

Beyond Human Agency: Environmental and Biological Dimensions of Distributed Agency in *Red Mars*

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Abstract:

In an age of increasingly defined by ecological crisis, conventional understandings of agency centred on human actions are now become increasingly inadequate. Anthropocene fiction consequently provides a space for rethinking agency as distributed across humans, environments, and other forms of life. The present study opts Kim Stanley Robinson's multiple award winner novel *Red Mars*, the first part of *Mars Trilogy*. It presents terraforming as more than a human driven project of planetary transformation. The text further reveals a dynamic interaction between humans and Martian environments, challenging the idea that humans are sole agents of shaping planetary change. To analyse this specific change, the paper draws on Adam Trexler's concept of distributed agency as its primary theoretical framework. This perspective enables an analysis of the environmental and biological dimensions of agency within the narrative, highlighting the ways in which nonhuman processes participate in shaping the course of planetary transformation.

Keywords:Agency, Actor-network theory, Distributed agency, Environmental, Environmental ethics, terraforming, biological

Introduction

Agency is the concept or term in fictional works to rearticulates the intricate threads among fiction, humans, technology, the moment of composition, and climate. It creates a bridge between fiction and truth telling via characters, setting, class, time, representation and milieu. It has numerous branches like material agency, political agency, and human agency. The material or non-human agency is usually referred to as "artificial", as it relates to the technology, vehicles, and capital and its positive or negative impact on living things. Jane Bennet defines non-human agency as "the capacity of things—edibles, commodities, storms, metals—not only to impede or block the will and designs of humans but also to act as quasi

agents or forces with trajectories, propensities, or tendencies of their own (viii). On the contrary, human agency represents intentional anthropogenic behavior towards the non-human and natural world (Bandura 2). Thus, the human agency and non-human agency is interconnected and has crucial impact on each other.

The distributed agency expands on this by concentrating that capacity in the relationships between human and non-human actors, material forces, technologies, environments, and institutional structures. N.J. Enfield argues that the elements of agency can be shared among multiple participants in one course of action, so that “multiple people act as one” (9). Within Anthropocene studies, this perspective is significant because planetary processes frequently exceed individual human intentions and produce effects that subsequently reshape human actions and possibilities. Adam Trexler extends agency into environmental criticism to understand “non-human things as actors in ecosystems, politics, and novels,” while acknowledging their “categorical hybridity” (23). Trexler’s formulation challenges the conventional division between active human subjects and passive natural objects by recognizing that non-human entities can participate in the production of events and relationships.

This core idea is complexly integrated in Kim Stanley Robinson’s *Red Mars*, the first novel of *Mars Trilogy*. It imagines the colonization and gradual transformation of Mars with the help of first hundred trained group of scientists. The terraforming of planet turn itself into a political and ethical debate. Although, this work falls in the genre of hard science fiction, but at the same time, it raises sustained attention towards geology, ecology, technology, economics, and political organization. However, *Red Mars*, does not present terraforming as a straightforward demonstration of human mastery. The Martian environment continuously conditions human possibilities. Its atmosphere, extreme temperatures geological formations, dust gravity, water, and vast temporal and spatial scales constrain technological ambitions while simultaneously creating new possibilities for settlement and transformation. Human attempts to redesign Mars consequently become entangled with the planet’s own material processes. Terraforming is thus neither a purely technological project nor an uncomplicated movement from human intention to environmental effect. Instead, it becomes an evolving interaction between human systems and planetary processes. These processes further shape Mars and its environment as well as human civilization.

Existing literature on this particular text examined the terraforming through environmental ethics, political economy, colonialism, and competing conceptions of nature. Thus, the environmental and biological processes can be understood specifically as dimensions of distributed agency provides an opportunity to reconsider the novel's human and nonhuman relationship. Therefore, if humanity terraform Mars, Mars remain merely an object of human action? Or it will form human lives?.

1. Research Objective

1. To analyze the impact of Environmental and Biological agency on human life

2. To evaluate the Martian environment as a dimension of distributed agency

Research Design

The present study employs qualitative textual analysis of Kim Stanley Robinson's *Red Mars*, to examine the role of non-human forces to shape the human lives as well as environment. The analytical corpus comprises passages depicting terraforming interventions, environmental change, biological introduction and development, and human responses to Martian ecological conditions. To achieve this objective, the study applies Adam Trexler's framework of distributed agency, supplemented by Bruno Latour's relational model of human and nonhuman agency. Integrating these perspectives demonstrates that causality and narrative momentum in the novel emerge through hybrid, socio-ecological networks rather than unilateral human mastery. To establish precise theoretical boundaries, the analysis deliberately limits itself to two dimensions—environmental agency and biological agency—in order to maintain conceptual focus. The environmental dimension traces how abiotic factors, such as regolith chemistry, ambient temperature, and vast geological landscapes, resist and constrain human projects. In parallel, the biological dimension isolates the autonomous proliferations of genetically modified lichen, microbial mats, and emergent ecosystems. Together, this two-tiered focus systematically articulates how physical and living matter act as co-constitutive agents alongside human settlers.

Theoretical Framework

Theoretically, the distributed agency necessitates a profound enquiry as a relational model which acts through “assemblages and configurations of human and non-human forces” (Bennett 21). Bennett's idea of vibrant matter is an attempt to break the idea that agency is a uniquely human possession by showing how action is produced in a collective way through interactions between humans, material objects, ecological processes, and technological systems. Agency, then, cannot be simply placed within a single human agent, an executive body, or even humanity as a whole. This relational understanding is further supported by Bruno Latour's actor-network theory, which sees action as always mediated, delegated, and shared between heterogeneous human and nonhuman actors (Latour 46-48). Likewise, Karen Barad's concept of intra-action is an attempt to move beyond the notion of autonomous entities and to view agency as a relational phenomenon in which humans and matter mutually create each other (Barad 33). Together, Jane Bennett, Latour, and Barad create a distributed notion of agency, one that emerges through networks, assemblages, and material relations.

In *Anthropocene Fictions*, Adam Trexler, following Latour, sees “genes, places, local climates, findings, and anthropogenic climate change itself” as hybrids that are created by natural and human processes (22). This view is contrary to the traditional view that historical causality and narrative action are only found in human subjects. The idea of ecological interconnectedness also resonates with Timothy Morton's work, which focuses on the interconnectedness of environmental phenomena and the complex relationships between humans and nonhuman systems (29). Through material ecocriticism, Serenella Iovino and Serpil Oppermann also contend that matter has narrative and agentic capacities, actively

contributing to the creation of meanings and event(6-7). The process of terraforming can therefore be considered as a two-way process, not a unilateral act of human control over Mars, but a process that emerges from the interaction of human intentions, scientific technologies, geological forces, atmospheric conditions and the material agency of Mars. Environmental Agency is the capacity of planetary, abiotic conditions and physical processes to constrain, enable, redirect, and transform human projects and socio-political possibilities. This category encompasses the physical architecture of the Martian landscape which comprises ambient surface and subsurface temperatures, atmospheric pressure and chemical composition, volatile balances, regolith chemistry, dust storms, water ice reservoirs, and deep geological structures. These abiotic forces do not act as inert staging grounds; their radical material resistance perpetually renegotiates the terms of human survival, technological efficacy, and ideological governance.

Biological Agency is defined as the capacity of living organisms and biological systems to actively participate in and alter ecological transformations, rather than functioning merely as inert, passive products of bioengineering. This category captures the dynamics of biological introduction and propagation: genetically modified methanogens, pioneer lichens, micro-algae, emergent tundra flora, cycles of ecological succession, and metabolic exchanges. Once introduced, these living organisms do not merely execute human designs; they metabolize, mutate, reproduce, and generate autonomous ecological feedback loops that exceed human predictive control. These theoretical lenses can be used together to ask the question: How is action distributed?

Analysis

Red Mars by Kim Stanley Robinson is an epic novel about the colonization of Mars. The novel takes place between 2026 and 2061. The story is a journey of mankind on its search for immortality and a new world in which to begin a new life while earth suffers from over-population and ecological disaster. For this purpose, one hundred participants are chosen to go to Mars after a rigorous selection process, and include geniuses from Russia and the United States, as well as from other countries. Following a long and somewhat troubled journey through space for nine months, the crew lands on Mars and begins work on Underhill, the first colonization base. Nuclear generators are built for power, medical stations are built, biologically engineered farms produce food, and the bio-engineers create life forms that can survive on the surface. A debate, rising on the Ares (largest interplanetary spacecraft ever built and home to a crew who are to be the first hundred colonist Martians) and continuing both on Mars and on the Earth, rages in terms of whether Earthlings have the right to terraform and mine Mars for their own benefits. Another potential perspective is that non-living materials have power to shape the Mars, Earth and lives of Anthropos.

5.1 Environmental Agency: Mars as more than a Passive Object

Robinson's description of radiation foregrounds environmental force as active participant in shaping human experience. The "Billions of particles were penetrating the ship and colliding with the atoms of water and metal they were huddled behind; hundreds of millions were flying between these atoms and then through the atoms of their bodies,

touching nothing, as if they were no more than ghosts” (76). It demonstrates that agency is distributed among radiation, the material structure of the spacecraft, and the human body. Here, penetration functions as an active force and material objects such as atoms of water and metal are not passive, although participate in the process. The movement of particles through the atoms of their bodies further collapses the boundaries between the environment and anthropogenic dominance. Robinson’s usage of simile ‘as if they were no more than ghosts’ reflected the inviable yet strong environmental force which has the capacity to operate beyond human awareness and control. Adam Trexler calls these material circumstances “an artful combination of human and non-human agency”(pg. 64). It suggests that material entities possess the capacity to respond to environmental and climatic changes, however, the destructive consequences of such transformations are frequently intensified by anthropogenic interventions. Bennet also supports this idea by arguing “an actant never really acts alone” (21), as agency depends upon the collaboration, cooperation, or interactive interface of many bodies and forces. Here, the ship, the metals and other technological interventions made by humans interact with environmental substances such as particles and atoms of water to produce a collaborative result which impacted the both in positive or negative manner. Likewise, the temperature, dust storm and extreme cold impacted the human existence as an active participant rather than passive entity which has no value. Robinson states that the great storm was now four months old, the longest in years— and it still showed no sign of ending. Temperatures had plummeted, people were eating canned and dried food, and an occasional salad or vegetable grown under artificial light. And dust was in everything” (378).

The portrayal of prolonged dust storm and plummeting temperatures demonstrates how climatic conditions penetrate human technological systems. The storm, temperature, dust, human bodies, food systems, machinery forms an interconnected system which establishes cause and effect relationship. The storm damages machinery, downfall in temperature alter food production, and the dust produces respiratory problems while simultaneously affecting technological systems. It resulted in lack of natural habitat for vegetation which forces *Anthropos* to consume packaged food sequentially led to headaches, respiratory problems, and failure of organs. Climate acts upon bodies, bodies respond through altered practices, and environmental conditions simultaneously disrupt technological systems. Thus, agency or environmental agency cannot be attributed either to humans or to climate, but it emerges through their material interaction. Latour, in *Reassembling the Social* argues that “action is not done under the full control of consciousness” but should be understood as “a node, a knot, and a conglomerate of many surprising sets of agencies” (44). All the elements mentioned by Robinson functions as interconnected actants. The technological breakdown is not produced by a human agent alone, rather it emerges from the interaction of climatic and technological actors together. In this lieu, Karen Barad interpreted the situation through his concept of agential realism. Her concept of intra-action argues that agencies are not independent entities that exist prior to their relations, rather they “emerge through their intra-action” (33). The storm does not

simply interact with already independent humans, rather it produces new forms of human behaviour in which food preservation, artificial agriculture, technological dependence, altered bodily experiences are comprised. All these responses simultaneously reshape the human-Martian relationship. Barad, further states that this intra-action led to social and natural entanglements. The phrase ‘dust was in everything’ indicates that dust is not only external natural material, but it entangled with human food, bodies, habitation, and even technological systems. It proves that the line or boundary between environmental objects and humans becomes unstable or completely entangled. Her perspective illustrates that the storm which begins four months ago and has no sign of ending and falling temperature indicates the alive material existence. Moreover, ‘dust is everywhere’ intensify the situation. It enters in bodies and damage machinery.

Furthermore, the Martian environment has prominent effect on its colonist. As one of the colonist remarks that “He was holding his breath and could feel dust on his lips, caking his mouth. Impossible to tell how much CO₂ was getting into his oxygen supply, but it didn’t take much to kill you” (Robinson 392). The character’s bodily experiences indicate that external material changes directly affect his internal physical condition. Although he tries to limit its impact by holding his breath, but he cannot completely escape the influence of the atmospheric conditions. This situation rejects the autonomous human power and establishes a relationship in which human action is continually conditioned by nonhuman material forces. Bruno Latour’s concept of nonhuman actants clarifies the situation by stating that nonhuman entities can make a difference to how events unfold (63). The description of CO₂ and dust performed its role as nonhuman actants. Again, result depends upon the encounter between human body and hostile atmosphere. The material dimension of this interaction further discussed by Serenella Iovino and Serpil Oppermann through their concept of material agency, in which they state “matter as active and relational rather than inert, emphasizing how human and nonhuman materialities become entangled in ecological processes” (5). Robinson portrayed this entanglement tangible through the image of dust ‘caking’ in the characters mouth. In this way, external matter again enters in bodily space, while breathing connects the character physiologically to the surrounding atmosphere. The concept of “ecological mesh” further broadens this interpretation by emphasizing the interconnectedness of entities that are often treated as separate. For Morton “ ecological existence involves complex relations in which no organism or object exists entirely in isolation” (30). So, the character cannot survive in isolation, he depends on environment and its composition for his biological process of breathing. His existence on Mars is consequently shown as embedded within a larger material network. The character as a human cannot impose his will on nature.

Thus, Robinson decentralizes human agency and presents environmental agency as relational, material, and distributed across human and nonhuman actors. In *Red Mars*, planet Mars is presented as active geographical participant which shape the human lives.

5.2 Biological Agency:

Humans continue to decide which species are introduced, engineer the genetic and ecological parameters within which those species operate, and retain the power to intervene—through eradication, reintroduction, or genetic modification—when biological outcomes diverge from desired ones. The very language of "desirable" versus "undesirable" life forms indicates that biological agency, however real, remains framed by human technological objectives. The question that must therefore be pressed is whether the unpredictability and participatory quality of biological processes constitute genuine agency, or whether it is simply the appearance of agency within a system still ultimately oriented, monitored, and correctable by human design. This tension—between biological life as a semi-autonomous participant and biological life as an instrument whose autonomy is itself managed—cannot be fully resolved at this stage.

Robinson's representation of genetically engineered microorganisms as "shifting, clipping and recombining genes from algae, methanogens, cyanobacteria, and lichens" to produce organisms that could survive on Mars (134). Although humans initiate genetic manipulation, but the end result and process fundamentally depend upon the inherent capacities of microorganism and its adaptability, metabolic functions, resilience, and evolutionary potential. Their potential to "survive on the present Martian surface" demonstrates that terraforming depends upon an interaction between human technology, biological processes, and planetary conditions (Robinson 134). Humans give More significantly, the concern over "possibly lethal mutations of genetically engineered microorganisms" (Robinson 182) reveals the unpredictability of biological agency. Mutation may generate consequences beyond human intention and control. Trexler on it states that Anthropocene transformations emerge through "distributed, impersonal causes" rather than a single controlling agent (14). Thus, microorganisms, alongside radiation, chemical conditions, and the Martian landscape, participate in producing terraforming outcomes, making agency fundamentally distributed rather than exclusively human. Bruno Latour's concept of agency as emerging from networks of human and nonhuman actors. Latour challenges the conventional distinction between human subjects and passive nonhuman objects, arguing instead that action is produced through associations among heterogeneous entities (5). The creation of organisms capable of surviving on Mars is not solely the achievement of human scientists. Rather, agency is distributed across scientists, genetic technologies, algae, methanogens, cyanobacteria, lichens, genes, and the Martian environment. The genetic materials of different organisms actively participate in the transformation and production of new life forms. Thus, the passage illustrates Latour's idea that scientific and technological outcomes emerge through complex networks in which humans and nonhumans collectively mediate and generate action (138). Karen Barad's concept of agential realism, which understands agency not as an individual possession but as something that emerges through material interactions or "intra-actions". The production of organisms capable of surviving on Mars therefore results from the entanglement of scientists, genetic technologies, microbial organisms, genes, and the extraterrestrial environment. Neither scientists nor biological entities function as independent agents; rather, their

capacities emerge through their mutual intra-actions. The genetic materials of algae, methanogens, cyanobacteria, and lichens actively participate in the reconfiguration of life, demonstrating that matter itself possesses transformative potential. Thus, the passage reflects Barad's understanding of agency as distributed across interconnected material-discursive practices rather than originating exclusively from human intentionality.

Red Mars, further foregrounds the active and adaptive capacities of biological life when “Life adapts, you see. It has only a few needs, some fuel, some energy; and it is fantastically ingenious at extracting these needs from a wide range of Terran environments” (Robinson 217). It challenges the anthropogenic assumption that all the adaptations and environmental transformation are ruled by human sources. Likewise, Trexler’s presentation of planetary transformation as the outcomes of future emissions, “human efforts at adaptation, and, to some extent, geophysical forces beyond human control” (1). These two ideas indicate that planetary change results from ‘future emissions’, and ‘geophysical forces’ along with human efforts and adaptation strategies. It may take place with or without human control. Hence, it destabilizes the conventional binary relationship of humans with non-human, in which humans are always portrayed as ruling and dominating power. In fact, Robinson’s masterpiece reflected the active ecological assemblage, where biological processes, human interventions, and geophysical forces collectively shape planetary change.

The representation of Martian life challenges the assumption that ecological transformation remains under human control, as “some proposed: survival of the fittest” (Robinson 244). By foregrounding natural selection, author gives nonhuman life an active role in determining the direction of the developing Martian ecosystem. The colonist may introduce life to Mars, but its subsequent survival and development depend upon interactions among organisms and their environment. Robinson further establishes the biological connection by stating that “Some prospered wildly, at the expense of other organisms, and then chemicals in their excretions activated their suicide genes, and they died back until the levels of those chemicals dropped again” (244). One organism affects the another for long time and their excretions altered the chemical environments. These chemical levels construct a chain of reciprocal effects. Especially when its activates genetic mechanism and those mechanised genes regulate the organism’s proliferation and stays for a very long time. It may harm the future generations. Latour observes that it is not an isolated organism but emerges through the interaction of multiple factors. Bennett calls it agentic assemblage, in which no single component possesses complete control over the outcome. The organism initially proposed wildly, but their own biological activity generated chemical conditions that eventually activated their genetic self-limitation. Thus, the same biological processes that enable expansion also contribute to decline. Bennett’s concept of assemblage indicates that human intentions and capacity to manipulate the environment may trigger the capacity of heterogeneous material forces to produce effects.

Agency, therefore, does not originate from an isolated organism but emerges through the dynamic relations among biological, chemical, genetic, and environmental forces. This distribution of agency challenges the anthropocentric assumption that the capacity to act, respond, and produce change belongs exclusively to human beings. Robinson's representation of the Martian ecosystem suggests that even nonhuman and non-living material forces can participate in processes that generate effects and consequently influence the conditions of human existence. Importantly, however, these forces are not portrayed as seeking domination or attempting to replace human authority. Rather, their agency emerges through their capacity to respond to human interventions and to the changing ecological conditions produced by them. In this sense, the Martian environment does not simply submit to the colonists' desire to appropriate and transform it. It responds through biological adaptation, chemical reactions, genetic mechanisms, and ecological feedback. Robinson thus subtly shifts the human–nature relationship from one of unilateral control to one of reciprocal interaction, revealing the limitations of the human desire to possess and regulate the natural world.

Conclusion

In *Red Mars*, Kim Stanley Robinson portrays the Martian environment as an active ecological force rather than a passive setting for human colonization. Through its extreme climate, geological conditions, scarce resources, and ecological transformations, Mars continually responds to and constrains human interventions. The blind use of environmental assets (metals, atoms, water, temperature, dust, and extreme cold) by considering them dead led to the destruction. It proved that even dead and non-living entities has the potential to shape the living. Moreover, these interventions also harm human physical health and may affect future generations through chemicals that persist in the body. Genetic manipulations can hinder adaptation, natural selection, and natural genetic responses, making survival more difficult for humans and genetically modified alike. The text therefore challenges the idea that humans are the supreme power on Earth or on other celestial bodies such as Mars. By portraying non-living elements as active participants, author points toward mutual understanding and respect between humans and the environment. Human dominance may ultimately harm humanity itself. Empathy and resilience towards the environment considering it as equal counterpart can maintain the equilibrium.

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