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Fall Guys: On Thought Experiments and Simulation

What if thought experiments were not only a way to articulate the pivotal but often obscured connections between fiction and simulation, between philosophy and science, between storytelling and critical argument, but also a way to reconcile the supposedly hard-science culture of computer simulation and the so-called artistic and humanistic tradition of posing critical questions? What if these two cultures in fact were one and the same, derived from the same stories and insights?

Another way to formulate that guiding supposition is to ask whether computers in fact do or do not give rise to a culture of the thought experiment that transcends and actualizes the status of the merely theoretical, fictional, imaginary. One of the most elaborate examples might be the recently rediscovered Rainer Werner Fassbinder film *World on a Wire* (1973), a low-budget yet highly inventive adaptation of the dystopian American novel *Simulacron-3* (1964) by Daniel Galouye about a corporation manufacturing a supercomputer that generates and supports a virtual world that is robust enough that the artificial intelligence entities in it believe themselves to be real. The film's setting in the Institute for Cybernetics and Futurology is portrayed as a labyrinth of reflections, steeped in art-historical allusions but entirely in the service of artificial life and simulated reality. Similar territory is pursued by Greg Egan's influential novel *Permutation City* (1994). Is consciousness merely information processed in certain ways, regardless of what machine or organ is used to perform that task? Or is this invalidated by reminding ourselves that a hurricane model does not make anything wet, a fusion plant simulator does not produce energy, a metabolic model does not consume actual nutrients—so a model of the human brain does not amount to giving rise to actual thought? What if cellular automata could, given enough time and processing power, evolve into a structure complex enough to permit flight from this planet and its constraints into a realm that is unlimited by everything that holds humanity down? What if every thought experiment, even as it pushes

collapse time verbally? . body implicated in thought experiment always . braid . but we must not succumb to

at the material constraints of our existence on earth, was by the same token partly practicing that step off-world, out of place, out of time?

Suppose you could overcome gravity and the grave? What if global warming, infectious diseases, overpopulation, and other urgent questions confronting humanity today could be addressed at the planetary level? This kind of thought experiment may seem like the province of science fiction (what if there was another planet that could sustain human life?)—but in this age of the rapid emergence of many dire emergencies, that supposition has become the pivot of our engagement with planetary problems. Whereas our default mode of troubleshooting environmental, pedagogical, political, or aesthetic crises had been ad hoc, partial, local—but increasingly now, our problems are of a planetary scale, and require attention to possible solutions at a larger scale. A global response would require a model at a much larger scale—what if a large-scale solution to large-scale problems could be modeled, tested, improved, and deployed? What if all the various emergency responses demanding full attention were to be connected, on a scale that integrated them into a global geometry of attention, or a planetary model? What if one modeled that kind of whole-earth response?

Computers of course are much faster than human brains at chaining together complex branching cascades of what-if, what-if, what-if. So even if some may wonder whether computing is not also part of the problem, increasingly we assume that computing must be part of the solution, too. But let us slow down and look back on a longer history of simulation and thought experiments. There are numerous well-known examples both in science and in philosophy of thought experiments—whether we think of Maxwell's demon, Schrödinger's cat, the Turing test, or Searle's Chinese room. Outlining the trajectory of a brief history of the thought experiment, we may find that the gesture is somewhere between falling and throwing (yourself). In the history of science, serious thought experiments date back to the day Thales of Miletos (in Asia Minor or what is now the West Coast of Turkey), speculating about the stars above, fell into a well. Considered by Aristotle one of the Seven Sages of Greece, and by Bertrand Russell the first philosopher, Thales wanted to explain natural phenomena without reference to mythology. However, this pre-Socratic stargazer is said to have been observed falling into the well by a maid who laughed at his distracted tumble. So at the anecdotal origin, we also have to deal with a lack of recognition for the significant potential of the thought experiment. Moreover, it could also be said that

permanent indecision (stress) . call on the body . call and response . call and response in jazz, hip-hop, blues, and

what the anecdote highlights, by way of a dangerous absence, is the middle ground between transcendent gaze and empirical pragmatics. At any rate, Thales' rejection of mythology and insistence on testing hypotheses based on general principles establishes itself firmly at the core of the scientific process, of rational thinking.

Albert Einstein improved on the experimental set-up when he observes a Berlin roofer tumbling down. Just like Thales, had the roofer not survived *and* been observed, our intellectual history would be so much the poorer, since he shares with the bystander Einstein the fact that during free fall he felt no gravity. This insight was gained without risk to Einstein's life and limb. When the need for complex calculations—such as ballistic trajectories and the fluid dynamics of weather and of explosions—challenge traditional methods, that significantly spurs the development of computing towards the end of World War II, and thought experiments start to be conducted more regularly "in silico." Yet this practice could build upon a long tradition in political consulting, military history, and in games. From antiquity to the eighteenth century, people knew chess, for instance, as a model of pre-gunpowder combat. The nineteenth century saw the Prussian *Kriegsspiel* adopted by other military commands as a way to prepare officers for informed decisions. And by the turn of the twentieth century, feedback from the front was regularly infused into training before experience grows stale.

Simulation is of course particularly useful in closed mechanical systems; one example is the airplane. Charlie Chaplin's half-brother Sydney (who had briefly formed the first privately owned domestic American airline, based in Santa Monica, California—it lasted less than a year) was a pioneer in offering flying lessons—but in fact he just flew his affluent clients around, and scared most of them away; he got out of the business after pilot licensing and air traffic regulations commenced. Not only were Syd's methods evidently not the best pedagogy, it was just as obvious that it would be costly to train people on the real thing—they can get hurt, expensive planes can be destroyed, so it is better to train pilots on simulators. In a quick distinction owed to the work of Claus Pias, one might say that action games today still mostly depend on the setup of a flight simulator providing instant feedback on twitchy controls, in the rhetorical order of the metaphor: this rolling log, this bucking bronco is a plane. This trajectory of throwing yourself into the sky in order not to fall continues from the wooden Link Simulator to the current generation of Microsoft Flight Simulator

games. Mastering its controls in a first-person perspective affords the users a speed or other rush, transgressive thrills that please the Id. In the mode of role-play, the critical element is not so much time and speedy reaction as it is the making of decisions, in the rhetorical order of metonymy: you go this way or that way, you are dwarf or elf, you have long hair or short, as you perform the constitutive tasks of the Ego in a second-person perspective. And the third-person perspective of strategy games affords oversight, laying down rules like the Superego and seeing how they play out—tax rates, religious prohibitions, traffic laws, surveying the tabletop or board or floor game in the rhetorical mode of synecdoche, whereby a tank or a plane stands for armies, a tree stands for the forests cut down to make room for pasture in South America, and the critical element is neither a series of individual performative substitutions nor reaction speed but the coordination of large-scale systems.

For the most complex systems, such as epidemiology or economics, simulation can still be a good introduction to dynamic system behaviors, a way to explore options and test the validity of assumptions. When Alice falls down the rabbit hole, grabbing a jar of marmalade on the way down, the thought experiment is still a pre-global one: what if you fell right through the center of the planet? Would you accelerate and pop out the other side? Where would that be? When Lewis Carroll wrote in the 1860s, people could still suppose the Earth is hollow, and indeed hollow Earth theories remained popular until explorers fought their way to the North and South Poles. It was not until a century later that Buckminster Fuller seized the nascent planetary consciousness and suggested that we are all hurtling through outer space, that we are falling through nothingness on Spaceship Earth. His planning games, meticulously arranged on large maps that could cover the floor of a gym or conference hall, soon gave rise to computer-based planning exercises that shifted the metaphor further: Operating System Earth—how would you run the planet? It took a minimal observer's distance from the Earth to arrive at this new planetary consciousness—not by coincidence did the Apollo shot of the "blue marble" become the omnipresent logo of the green movement, the most trafficked photo in the history of mankind.

Today, there are a number of institutions researching simulation and its uses for government, military, and business: the Technical Support Working Group, the Modeling Virtual Environments and Simulation program at the Naval Postgraduate School, the Air Force Agency for Modeling and Simulation, the Navy Modeling and

Simulation Office, the National Simulation Center. But before we dismiss them as part of the military-industrial complex that has little to do with our cultural lives, let us remember that artists including Leonardo, Michelangelo, Dürer, and Galilei drew and built models of fortresses and of weapons. Closer to our time, it was famously the Tech Model Railroad Club whose elaborate play set and communication system gave rise to the MIT hacker scene. Of course, even when computer simulations use fundamental theory to generate models, they must beware of any confirmation bias and strive to use simulations as tests of the underlying theory.

Given that more and more of our most pressing problems are global in scope and cause, an interesting extension of the trajectory of simulation is the Living Earth Simulator or Large Knowledge Collider proposed by Swiss sociologist Dirk Helbing. To predict infectious disease outbreaks, combat climate change, or foresee financial crises, Helbing wants to connect the knowledge of domain experts across all scientific fields with a large-scale real-time data mining capacity. His grant proposal to the European Union asked for funding of a billion euros. Resembling to some critics the Seldon Plan, which you might recall is named after Isaac Asimov's fictional character Hari Seldon of the Foundation series, the Large Knowledge Collider would simulate all systems that are critical to managing our planet.

To wrap up, the task of strategy games had the flow of data as its driver, optimizing command and control, but their trade-off is that they are slow. Simulations sought to offer safe training driven by feedback principles, optimizing survival, but the trade-off is that those systems need to abstract and omit variables. Equation-based modeling took that logic into the computer age, driven by complex calculations, optimizing the predictive value of the model, but the trade-off is that the computer models become a black box. Agent-based modeling sought to improve on this setup in a distributed model, driven by artificial intelligence, optimizing individual behavior, but the trade-off is that they are very decentralized. The Living Earth Simulator or Large Knowledge Collider takes global modeling as its task, driven by data mining technology to optimize collective behavior. Of course, the trade-off of such a totalizing model is that . . .

Oh, I'm out of time.

and tell what happened . come prepared to do something w/ language . come to my window I'll be home soon .