

Simulation Arts and Causality Montage

Miracle as Metaphor

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Simulation Arts: Strange Physics as a Medium

A new type of image appears more and more frequently in our media environment. Hyperrealistic visually, and yet utterly impossible, these animations and models play with and undermine our expectations for the behavior of material in the world. Where hard bodies are soft bodies, where glasses don't break but break things, where everything solid turns out to be inflatable. A world constantly in motion, a world we are not sure of. It is what it is not. Some examples of this are Ed Atkins's piece *Safe Conduct*, where a man at airport security keeps removing parts of his body to put into the X-ray machine; Albert Omos's *Forms*, where human bodies come together and form new fluid colonies; and John Gerrard's *Western Flag*, where a flag is formed out of perpetually-renewing black smoke at the simulated sight of world's first major oil find.

Works in this vein are widely varied, but they share the use of certain software in their construction and thus certain aesthetics made accessible by this software. Unlike traditional animation, which has also easily bent reality, this cohort of work relies on the existence—and modification—of a computational representation of reality. Thus, I will call them “simula-

tion arts.”¹ Simulation arts are works that use physics engines. Simulation arts can be real-time as seen in video games or virtual reality experiences or pre-rendered as seen in film or video art. This term is not about what the media is, for example, digital animation or interactive media, but more about how it is produced through the extensive use of physics engines which enable “simulations” of rule-based reality.

These types of work can employ a technique I propose to call causality montage that uses tools of physics simulation, not to simulate reality, but to depict and imagine phenomena that are difficult to perceive or don’t exist in reality. In this chapter, I also look at causality montage as a mechanism to apprehend issues pertaining to the climate crisis, a highly urgent condition we live in where human comprehension is mediated and difficult.² We don’t understand the complexity of the earth system and how our actions affect and influence change. Before exploring examples of causality montage, I will lay out more specifically what is involved in creating works of simulation arts.

Causality Montage: Cause and Effect Remapped

In simulation arts, the physics of the world are arbitrary and can be changed using physics engines. Physics engines are found in diverse software, from game engines such as Unreal Engine to animation software such as Cinema 4D. A physics engine is a set of rules that govern the universe of the project, though they generally begin or have standard settings “out of the box” that are identical to our physical world. A creator working with these tools can easily change the physics of the game world by modifying a few parameters. For example, a creator can change how the sun moves, the gravitational constant, and how different objects interact with each other: do solids carom off each other, pass

1. There are several degree programs with “Simulation Arts” in their name, but as far as I know, there is no definitive description of what simulation arts is. It is often used interchangeably with “games.” We still lack a broader term to describe work that is created using game engines and simulation-based animation software; because of that lack, I use simulation arts in this chapter.
2. Timothy Morton’s concept of the “Hyperobject” is very useful in thinking about the complexity and incomprehensibility of climate change. See Morton, *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: University of Minnesota Press, 2013).

through one another, accrete? A physics engine allows artists to modify the “physical” behavior of the game world or simulation. Put differently, an artist can take very fundamental elements of “cause and effect,” and use that “causality” for artistic aims. This may mean drawing relationships between the laws of physics and other elements of the world or the characters residing within it. Because most people have an intuitive grasp of physical cause and effect, changing or modifying that creates a new sensation along the lines of a physical or performative metaphor created with the environment. Thus, a physics engine allows artists to modify and create causality for artistic aims, leading to causality montage.

Causality montage is a narrative technique where cause and effect are changed in a simulated environment.³ Similarly to the dialectical meaning created in film montage through the juxtaposition of disparate images and sounds, a novel and dialectical meaning can be created through causality montage. Instead of juxtaposing images, the artist juxtaposes disparate causes and effects, such that the participant sees the causality as a creative decision intended to convey a meaning, no matter how contradictory, elusive, or disparate it is.

Simulation Arts and Extro-Science Fiction

The first time the idea of causality montage started to take root in my mind was when I watched Anne Macmillan’s video work *Open Seating* (2015).⁴ In *Open Seating*, the camera moves in a mostly empty room: several steel folding chairs are sparsely scattered around the room, far apart from each other. As the camera (and the observer) moves closer to the chairs, and as the gaze of the camera focuses on the chairs, the chairs rotate around in their place according to the camera’s position. The camera is never able to see the front of the chairs and always looks at their backs. The chairs never show their faces to the camera, or to us, the audi-

3. I have previously proposed the term “embodied montage,” a narrative technique in virtual reality for creating new relations between the body and the environment. Embodied montage is not only possible in virtual reality but also in other simulation arts. Causality montage is a more descriptive term for this broader application. See Halil Deniz Tortum, “Embodied Montage: Reconsidering Immediacy in Virtual Reality” (master’s thesis, MIT, 2016).

4. <http://www.annemacmillan.com/#/openseating/>.

ence. Chairs in everyday life are not animated by the gaze of a viewer, but in this piece they are. The physics engine binds the rotation of the chair to the viewer's gaze, and this new physics is intentional and part of the artistic gesture. This in-universe physics creates a new causality where chairs move in response to the viewer's attention by some novel but invisible force.

Turning back to how simulation arts and causality montage are urgent in the present moment, I want to discuss the relationship between simulation and climate crisis. The climate crisis is primarily revealed to us via simulations. "Simulations are necessary precisely because there is no real climate in itself, no hyperobject called global warming," writes Mark B.N. Hansen.⁵ Climate change is only understood through our tools of measurement, collected weather data, and simulations that provide probability about future events.⁶ The unique, sprawling, and somehow imperceptible new reality of climate change is perceived in its real scale only through simulations. Therefore, artistic work grappling with it can uniquely benefit from also seizing the "simulation" as its medium. What tools and resources do simulation arts provide us in order to think about the climate crisis?

In *Science Fiction and Extro-Science Fiction*, Quentin Meillassoux proposes a new literary genre: the extro-science fiction. Science fiction, he writes, "implicitly maintains the following axiom: in the anticipated future it will still be possible to subject the world to a [sic] scientific knowledge."⁷ But what if the underlying laws of the universe were changing, such that science is not reproducible anymore, that our ability to predict events no longer exists, that the future would not resemble the past?⁸ This genre would have the power to explain the world we live in: the world in climate crisis, where everything we know slips under our feet as we enter a period of terra incognita. The works that I discuss here can be seen

5. Mark B.N. Hansen, "Media Entangled Phenomenology," in *Philosophy after Nature*, ed. RosiBraidotti (London; New York; Lanham: Rowman & Littlefield International, 2017), 92.

6. *Ibid.*, 92–94.

7. Quentin Meillassoux, *Science Fiction and Extro-Science Fiction*, trans. Alyosha Edlebi (Minneapolis, MN: Univocal, 2015), 5.

8. *Ibid.*, 5–6; 37–38.

as extro-science fiction, as training modules for the Anthropocene and spaces for contemplating the impossible. They depict a world in which every action—walking, staring at objects, opening doors—can have a new consequence: nothing is stable with causality montage.

To return to *Open Seating*, this work would have been more difficult to imagine without software that has physics engine capabilities.⁹ An artist, spending a lot of time with the software's interface and becoming familiar with its capabilities and properties, can see how this engine, intended to make realistic physics possible for game developers, can be used as a tool for expression. Because of how a physics engine works, every object in this virtual space has a relationship to all other objects, a rule set about how they interact. This could either be pre-set by the software or intentionally set by the artist. Defining such a relationship, akin to the relationship between the camera and the chair, has become part of an artist's toolkit with software like Cinema 4D, Blender, or Unreal Engine.

In *Open Seating*, the relationship is defined as follows: the rotation of the chair is connected to the position of the camera. In other words, the camera position affects the chair rotation. This is already a new perspective on virtual objects, one that requires an artist to make a conceptual leap: the virtual gaze itself, though it is by default a massless entity, can also be included in the physical rules of the environment. With physics engines, relationships between different virtual bodies have become straightforward to experiment with and modify, to play with and try new relationships out. This question of "why not?" makes the work possible. You can imagine an artist, experimenting with a physics engine, asking: If we set such a relationship between the observer and the chair, what would be the result? What type of affective feelings could it inspire? Would we believe that a chair can have this kind of responsiveness, such that it almost seems alive or has some agency? What would a chair with agency look like? How does it make us feel when the chair turns away from us?

9. It could technically be accomplished in older animation techniques, such as stop motion, or CGI. Alternative physics exist in partial in mythology, architecture (from Trompe l'oeil effects to upside down Wonderwork attractions), magic tricks, futurist novels, cartoons (from Road Runner to Tom and Jerry), and films (from Star Wars to Marvel). A key difference here, however, is that alternative physics becomes the foundational aesthetics through the use of physics engines.

Does it turn with embarrassment, with anger, with shame—what is it? If we throw a chair, we expect it to go a short distance, fall or otherwise hit the ground, and act predictably. When there are new causalities, we find ourselves at a starting point: what is governing the chair's movement? Is it us? The chair itself? The new causality imbues the relationship with possibility.

In *Open Seating*, this unexpected and fresh relationship between the chair and the observer is almost like a new law of nature. In fact, it is a law of nature within the world of the video. Like flowers turning to face the sun, or the fact that we never see the dark side of the moon from the Earth, it is a new causality. The position of the viewer's camera causes the chairs to swivel. What does this new causality in the world of *Open Seating* mean? Is it a metaphor? It has poignancy, but, for me at least, its meaning is both evasive and somehow expansive. The novel aesthetic of the piece offers us a productive ambiguity and a wide range of possible meanings. What could a larger world be like where this is the order of things? A world where agency is not only limited to humans, but in which even an object we consider inanimate and banal, like a chair, can respond to us.

Embodied Meaning

Causality montage can provide us with tools to think about non-human agency and invisible causality. It also helps us to understand the world through the logic of simulation. In reverse, it can help us to recognize where and how the world already runs on the logic of simulation. Causality montage can go beyond understanding and recognition and create experiences and works that break out of the current mold. Perhaps it is a way to think new thoughts, create new embodied metaphors, new miracles, and contribute to a foundation for a reconceptualized relationship to the world we inhabit

Viewing Rachel Rossin's virtual reality piece *The Sky is a Gap* (2017)¹⁰ through this lens helped to clarify and reinforce this aesthetic technique of causality montage, as well as provide another example of its use. In this piece, when the viewer puts on the VR headset, they find themselves in a room.¹¹ Although they don't know it yet, this room is in the midst of an explosion. As long as the viewer remains stationary, the room also remains stationary. However, if the user walks forward, the room begins to explode. When they walk backwards, the explosion reverses: the room "de-explodes," moves backwards, and becomes whole again. This is an impossible spatio-temporal logic as the viewer's position in the room is tied to the progression of the explosion. Walking is the cause of time moving either forward or backward. In everyday life, this is certainly not a cause and effect of physics we expect, but, in this simulation, physics is re-organized around this new relationship: walk forward, time moves forward; stop, time stops; walk back, time moves backwards. It is a novel mapping of time and space, a new law of nature, a new causality

In the first year of life, infants build their expectations of the physical world, by observing how things move, fall, progress, and break. Humans can make predictions about "the trajectory of a thrown ball, the direction that a chopped tree will fall, or the path of a breaking wave."¹² This knowledge is called intuitive physics. Humans learn, early on, that dropped objects fall to the ground; gravity is one of the first things that we understand about physics. We also know that we stand upright when we are energetic, and we lie down when we feel tired. Our relationship with the world, guided by causality, allows us to create meaning and new conceptual structures driven by embodied cognition.

10. <https://www.xrmost.com/xrdatabase/all-experiences/the-sky-is-a-gap/>.

11. Although *The Sky is A Gap* is not photorealistic like *Open Seating*, the viewer is situated bodily in the space and controls the movement of the virtual camera with their gaze. Because of this, both pieces produce a strong first-person perspective, regardless of visual realism.

12. James R. Kubricht, Keith J. Holyoak, and Hongjing Lu, "Intuitive physics: Current research and controversies," *Trends in Cognitive Sciences* 21, no. 10 (2017): 750.

The writers Lakoff and Johnson, in their work *Metaphors We Live By*, suggest that our lived, physical, and sensorimotor experience of the environment can underpin our metaphorical sense-making of the world we live in. For example, a person saying they're feeling "on top of the world," is referencing a metaphorical relationship between "up" and "happy" or "good," internalized and part of that person's mental and verbal model for the world.¹⁵ Metaphors can draw on human embodiment as well as on the rules of physics in regard to how different bodies relate to each other and the parameters of spatio-temporal mappings to derive new, unexpected meanings. Causality montage provides a sort of sideways approach to the model of language and sensorimotor development, where new metaphors can skip over language and be built from new physical experiences—new causalities—that are in dialogue with our learned or internalized causality.

In *The Sky is a Gap*, the new mapping of time to space feels as essential in the world of the piece as gravity does in our world: it presents the viewer a space with different intuitive physics. Just as they understand that objects fall under gravity, the viewer learns that in this world, time will move forward if they walk forward. The capability of the body and the (virtual) world is changed, meaning new metaphors can emerge. What new, embodied meanings does this give rise to? How can our thinking change in a world in which walking is given new meaning? To return to my earlier observation about simulations and complex concepts like climate change, maybe it can produce a new sensitivity to connections we previously could not perceive. In *The Sky is a Gap*, every step we take has consequences and changes the environment. We know with our whole body that the world is constantly shaped by ourselves and countless other agents at each moment.

13. George Lakoff and Mark Johnson, *Metaphors We Live By* (Chicago: University of Chicago Press, 2003), 15.

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In Universal Everything's *Emergence* (2019),¹⁴ the player controls a person that is made of light. This light-person is in the middle of a desert surrounded by a large crowd of people. As they move, the crowd moves; as they stop, the crowd stops. The body of the light-person is also the body of the crowd: there is an invisible tie between the person and the crowd in a way that evokes murmurations of birds or schools of fish but does not replicate this. There are several vertical beams of light dispersed in the desert, and each time the player moves the light-person into the beam, the relationship between the light-person and the crowd changes. New rules govern the crowd's movement, driven by the player's actions but mediated by unknown or invisible forces. Throughout the experience, different causalities form between the light-person and the crowd. At times, the crowd runs away from the light-person; at times, the crowd forms a large circle around the light-person; at other times, the crowd forms small groups and changes position depending on the light-person's position. In *Emergence*, a crowd is a strange, unpredictable extension of one's own body, moving with and driven by one's own movements but rendered strange through the application of regularly changing physical rulesets.

Causality montage has echoes of a religious story as myth and miracle. Other myths and miracles carry similar mechanics where the cause (physical action) and the effect (manipulation of the physical world) are both impossible, yet meaningful: "In the Bible, Lot's wife looks back when leaving Sodom and turns into a pillar of salt; Medusa turns onlookers into stone by making eye contact; Midas turns everything he touches into gold."¹⁵ With physics engines, myths and miracles become reproducible events. They are metaphors, narrative techniques, and physical experiences. Through causality montage, miracles and myths can be studied as narrative form and lived as physical experience. Furthermore, new mira-

14. <https://store.steampowered.com/app/1337820/Emergence/>.

15. Tortum "Embodied Montage," 67.

cles can be built through causality montage as new metaphors that reconceptualize the world. Causality montage produces and constructs new worlds: it is not only a tool of storytelling, but a tool that enables emergent stories.¹⁶

Revealing Invisible Causalities

In her lecture “Causality is Broken: Can We Fix It With Art Design?” Pinar Yoldas talks about how causality is invisible in our world: “Drinking water from a plastic bottle kills a marine bird somewhere, buying tomatoes grown in a greenhouse in Spain murders a whale.”¹⁷ Often, we cannot see the effects of our actions as these effects are imperceptible to us, even as we “know” of their abstract possibility. A bottle of plastic water we drink may cause an albatross to die, but there is a disconnection in time and space between these two actions. Yoldas suggests something like this: what if a dead albatross fell on our head every time we drank water from a plastic bottle?¹⁸ What if this invisible causality became physical knowledge that we could comprehend not only with our minds, but with our bodies? An albatross falls on our heads when we drink water from a plastic bottle: this is a causality montage—a new creation of causality explaining the world, making the invisible visible, providing us with moments of recognition—a miracle.

Amitav Ghosh asks a crucial question in his book *The Great Derangement: Climate Change and the Unthinkable*. Outside of genre fiction, climate change has been rarely depicted in literature. This is a phenomenon we could say is the most urgent issue facing our time. What is the blind spot? For Ghosh, the modern novel took shape when a “regime of statistics, ruled by ideas of probability and improbability” was shaping society

16. Some other examples of causality montage can be found in Ian Cheng’s *Emissaries*, David O’Reilly’s *Everything*, and Alan Kwan’s *Hallway*.

17. UCLA Design Media Arts, “PINAR YOLDAS CAUSALITY IS BROKEN: CAN WE FIX IT WITH ART DESIGN?” Counterforce Now Lecture Series 2019, streamed live on May 23, 2019, YouTube video, 1:25:26, https://youtu.be/7w0Uf_BKXJg.

18. *Ibid.*

and the tastes and ideas of the ruling class.¹⁹ In this world, science led, and improbable events always had a scientific explanation. This world, in which we have lived in the last century, had “few surprises, fewer adventures, and no miracles at all.”²⁰

However, the world we are into right now is completely different. Improbable events, such as a 100-hundred-year storm happening every year, flash floods devastating major cities, heat waves killing millions in a single day, and aerosol-covered skies blocking sunlight, are now the realities (or imminently possible realities) of our world. We need a new literary or artistic aesthetic to communicate these realities. Causality montage can lead to moments of recognition that the world “as we know it” is not necessarily what it is or will be in the future. Ghosh starts *The Great Derangement* with the following observation:

Who can forget those moments when something that seems inanimate turns out to be vitally, even dangerously alive? As, for example, when an arabesque in the pattern of a carpet is revealed to be a dog's tail, which, if stepped upon, could lead to a nipped ankle? Or when we reach for an innocent-looking vine and find it to be a worm or a snake? When a harmlessly drifting log turns out to be a crocodile?²¹

Causality montage can provide these moments of reveal and recognition. It can help us think through non-human agency, solidify invisible causality, and better understand the logic of simulations. It can also act as a miracle engine, creating experiences that inspire new thinking. Therefore, simulation arts stands at a very critical point. Will they make us look at the earth afresh, make the complex relations of the world more understandable? Can the uncanny relationships of causality montage enable us to see existing causality anew, and perhaps see as mutable dynamics that were previously accepted as given?

19. Amitav Ghosh, *The Great Derangement: Climate Change and the Unthinkable* (Chicago: The University of Chicago Press, 2017), 19.

20. *Ibid.*, 19.

21. Ghosh, *The Great Derangement*, 3.

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