The Intersection Between the Overview Effect and Systems

By Christine P. X. Tan and Frank White

Abstract

The intersection between the Overview Effect and systems theories, while promising, remains largely underexplored in literature and research. This article represents an attempt to build a bridge between these fields, especially given that Frank White intended the Overview Effect to be understood as inherently a systems theory. We discuss the intersection in three ways. First, the ongoing positive impact of the Overview Effect on Earth can be better understood through systems thinking and systems change theories, especially with that of Donella Meadows. Second, we explore examples of systems methodologies, such as network analysis, that can be applied to amplify the impact of the Overview Effect. Finally, we discuss how the Overview Effect can and should be extended to other complex systems of which we are a part, other than the whole Earth, such as our organizations, countries, social circles, and more. Here, one can envision many different applications and innovations that allow individuals to understand the different complex systems in which they reside and function.

Keywords: Overview Effect, systems thinking, systems change, space exploration, systems, systems theory.

Introduction

As coined by Frank White, the Overview Effect characterizes the cognitive shift in awareness that occurs when one views the Earth from space and in space. The Overview Effect has been described as a profound understanding of the beauty, wholeness, and interconnectedness of our home planet and a consequent shift in worldview that embraces this reality. Many astronauts report experiencing a more profound sense of responsibility, love, and care for our world.

This article emphasizes that the Overview Effect is inherently a systems theory, which is how Frank White intended it to be understood, and that there are many intersections between the two fields. However, this aspect has been generally overlooked and underexplored in the literature. In fact, White's first academic paper on space-related matters was titled "Understanding Space Settlements as Human Systems," which he presented at a Space Studies Institute conference in 1983. White considered himself a systems theorist before he published the first edition of *The Overview Effect*: *Space Exploration and Human Evolution* in 1987, so it should come as no surprise that he considered the Overview Effect as more than a phrase; it was, he thought at the time, a theory, and a systems theory, at that.

Still, at the time of the submission on November 8, 2022, we found no other journal articles explicitly discussing the intersection of system theories and the Overview Effect.

There were zero results in a Web of Science database search for the keywords *systems AND overview effect* in the abstract, title, and author keywords of journal articles. We also performed a search on Google Scholar and found no articles with *systems* and *overview effect* in their titles.

As one of the first attempts to build a bridge between systems theories and the Overview Effect, we explore the intersection between the Overview Effect and systems theories (i.e., systems thinking and systems change) in three critical ways. First, we seek to position the positive impact of the Overview Effect on Earth through the lens of systems thinking and systems change. Second, we explore how systems methodologies and concepts can be used to amplify the beneficial impact of the Overview Effect on Earth. Finally, we discuss how and why the Overview Effect can be extended to different systems beyond the entire Earth as one system.

1. The Overview Effect as a Catalyst for Systems Change

Why does systems change matter? Many global-scale challenges we seek to solve are embedded within highly complex systems, such as our climate, economics, countries, and more. Due to such complexity, these problems cannot be effectively solved with a linear and reductive perspective that ignores the medium surrounding them—systems. Any positive change we wish to enact, such as the move toward a more equitable and sustainable world, will be most effective when we seek to understand, address, and change the systems underlying such problems. In fact, the very definition of a problem cannot be adequately expressed without understanding systems. Often, the solution actually creates new problems if the complexity of systems is ignored.

The question follows: How does the Overview Effect support positive systems change? Here, one can understand the Overview Effect's impact in two parts. First, the Overview Effect supports systems change because it acts on the leverage point of paradigm change. Second, the type of paradigms such an experience moves us toward are those that help us to function and understand ourselves more effectively and harmoniously as one system.

Leverage Points for Systems Change

Donella Meadows, a thoughtful systems thinker, describes leverage points as points of power in which a slight shift in one thing can produce massive changes in everything else within a system. In *Leverage Points: Places to Intervene in A System,* Meadows discusses how paradigms are the foundation of the systems we design and create.[1] The structure and goals of our systems stem from our mental models of the world. Because our paradigms and beliefs are the sources of our systems, they are also the sources of the messes within them. This is why Meadows, in her identification of the twelve leverage

[1] Donella Meadows, "Leverage Points: Places to Intervene in a System," Sustainability Institute, 1999, donellameadows.org/archives/leverage-points-places-to-intervene-in-a-system/.

points to change systems, ranked the two most effective ones as those related to changing or transcending our mental paradigms.

Changing a system requires changing the behavior of the agents within it. Changing the behavior of individual agents occurs when their perspectives, beliefs, and paradigms evolve first.[2] The importance of paradigms can be seen in how many well-intentioned efforts fail to cause long-lasting change. Without tackling the paradigms underlying systems, we are vulnerable to reproducing them in the new systems we create. This reality has been seen again and again with political revolutions, for example.

Paradigm Change Through Awe

One critique of such a theory of systems change is that paradigms are often the hardest to change in individuals, and hence an ineffective and slow way to change systems. To this, Meadows wrote:

> There's nothing necessarily physical or expensive or even slow in the process of paradigm change. In a single individual it can happen in a millisecond. All it takes is a click in the mind, a falling of scales from eyes, a new way of seeing.[3]

The Overview Effect is characterized by a cognitive shift in awareness, perspective, and worldview, which naturally occurs when viewing the Earth from space and in space. Such a shift is rapid, and its theorized mechanism of action is often related to the emotions of awe and wonder. These two feelings have been hypothesized as among the fastest and most powerful ways to change our values, goals, and behavior. This is explained because awe-inspiring events require the questioning and reorganization of our preexisting beliefs, due to their inability to be reduced.[4] Wonder has also been described as resulting in an abrupt decentering of the self and a consequent recentering of the self.[5] As such, the Overview Effect, as an experience that precipitates awe and wonder, acts on the leverage point of paradigm change.

Transformation of Systems

White's Overview Effect theory, which describes how the Overview Effect is inherently a systems theory, includes two central concepts—one of which is system states. White suggests that systems are always in a dynamic process of becoming something other than what they are at the moment. All evolving systems are in a continuous state of motion in

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[2] Meadows, "Leverage Points."

[3] Meadows, "Leverage Points."

[4] Dacher Keltner and Jonathan Haidt, "Approaching Awe, a Moral, Spiritual, and Aesthetic Emotion," *Cognition & Emotion* 17, no. 2 (2003): 297–314.

[5] Kelly Bulkeley, "The Evolution of Wonder: Religious and Neuroscientific Perspectives," paper presented at the Annual Meeting of the American Academy of Religion, Toronto, ON, November 23, 2002.

time and space, and information is the fuel that powers this process. As they respond to feedback, systems move through different states.

The three most important system states are equilibrium, in which the system appears to be unchanging, at least for a period; change, in which the system appears to move away from equilibrium but is still recognizable as the same system; and transformation, in which the system becomes something else altogether while still retaining characteristics of earlier states.

Given this framework, it seems clear that the Overview Effect, which represents dramatically new information for terrestrial society, is going to move our social systems into a transformational state. Just as the Overview experience transforms single individuals due to the novel view it presents to them, the same can occur for our entire species as a system.

Paradigms of the Overview Effect

One of the more crucial elements in the discussion of systems change through paradigm change is the type of paradigms toward which we are transforming. Systems change as a concept is arguably neutral, so the types of paradigms we adopt or shed are extremely important in shaping the types of values underlying the systems we create.

As such, the power of the Overview Effect is not only in that it results in paradigm change, but also that it transforms us toward adopting new paradigms that can aid us in dealing with our existing complexities more effectively and transitioning us toward a more ethical world. Once again, we see the interconnectedness paradigm rising to the surface of our thought.

Understanding of Systems

We hypothesize that the Overview Effect and the paradigms that result from it are intrinsically linked to a more accurate understanding of systems. One key concept to understanding systems is to see the whole context, and hence the interconnectedness of the elements within a system.

In systems, there are rarely clear borders because everything is connected and not separated in a clear-cut manner.[6] While we often need boundaries to navigate a complex world, holding too tightly to such borders and forgetting that they are of our own creation produces deep complications. As such, the key to understanding systems is to see the whole beyond the myopic boundaries we have created. For example, the borders between countries can be useful in administrative terms but can also become lines in the sand, leading to war. As another example, though astronauts perceive that there are actually no political boundaries on the Earth when seen from orbit, climate negotiators operate with national borders in their minds. This is a classic mismatch between the nature of the

[6] Donella Meadows, *Thinking in Systems: A Primer* (White River Junction, VT: Chelsea Green, 2008).

system and the perceived nature of the problem of climate change, which makes the challenge of, for example, global warming much more difficult to solve.

The Overview Effect offers us the rare experience of what Timothy Morton describes as hyperobjects—massive systems that are often obscure from human perception but whose contact with us can fundamentally alter our understanding of the universe.[7] The experience of viewing the Earth from a distance results in replacing our myopic views of the world with one that is more expansive and that more truthfully reflects one of the larger boundaries that unite us all—our whole Earth. In doing so, we can more truthfully perceive the whole system of which we are all a part, in addition to placing ourselves in the larger context of the solar ecosystem and the cosmos in which we exist.[8]

Importantly, the understanding of ourselves as systems is also key to navigating the great challenges of our time. One key reason for the difficulty in navigating complex problems is the complexity gap—the mismatch between the complexity of our problems and our ability to manage them effectively. This can be observed in how traditional institutions are often overwhelmed by 21st-century adversities stemming from an exponential rise in interconnectivity, such as climate change, AI governance, global poverty, social inequalities, and more.[9] Paradigms that help us to understand systems better can, thus, also aid us in dealing more effectively with nonlinear and emergent environments.

Crucially, the notion of the Overview Effect as an experience of understanding the nature of systems better is supported by anecdotes from astronauts. Astronauts viewing the planet from space experience it as a coherent unity and a whole system that is quite beautiful. At the same time, they recognize that the view on the surface is different. It is diverse and even chaotic. Both views are valid and depend on the location of the viewer. This is true of any system, and it brings out the concept of a holon, i.e., each system is both a whole and a part.

Planetary Identity

The big planetary-level problems of our time necessitate a planetary-level perspective and identity to manage and resolve. The challenges we face are not bounded by single individuals, countries, or regions. To address them effectively, we must unite and coordinate at the same level they present themselves—the entire Earth. The shift in awareness provided by the Overview Effect allows us to reframe our self-identity by realizing that we are a part of this whole planetary system we see before us. Such an

[7] Timothy Morton, *Hyperobjects: Philosophy and Ecology After the End of the World*, Posthumanities, vol. 27 (Minneapolis: University of Minnesota Press, 2013).

[8] David Norris and Frank White, "Leadership Lessons from Outer Space: Bringing the Overview Effect Down to Earth," *Journal of Space Philosophy* 4, no. 1 (2015): 77–84.

[9] OECD Observatory of Public Sector Innovation, "Working with Change," 2017, www.oecd.org/media/oecdorg/satellitesites/opsi/contents/files/SystemsApproachesDraft.pdf.

experience is crucial for us to shed zero-sum perspectives in an increasingly non-zero-sum world. It has often been noted that when astronauts first reach orbit, their identity is initially tied to their hometowns on the surface of the planet, then their home state and home country. Eventually, their identity shifts to embrace the entire Earth—that becomes home.

Moral Circle Expansion

Through an understanding of our whole, the Overview Effect gifts us with the consequent expansion of our moral circle. Humanity's history and progress can arguably be understood through how our moral circle has extended over time—from expanding beyond our nuclear family to our tribe, nations, races, and even species. The awareness of our true interdependence can act as the source of the expansion of our boundaries of compassion. These new boundaries broaden our horizons of caring not purely for its own sake but also because it is the reality of our existence—that our flourishing and wellbeing are tied together.

> I believe the most interesting challenge we face … involves seeing and acting from the whole, and that requires us throughout larger systems to wake up to another level of awareness that we collectively begin to operate from.[10]

A New Value System

Crucially, the Overview Effect embodies a new system of values that can underlie the design of more ethical, sustainable, and equitable systems of the future. Such a value system will be crucial for our functioning as a global society on Earth and for humanity's long-term future in space when we become multi-planetary.

> The Overview Effect represents a new system of values that holds the key to human evolution. This "human technologies interface" is where value systems and philosophies are formed as the foundation of a culture's sense of vision and purpose. Where these are lacking, the interface becomes unstable, and the system loses energy in trying to define itself. Managers of the system spend their time tinkering with subsystems and feedback loops when the problem is with the value system at the interface among them all.[11]

A New Planetary Overview System

Humanity's experience of the Earth from space in the late 1960s led to the emergence of a new system—a planetary overview system, one of the two central concepts in White's

[10] Otto Scharmer, Twitter post, twitter.com/silondonhub/status/1527638099932729344.
[11] Frank White, *The Overview Effect: Space Exploration and Human Evolution* (Denver: Multiverse, 2021).

Overview Effect theory. Regarding this concept, White suggests that, with the advent of the Overview experience and accompanying technologies, the Earth is no longer to be understood as a simple physical system. Just as systems transform with new information, agents, interactions, and boundaries, White theorizes that we have moved from seeing the Earth as just a physical system to seeing it as a physical living system, with Earth and life as its components, to now seeing a planetary overview system (Terra) consisting of the Earth, life, *Homo sapiens*, and *technos*. This can be understood as a manifestation of a planetary civilization with a presence in Earth orbit, institutionalized awareness of the planet as a whole, and planetary management as its primary science. Importantly, this evolution in the understanding of our place in the cosmos can lead to important behavioral changes on Earth.

2. Systems Theories to Amplify the Overview Effect on Earth

While the Overview Effect is a cognitively inexpensive way to change perspectives and create shifts in awareness, spaceflight is not yet accessible to all and is materially expensive. As such, sending each individual into orbit or on a suborbital hop for a direct experience of the Overview Effect is still infeasible. Because of that, another important and underexplored intersection is the use of systems theories and methodologies to propagate the paradigms of the Overview Effect effectively through networks of individuals on Earth.

Before Spaceflight

Identifying Influential Nodes

Network analysis is one relevant and important system methodology. This methodology has been helpful in analyzing social-level emergent phenomena, such as the outbreak of epidemics and pandemics, the spreading of rumors, marketing, and more.[12] This is especially relevant in analyzing social networks in the context of spreading information. Through such methodologies, we can identify highly influential nodes within a system whose influence can quickly spread to most other nodes in their network. Here, different measures have been developed to identify vital nodes, such as degree centrality, betweenness centrality, closeness centrality, and more.[13]

In a 2013 OECD working paper on education, Snyder outlines how whole systems change would not require a broad-brush application, but rather targeted applications on the most influential nodes to result in a ripple effect throughout the entire system.[14] This

[12] Chungu Guo, Liangwei Yang, Xiao Chen, Duanbing Chen, Hui Gao, and Jing Ma. "Influential Nodes Identification in Complex Networks via Information Entropy," *Entropy* 22, no. 2 (2020): 242. doi.org/10.3390/e22020242.

[13] Xiaohui Zhao, Fang'ai Liu, Jinlong Wang, and Tianlai Li, "Evaluating Influential Nodes in Social Networks by Local Centrality with a Coefficient." *ISPRS International Journal of Geo-Information* 6, no. 2 (2017): 35.

[14] Sean Snyder, "The Simple, the Complicated, and the Complex: Educational Reform Through the Lens of Complexity Theory," OECD Education Working Paper, 2013, doi.org/10.1787/5k3txnpt1lnr-en.

points to the possible application of systems methodologies to understand which individuals may be the best candidates for spaceflight because of their influence and ability to spread the impact of such a profound experience widely through their communities and beyond. One of the key organizations working to identify and send individuals to space based on their potential impact is Space for Humanity.

An essential feature of systems is interconnectedness: what happens in one domain of a system inevitably has an impact (feedback, in systems terms) on other domains. The result is that unconscious behavior by human actors somewhere in a system may produce negative results elsewhere. By contrast, conscious decisions by influential actors can leverage positive results elsewhere.

After Spaceflight

Systems Entrepreneurship

The notion of systems entrepreneurship can help individuals who have experienced the Overview Effect to create positive systems change more effectively after they return. One definition of a systems entrepreneur is "a person or organization that facilitates a change to an entire ecosystem by addressing and incorporating all the components and actors required to move the needle on a particular social issue."[15] Other authors summarize systems entrepreneurship "as a systemic process leading to change in one or more of the three systems' constituents—elements, interconnections, and functions or purpose."[16]

Here, leverage points are an important concept. Leverage points allow system entrepreneurs to identify points of intervention where they can create their desired changes better. Specifically, Schlaile et al. discuss which leverage points entrepreneurs can act upon to create change within their target system, and they narrow it down to "three deep leverage points of directionality, formal institutions, and information flows and network structure."[17]

Agent-Based Modeling

Agent-based modeling and simulations as systems methodologies can also prove useful in understanding how to amplify the Overview Effect effectively on Earth. Such methods seek to simulate how autonomous agents within a system act and interact with each other to produce emergent behavior at a systems level. For example, agent-based

[15] Elizabeth Fisler, "Want Big Social Change? Find a Systems Entrepreneur," *Geneva Global*, October 3, 2016. www.genevaglobal.com/blog/want-big-social-change-find-systems-entrepreneur.

[16] Michael P. Schlaile, Sophie Urmetzer, Marcus B. Ehrenberger, and Joe Brewer, "Systems Entrepreneurship: A Conceptual Substantiation of a Novel Entrepreneurial 'Species,'" *Sustainability Science* 16, no. 3 (2021): 781–94.

[17] Schlaile et al., "Systems Entrepreneurship."

modeling has been applied to investigate the diffusion of information,[18] social-behavioral change,[19] and the emergence of culture from individual mental representations.[20] Thus, the Overview Effect, as a culture and new value system, can be the subject of such modeling and simulations as well.

The examples presented in this subsection are by no means exhaustive of the potential intersections between systems theories and the Overview Effect. Here, we invite the continued open discussion and ideation of more ways in which system theories and methodologies can be applied toward amplifying the Overview Effect on Earth.

3. Extending the Overview Effect to Other Systems

While the Overview Effect has been discussed in the context of perceiving the Earth as one system, we theorize that the Overview Effect can and should benefit from being extended to other systems, with the goal of creating a cognitive shift in awareness toward understanding a target system as a whole.

Given the importance and ubiquity of complex systems, the Overview Effect, as an experience of outer space, presents exciting opportunities for providing us with an overview of the many other systems in which we are embedded. As discussed, the myopic view of our reality and the inability to see the whole system oftentimes results in the inability to solve the challenges contained within them. As such, could creating an Overview Effect for other complex systems provide us with the mental models and perspectives necessary to address these challenges effectively?

Notably, we can also potentially benefit from understanding systems at a smaller scale than the entire Earth wholistically. For instance, dealing with decreased employee wellbeing in an organization necessarily requires its leaders to understand not just what is affecting their employees' health and happiness at an individual level, but also organizational-level factors, such as team interactions.

Even at an individual level, humans can perhaps better understand their own lives when they see them from a distance. This is an exercise that Frank White undertook in his memoir, *My Life as Seen from Orbit*. The astronauts see the Earth as an interconnected whole when viewed from a distance while knowing that events on the surface may seem chaotic. Similarly, when White looked at the first six years of his life from a distance, he saw patterns and had insights that he had not perceived before. Understanding the context that surrounds us and our reality as not just individuals, but also as parts of a

[18] Zhuo Chen, "An Agent-Based Model for Information Diffusion over Online Social Networks," *Papers in Applied Geography* 5, no. 1–2 (2019): 77–97.

[19] Shannon C. Roberts and John D. Lee, "Using Agent-Based Modeling to Predict the Diffusion of Safe Teenage Driving Behavior Through an Online Social Network," *Proceedings of the Human Factors and Ergonomics Society Annual Meeting* 56, no. 1 (2012): 2271–75.

[20] Lynette Shaw, "Mechanics and Dynamics of Social Construction: Modeling the Emergence of Culture from Individual Mental Representation," *Poetics* 52 (2015): 75–90.

greater whole can lead to a more holistic view of ourselves, as well as positively changing our behavior when we function as part of a larger system.

Here, we would like to suggest future applications of the Overview Effect in different systems, which can vary across two main variables—the target system and the modality in which one perceives or experiences the Overview Effect. Importantly, this would most heavily rely on the applications of our emerging technologies and the science of human perception and cognition. This readily draws from the field of sensory augmentation, in which technologies can be used to expand human perception beyond our current limitations. For instance, given that the view of the whole Earth can shift one's cognition toward embracing the Earth as a whole system, we hypothesize that other shifts in perception can be created through a variety of technologies, such as virtual reality and sensory augmentation devices.

The Target System

As a brief overview, the first variable would characterize the system that is the target of the Overview Effect. Here, one could imagine creating an Overview Effect for a system at a different scale from the whole Earth. For example, this could include micro-level systems such as one's family, meso-level systems such as organizations, and macro-level systems such as healthcare systems.

The Sensory Modality

Following that, the modality in which one perceives or experiences the Overview Effect can also vary. The Overview Effect, as discussed in the context of viewing the planet Earth from space, can be characterized as a visual experience. However, the extension of the Overview Effect to other target systems can involve different sensory modalities. For example, David Eagleman, in his renowned TED talk discussing applications of sensory substitution, imagined the possibility of converting data on the functioning of a spaceship into haptic vibrations that astronauts could feel on their skin.[21]

Virtual reality also presents promising and exciting opportunities for recreating the Overview Effect without sending people on suborbital hops or orbital missions. Some experiences, like the infinite, have been characterized as the "closest thing to the real thing." While we can maintain that the Overview Effect's full experience requires seeing the planet from a distance, we can also derive benefits from analog experiences. And while virtual reality is currently being explored for experiencing the Overview Effect of Earth as a whole system, one can also imagine a range of future applications in which it is intentionally applied to other smaller or even larger scale systems.

For such applications, substantial work will need to be done to understand how one can methodically create an overview of a system with the same qualitative and emotional

[21] David Eagleman, "Can We Create New Senses for Humans?" TED Talk, www.ted.com/talks/david_eagleman_can_we_create_new_senses_for_humans.

characteristics of the Overview Effect in space—namely, a cognitive shift in awareness and worldview.

Conclusion

In this article, we aimed to highlight three intersections between the Overview Effect and systems theories—how the Overview Effect creates positive systems change, how systems methodologies can be used toward amplifying the Overview Effect, and how the Overview Effect can be extended and applied to different complex systems of which we are a part. We hope this article will spark the beginning of more discussions and research working to bridge the Overview Effect and systems theories. Importantly, both spaces can benefit from a bidirectional relationship. Given the ubiquitous nature of complex systems and the need to understand and solve the problems within them better, the Overview Effect presents many exciting opportunities to address this gap. As the Overview Effect is inherently a systems theory, the lack of a systems lens necessarily limits the depth of our understanding and application of it. We continue to invite more exploration of ideas and applications at this intersection, with the goal of increasing our ability to understand and manage the complex systems of which we are a part effectively.

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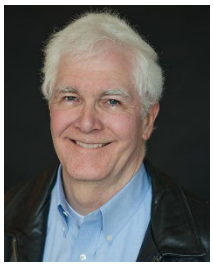
Christine Tan explores the intersection of systems thinking, wellbeing technologies, and neuroscience with the aspiration of co-creating a future of exponential compassion. As a member of the Board of Advisors at Space for Humanity, which is organizing the planet's first Sponsored Citizen Astronaut Mission, she seeks to apply systems thinking to understanding our future in space and how it can shape our culture and values here on Earth. As a Wellbeing Technology Analyst at the Transformative Tech Lab and Niremia, she strives to contribute to solving one of our greatest quests—the quest for global wellbeing, through some of our greatest tools—science and technology. She graduated with a degree in Neuroscience and a minor in Philosophy & Ethics from Minerva University, an innovative undergraduate program aimed at reimagining higher education in which students travel to seven cities across four years.



Frank White has authored or coauthored numerous books on topics ranging from space exploration to climate change to artificial intelligence. His best-known work, *The Overview Effect: Space Exploration and Human Evolution*, is considered by many to be a seminal work in the field of space exploration. A film called *Overview*, based largely on his work, has had nearly 8 million plays on Vimeo. Since the first edition of his book on the subject was published in 1987, the Overview Effect has become a standard term for describing the spaceflight experience. The fourth edition of *The Overview Effect*, including original interviews with 31 astronauts, was published in 2021.

White considers himself to be a space philosopher, and he has long advocated developing a new philosophy of space exploration. His book on this topic, *The Cosma Hypothesis: Implications of the Overview Effect*, was published in 2019. In it, he asks the fundamental question, "What is the purpose of human space exploration? Why has the evolutionary process brought humanity to the brink of becoming a spacefaring species?" In the book, he shares the idea of "the Human Space Program" as a "central project" that will engage all of us in the process of becoming "Citizens of the Universe."

Frank lives outside Boston, MA.