functions as well. Davies and Gribbin seem to be contradictory concerning this point. At one place in their text they write:

> In *principle*, even macroscopic objects such as people and planets have their individual quantum waves. . . . The reason we never notice those waves . . . [is because] the length of the waves diminishes in proportion to the momentum. So the greater the mass of the object involved, the shorter the waves. . . . When it comes to people and planets, the waves are so ridiculously short that *for all practical purposes* they can be ignored.

They continue, "There are, however, deep issues of principle connected with the fact that matter waves exist even for macroscopic bodies" (Davies and Gribbin 207; my emphasis). Yet later in the same chapter, after discussing how an observer is implicated in the experiment and the role that observer plays in collapsing the wave functions of particles, Davies and Gribbin state:

> If nobody looks then the wave never collapses. So the behavior of a particle such as an electron appears to vary according to whether it is being watched or not. This . . . may not seem of any great concern . . . --who . . . really cares what an electron is doing when we are not looking at it? But the issue goes beyond electrons. If macroscopic objects also have associated waves, then in principle the independent reality of e*verything* seems to go into the quantum melting pot. (Davies and Gribbin 217; original emphasis)

This apparent contradiction or ambivalence within Davies's and Gribbin's text about the "real" effects of the waves of macroscopic objects reflects disagreements within the scientific community about those effects.

The problem of macroscopic waves and their possible effect upon the "objective" reality of macroscopic objects is illustrated by physicist Erwin Schrödinger's thought experiment popularly known as "Schrödinger's Cat." A cat is placed in a box along with a bottle of cyanide and a hammer for breaking the bottle. The hammer is attached to a Geiger counter near a source of radiation. If an alpha particle is emitted from the radioactive source it will be detected by the Geiger counter which will trigger the hammer, release the cyanide and thereby kill the cat.[1]

The difficulty is with the alpha particle and its ability to tunnel free of its host atom. This tunneling is a quantum phenomenon in which the particle's wave function is bouncing around inside the atomic nucleus, kept there by a force called the "strong" force. One of the characteristics of waves in general is their ability to occasionally pass through (or "jump" or "tunnel through") very thin barriers (Davies and Gribbin use the example of a light being able to pass through a very thin reflecting surface). The strong force keeps most of the alpha waves inside the nucleus, but there will always be some leakage, which results in an alpha wave appearing outside the nucleus. As a wave, of course, it is a set of statistical probabilities and not a discrete particle, still indeterminate. It is only when an observer attempts to locate the particle that the wave function collapses from indeterminacy about its

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[1]An alpha particle is basically an atomic nucleus consisting of two protons and two neutrons, chosen for this experiment because of its ability to escape from its host atom, a very rare occurrence for any single atom but, because of the large numbers of such atoms, frequent enough to be noticed by researchers..

activities and location into determinacy. So while the cat and the radioactive atom are both locked away inside the box, unobserved by the researcher, it is impossible to determine whether an alpha particle has escaped from the atom or not and therefore whether the cat is dead or not. The quantum wave associated with the cat becomes interdependent with the wave of the alpha particle creating an unresolved indeterminate set of probabilities leaving a quantum cat in the box, both living and dead at the same time. The cat is regarded as being both living and dead at once because quantum phenomena are not only affected by what actually ends up happening to them, but also by everything that *might* happen. Thus the "quantum" cat contains both possibilities (live and dead) until the box is opened and a researcher collapses the combined wave functions of both cat and alpha particle to determine the corporeal state of the cat.

"Schrödinger's cat" illustrates the complex interrelatedness of the subjectivity of the researcher with the objects or phenomena observed, even with macroscopic objects such as cats. This interrelatedness can even extend to humans. For example, the indeterminate state of the cat can become more complex by increasing the area containing the wave function. The question arises: if a lone scientist in a lab looks in the box and knows the state of the cat, does that determinacy apply to a scientist working in the lab next door? It would seem that the wave function has collapsed for one scientist and not for the other until the first scientist communicates the news to the other. The chain can then be increased from labs to lab building to city to world at large to universe. There are major disagreements among quantum physicists about how to resolve these problems, as Davies and Gribbin relate.

> Some physicists believe quantum mechanics will fail for systems as large and complex as cats. Another opinion is that quantum physics can tell us nothing about individual alpha particles or cats, but only about the statistics of collections of identical systems, so that we can say that if we were to perform the same experiment with a thousand

> cats in identical boxes then a certain fraction of the cats (as determined by the quantum rules) will be found alive and the rest dead. But that simply dodges the question of what happens to any individual cat. (Davies and Gribbin 219)

Whatever conclusions the scientific community may arrive at to these problems, it seems undeniable that according to quantum discourse the universe does not exist in quite the way Newton formulated in his classical mechanistic conception of physics, well-ordered and solidly objective no matter what. Instead, Davies and Gribbin conclude, "[Quantum phenomena endow] the world with an extremely subjective element, for [they oblige] us to suppose that, in the absence of observation, the external world does not exist in a well-defined sense. It is as though through our observations we actually create, rather than explore, the external world" (Davies and Gribbin 226).

This subjective and indeterminate nature of reality is what scientists like Sax Russell are forced to come to grips with. Robinson's text explores the effects of Sax's initial resistance to, and repression of, chaos and indeterminacy in his "scientific" conception of reality, and shows how he is finally required to accept and even appreciate those very qualities as they affect his life and refine his scientific understanding of the universe.

2. The Indeterminate Moment

Because of the effects of quantum phenomena at the subatomic level, Sax Russell is forced to accept a certain amount of unpredictability in particular macroscopic phenomena he needs to deal with. As I indicated earlier Sax was unable to accept this with a "chaotic system" such as a human being and, consequently, with discourses concerning human affairs like politics, history or psychology, even when he discovers that, in the case of history, the phenomena concerned are not "chaotic" but indeterminate. He chooses to begin investigating indeterminacy in a much "safer" discipline, physics, and specifically the areas

of quantum gravity and superstring theory. Sax's ruminations on quantum gravity begin at a significant point in the narrative of Blue Mars. He is out wandering a Martian tundra that is literally covered by new genetically altered plant life introduced over several decades by the Martian colonists. Sax is awestruck by how life has so quickly appeared on what was formerly a lifeless planet. He begins thinking about it in terms of entropy. "Why was there increasing order in any part of the cosmos, when one might expect nothing but entropy everywhere?" (Robinson, BM 371). Spencer, along with Sax one of the First Hundred scientists to settle Mars, offers Sax a theory. "[I]n an expanding universe . . . order was not merely order, but the difference between the actual entropy exhibited and the maximum entropy possible" (Robinson, BM, 371). Sax finds this an intriguing idea, but while looking at sunlight falling on flowers he thinks of the plants as "[i]deograms of order. They did not look like a mere difference in entropic levels" (Robinson, BM 371).

What is significant about these speculations as a starting point for Sax's thoughts on quantum phenomena is the concept of entropy. Davies and Gribbin define entropy as "a precise quantification of the degree of disorder in a physical system" (Davies and Gribbin 125). Entropy can never decrease in a closed system, which ultimately is what the universe is, albeit a quite large system. Entropy, or chaos, is what Wilson wishes to deny and fight against using a science based on strict, mechanistic principles. Sax, likewise, shares Wilson's anxiety about chaos, choosing to see flowers as "ideograms of order" rather than as entropy. While Sax may be falling back on a sort of "common sense" interpretation of floral reality, he does so at the expense of ignoring what his valued scientific discourses tell him about the nature of reality and its fundamentally (and foundationally) chaotic and indeterminate make-up. He (along with Wilson) is still refusing to accommodate the presence of chaotic systems in his conceptual (allegedly scientific) framework.

Part of what is causing Sax problems at this point in the trilogy is an inability to conceive of different levels of reality other than the macroscopic level at which lived experience occurs, as perceived by the human brain. Sax fleetingly notes this while gazing at the chaotic (i.e., nonlinear because ultimately entropic) systems of the tundra flowers.

> Such a fine texture to a flower petal; drenched in light, it was almost as if it were visible molecule by molecule: there a white molecule, there lavender, there clematis blue. These pointillist dots were not molecules, of course, which were well below visible resolution. And even if molecules had been visible, the ultimate building blocks of the petal [subatomic particles] were so much smaller than that that they were hard to imagine--finer than one's conceptual resolution, one might say. (Robinson, BM 371)

This passage is directly preceded by Sax's rejection of the flowers as entropic constructs and immediately followed by a ten page discussion of work the Da Vinci group has been doing on a quantum/superstring theory of gravity. This baffling of "one's" (Sax's?) conceptual resolution is a sign for the difficulties Sax's mode of science causes him. The confusion is rooted in a lived experience at the macroscopic level (looking at flowers) and launches the "one" who experiences it into an abstract chain of thought at a conceptual level far below lived experience (superstrings and quantum mechanics). Sax's science cannot bridge the gap between lived experience and subatomic phenomena. While Sax, the observer, is observing the flowers and intimately experiencing them as objects in a "real" world, he has to distance himself from the object of his thoughts when that object becomes subatomic (signaled by the appearance of "one" as a term for the self, an attempt at distance and objectivity). This distancing is paradoxical since the proper scientific attitude while "observing" macroscopic objects is one of remove and distance, a separation of the observer from the observed, whereas with quantum phenomena the observer intimately interacts with the phenomena

observed. In line with this move to distance his subjectivity from the object he is observing is Sax's move towards aestheticization of the observed, a move which effectively imposes a framing device by placing the object (in this case flowers) within an artistic discourse that objectifies the observed phenomenon and asserts the dominance and control of the observer over that phenomenon. This sort of aesthetic move is common to Sax when he is faced with phenomena he feels he cannot control or place within his rigidly ordered scientific framework. It is a move which has some disturbing implications, especially when, as is increasingly the case in the latter half of the last novel in Robinson's trilogy, the "objects" aestheticized are women. However, this move also represents his genuine attempt to find a way to reconcile his own "quantum" lived experience with his scientific paradigm, a move which comes to fruition in his final dealings with Ann Clayborne.

Sax's confusion at the place in Robinson's novel where he aestheticizes and admires the tundra flowers is mirrored in the text by a blurring and confusion of chronological time in the plot. The chronological relation between the individual, Sax Russell, gazing at flowers on the Martian tundra, and the "one" objective Sax Russell who sits in on the afternoon discussions of gravitation at Da Vinci is unclear (and indeterminate). In the long paragraph that takes Sax in his thoughts from flowers to quantum gravity (Robinson, BM 371-372) the terms describing time are all imprecise: "recently the theory group at Da Vinci," "Sax had recently started trying to understand what they were doing," and "in the rainy season he had [foregone seacliff for seminar rooms]." It appears as if the quantum gravity sessions occurred before Sax's tundra flowergazing experience, but the reference to a rainy season makes them also seem like ongoing events before, during, and after. The text never returns to a solitary Sax on the tundra; instead, when he is next described as looking at flowers it is in the presence of the female physicist/mathematician Bao Shuyo, near the end of the ten page discussion of quantum gravity. At Sax's moment of confusion the text's time becomes

"smeared," much like Davies and Gribbin's description of occurrences on the smallest scale of reality, the Planck scale (10^{-33} cm; see Davies and Gribbin 163-164), the scale on which quantum gravity appears to operate, and at the same time the causation of Sax's train of thought becomes uncertain. Do his reflections on flowers turn his thoughts to his experiences with quantum gravity, or vice versa? Or does his flowergazing experience with Bao, seemingly in the "future" of his solitary experience, act as a causative agent for what precedes it? The blurring of the bounds of Sax's experience, the smearing of time in the text, and the indeterminate causality of events at this point in the novel make it tempting to see Sax as having a peculiarly "quantum" experience.

The blurring of the abstract with his lived experience, and the realization of that blurring, cause Sax an epistemological dissonance which continues through his experiment with the "anamnestic" (from "anamnesis," literally "loss of forgetting;" Robinson, BM 587) memory restoration drug he helps to create. The moments of dissonance are always brought on by Sax's realization of the shortcomings of his conceptual resolution, and they are almost always connected with his relationships with women. The first of these women to appear after his realization of his confusion is the young Martian physicist Bao, who is "one of the pantheon" of great physicists and mathematicians, the "driving force" of the quantum gravity sessions and "the only female mathematical genius [Sax] had ever even heard of" (Robinson, BM 374).

From the moment she enters the text it is clear that Sax is in awe not only of the subjects under discussion, but of the genius, looks and mannerisms of Bao herself. She is "small for one of the young natives [of Mars], though still half a meter taller than Sax. . . . [S]he even sometimes stuttered, which Sax found extremely endearing" (Robinson, BM 374). He is overwhelmed most of all by her brilliance, her genius at mathematics. When Bao leaves Da Vinci a few pages after she comes into the text, Sax reflects that even he "himself, who had

no prejudices whatsoever, had been amazed to see a woman mathematician at work" (Robinson, BM 380). This sentence is evidently not tongue-in-cheek; Sax truly believes that his dedication to science lends him an objectivity that puts him above trivial prejudices, or everyday life (he refers to unscientific conversational topics as a "waste [of] time . . , trivial things;" Robinson, BM 375). When Bao leaves, Sax is no better at understanding her and her genius, or how to reconcile work on superstrings with personal life, than he was when at the height of his quantum confusion.

Again, Sax's confusion is clearly signaled in the text during a discussion of the basics of superstring theory and the attempts of twenty-second century scientists to unite that theory with quantum mechanics for the ultimate purpose of unifying gravity to the other forces in the universe. Superstring theory "describe[s] the smallest particles of spacetime [e.g., quarks which make up subatomic particles] not as geometrical points but as ultramicroscopic loops . . . vibrating in ten dimensions" (Robinson, BM 372). Sax can accept this theory on a purely discursive level; it "account[s] very elegantly and plausibly for the various forces and particles as perceived at the subatomic level . . . and their gravitational effects as well," although their scale makes them "somewhat exotic mathematical objects" to his mind (Robinson, BM 372) and ultimately it is the extreme scale of the events described in the theory that causes him trouble.

It first appears that the problem is purely one of objective experimentation and methodology. This is the beginning of the last full paragraph on page 372 of Blue Mars:

> [Referring to advances in superstring theory:] All very well; indeed, exciting. But the problem, for Sax and many other skeptics, came with the difficulty of *confirming* any of the beautiful math *by experiment*, a difficulty caused by the very, very, very small sizes of the loops and spaces being theorized. These were all in the 10^{-33} centimeter range, the so-called Planck length, ... (my emphasis)

Quite suddenly, in the middle of a sentence in the middle of the paragraph the "problem" with the theory shifts from objective methodology to subjective imagination:

> . . . and this length was so much smaller than subatomic particles that it was hard to *imagine*. A typical atomic nucleus was about 10^{-13} centimeter in diameter, or one millionth of a billionth of a centimeter. First Sax had tried very hard to contemplate that distance for a while; hopeless, but one had to try, one had to hold that hopelessly inconceivable smallness in the mind for a moment. And then remember that in string theory they were talking about a distance twenty magnitudes smaller still--about objects one thousandth of one billionth of one billionth the size of an atomic nucleus! . . . A [size] which rationality itself could scarcely comprehend. (my emphasis)

The beginning of the next paragraph continues the thought about problems of experimental methodology.

The above paragraph displays the confusion Sax feels about objective and subjective positions when contemplating such minuscule scales. The confusion is marked not only by the abrupt shift between the two states in the middle of a single sentence, but also by the sudden appearance of an attempt to regain objectivity through the use of "one" as a referent for the self ("one had to try," "one had to hold"). Sax, in this paragraph, seems more or less unaware of his confusion. He first becomes cognizant of his confusion in his interactions with the mathematician Bao, the person who is successfully making "several specific predictions [about the effect of superstrings] in the larger realms of the atom and the cosmos . . . some of [which] had since been confirmed" (Robinson, BM 375).

In the person of Bao Sax faces a scientist who has no troubles bridging the gaps that cause him so many problems: subjective and objective states, scientific and lived experiences, Planck and macroscopic scales. Nor is she bothered by matters of indeterminacy or chaos. While her theory of gravity relies on quantum indeterminacy, she is able to bridge the

conceptual gap between indeterminate acausal effects and determinate causal effects through her understanding of how superstrings, "vibrating harmonically in ten-dimensional spin networks" (i.e., strings working together in a sort of emergent quantum system; Robinson, BM 372), form the effects and substance of quarks and particles which are otherwise indeterminate.

Sax first recognizes this quality in Bao during a conversation they have while sailing (the first of many "dates" they have). Sax asks her, "Do you ever worry that work on a realm so far beyond the reach of experiment will turn out to be a kind of house of cards--knocked over by some simple discrepancy in the math, or some later different theory that does the job better, or is more confirmable?" Bao replies, "No. . . . Something so beautiful as this has to be true" (Robinson, BM 376). This answer makes Sax uncomfortable; it replaces the aspiration in scientific discourses towards objectivity through confirmable experimental results (which Sax still believes to be desirable) with a subjective aesthetic criterion for judging scientific validity (an aesthetic criterion which differs from Sax's aesthetic moves, I would argue, in that it is entirely predicated upon the fundamental uncertainty of the phenomenon involved, and therefore does not deprive the phenomenon of agency in the reality outside of scientific discursive spaces). His discomfort is made more acute by his awareness of Bao's scientific genius. During a lull in the conversation Sax observes Bao and begins to understand consciously the source of his discomfort. "She closed her eyes--as if she could see it all written down, on the inside of her eyelids. Everything in the world. Sax felt a piercing stab of envy, of--loss. He had always wanted that kind of insight, and there it was right in the boat beside him. Genius was a strange thing to witness" (Robinson, BM 377). He begins to comprehend that her genius and her ability to conceptualize differing scales of reality are linked up with her ideas of science as a subjective appreciation of beauty, something his rigid scientific paradigm cannot allow. He has "always wanted" what

Bao has, and yet his feeling of loss seems to imply that once, perhaps in a time he cannot remember, he did indeed have it. But at this point in his life he cannot find it, though he attempts it through his objectifying aesthetic appreciation for Bao's (plain) beauty. "Light flaked off the fine black hair gathered at the back of Bao's neck. . . . Networks, trembling at the touch of the sun--no. He could not see it, with eyes open or closed" (Robinson, BM 377). He is still incapable of conceptualizing a realm as small (chaotic and indeterminate) as that in which superstrings vibrate.

Yet his failure of conceptualization is not as complete as Sax himself might believe. In a scene that echoes his earlier quantum flowergazing experience Sax and Bao go out to look at tundra flowers and discuss superstring theory. He once again marvels at her ability to "intuit [the Planck] level, and then make the speculations and deductions necessary to flesh it out and understand it," yet he realizes that there is still a lot of work to do on this theory. Sax is experiencing a moment that combines the aesthetic (experiential) beauty of flowergazing with the abstract terminology of physics and abruptly recognizes the dissonance this creates in him. "[T]hey could lie side by side in the grass in the sun, staring as deeply into the petals of a tundra flower as ever one could, and no matter what was happening at the Planck level, in the here and now the petals glowed blue in the light with a quite mysterious power to catch the eye" (Robinson, BM 378). What is interesting about this moment of dissonance is that until he begins analyzing the situation there is no problem. Once he begins thinking about it, he is forced to reject the physics (unable to conceptualize the Planck level) in favor of looking at flowers "here and now." Yet previously both physics and aesthetics had existed together, and even when he rejects physics, time smears away for him in another quantum moment. The moment in which he looks at flowers with Bao becomes timeless and therefore a moment ruled by a quantum physical discourse which once again fractures the

very text. A text break appears at this point in the narrative, creating a dissonance and sense of timelessness in the text of the novel itself.

Yet by the time his brief association with Bao comes to an end Sax has not developed a way to come to grips with the dissonance between personal experience and abstract scientific theories, despite having the apparently integrated example of Bao from which to draw understanding and inspiration. Dorsa Brevia, where Bao is from, has a culture organized around ultimogeniture, the descent and inheritance of power and property from mother to youngest daughter. Bao's mother dies and the physicist, being the youngest daughter, must return to Dorsa Brevia to take control of the family. Bao is "matter-of-fact" about her responsibility; "it was just something that had to be done," even if it forces the entry of uncertainty into her career as a physicist. "Bao wasn't sure when she would be back [to Da Vinci]; there was even a chance she wouldn't be" (Robinson, BM 380). In spite of what he knows about Bao, Sax cannot help but "shak[e] his head" at how calmly she acquiesces to family duties over science. He thinks gloomily, "[Scientists] would understand the fundamental laws of the universe before they had even the slightest handle on society. A particularly obdurate subject of study" (Robinson, BM 380). It is evident that Sax is characteristically (scientifically) misreading Bao's fate. Can a physicist who can "intuit" the Planck level into her experiential framework be barred from continuing scientific work away from the confines of a laboratory? Sax was told a mere two pages earlier that Bao received most of her mathematical training outside of institutional confines. "[Bao said,] 'My mom gave me quadratic equations at four [years of age], and all kinds of math games . . . . Math was mostly something I did by reading, and correspondence with the department in Sabishii [University]" (Robinson, BM 378). Bao is someone who *lives* physics, who has no trouble living and experiencing both abstract and experiential realms simultaneously. Contrary to

Sax's evident viewpoint, life for Bao is not either family or science but a combination of the two.

3. The Present Is All

The second of the three women whose interactions with Sax seem instrumental in demonstrating to him the ineffectuality of his scientific viewpoint in describing or explaining his experiential reality is Zo. She is, like Bao, a native of Mars, though unlike the mathematician/physicist Zo has little interest in scientific matters; she is more concerned with the pleasures of the moment (flying in a "birdsuit," and sex) and with the present political situation within which she does work for her mother, influential Martian politician Jackie Boone. Yet another difference, aside from the scientific, between the account of the relationship of Sax with Bao and Sax with Zo, is that the latter account is narrated from the point of view of Zo, providing a valuable "outside" view of the scientist from a nonscientist and member of a younger, non-Earthborn, generation.

It is significant that, even through Zo's viewpoint, many of the textual features present in Sax's interaction with Bao are also present at his meeting with Zo, chief among them plants and sunlight, bringing in quantum phenomena as one subtext (though Zo's experiential paradigm is so different from Sax's that the quantum is not a point of focus in this section of the text). Zo and Sax are introduced at Moreux Crater, where Zo's home is, and he persuades her to take him to the bottom of the crater so he can observe the forest and marsh biome that has been planted there. As with his walks with Bao, Sax is, at first, primarily intrigued by the plant life and he asks Zo if she knows any of their names.

> "The names of plants go in one ear and out the other, I'm afraid," [Zo] admitted cheerfully.
>
> [Sax's] forehead wrinkled at this.

"I think that helps me to see them better," she added.

"Really." He looked around again, as if trying it. (Robinson, BM 456)

Here Zo expresses a sentiment similar to one expressed by another of Robinson's characters, Spiff, which appears in the epigraph to this paper, namely that knowing too much about something actually interferes with experiencing it. This idea is apparently new to Sax who immediately "[tries] it." As in his interaction with Bao, Sax is introduced to another viewpoint besides the rigidly determined scientific paradigm he has held for most of his life. But unlike Bao's example of the possibilities of integrating extremely technical and abstract physics with her experiential reality, Zo's paradigm has little to do with science and everything to do with fully experiencing the present moment without (supposedly) any paradigmatic filters.

The sunlight is more evident than plants in Zo's awareness, though the light, in her mind, is connected to the same objects to which Sax connects sunlight during his time with Bao: foliage and human bodies. Still, the difference between Zo's and Sax's conception of sunlight is profound, perhaps even mutually exclusive. "Sunlight filled the entire crater bowl, . . . the air shot with parallel columns and wires of slanting yellow light" (Robinson, BM 456-457). Where Sax conceives of and experiences the light in terms of "color molecules" in the petals of flowers, Zo sees the light as "columns and wires," a perception which marks the differences between their two conceptual paradigms: Sax focuses on a sort of aestheticized physics of the light and Zo on its nonscientific architectural, purely aesthetic characteristics. Their paradigms do share appreciation for the color of reflected light: "The long blades of grass gleamed under the lilac midday zenith" (Robinson, BM 458).

Light also interacts with human bodies. When Sax is sailing with Bao there is a brief mention of an observation he makes concerning the interaction of the sunlight with Bao's hair. "Light flaked off the fine black hair gathered at the back of Bao's neck" (Robinson,

BM 377). This sight makes Sax think of string spin networks and leads directly to his realization that he can't conceptualize the Planck level as Bao can. Zo, too, focuses on the interaction of the sunlight, though focused on her own body. After swimming in a lake, Zo "[lies] on the sand, feeling . . . the solar radiation cook both sides of her," "the sunlight hot on her exposed vulva" (Robinson, BM 458, 459). During her sexual encounter with Sax she thinks of the light as "the sun's hot rain" (Robinson, BM 459). This conception of the light also contrasts with Sax's particulate "flakes of light," for while rain is composed of individual particles (droplets), they form a coherent whole in Zo's conception (a "rain"). Where Sax sees the light as fractured flakes which are easily dispersed, Zo sees light as rain, the particles of which adhere as drops and come to soak every surface.

Since the scene is narrated from Zo's viewpoint there is little evidence of how Sax is affected by the sunlight. It is interesting that he is described as wearing "round sunglasses, like mirrors in his face" (Robinson, BM 458) through which he observes first plants and then lake mud. The sunglasses, which Zo clearly views as an anachronism, are interesting textual markers of Sax's conceptual paradigm. They distance him from, and filter out, the light whose string or particle nature makes him uncomfortable about his conceptual abilities. They also reflect the light away from his eyes and back onto the surrounding objects he is observing.

Despite the lack of access to Sax's consciousness in Zo's section of text, it is significant that Sax is at this point engaged in similar activities to the ones he pursued in the section concerning Bao. He observes first plants and then mud (both filtered through his sunglasses) as if attempting to come to an integrated conceptual framework taking into account macroscopic (plants, humans) and microscopic (bacteria or amoebas dwelling in the mud) levels of life. His observed (and vocally articulated) sexual desire for Zo can be seen as the locus of his interest in synthesizing a coherent paradigm out of several levels, the differences

between most of these levels being visually marked: the large physical stature of the Mars-born native relative to the stature of the earthborn Sax; the extreme youth of Zo and the extreme age of Sax; the biologically female and the biologically male; and even the differences between their two paradigms, which are marked by Zo's awareness of physical anachronisms associated with Sax.

The text of Zo's and Sax's interaction is rife with examples of the latter difference. Aside from his sunglasses Sax wears another anachronistic device, an "old wristpad [computer] that hung on his wrist like a manacle" (Robinson, BM 458). Freedom from the past and tradition is something that Zo apparently prizes and her conception of Sax's wristpad as a "manacle" is a sign of this. (Ann Clayborne also refers to Sax's wrist computer as his "manacle to spacetime," that is, what keeps him tied to the orderly universe. She makes him take it off in order to fully experience the Martian wilderness [Robinson, BM 609]).

Zo's feelings about the older earthborn people are clearly spelled out at the end of her interaction with Sax.

> Most of the ancient ones Zo had met seemed especially bound in the tightly warped spacetime of their values; and as the way people lived their values was in inverse proportion to how tightly they were bound in them, the old had ended up Tartuffes to a man, . . . hypocrites for whom she had no patience at all. She despised the old and their precious values. (Robinson, BM 462)

The metaphor of the values of the old as "tightly warped spacetime" is telling as it parallels Sax's and Bao's shared fascination both with gravity and superstring theory. It is as if Zo sees Sax's scientific paradigm as a constraining straitjacket which doesn't allow those who adhere to its values the freedom to live in the present. When Sax tells Zo that he is under the impression that all the "young natives were sociobiologists," Zo responds, "Oh no. Of course not. We're much freer than that" (Robinson, BM 457, 458).

But it is not only the anachronistic sunglasses and computer but anachronistic Sax himself, both as a historical figure whom Zo has read about in schoolbooks and as an old man whose "wizened" body marks him as having lived beyond his time, which separates Zo's and Sax's respective conceptual paradigms. From the moment she first sees him Zo is struck by the gravity of historicity that is attached to Sax. "[I]t was bizarre to have a figure out of the books saying hello to her, . . . the dead hand of the past still there living among them, perpetually dumbfounded by all the latest developments" (Robinson, BM 455). It is his age which Zo finds most compelling in Sax as a marker of his difference. Their sexual interaction has many descriptive markers concerning his physical anachronism. Zo conceives of Sax as a "farmer-tanned little bald wizened primate, like her image of Gandhi or *Homo habilis* . . . . [S]o ancient and small." When Sax touches her, Zo thinks of "a ,monkey's little hands on her skin, clever and knowing" (Robinson, BM 458, 459). She decides that it's "even a bit sexy how different" Sax is (Robinson, BM 458).

The tenor of Zo's thoughts is rife with discourses of evolutionary differences, as if she is hyperaware that she is a new species of creature in the presence of a member of a remote ancestral line. In fact, her thoughts are disturbingly similar to nineteenth century Western European and American discourses about the evolution of the "white race" (the supposed end point of evolution) which equated blacks, supposedly at the bottom of the racial hierarchy, with apes and monkeys while at the same time circulating contrasting discourses filled with suppressed sexual attraction to these "others." It is significant that while Sax is also attracted to Zo because of her difference from him, he doesn't view it in the same evolutionary terms as Zo. It seems as though he retains a bit of scientific detachment concerning her difference. After their sexual activity, Sax and Zo discuss the physical differences of the Martian natives.

He was looking at her body. "It's interesting how big people are getting . . . . Depth of

chests have grown greater, I read."

She laughed again. "The thin air, right?"

"Presumably. It's true in the Andes, anyway. The distances from spine to sternum in Andean natives are nearly twice as large as they are in people who live at sea level." (Robinson, BM 461)

When Zo attempts to impose her Mars-centered evolutionary framework on the subject, Sax emphatically resists. "He shook his head. 'It's phenotypic. If you raised your kids on Earth their chests would shrink right back down'" (Robinson, BM 461). It is interesting that from Zo's particular situated position in relation to Sax she views herself as much advanced over him and other "old ones," especially in her freedom from the bind of values and sociobiological and other outmoded scientific discourses. Yet clearly, she conceives of her superiority in the terms of just such an outmoded scientific discourse. It is surely more than coincidental that the section of the novel narrated from Zo's viewpoint (Part 11, "Viriditas") is the locus point for the meeting of Sax's musings on history (the material in this section's introduction on the historical paradigm of Charlotte Dorsa Brevia) and his growing awareness of the indefinite state of his memory. It is also significant that the point-of-view character is a future Martian native whose conceptual and experiential paradigm is partially composed by a historical scientific discourse.

It does seem to be through conversation with Zo that Sax first becomes aware of his "memory problems." Zo asks Sax about what her mother Jackie, whom Sax taught as a child, was like when she was younger. Throughout this conversation Sax's remarks are ambiguous and fractured. To several of Zo's questions he is forced to reply, "I don't know," which prompts her to respond,

"You aren't much help."

"No."

"Forgotten it all?"

"Not all. But what I remember is--hard to characterize . . . . And--I remember her crying once."

"Why? And don't say I don't know!"

This balked him. Finally he looked up at her, with a smile almost human. "She was sad. . . . Because her mother had left. Esther?"

"That's right."

"Kasei and Esther broke up, and Esther left for--I don't know. . . . And then she cried."

"What did you say to her?"

"I don't. . . . Nothing, I suppose. I didn't know what to say. Hmmm . . . ."

(Robinson, BM 457)

This passage has features which echo those of Sax's earlier "quantum moments" during his association with Bao. His answers are fragmented and inconclusive, much like his sense of the present and the very composition of the text in the earlier passage. His sense of time has become fluid and imprecise as well, even aside from his uncertain memory. This temporal blurring is signified by how history bleeds into the present in his memory of Jackie asking Sax about her grandfather John Boone, just as Zo now asks Sax about her mother (Robinson, BM 457). While Sax's experience during this portion of the text may be splintered and unmoored in time, Zo does not share this experience; the portion of the text during which Zo and Sax take their walk in the wilderness is fluid and unbroken, even during the description of their sexual activity. Zo's conceptual paradigm does not interfere with the cohesion of the reality she experiences, even when that reality occurs on multiple levels of perception.

Where Sax is confronted, in the figure of Bao, with an example of the possibility of a coherent paradigm that pulls together abstract, ordered scientific speculations and indeterminate experiential realities (while not denying the indeterminacy a presence and freedom within the abstract), in the character of Zo he comes up against someone whose paradigm is radically different from his, but who still has important things to say to him about the interactions of experience, memory and history. Bao's paradigm is more closely related to Sax's own because they share the basic discursive framework of science. Zo's paradigm is quite different from his, since she conceives of Mars in much different ways, without the benefit(?) of the contemporary scientific discourses: she instead uses a hodgepodge of discourses from the past. Yet both women are perceived of, by both Sax and by the text, as being "different" from him because of their gender and their agency, their refusal to be reduced to objects for his scientific (and aesthetic) observation.

Because this section of the novel is narrated by the "different" Zo, the text seems to invite the reader to compare her discursive and experiential realities with those of Sax. She appears to be both extremely "presentist," living in the moment and for the moment, and lacking a sophisticated and/or scientific paradigm of her past and her experiences. Sax, on the contrary, seems to lack an ability to (voluntarily) exist in the chaotic and indeterminate moment and, while lacking a solid scientific paradigm that would order "the past" as history, feels that he has a paradigm which serves him well otherwise. However, it is his lack of ability to keep control of the present moment and time/memory which he begins to recognize as the crux of a problem he later ties to the gerontological treatments and the "anamnestic" memory drug. The final part of his solution, and the end of both the trilogy and his journey of experiential revelation, are provided by his interactions late in the novel with his political nemesis (because of her anti-terraforming views concerning Mars) Ann Clayborne. His final interactions with her are set up in his association with Zo, when he asks Zo to take Ann to

Miranda. Uranus's moon, a "moon knocked apart in an impact, and then reassembled, moon and impactor together. It's an image I'd . . . like [Ann] to see" (Robinson, BM 460). That trip appears to build the foundations for the "jumping together" of Ann and himself which Sax alludes to here, though Zo does not live to see it.

4. The Dilemma of Quantum Memory

Sax clarifies his resolve to work on his memory problems, before his reunion and reconciliation with Ann, while sitting on a terrace and watching the sunset with Maya. He has just finished musing on the huge "structure" or "parthenon" of science during which he concludes that the reality of science, a series of interlocking complex models of various aspects of "reality" or "nature," is "more supple and various" than Thomas Kuhn's paradigms ("model[s] of modeling") (Robinson, BM 580). At this point, Sax recognizes that the more layers of abstraction used to filter (or "model") reality, and therefore to attempt to control that reality through the order of the "model," the less exact the accuracy of the description of that reality becomes Kuhn's theory of paradigms, by adding a further "model" layer to the "models" being used to describe reality, merely obstructs the description of reality even further Sax realizes that in science the most basic layer of abstraction is mathematics, which he calls the "language of the poem [i.e., science]," used because it "appeared to be the language of nature itself; there was no other way to explain the startling adherence of natural phenomena to mathematical expressions of great difficulty and subtlety" (Robinson, BM 579). Sax seems here to conveniently ignore his own earlier observation that certain "exotic" and "beautiful" mathematical constructs, such as string spin networks, may not necessarily adhere to any reality (Robinson, BM 372). Perhaps he has had time to fully appreciate Bao's faith that "[s]omething so beautiful as this has to be true"

(Robinson, BM 376), a sentiment that at least adheres to the experience of reality rather than multiple abstractions of it.

Despite his recognition of mathematics as a "language," abstract signs signifying completely different phenomena, Sax makes the usual move made by scientific discourses: he conflates the signifying system of mathematics with the reality it supposedly signifies: ". . . [I]n the end politics could not materially affect the structure [of science] itself, the mathematical edifice of their understanding of the phenomenal world. . . . Science was a social construct, but it was also and most importantly its own space, conforming to reality only; that was its beauty. Truth is beauty, as the poet had said, speaking of science" (Robinson, BM 581).

What Sax is admitting here is his desire to use science as a means of ordering reality. He envisions science as a solid, large stony edifice with very little room for change, while at the same time recognizing what seems to be the contrary view of science as "supple and various." Almost within a single thought he draws science as a "social construct" that has its own space, a space necessarily different from the "reality" it "conforms to" and conflates the two spaces into one space: "Truth" equals "science" equals "beauty." By this construction of science Sax papers over an indeterminate world, where the truth of any given situation is often hard to recognize, with a nice, neat and ordered almost-real (or "as-good-as-real") space where Truth is obvious. He then accepts the almost-real space of science as "truly" real, while repressing the real space behind the almost-real, since his science is incapable of controlling that reality.

Having constructed this space ("edifice") for himself, within which he feels "comfortable, capable," he nevertheless only feels "content" "on some levels" (Robinson, BM 581). He must almost immediately venture out into the indeterminate reality he was attempting to shield himself from. The problem seems to be in how vast and slow-moving (fixed?) the

"edifice" is in solving large problems. "But he began to understand that as beautiful and powerful as science was, the problem of biological senescence was perhaps too difficult. Not too difficult to be solved ever, nothing was that, but simply too difficult to be solved in his lifetime" (Robinson, BM 581).

Despite his repression of science's lack of flexibility and desire for ultimate control ("nothing was [too difficult to be solved]"), Sax realizes that to solve the large issue of why old people are dying in spite of years of gerontological treatments, science must refine its "understanding of matter, space and time" (Robinson, BM 581), problems he feels are too large for him to do anything about. "He was only mortal after all" (Robinson, BM 582). In other words, the edifice of science is too controlling and too fixed to be rebuilt (repaired) in time to be useful to him.

Thoughts of his own mortality seem to make him conclude that the "problem" of death will never be solved (in spite of his assertion just paragraphs before that nothing was "too difficult to be solved"). Perhaps death is too indeterminate a state to ever fit comfortably within Sax's almost-real space of science. "Postponements [for death], yes; solutions, no." Yet, even as an indeterminate phenomenon death must be accepted within the constructed space.

The intrusion of the indeterminate into the neat space of science leads Sax to a startling realization. In a sentence striking for its proximity to his assertion of his own mortality, he declares to Maya, "Reality itself is mortal," a statement which neatly collapses three separate (though stacked and interrelated) spaces into one: Sax and his personal experience of reality, the reality of science (the edifice must crumble eventually), and the reality beyond the reality of science. Maya, "absorbed in the sight of the sunset," fully in the all-too mortal moment of the senescence of light, replies simply, "Of course" (Robinson, BM 582). Sax, spurred both by his concern for Maya's major memory troubles and by his own "blank-outs" chooses to

focus on the "smaller" problem of memory, a problem that leads him directly into the realm of quantum indeterminacy and takes him ultimately to his complete awareness of the nature of "the moment," of time itself.

Sax must immerse himself in the scientific literature on memory research in order to understand the most recent theories about how memory works and where it is located in the brain. This reading gives him some interesting information about the construction of the brain which he had not been aware of before his research. While reviewing the history of twentieth century attempts to discover the location of memory sites (so-called "engrams") in the brain Sax comes across a description of an experiment using rats. ". . . [V]arious parts of rat's brains were removed after they learned a task, with no part of the brain proving essential; the frustrated experimenters concluded that memory was 'everywhere and nowhere'" (Robinson, BM 584). Sax understands that this "frustration" on the part of the experimenters led to the idea (he calls it an "analogy") that the brain works like a hologram, an idea which he considers to be "even sillier than all the other machine analogies [of brain function]" (Robinson, BM 584).

A hologram is a photograph created by a laser beam, that beam being a particular sort of emergent quantum system called a Bose-Einstein condensate (see Zohar and Marshall, Chapter 3, "A New Physics of the Mind" 65-90). The property of the hologram alluded to by the researchers Sax is reading is that the information of the entire photograph is contained in any and every portion of that photograph. That is, if a person had only one tiny section of the photograph, that section would contain information that would enable the person to recreate the whole photograph. This property originates in the emergent quantum nature of the laser beam that created the hologram. One of the current theories in neurology (as described by Zohar and Marshall) is that consciousness is, itself, evidence of the operation within the brain of a Bose-Einstein condensate; that is, the brain functions as an emergent quantum

system. In this model, consciousness, and its ability to integrate varied and disparate elements of sensual experience into a coherent whole, exists in a manner similar to the existing properties of a hologram; thus, memory is "everywhere and nowhere" in the brain.

Sax, while dismissing mechanistic paradigms for brain function, cannot quite integrate the quantum nature of memory, apparently confirmed by scientific experiments, with the idea of a "hologram analogy" of brain function. He again displays signs that he cannot fully appreciate differing levels of existence or reality. He is incapable of conceiving that the hologram analogy may be an analogy based, not on the crude level of surface resemblances, but rather on the idea that the brain may be an emergent quantum system, like a laser beam, which takes a holographic photo of reality and pieces it together as "consciousness." He may in fact feel motivated to dismiss this idea simply because it is an analogy, rather than his preferred "homologies." While Sax is never described as consciously coming to accept the validity of a "holographic" conception of the human brain, the text's description of the quantum "weirdness" associated with people's memories of the same event, and the eventual relationship forged by Ann and Sax, with its quantum characteristics, give evidence that the brain, the source of human consciousness, is to be considered as quantum in nature.

Sax's research certainly shows signs that consciousness and memory are a quantum system. He discovers that research indicates the "engram" may exist on a smaller level in the brain than the neuron, perhaps on the level of "dimers," proteins that help create the external structure of neurons. He notes that dimers "[exist] in two different configurations, depending on their electrical polarization. So the dimers represented a possible on-off switch of the hoped-for engram" (Robinson, BM 584). Yet, if this is the case, there is a problem in relating, for example, one engram to one dimer. The dimers are "so small that the electrical state of each dimer was influenced by the dimers around it" (Robinson, BM 584); thus each individual dimer operates as part of a larger coherent system that potentially connects all

parts of the brain in a common network of consciousness. This is a primary characteristic of such Bose-Einstein condensates as superfluids and superconductors, and even Sax has to come to the conclusion that there is something quantum going on.

> . . . [C]ontained inside the dimer columns were tiny threads of water in an ordered state, a state called vicinal water, and this vicinal water was capable of conveying quantum-coherent oscillations for the length of the tubule. . . .
>
> . . . So now the best current model had it that memories were encoded (somehow) as standing patterns of quantum-coherent oscillations, set up by changes in the microtubules and their constituent parts, all working in patterns inside the neurons. (Robinson, BM 584-585)

Quite suddenly Sax comes up against two things which gave him trouble in his conversations with Bao: quantum indeterminacy and the interactions of different levels of reality. From the quantum oscillations of the vicinal water at the lowest level science can yet measure to the dimers to the neurons, all the levels are integrating into an emergent system the sum of whose parts is greater than the whole of those parts, a true quantum system. Sax even links the brain activities explicitly to Bao's work on quantum particles as superstrings: "some [researchers] saw signs that the oscillations were structured in the kind of spin-network patterns that Bao's work described, in knotted nodes and networks that Sax found eerily reminiscent of the palace-of-memory plan" (Robinson, BM 585). The "palace-of-memory," a memorization technique in which each item memorized is visualized as being placed in a different location within a building, signifies that Sax is finally beginning to be capable of conceptualizing the level of quantum activity in terms with which he is familiar.

So, for the most part, this heavy-duty research Sax has been engaged in has still been set within the almost-real, self-constructed space where he is comfortable. But the space, so ordered and determinate in Sax's mind, begins to unravel once Sax realizes he will have to

deal with quantum effects. "So, not only was there simply more going on [in the brain than researchers had thought], but it was also happening at such fine levels that quantum effects were certainly involved. . . . [T]his meant that all the counterintuitive phenomena and sheer paradox of quantum reality were an integral part of consciousness" (Robinson, BM 585). Again Sax virtually contradicts his assertion that nothing is impossible for science to discover when he decides that he is "not greatly surprised" by the appearance of quantum phenomena in the brain, as he had always felt that the mind was something "science could scarcely investigate" (Robinson, BM 586)

In a paragraph whose awkwardness seems to emphasize Sax's discomfort with indeterminacy (Robinson, BM 586) he goes back and forth between his faith in science and his belief that science has not fully accepted (three hundred years after the discovery of quantum phenomena) the implications of quantum physics. "[S]cience had learned," this paragraph begins, that quantum phenomena were "outrageous at the level of human senses and ordinary experience." Science backs up Sax's inability to bridge conceptual levels of reality. But then his uncertainty about science's capabilities manifests itself. "They had had three hundred years to get used to [quantum phenomena], and eventually they had to somehow incorporate this knowledge into their worldviews, and forge on." This uncertainty undermines the statements directly following it ("Sax would have . . . said that he was comfortable with the familiar quantum paradoxes;" quantum phenomena are "at least . . . quantifiable") turning them into testimonials of science's inability to adequately deal with these phenomena. The foundation of Sax's firm "structure" (science) is shakier than he can explicitly (consciously?) admit, as if the builders of the hyperordered ramparts (Sax among them) had never been forced to look into the basement (the microlevels of reality) and see how indeterminate and chaotic the darkness "down there" really is. Instead of adapting that uncertainty into their construction scheme, scientists chose to repress that knowledge. Sax,

however. is finally coming to understand that he must deal with it in order for the building to continue growing, let alone remain standing.

Part of science's problem with quantum discourse is that discourse's heavily subjective nature, and as a quantum phenomenon, Sax realizes, memory is heavily subjective and prone to be influenced by lived experience. He is (paradoxically) able to accept this as part of his memory hypothesis because, even though science desires to retain objectivity and control, this particular quantum effect provides an explanation for why the brain more easily retains vivid memories: "Thus the emotional charge of an event had much to do with how fully it was laid out in the memory. Things happened, and the consciousness witnessed or experienced them, and inevitably a great deal of this experience changed the brain, and became part of it forever" (Robinson, BM 586). Reality in the memories of individuals is highly subjective, not subject to scientific objectivity, yet explainable by a scientific discourse that science itself cannot fully integrate. At very basic levels of reality, Sax begins to recognize, indeterminacy reigns and shapes macrolevel reality.

Sax at last has read up on the field enough to come to some basic conclusions about memory loss in people whose lives have been artificially extended by the gerontological treatment. He concludes that senescence at the quantum level in the brain is fundamentally tied to entropy and the effects of chaos. ". . . [A]fter about 150 years of [memory] storage, experiments suggested, the [memory] pattern [physically structured in the brain] began to degrade more and more rapidly, due apparently to the accumulated quantum effects of free radicals collecting randomly in the brain" (Robinson, BM 587). Sax makes an entropic connection to blindness: "[Senescent memory loss] was probably about as clocklike, Sax thought glumly, as the thermodynamic clouding of the lens of the eye" (Robinson, BM 587). Sax is still resistant to Spencer's "interesting cosmological notion" (Robinson, BM 371) that all order (most especially human life, the most complexly arranged order in the universe) is

really just differential entropic layerings of chaos. The thought of chaos makes Sax "glum," and his subtle conceptual intermingling of the construction of memory, from the only-briefly-mentioned diffuse "network," to the "ordered patterns" with which he becomes obsessed highlight his desire to repress and deny the chaotic nature of reality, as well as that chaos's collusion with indeterminacy ("quantum effects of free radicals collecting randomly") in causing his own memory problems.

This repression and denial of chaos leads Sax to a dramatic conclusion.

> . . . [T]he mind-body connection was so strong--so strong that the distinction itself was probably false, a vestige of Cartesian metaphysics or earlier religious views of the soul. Mind was one's body's life. Memory was mind. And so, by a simple transitive equation, memory equaled life. So that with memory gone, life was gone. . . .
>
> [People] had to remember to be truly alive. (Robinson, BM 588)

The logic, on first examination, appears to be sound, and yet this conclusion is refuted in at least two places in the text: in the experience of Maya Toitovna which I will examine in the next chapter, and in the near-death experience of Ann Clayborne in the very last section of the novel, which I will describe at the end of this chapter. If Sax's conclusion is incorrect, or at least only partially correct, where is the flaw in his logic? It would appear to be at the point where he conflates "memory" with "mind;" this equation underemphasizes the role of present experience in "living" and is a direct result of Sax's desire for order and repression of chaos and indeterminacy. As I have argued, Sax's experience of the "present" moment becomes fractured, indeterminate and timeless at several points in the text, usually when he is in the Martian wilderness with a female companion examining the local flora. This fracturing of Sax's experience seems to be related to his realization that the women he is with are "other" than himself, with their own talents, ideas and conceptions of physical reality. They are different and, therefore, his experience of them necessarily has a large

indeterminate, if not chaotic, element to it. In attempting to resolve the discomfort he feels about this, Sax attempts to take his cue from his appreciation of "nature," and to transform the women into aesthetic objects which at once reasserts a measure of control in his experience while appearing to make them "wild" and "beautiful" objects of appreciation. Again suppressing his discomfort with Spencer's theory of all reality being entropic, Sax links Bao and Zo with the living Mars he has helped create out of the dead entropic state it was in before his arrival. Unfortunately, the suppression of the agency of his aestheticized "objects" and the suppression of the reality of chaos causes his experience to fracture in ways he cannot comprehend until his memory research. Thus the full impact of the linkage of "women" and "planet/nature" won't be driven home to Sax until his reunion with Ann Clayborne, as I will describe in a moment. I would argue that Sax's emphasis on memory, the ordered pattern of his past experiences, in preference to his often chaotic and indeterminate present experience causes him to overemphasize the role of memory in being alive and, by overgeneralizing, thus to attempt to impose a definition of life which the text ultimately reveals as false or incomplete.

The text does indicate that Sax finally begins to integrate and understand all the lessons he has received about the indeterminate nature of reality (and, contrary to his expectations, memory) and of the value and validity of conceptual frameworks different from his rather narrow scientific and macroscopic one. The locus moment for this integration of lessons is the comparison, by Sax and Ann, of a mutual memory while under the influence of the anamnestic drug Sax has devised. The memory is of a private conversation between Sax and Ann during their Antarctic training for the Martian colonization mission. Sax remembers, "We sat there and I thought we were getting on and I took your hand but you pulled it away, you didn't like it. I felt, I felt bad. We went back separately and didn't talk again like that, in that way, not ever" (Robinson, BM 626).

Ann, however, remembers things differently. "Yes, [I remember]. . . . But that wasn't what happened. . . . It was me. I mean, I put my hand on your shoulder, I liked you, it seemed like we might become . . . but you jumped! Ha, you jumped like I had shocked you with a cattle prod. . . . [N]o. It was you. You didn't--it wasn't your kind of thing, I figured (Robinson, BM 627). Sax is shocked by the difference in their memories of the same event. His memory is so clear: "He could still see in his mental theater that awkward instant, . . . the whole thing clear almost word for word, move for move" (Robinson, BM 627). "But Ann's hand *had* jerked away from him, a somatic memory just as solidly real, just as physical, a kinetic event remembered in his body, in the pattern of cells for as long as he should live" (Robinson, BM 628).

Despite the solidity of his memory, the fixed "pattern of [his] cells," however, he can see that Ann is telling the truth and remembering just as solidly as he. "But there was that look on Ann's face as she recalled the incident, that look of someone in full possession of a moment of her past, alive with the upwelling--clearly she remembered it too--and yet remembered something different than he had. One of them had to be wrong, didn't they? Didn't they?" (Robinson, BM 627). Here is where Sax begins to comprehend that, although he "would have . . . said that he was comfortable with the familiar quantum paradoxes," that he "had to somehow incorporate [quantum] knowledge into [his] worldview" (Robinson, BM 586), he has not even begun to understand and integrate the implications of quantum memory. The "solid," "kinetic" yet differing memories of an event he shares in common with Ann lead to this ambiguous sentence: "That one [memory] had to be true; they both had to be true" (Robinson, BM 628). The ambiguity of this statement arises from its position in the flow of Sax's thought processes in the text. Directly before his comprehension that Ann's memory had been as solid as his own, Sax had been thinking about another memory held in the "pattern of [the] cells" of his body, the memory of Hiroko (one of the First

Hundred scientists on Mars, long missing and presumed dead) pulling him to safety out of a snow storm. Although no one believes him when he relates this event, and Hiroko does not appear again in the text to confirm that she did perform this action, Sax has a clear and vivid memory of her hand tightly gripping (and bruising) his wrist. Following his recall of this memory comes his reflections on the kinetic nature of Ann's memory of their common event. and then the sentence I quoted above. It is unclear whether that sentence refers to "both" Sax's memories or to "both" Sax's and Ann's memories of the same event. I would argue, however, that the sentence, in true quantum fashion, refers to both aspects at the same time. At this moment in the text Sax is fully under the influence of the anamnestic and his sense of the flow of time is about to be fractured by his realization of the quantum nature of memory (as I will describe shortly). He is about to realize how tenuous and indeterminate a thing reality really is, and it all starts with the ambiguity of the statement "they both had to be true." As Zohar and Marshall argue (41-47) a basic feature of ontology for quantum phenomena is the (fractured) duality of the phenomenon (e.g., wave/particle). Sax's statement, the beginning of an uncomfortably indeterminate train of thought, is such a fractured textual phenomenon, applying equally to both his two memories and his and Ann's memories.

Sax's recognition that there are a multiplicity of "truths" existing simultaneously, that is, of the extremely subjective nature of "objective" reality greatly disturbs him, at first because of the doubt it casts on *his* truth. ". . . [T]here was . . . no way to be sure what had really happened. . . . If he could not trust these upwelling memories to be true--if one so crucial as this one [memory about Ann] was now cast in doubt--what then of the others? . . ." (Robinson, BM 627). His moment of realization about the truth of "both" memories, however, seems to be the shift point between his former "objective" and "ordered" conceptual paradigm of reality and a new paradigm which, like the Kuhnian "models of

modeling" composing Dorsa Brevia's telos of historico-economic epochs, is made up of a mix of new insights and fragments of the older paradigm, such as his aesthetic appreciation for "present" reality and his sense of purpose for his life. At first, of course, he does not know how to live with the implications of the new paradigm.

> So that was the past. There and not there. His whole life. If nothing was real but this moment, Planck instant after Planck instant, an unimaginably thin membrane of becoming between past and future--his life--what then was it, so thin, so without any tangible past or future: a blaze of color. A thread of thought lost in the act of thinking. Reality so tenuous, so barely there; was there nothing they could hold to? (Robinson. BM 628)

Here, again while conflating "reality" and "his life" as he earlier conflated "reality" and his own "mortality," Sax is finally consciously aware that his present (chaotic, fractured, indeterminate) is the only "solid" thing he has to hold on to. There is no such thing as objective memory or history, and thus no objective past and no determinate basis on which to build a determinate future. The foundations of the almost-real scientific "reality" Sax had earlier created have crumbled and thus his relationship with other people has changed. During a silence in their conversation Sax experiences the nature of this change. "Awkward instant. Another awkward instant. This was life with the other; one awkward instant after the next. He would have to get used to it, somehow" (Robinson, BM 629). If there is "nothing for [them] to hold to," Sax at first attempts to shoulder the responsibility for creating a shared present by himself. "He would have to get used to it." However, his comprehension of subjectivity will change yet again as he realizes that the key to interacting with the "other" is to mutually construct a community from which it is possible to initiate common action.

The awareness that reality is subjective, different for different people, means that Sax can no longer assume that reality (and therefore other people) are the same as he. People are different and have different interpretations and reactions than he does, thus his recognition of Ann as a person "other" than himself who possesses her own agency (just as she possesses a different memory than Sax's). When Sax first finds Ann while they are both under the influence of the anamnestic he conceives of Ann and Mars as "all intertwined" (Robinson, BM 626), as objects to be acted upon, as materials with which to create an aesthetic object. In the case of Mars Sax created a living planet whose breathable atmosphere (Sax's creation) is a "blue sign of their [scientists'?; humanity's?] power and their responsibility, their place in the cosmos and their power within it" (Robinson, BM 626). Yet Ann had never acknowledged that Sax's arrogant and grandiose creation meant to her what he evidently felt it meant for all humanity. She can only see his meddling with the original planet as a violation, which Sax at last recognizes and tries to apologize for. "I didn't see the . . . beauty until it was too late," he tells her (Robinson, BM 626). Sax had assumed that if he could only argue and push Ann far enough she would see the "objective" truth of what he had done; his arguments could act upon her (a being made subject to his "objectivity," and therefore lacking agency) to bring them together on his own objective terms (like the metaphor, ominous in this light, of Miranda, Uranus's moon, which Sax discusses with Zo: "[a] moon knocked apart in an impact, and then reassembled, moon and impactor together" [Robinson, BM 460]). This is the direct, contextualized end result of a philosophy of science, like Edward O. Wilson's, which refuses to take into account indeterminacy and chaos: an imperialist force which robs its objects of agency and violates them.

Sax's actions toward Ann after recognizing her as an "other" reveal the extent of the change in his understanding of her and her "other" conceptual framework. "He stepped back. He reached out and held her hand, squeezed it hard. Then let go" (Robinson, BM

629). Sax first steps back providing Ann her own space, her own truth, but not far enough for complete separation and further objectification; he can still touch her. He doesn't "take" her hand, but "reache[s]" out to hold it, as an equal, another person. He communicates his joy at their reconciliation (a kinetic memory he experiences in the "tenuous" present of her hug: "[y]ou will remember this forever, he thought" [Robinson, BM 628]) by a kinetic present action, a hard "squeeze" of Ann's hand. Finally, he does not attempt to further conquer her reason or her agency: instead he "let[s] go" of her hand. Where only moments before Sax had desperately wished for something to "hold to," for something he could order and therefore control, he is now able to "let go," allowing indeterminacy and perhaps (subjective) chaos to exist in his relationship with another person. He is able to enter into a true dialogue with an "other," which becomes the key to resolving the growing tensions between Mars and Earth at the end of Robinson's trilogy.

The dialogue between Sax and Ann allows them to understand, accept, and assume the viewpoints of the other. In a public address to the people of Mars and Earth, Ann takes Sax's position (growing human populations on Mars are inevitable and not entirely a bad thing) while Sax takes Ann's position (the biospheric and "natural" states of the planets must be maintained as much as possible). The shock resulting from this apparent double reversal of the two most famous antagonists in Martian history causes a negotiation of more equitable treaties between the two planets (see Robinson, BM 656-657). Sax, by changing his conceptions of science and objective truth, is able to enter into what Zohar and Marshall call a "quantum" relationship, one in which both Sax and Ann retain their identities as individuals while being able to link together into an emergent quantum system through dialogue, thus increasing their effectiveness as a social force (see Zohar and Marshall, 191-194; they use the model of a benzene ring, individual molecules sharing electrons in common, as a metaphor for the form and possibilities of a quantum relationship with others).

But at the moment in the text which opens up these new possibilities for Sax, it is enough for him to let Ann go, giving himself time to become acclimated to his new way of looking at reality. As the remaining First Hundred are coming down from the effects of the anamnestic, under the watchful and caring eyes of Maya, Sax feels a great sense of peace and accomplishment, a joy at being fully in the present moment, yet also needing to fortify himself for the trying times ahead. He thinks drowsy thoughts: "Sleep, memory, sleep, body; fall thankfully into the moment, and dream" (Robinson, BM 632).

5. Uneasily Fractured Subjectivity

Ann is the perfect person to help initiate Sax's paradigm shift because she holds a very nearly antithetical position to Sax on the purpose of science and the nature of reality. When Sax is reliving his memory of the conversation with Ann in Antarctica, he very briefly touches on the subject of their argument on that occasion: "it's a net gain in order, he had said, trying to explain the purpose of science; and she had said, for that you would destroy the entire face of a planet. He remembered it" (Robinson, BM 627). Yet despite that last little sentence, he has not remembered it until this point in the text, and then he promptly buries it again, never mentioning it afterward. His memory of that argument provides a telling insight into Ann's position which has been lacking throughout the entire trilogy.

When Sax argues emphatically for science as a tool against an entropic reality, as a "net gain in order," Ann can only too clearly see that he wishes science to accomplish this by objectifying, and removing agency from, an entire planet. Seen in this way, it is clear that Ann's bitter fight to maintain a Mars unchanged from its condition before the arrival of humans is not a celebration of a "dead world," an attitude which others have accused her of holding during the course of the trilogy and which Sax attempts to combat by showing her the "beauty" of the living planet Mars. Rather, what Ann wishes to celebrate is the

complexity, agency and indeterminacy of Mars in the present moment of humanity's encounter with the planet. She does not want to "order" Mars; she knows it is ordered in its own way already.

It is implied in the text that Ann's attitudes on these subjects are influenced by her own experience of reality from a fractured subjectivity, perhaps caused at this point in her life by neurological problems suffered in common with many older people who have taken the gerontological treatments. Ann's fractured subjectivity is first revealed in the text when Sax approaches her with the intention of persuading her to participate in the anamnestic experiment with the remaining First Hundred. As they hike in a non-terraformed "wilderness" area of Mars, she tells him of her increasing awareness of her own chaotic subjectivity.

> [Ann said,] "I've forgotten my whole self. I think there's someone else in me now. In partway. A kind of opposite. My shadow, or the shadow of my shadow. Seeded and growing inside me."
>
> "How do you mean?" Sax asked apprehensively.
>
> "An opposite. She thinks just what I wouldn't have thought. . . . I call her Counter-Ann."
>
> "And how would you--characterize her?""
>
> "She is . . . I don't know. Emotional. Sentimental. Stupid. Cries at the sight of a flower. Feels that everyone is doing their best. Crap like that."
>
> "You weren't like that before, at all?"
>
> "No no no. It's all crap. But I feel it as though it's real. So . . . now there's Ann and Counter-Ann. And . . . maybe a third."
>
> "A third?"
>
> "I think so. Something that isn't either of the other two."

"And what do you--I mean, do you call that one anything?"

"No. She doesn't have a name. She's elusive. Younger. Fewer ideas about things, and those ideas are--strange. Not Ann or Counter-Ann. Somewhat like that Zo, did you know her?" (Robinson, BM 610-611)

While Ann gains a great deal of understanding of the negative effects of attempting to force an objective order on experiential reality, she is not entirely comfortable with the apparatus that gives her that understanding, that is, her experience of a fractured identity. She is particularly uncomfortable with her nameless "elusive" third personality, and in the final section of Blue Mars, narrated from Ann's perspective, the text gives some indications that this third self is related to a traumatic personal event in her childhood. During the session with the anamnestic, she "[n]ever once thought of Earth," in an attempt to deny reinforcement of her memories of Earth and thus allow them to decay and be utterly forgotten. Ann conceives of forgetting her time on Earth, essentially repressing it, as "a trick she had gotten good at, the single-mindedness of the great refuser, a kind of strength" (Robinson, BM 664). The indication that she has been repressing these memories for a long time, and that she finds empowerment through this severe repression, indicates that the event in her past may have something to do with the forced denial of her agency over her own body, or self. Ann wishes to forget her time on Earth in order to re-consolidate her fractured self, or rather, as she conceives of it, to become a new self. "So she was a new Ann now. Not the Counter-Ann, not even that shadowy third person who had haunted her for so long. A new Ann." Then comes her most explicit statement of what she is attempting to forget. "And if there was a Terran Ann still in there, cowering in a lost quantum closet of her own, that was life" (Robinson, BM 665). The new Ann is determined not to allow her agency to be suppressed again, to avoid having to "cower" in a "closet."

Yet the new Ann also believes in balance and compromise. She has come to think of her sexual relationship with Sax as constituting a "communal body" (Robinson, BM 663), that is, individuals sharing bodies in a free and balanced system. Of her memories, Ann thinks, "A balance had to be kept. And here, now, she was the Martian Ann, . . . in the moment and the only moment" (Robinson, BM 665). Ann, while helping Sax to shift his conceptual paradigms, has also enabled herself to reach the same sort of quantum paradigm he has. She knows she must keep a balance between herself and others, between Mars and Earth, and between the "tenuous" reality of the moment and the weight of the past.

Finally, in the last pages of the novel, the text reveals just how such an emergent quantum outlook can benefit Ann. Ann is on the beach with the children of some friends, with Sax and Maya nearby, when she begins to get the symptoms of the "quick decline," the sudden onset of death which strikes very old people who have taken the gerontological treatment to extend their lifespans. One of the symptoms is a wild heart arrhythmia which Ann thinks of in significant terms. "Her heart pounded madly in her chest, like a child trying to get out of a black closet" (Robinson, BM 669). It is the past Ann has been trying to forget that is killing her, attempting to reassert its authority over her very life and to deny her agency. She attempts to say "No," and attributes that statement to the "new Ann, no doubt, but there was no time for that, Ann herself squeaked 'No'" (Robinson, BM 669). While the past crowds up in her, destroying her, Ann in effect balances out its effects by focusing solely on this moment, the moment of her quick decline. She "has no time" for the model of her self she has recently built, the "new Ann," she can only be "Ann herself." Her intense focus on the moment "by will alone" (Robinson, BM 669) allows her to survive the quick decline, which rapidly recedes.

So, contrary to Sax's fears when setting out to develop the memory drug, "memory [does not necessarily] equal life" (Robinson, BM 588) but it can sometimes equal death. Ann

understands that, rather than "[having] to remember to be truly alive," she must strive to forget, to undermine the solidity of the body's memories, to fully acknowledge the subjective, empowering, constructed nature of memory and balance it with living in a free, indeterminate present moment. Her understanding allows her to escape her past and to live free, triumphant in the moment, the final words echoing the solid beat of her heart, "walk[ing] over the sand toward her friends, in the wind, on Mars, on Mars, on Mars, on Mars, on Mars" (Robinson, BM 671).

In the character and experiences of Ann Clayborne the text offers a contrast to Sax's understanding of subjectivity as based in memories of the past, both personal and collective (i.e., histories). Ann serves as a balance in the polarity of conceptions of subjectivity created by Sax, in his pre-quantum understanding of memory (the massive edifice of science, "memory equals life"), and Maya Toitovna whose conception of subjectivity is entirely based on present experience and who resists the urge to succumb to ossified structures of past memory. Ultimately, Robinson's text endorses Ann's (and Sax's) final schema for interacting with the present moment as the only way experience of reality can remain fluid while still maintaining enough structure in life to allow necessary political agency.

CHAPTER 4: A CHAOS OF SELVES: MAYA'S MEMORY

Late in Kim Stanley Robinson's Mars trilogy Maya Toitovna goes diving in "the drowned world of lost time, the city she had loved so much" (Robinson, Blue Mars 495; cited hereafter as BM), the city of Burroughs, locus of so many of her conflicted and hazy memories. The dikes surrounding the city had been destroyed at the end of the previous novel during the Second Martian Rebellion against the metanational corporations of Earth, allowing the surrounding waters of the Isidis Bay to "drown" Burroughs. Several decades later the spot is a popular tourist site. Maya's lover Michel theorizes that the water's preservation of the submerged cityscape could provide a convenient space for Maya to explore her troubled memory and come to some sort of peace with her past and herself. This spatialization of memory, or topology of the past, allows Maya to "float . . . over the [city] like a ghost" and spy upon events which she has been repressing for decades. At the time of her dive, Maya appreciates the rigidity and order this experience imposes on her memories of the past, but within a few pages she comes to recognize the conflicts her watery excavation creates within her self/selves. Her fragmented subjectivity and her experiences of the present, fractured by her memories, cause her to reject a rigid structuring of reality in favor of an open-ended, indeterminate existence within the present moment.

The memory/place Maya is drawn to is one which she has dwelt upon/in at several points during her life, experiencing a certain past event with many different "selves" (she herself expresses this idea, as I will discuss in a moment). As she floats through the water above the city, she uses various topological markers, registering other significant memories, to guide her to this particular memory site: a "sidewalk café." "[Maya] swam back up the length of Canal Park. . . . Again she spotted the row of salt columns. . . . There beyond the columns was a row of buildings. The buildings were the anchoring point for a line of kelp. . . . There had been a café in the front of that end building. . . . The last salt column served as a marker, and Maya was sure of her identification" (Robinson, BM 496). It is this spatialized frozen

moment of past-time where "a hundred and twenty years later" (Robinson, BM 497) Maya floats and remembers yet another version of an argument she had with Frank Chalmers, her former antagonist/lover, which has proven to be a pivotal event in her life. Time (memory) and Maya's subjectivity are entangled at the site of her conflict with, and search for, the "real" Frank Chalmers, an entanglement which allows her access, earlier than any other character in the trilogy, to insights about the relationships between a chaotic and indeterminate present reality, memory, and subjectivity.

The memory of the past event which draws Maya back, physically and mentally, to the site of the café concerns an argument she had with Frank Chalmers and a broken coffee cup. In Red Mars, the first time in the trilogy this scene is narrated, the action is told from the point-of-view of Frank. After an argument from which Frank has stormed away, Maya tracks him to a sidewalk café where he sits drinking coffee and confronts him.

> "What do you mean by this?" she said. She gestured at the table, at his own annoyed scowl. "What is wrong now?"
>
> He stared at his coffee cup, looked up at her, then back down at the cup. It was impossible. A sentence was pronouncing itself in his mind, each word equally weighted: I killed John.
>
> "Nothing's wrong," he said. "What do you mean?" . . .
>
> "Look," she said slowly. "I don't care what happened in the past." She stopped speaking, and he risked a glance at her; she was staring down, looking inward. "What happened in the *Ares*, I mean, or in Underhill. Or any of it."
>
> . . . Did she know? Did she know what he had done . . . ? It was impossible, or she would not have been here (would she?); but she ought to have known.
>
> "Do you understand?" she asked.
>
> He hadn't heard what she was referring to. He continued to stare at his coffee cup, and suddenly she slapped it away with the back of her hand. It clattered under a

> nearby table and broke. The white ceramic semicircle of the handle spun on the ground. (Robinson, RM 419-420)

The tension between Frank and Maya leading up to the scene in the sidewalk café is linked to a difference between Frank's conception of the "self" as paralyzed and unchanging over time, and Maya's conception of the "self" as shifting radically across different temporal contexts.

Frank Chalmers first enters the text near the beginning of the trilogy as he makes arrangements to have his friend (and rival for the affections of Maya) John Boone murdered. While listening to John make "the usual Boone Inspirational Address" at the dedication of the first tent city on Mars, Frank reflects that the trip to Mars, far from "changing" those who had gone there (as John claims in his speech), had instead made them "more like themselves than ever, stripped [them] of habits until they were left with nothing but the naked raw material of their selves" (Robinson, Red Mars 4; cited hereafter as RM). Shortly after his endorsement of a belief in the existence of "naked, raw . . . selves," Frank begins preparing the mechanics of his plan for the assassination of John. One of the things Frank does is to acquire a mask, "a black face studded with red paste gems. He put [the mask] on" (Robinson, RM 12). The purpose of the mask is to enable Frank to blend in with the celebrants at the dedication festivities, in a word, to acquire anonymity; he recognizes that everyone wears a mask, an insight he elaborates on a few years later in his conflict with Maya.

Yet the mask also achieves another effect for Frank, that of hiding his true intentions (his "naked" self) from others, especially the target of his plot, John Boone.

> [John] saw Chalmers approaching and waved, recognizing him despite the mask. That was how the first hundred [scientists to land on Mars] knew each other . . .
>
> "Hey, Frank," he said. "You look like you're having a good time."
>
> "I am," Frank said through his mask. "I love cities like this, don't you? A mixed-

species flock. It shows you what a diverse collection of cultures Mars is." (Robinson. RM 14)

The references to his mask reveal Frank's hyper-conscious awareness of it and the role it is serving in his exchange with John. His awareness highlights his belief that he possesses an essential "naked self" which he needs to clothe. His remarks about the city and its mix of cultures also gives some insight into his political motivations behind his assassination of John and his later championing of a compromise treaty between Earth and Mars; he believes that cultures, like people, have some essential identity which is never missing even when being "mixed" in this particular Martian city. Significantly, John is not described as wearing a mask, not even a mask covering his "naked" self. "John's smile was easy. His eyes shifted as he surveyed the boulevard below" (Robinson, RM 14). All Frank recognizes in John is his "old friend," who reveals nothing of the malice toward other cultures Frank attributes to him. Also, John thinks he is able to recognize that Frank is "having a good time," and thus is taken in by Frank's material mask, or perhaps does not see the relevance of the mask, ignoring it and accepting the nonmaterial mask Frank has used to shield himself.

The fear Frank has that others can penetrate through his masks to his core self, and his inability to apply his "mask theory" of identity to others, exacerbates his conflict with Maya in the years following John's death. During his efforts to hammer out an immigration treaty between Earth and Mars, Frank and Maya become reunited as lovers, an occurrence that inflames his guilt over his role in the death of John, Maya's other lover. Frank translates that guilt into rage against Maya who is "so stupid," "so easy to deceive" (Robinson, RM 361). His rage is sparked because he cannot align his perception of her as a "real" and "insightful" person with her apparent lack of knowledge about his role in John's death. It is shortly after their first sexual encounter after their reunion that Frank first notices Maya's "gaze that seem[s] so insightful." He is afraid that she can penetrate through his masks and discover his guilt.

> [S]uddenly he felt not only naked, but exposed. He pulled the remaining sheet up over his hip, then felt that he had given himself away. Surely she would see. . . . He blinked, returned her smile. He knew it was a wan and crooked smile, but feeling his face like a stiff mask over his real flesh he took comfort. No one could accurately read emotions from facial expressions. . . . So he was safe. (Robinson, RM 360)

And indeed she doesn't see "right through him," she appears to enjoy his company, to care about him, and Frank finds this "intolerable. That it should be so easy to deceive even the people who knew you best . . . that she should be so stupid. . . ." (Robinson, RM 361).

This insight, that Frank has essentially gotten away with murder and come up with the object of his desire, leads to the first explicit articulation of his theory of identity.

> How hidden the true self is, he thought, under the phenomenological mask. In reality they were all actors *all the time*, playing their video parts, and there was no chance of contact with the true selves inside others, not anymore; over the long years their parts had hardened into shells and the selves inside had atrophied, or wandered off and gotten lost. And now they were all hollow. (Robinson, RM 361; original emphasis)

His theory is immediately problematized by his perception of Maya. "Or maybe it was just him. Because she seemed so real! . . . A true self, didn't it have to be so? Didn't it? He could hardly believe otherwise. A true self" (Robinson, RM 361). At its most basic, Frank's rage is really despair that everyone else he knows seems to have a real self while he himself is merely a set of ossified masks covering nothing. Without a self, like Sax's anxiety over the lack of an "objective" memory, he has nothing to hold to. The only thing at Frank's core is his guilt about John's death.

In an argument shortly after Frank's realization Maya seems to provide him with confirmation that he is, indeed, a hollow mask. He is once again "furious at her stupidity, to be so ignorant of him, so vulnerable to him, when it was all an act anyway" (Robinson, RM 362). Yet she seems not to be taken in at all. "She was dressed, standing at the door. She

stopped to glare at him. . . . [H]e stood there naked before her, exposed to the full blast of her scorn. 'You don't have any feelings, do you. I've tried, believe me, but you just--' She shuddered, apparently unable to think of words vile enough to describe him. Hollow, he wanted to say. Empty. An act" (Robinson, RM 363). Curiously, Maya's accusation that Frank lacks feeling is echoed 120 years later during Maya's dive, except that at that time it is Maya herself who is "numb" (Robinson, BM 496), who literally dives into the ossified past (dead Burroughs rather than Frank's dead masks) in order to feel once more. Frank and Maya part ways after her denunciation of his self and it is not until several months later that they reunite once more and have the argument in the sidewalk café that becomes the spatial/temporal locus for Maya's memory and subjectivity crises.

After their reunion Frank feels stifled by the fact that Maya does not seem to have changed, that she still seems to love him despite what Frank feels she should know about him (his memory is quite selective, not at all the stable ordered set of masks he believes it to be). It is at this point in the text that the first narration of the breaking of the coffee cup occurs, and it is that moment of time which becomes fixed in Maya's memory (although imperfectly) and replayed over and over while the rest of the argument, even who she was arguing with or where exactly it happened, become nebulous. It is the past shared in common by Maya and Frank that is the problem in this first café scene, a past that becomes ossified and ordered and thus continues as a major problem for Maya's memory.

Frank's lack of response opens a space in the text for her to articulate her own theory of subjectivity, similar to Frank's in that there is no place for a fixed self, but different in her valence of that idea and in how she and Frank consequently read and interpret the presence of the past in the present moment. She tells him, "You think I care. . . . As if I would care more about then than now. . . . It was thirty years ago [that we had our first romantic problems]. . . . I am not that Maya Katarina Toitovna. I don't know her, I don't know what she thought or felt, or why. . . . It doesn't matter to me now. I have no feeling for it. Now I

am here, and this is me" (Robinson, RM 420). For Maya, subjectivities shift with time, do not remain stable over years. She has enough insight to know that most of the past, because of selective memories, is unavailable to the present self in its engagement with the current experience, and so she places no value on the past. She "doesn't care what happened in the past" because she cannot know what happened for certain; she accepts indeterminacy.

Frank cannot accept the out she offers him, however.

> Suddenly he was afraid; they *were* their pasts, they had to be or they were nothing at all, and whatever they felt or thought or said in the present was nothing more than an echo of the past; and so when they said what they said, how could they know what their deeper minds were really feeling, thinking, saying? They didn't know, not really. Relationships were for that reason utterly mysterious, they took place between two subconscious minds, and whatever the surface trickle thought was going on could not be trusted to be right. Did that Maya down at the deepest level know or not know, remember or forget . . .? There was no way of telling, he could never be sure. (Robinson, RM 421, original emphasis)

Frank's line of reasoning at this point is quite similar to Sax's thinking about the solidity of memory much later in the trilogy. Frank decides that human subjectivity is that subjectivity's past, the order imposed on the life by memory. Anything a subjectivity does is merely a repetition of the past (compare this with Sax's fear that "memory equaled life:" Robinson, BM 588). There is no present, only the past and by conflating the two Frank effectively paralyzes himself with too much order. Sax, fortunately, comes to an understanding of subjectivity based in a quantum discourse which allows him to free himself from the rigid determinism of the mechanistic scientific order. That rigid order had paralyzed Sax previous to his acceptance of a quantum paradigm by failing to conform to his experiential reality during his quantum dissonances. Frank, in contrast to Sax's final freedom from too-rigid order, no longer believes that spontaneous action, or subjective

experience of the present moment, is possible. People are only the "habits" he had originally claimed they had been "stripped" of; walking, talking masks of past walking, talking masks. By this over-ordering of life, relationships with other people (who, because their subjectivity can never be accessed even by themselves, can "never be [known] for sure") are random, chaotic endeavors. There is no hope in a universe dominated by guilt over the past.

Unfortunately for Maya, this conceptualization of subjectivity and memory is exactly the trap she falls into by having the single memory (or rather, multiple memories) of the breaking coffee cup "ordered" into her selves across time. The first repetition of the coffee cup incident in the text is sparked by a revelation occurring late in the second volume of the trilogy when Maya, Sax, Marina and a few others from the First Hundred meet in a park to discuss strategies of resistance against the metanational corporations on Earth. Maya separates herself from the group and, from a unique architectural point in the park which allows her to hear what the others are saying from across a pond, she hears Marina say, "Frank. . . . If he hadn't killed John none of this would have happened" (Robinson, Green Mars 374; cited hereafter as GM). This statement severely upsets Maya, who flees from the park to her home. Although certain comments she made to Frank at the sidewalk café might be construed as meaning she knew full well that Frank killed John, and had forgiven him for it, the Maya at this present moment nearly fifty years later is a different Maya from that past one. The present Maya clearly did not know, or did not remember that she had ever known, that Frank had been instrumental in John's assassination.

Maya stands in front of her mirror, examines the "nauseating image" of her aged face and begins to perform an archaeological exploration of just what she does remember about Frank. Just as in her dive in Blue Mars she conceives of retrieving her memories as digging up the past, an image of spatialized and stratified memories accumulated in layers, similar to Frank's conception of the past and subjectivity as layers of masks. "When she put her mind to it, and forced herself to *remember*, to recollect, it was frightening how little came up.

Fragments; moments; potsherds of an entire civilization" (Robinson, GM 375, original emphasis). She can only remember a brief flash of significance. "Once she had been so angry she had knocked a coffee cup off a table, the broken handle bare like a half-eaten bagel on a table. But where had that been, and when, and with whom? She couldn't be sure!" (Robinson, GM 375). What is interesting about this particular memory is that it runs contrary to the scene as it was recorded in Red Mars from Frank's point of view. In the first scene the handle of the cup comes to rest beneath another table, while in this version of Maya's memory it lies on top of a table. Given Sax's research into quantum memory (still nearly 800 pages farther along in the text) it could be argued that what is going on is merely the quantum differences between two different subjectivities' memories of a single event. However, the implications of Maya's original articulation of a theory of subjectivity combined with her final version of this memory given in Blue Mars (which differs again from the first two as I will describe in a moment) go further into the implications of an indeterminate quantum memory than even Sax will realize. Given that subjectivities of a single person can differ across time, then not only can a single event happen differently for two people, but differently for one person as well, depending upon who she is at any given moment in time. Quantum memory at this juncture in Robinson's text becomes able to accommodate poststructuralist notions of fractured identities and provides a theoretical framework for those identities' conditions within varying temporal contexts; that is, it theorizes how identities are fractured not just at any given moment of time, but across any several moments of time.

Ironically, however, because Maya is a different Maya than she was when the cup first broke, she cannot remember what she said in that moment about the constitution of differing subjectivities in different times. When she looks at herself in the mirror, she can't recognize herself, only a "haggard antediluvian face . . . with its pathetic reptile pain. So *ugly*. And once upon a time she had been a beauty, she had been proud of that" (Robinson, GM 375;

original emphasis). By forgetting she is different selves at different times, and realizing that she cannot remember much of anything, Maya falls back on Frank's conception of the past as the self. Because she cannot "be sure" of her past, she can no longer recognize herself, or find validation in what she does see. She becomes an "ugly" reptile, a mask which covers her true past as a "beauty," if only she could dig up the pertinent "potsherds" so as to reconstruct and order as much of her past/self as she can. In order to perform this excavation she decides to search out who the "real" Frank Chalmers was, thinking that if she can "be sure" if he killed John or not, then the past really will be solid and she can have something on which to pin her subjectivity. She is supported in her endeavor by Michel, her lover and therapist who is very concerned about the various memory problems Maya is experiencing. Michel's belief in the fundamental importance of memory in human life arises from his own Proustian attachment to an objective ordered past-through-memory which most likely becomes responsible for his death.

Maya does text-based homework (similar to Sax's research into the first Martian Rebellion earlier in Green Mars) on the history of Frank and the assassination of John Boone, and like Sax, she comes to the conclusion that history is far too chaotic a subject to be useful to her in ordering her own present; there are simply too many theories purporting to be the truth of what really happened in the past. While performing this research, and working for a small hydrological company, her memory problems become much more severe The problems consist of two basic experiential phenomena: deja vus in which "every single event of [the] day felt like something that had happened before" (Robinson, GM 410), and jamais vus, "occasional moments when . . . she was struck by the sense that nothing like this had ever happened ever, even though she might be doing something like stepping onto a tram" (Robinson, GM 412). The dichotomy between these two extremes of experience, one experience which is overdetermined and one which is too chaotic, make Maya uncomfortable. While the jamais vus are experiences that parallel the sort of reality Sax

fears and, through most of the trilogy, chooses to overcompensate against using science as a stronghold of order, the deja vus (the experiences that give Maya the most trouble) are the same sort of experience of reality that Frank came to have by the time of the argument in the café. Maya conceives of these events as making "the world [become] an acute frightful prison, and she nothing more than a creature of fate, a clockwork mechanism unable to do anything that she had not done before in some forgotten past. Once, when it lasted almost a week she was almost paralyzed by it" (Robinson, GM 411-412). This overdeterminate reality is similar to one which might conceivably result from a mechanistic paradigm like Edward O. Wilson's taken to (logical) extremes.

The only things that help Maya live with these problems are her work, "a sort of gigantic treasure hunt . . . [requiring education] in the secret habits of submartian water" (Robinson, GM 412), and her interviews of other people who were in the city where and when John was killed. When she asks Spencer whether Frank had something to do with John's murder, this man who "surprised" Sax with his theory on entropy replies insightfully, "Does it matter anymore?" (Robinson, GM 393). While this answer may not help the present Maya who is making the inquiry, it echoes her former theory of subjectivity ("I don't care what happened in the past"). (The character Spencer highlights a problem in Robinson's trilogy, namely the lack of point-of-view subjectivities of groups other than white men and women. In these texts all differences and their effects are elided into the differences between Earth-born and Mars-born subjectivities, in order to create a "utopian" society where external markers of difference are allegedly meaningless. It is quite possible that Spencer's ethnic subjectivity, African-American, might provide insights into the conception of quantum subjectivities, but the text does not allow those insights).

At last, Maya interviews Zeyk, who "has the opposite problem to everyone else [i.e., people who have undergone the gerontological treatment]. . . . He remembers too much" (Robinson, GM 425). The information he gives her, that there were definite links between

the men who killed John Boone and Frank, convinces her of Frank's guilt. She feels that this information also implicates her; she feels guilt for being the motivating cause of Frank's jealousy (she loved John) and therefore driving him to kill his former friend. Unlike Frank, Maya does not allow her guilt to ossify into a masked subjectivity. She begins to subconsciously reacquire her former conceptualization of the self as changing across time. About Frank's agency in John's murder, she says, "Some things you must forget" (Robinson, GM 427). Like Ann Clayborne's experiences, Maya's memory problems have brought her to the realization that, contrary to Sax's or Frank's view that a person must objectively remember everything exactly how it happened in order to be alive, forgetting is essential in certain situations. During her historical research, Maya acquires a photograph of Frank at twenty-three years of age, which she hangs next to the sink so she can look at it every day while doing the dishes or cleaning the kitchen with Michel, "everything habitual, everything known, deep in that deja vu that one determines oneself, that makes one happy" (Robinson, GM 413) (notice, though, that in conceptualizing of necessary deja vus, Maya uses the impersonal "one," suggesting the distanced objectivity which characterizes Sax's language prior to his first quantum moment). After her acknowledgment of Frank's guilt and her decision to forget certain things, "the photo became little more than part of the decor. . . . Part of the stage set for this act of the play, as she sometimes thought of it, which however permanent it seemed would be struck at some point--would disappear utterly, as all the previous sets had disappeared while she passed through to the next reincarnation. Or not" (Robinson, GM 429). The photo of Frank, a representation of a self static in time, is the focal point for Maya's return to a variant of her original articulation of subjectivity. The very fact of the photo's impermanence is symptomatic of the presence of change in the world, change like that she has previously lived through on her way to a new self, or "reincarnation," although she also admits that even change is not necessarily a certainty.

Maya begins her dive in Blue Mars with the intention of once more reclaiming her past as an objective material object; she has not consciously re-learned her conception of time-fractured subjectivities, only experienced it. But the process of comprehension is forced upon her during the dive by her differing memories, once more, of the broken coffee cup and the implications these indeterminate memories have for an objective past. As she floats above the sidewalk café she attempts to remember her argument with Frank.

> She had . . . found him here hunched over a coffee. Yes. She had confronted him and they had argued right there, she had berated him for not hurrying up to Sheffield . . . she had knocked a coffee cup off the table, and the handle had broken off and spun on the ground. Frank got up and they walked away arguing, and went back to Sheffield. But no, no. That wasn't how it had been. They had quarreled, yes, but then made up. Frank had reached across the table and held her hand. . . .
>
> One or the other. But which had it been?
>
> She couldn't remember. Couldn't be sure. . . . It was all blurring together in her mind, into vague impressions, disconnected moments. The past disappearing entirely. (Robinson, BM 496-497)

The past is being replaced by present feelings, her numbness from a recent life dominated by the past (either too ordered, or actively repressed) is giving way to painful experiences in the present moment, an occurrence she views as a good sign. "Ah but there it was, that pinprick pain, there inside, encysted--insisted--hold on to it forever, hold on to any feeling you can, any feeling you can dredge up out of all that muck, anything! Anything but the numbness; sobbing in pain was rapture compared to that" (Robinson, BM 497).

Rather than attempt to "encyst" the past in its entirety, Maya realizes it is the feelings of those memories which matter in the present. Her memories by themselves have only made her numb; it took a dive deep into the past and a specific memory to make her feel alive; rather than the rigidly imposed order of the past she experiences the indeterminate

embodiment of the present. When she attempts to add more memories to her present, she has to stop. The attempt detaches her from her "self." "Ah--too much to feel. One could only stand a single shard of the past at a time; this drowned city. . . ." Maya makes a slight change in her desire for a determinate past; she will concentrate on embodying the past in the present as feelings. "[S]he would have to work on that. Encyst them all, precious stabs of feeling held in her forever, till death did they part" (Robinson, BM 497). Maya, as the last phrase indicates, marries the past to the present in an ever-shifting, indeterminate relationship which somehow allows her to experience the reality around and within her more fully. As she rises to the surface, she is aware of aesthetic (visual, light-based) phenomena in the sea:

> Up, up, up, among the colorful tropical fish with their arms and their legs, back into the light of day, blue sunlight, ah God yes. . . . [T]he rapture of human depth, the way they lived and lived, giants plunged through the years, yes, and what they held on to. Michel was swimming up from below; . . . she kicked then waited, waited, clasped him and squeezed hard, ah, how she loved the other's solidity in her arms, that proof of reality. (Robinson, BM 497)

In the present of this moment, Maya understands that it is what a person feels in the present, not the sunken, dead, ossified layers of their memories, that allows them to interact with reality. It is also significant that her action ("squeezed hard") and her choice of words ("the other") echo Sax's action and thought in his present moment with Ann when he recognizes the quantum nature of the present's slippery relationship with the past.

This liberation of her self, from needing a constant determined memory as well as from unity across time, eventually causes her friends, and especially Michel, a lot of pain. Most of the characters in the trilogy cannot conceive of the self and memory as Maya has re-learned to conceive of them. For Michel, the past of his life in Provence and his memories of that life, are all that he had to cling to for several decades after he came to Mars. In some

respects, they made him miserable since he longed for the Provence of his memory rather than the Mars that he was currently experiencing. Michel conceives of the past as essential to life, and thus as the trilogy goes on he becomes more and more concerned about Maya's memory troubles. To her repertoire of "pathologies" is added the experience of presque vus, in which everything she experiences becomes more vivid and imbued with significance, as if the answer to everything were about to be revealed to her, but is always just withheld.

Things eventually come to a head while Michel, Maya, Sax and Nadia are looking at pictures, little fixatives of memory. They come across the photo Maya had found decades before of the young Frank Chalmers.

> [Maya] stopped at the kitchen table, put her hand on Michel's shoulder, and looked over it at a grainy black-and-white photo, stained by what looked like spots of spaghetti sauce and coffee. A faded picture of a young man grinning right at the camera, grinning with a confident knowing smile.
>
> "What an interesting face," she said.
>
> Under her hand Michel stiffened. Nadia had a stricken look. Maya knew she had said something wrong, even Sax looked somehow pinched, almost distraught. Maya stared at the young man in the photo, stared and stared. Nothing came to her. (Robinson, BM 556)

Maya, decades before, had been so intimately tied to Frank as a living person, and then as a discursive historical entity, that her friends are thoroughly alarmed by her lack of recognition of Frank's photograph. They view the self as continuous across time, with the key to that continuity being the self's memories, and the photo is emblematic of that unfractured self/memory. Yet, this particular photo is the same one Maya connects with the "things you must forget" in order to move on to the next "reincarnation." Her present self is no longer dependent on knowing who Frank Chalmers was, or on her former self's search for the "real" Frank Chalmers; she knows very well that there is no such thing. She has become

increasingly wedded to the present, but the reactions of her friends, and especially Michel, upset her into leaving the apartment.

Sitting in a park, she remembers her first view of Mars from the *Ares*, pristine, before humanity changed the face of the planet forever. Mars had been a "symbol of every potential happiness. She had never been happier than [at] that [moment], in all the time since" (Robinson, BM 557). Then, the presque vu returns and gives her one final insight that completes her transformation from a person dependent on memory to one who fully encounters and experiences reality.

> And then the feeling came on her again, . . . a vast significance suffusing everything, immanent everywhere but just beyond reach . . .--and with a little pop she got it--that that very aspect of the phenomenon was itself the meaning--that the significance of everything always lay just out of reach, in the future, tugging them forward--that in special moments one felt this tidal tug of becoming as a sensation of sharp happy anticipation, as she had when looking down on Mars from the *Ares*, the unconscious mind filled not with the detritus of a dead past but with the unforeseeable possibilities of the live future, ah, yes--anything could happen, anything, anything. And so as the *presque vu* washed slowly away from her, unseen again and yet somehow this time comprehended, she sat back on the bench, full and glowing; here she was, after all, and the potential for happiness would always be in her. (Robinson, BM 557)

The conclusion Maya finally arrives at strongly resembles Sax's realization about time a few pages later during his experience under the anamnestic drug. Maya understands that the present is a tenuous moment caught between dead order and potential life through indeterminacy ("anything could happen"). Yet Maya takes this conclusion farther than Sax ever would. For the entire trilogy, since John died in the opening pages, she has been trying to escape from being drowned in her past and in her guilt over what has happened in the past. Now, in direct opposition to Frank, Michel and Sax, she equates the past not with life, but

death: "in special moments . . . the unconscious mind [was] filled not with the detritus of a dead past but with the unforeseeable possibilities of the live future" (Robinson. BM 557). She gladly chooses to throw in her lot with the intersection of the present moment and the always-becoming potential of the future.

When Maya appears in the remainder of the trilogy, she is calm, happy, engaged in the aesthetics of a present sunset, or playing with children. Her mood swings have gone and she appears to finally be content. The others in the trilogy do not have the capacity to understand this change in Maya. Michel is killed outright by his shock over her lack of recognition of Frank's photo. Sax, who along with Ann will eventually come closest to understanding her viewpoint, is inspired by Maya's problems to develop his anamnestic drug. Part of his determination comes from his conviction that "memory equals life. So that with memory gone, life was gone. So Michel must have felt, in that final traumatic half hour, as his self tumbled into a fatal arrhythmia, under the anguish of grieving for his love's death-of-mind" (Robinson, BM 588). Robinson's text reveals that Sax is wrong on every count; Maya's mind has not died, nor has she herself died from lack of memory. Michel's problem was not Maya's self, but his own past-drenched self "tumbl[ing] into . . . arrhythmia." Despite his inability to understand Maya, the text charts the beginning of a change in Sax's conception of her. For example, Sax feels it necessary to defend Maya when Ann laughs at her and tells him, "Maya is crazy." "'Why no,' Sax said sharply. 'She certainly is not'" (Robinson, BM 614). It will take their experience of quantum memory to reveal to Sax and Ann just how sane Maya is.

While Maya's epiphany of selves brings her contentment, it does cripple her in one important way. Where she had played a major role in political actions before her memory problems became severe, with no past to rely upon she is no longer capable of being an effective political force. In the third confrontation with Earth, where Sax and Ann publicly speak for each others' political positions concerning human terraforming and settlement of

Mars, Maya can only stand with them in support. By rejecting all order in favor of indeterminacy she has paralyzed herself politically, much as Frank's earlier rejection of chaos and indeterminacy paralyzed him at the level of his subjectivity. In the end the text seems to value a sort of balanced homeostasis between past, present and future, recognizing partial order and partial indeterminacy in each of the three temporal contexts, mediated by quantum discourses and a willingness to engage reality in a partial way.

Yet Maya is content. Robinson's text shows that it is possible to live without reference to the stifling order Wilson advocates through his philosophy of consilience, or even by validating the unknowns and uncertainties of life through alternate scientific discourses. I would like to address Wilson using a paraphrase of his own patronizing comment addressed to Michel Foucault, the poststructuralist philosopher of discursive power/knowledge (see Wilson 43). To Wilson, I would say, it's not so bad. Once we get used to the inevitable presence of chaos and indeterminacy in life, and learn to interact meaningfully with them experientially, rather than distancing ourselves from them by building edifices of order, our many selves will discover that reality can be richer and more satisfying than anything your illusive holistic mechanism could account for. We'll at last have a fractured science whose discursive space can include both order and uncertainty, a science for every subjectivity.

Robinson's Mars trilogy argues for a balance between the extremes of Wilson's rigidly overdetermined mechanistic paradigm of scientific control over reality, and Maya's immersion within the completely chaotic and indeterminate present moment. This balance is exemplified in the relationship of Ann and Sax, a quantum relationship which allows them to forge their own agency and increases the effects of that agency through maintaining a homeostatic relation between the indeterminacy of the moment and the order of the past. In Robinson's text, quantum discourses are more effective in helping individuals relate to experiential reality than Wilson's mechanistic paradigm primarily because quantum discourses allow for indeterminacy and chaotic effects rather than repressing them. The

Mars trilogy argues forcefully for a subjectivity's full engagement in experiential reality, rather than in a constructed "model" of that reality, as the best way to interact with the universe and attain satisfaction and peace. The text's argument seems to shut the door on Wilson's fears about chaos and the indeterminate universe by showing that accepting these phenomena, and learning to live with them, improve science, people's lives, and the interrelation between the two.

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