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21

Simulated realities

(Or, why boxers and Artificial Intelligence scientists do mostly the same thing)

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Simulations are a strikingly regular feature of group life, organizational practice, and popular culture, yet most analyses of them completely miss how widespread they have become. Simulations are more than just sophisticated computer techniques for testing scientific theories. The social analysis of simulation is anemic if we only conceive of them as metaphor for symbolic economy and referential ambiguity. At both a more mundane and profound level, simulations are a central way that groups, organizations, and workplaces confront difficult tasks when direct experience is hard to come by. This chapter explores how two quite different groups develop and use simulation techniques and technologies to manage (although just as often exacerbate or create *de novo*) core organizational problems. That is, when Artificial Intelligence scientists and boxing coaches develop simulations, whether to study human-level intelligence or to prepare for an upcoming competitive match, they engage in a process of reality control that transforms particular organizational ambiguities into legible and tractable bits. This chapter shows the distinctive mechanisms of this process and argues that these simplified solutions develop complex social lives all their own. It concludes with a discussion of how the empirical study of simulated realities can help draw out a deep synthesis between the physical and the virtual, visual representation and organizational process, and lay and scientific expertise.

Introduction

On a humid but otherwise uneventful August afternoon in Chicago, IL, a friendly sparring session became a real fight. The stage for this transformation was Harlien's Gym, a municipally funded amateur boxing program on the city's North Side. Two teenaged boys, 13-year-old Keshawn and 14-year-old Lamar, had the starring roles. The two boys are regular training partners and friends outside the gym. Head coach Al Levinsky, a handful of young boxers, and me, Al's assistant trainer, monitor the exercise.

Physical props, from the visual management tools highlighted by Bateman and Lethbridge (Chapter 19, this volume) to the ring ropes at Harlien's Gym, focus group attention toward 'where the action is,' to borrow Goffman's famous phrase. We have all positioned ourselves around the ring ropes to maximize our sightlines and thus make the interaction available to collective manipulation. At the midpoint of the second round, we can all see and hear that Keshawn is breathing heavily. To compensate, the young boxer starts throwing noticeably harder, but fewer, punches. In boxing terms, he is 'loading up.' Al tells him to 'take it easy.' Instead, Keshawn connects with a hard punch that snaps Lamar's head back. A bit shook, Lamar fixes his twisted headgear and tries to respond in kind. Al instructs the boys to 'keep your cool,' but the intensity escalates. Both are falling out of their better form, creating openings for the counterpunches of their opponent and the critiques of their coaches and fellow boxers.

Outside the ring, boxer Reginald, a frequent rabble-rouser, looks to me and says with a grin, 'It's a fight, now! They're really fighting, Steve! You better stop it.' The round is nearly over. I glance at Al, who raises his palm to signal that he can handle this. Soon, the gym timer blares its round-ending bell. The boys part ways but Lamar gives Keshawn a little shove on the shoulder. This subtle escalation, far more benign than the punches that have just preceded it, draws the ire of Al, who yells, 'STOP!' In a cadence reminiscent of the drill sergeant in the movie *Full Metal Jacket*, Al commands, 'That's it. Take off your gloves. Now! Shake hands. Both of you.' Lamar refuses. Keshawn shrugs and walks to his locker. Al allows the situation to pass. Later that evening, however, the coach informs them that they will not be sparring for two weeks. Lamar's scheduled match in one week will be cancelled. The coach summarizes, 'Your sparring partner is your friend. You can't do that stuff.'

There is something odd about the scenario I have just described. You have an activity, competitive boxing, where the main goal is to instruct adolescents how to punch their opponent harder and more often than they punch back. So, when Reginald says 'it's a fight now!', that might strike you as a rather bizarre restatement of the obvious. If an alien visitor observed this scene, armed with a language translation app, it would find the definition of 'fight' to be perfectly well captured in the phrase 'a hostile encounter.' Our space alien might then be confident in classifying all sparring matches as clear examples of hostile encounters and would be rightly confused when Reginald violated that classification by implying that the one between Keshawn and Lamar had only recently become such a thing. Something is happening here. An act of interpretive flexibility is occurring *in situ*. There must be 'invisible factors' contributing to this interaction that the explicit performance does not immediately reveal (Berthoin Antol *et al.*, Chapter 16, this volume). What is the logic of this exchange? What background knowledge and implicit rules govern this negotiated order? For now, I bracket this scene at Harlien's so as to return to it with some better analytic tools.

These tools will involve the empirical life of simulation techniques and technologies in group and organizational settings. This is not the typical way that social analysts discuss simulation. The most common research literature on them is largely practical in orientation. It treats simulations as sophisticated computer systems for testing theories or providing rich visual and aural mediums for the exploration of data (Bainbridge *et al.* 1994; Gilbert and Troitzsch 2005; Sawyer 2005; Winsberg 2010).[1] While this is clearly an important epistemological and methodological development, this way of conceptualizing simulation provides a very limited analysis of its broader social, political, economic, and organizational repercussions. That is, if we focus primarily on the implications of simulation for the philosophy of science, we miss their quotidian character.

Another common way that scholars have discussed simulation is as a metaphor for a broad social transformation of Western societies. Here, simulation provides the basis for a postmodernist metaphysics attentive to the ascendency of symbolic economy in late capitalist, global, and information-based societies (Baudrillard 1994 [1981]; Bogard 1996; Hayles 1996). This post-structuralist approach has proven theoretically anemic, however, because it tends to simplify empirical variation, erase historical contingency, and ignore contextual specificity, despite its adherents' philosophical proposition to do just the opposite. While Baudrillard insists that we understand how postmodernism creates the world-as-simulation, the approach I offer suggests we focus instead on how simulations create worlds by asking a fundamental if jarringly straightforward question: Why do social actors create simulations and what do they do with them?

The main answer is that simulations are a key mechanism that groups and members of organizations use to manage the problem of 'stingy' or 'thin' experience (March *et al.* 1991). That is, simulations are used when some indexed reality (e.g. a 'real' boxing match, the impact of a hurricane on a metropolitan area, the role of analogy in human cognition, 'best practices' in lean enterprise, etc.) is unavailable to routine experience. Simulation transforms the extraordinary into the mundane by rendering an indexed reality tractable and legible through a series of simplified 'best guesses' on key sources of complexity. These guesses are then used to construct an interactive, repeatable, and highly portable situation, activity, or model. However, partial interventions can create new dilemmas and unintended consequences. Simulations can and often do exacerbate the very problems they were created to solve, especially when they serve as depositories for solutions that are uncoupled from the initial dilemma (see Cohen *et al.* 1972). Simulations forge new realities with risks, uncertainties, and ambiguities all their own.

One finds simulations in an enormous variety of empirical settings and they have become increasingly common in both scientific and organizational settings. In this chapter, I present ethnographic data on two groups that are quite different in purpose and personnel – boxing gyms and academic Artificial Intelligence (AI) labs. I argue that, despite their substantive distance, both groups are centrally in the business of designing simulation techniques and technologies. These techniques necessarily rely heavily upon visualization, whether of the physical (e.g. ring ropes) or virtual (graphical design) sort. As many of the authors in this volume point out, visualization props render group practices and identities explicit by foregrounding certain characteristics while framing out others. In boxing, coaches and boxers mostly engage with *physical* simulations, like sparring, hitting punching bags, or shadowboxing, although trainers and athletes also incorporate virtual inputs as well (e.g. watching YouTube clips of potential opponents). In AI, scientists primarily engage in research and development of *virtual* simulations like storytellers, battle-planning assistants, and other decision-making 'helpers' that exhibit intelligent behavior or decision-making capacity. They, in turn, profoundly rely on physical inputs (e.g. conceptual drawings on whiteboards, notes scrawled on paper, the electrical current required to run their computers) to refine their technical artifacts. What unites these two groups is that they both engage in a sense-making process, worked out through the medium of simulation, of reality control. Lab and gym life are both organized around policing the interpretive borders of the simulation and their indexed realities, subtly transforming both and, in the process, creating all new social worlds.

Data and methods

My observations of simulations as an empirical process began at Harlien's Gym, a city-funded park district boxing program in Chicago for youth ages 9 to 17. It is located in an inner-city neighborhood well known for its ethnic, religious, and economic diversity, although most members of the gym are African-American, white, or Latino boys who come from working-class or working-poor homes. My long background in the sport helped forge a niche within the gym, where I became an assistant coach for the youth program. After the conclusion of my ethnographic observations, I started an adult boxing program, which I ran for six years. In the two years I worked as an assistant coach, I openly took notes during and after regular workouts, two to three times per week, travelled with the team to hundreds of amateur competitions around the Chicago region, and took several long-distance trips to regional and national boxing tournaments. I relied on a digital recorder to record training sessions while I worked 'hand in glove' with my boxers.

Approximately two years after finishing my observations at Harlien's, I began a three-year ethnography of two academic labs working on Artificial Intelligence technology to observe the production of simulations within a science and engineering setting. Unlike my background in boxing, I had no expertise in AI or computer science beyond a baseline familiarity with computer technology. Nonetheless, both labs were welcoming due primarily, I believe, to my academic credentials, and I quickly settled into a role as a sounding board for ideas and de facto editor of rough drafts of lab papers.

Both labs are part of the same Department of Computer Science at a well-endowed private research university in the American Midwest. I was allowed to share an office at the IntelliLab with an advanced graduate student. I observed both labs approximately two to three times per week for this period, although for several month-long periods I came nearly every day. I participated in weekly project meetings and other brainstorming sessions and remain in semi-frequent contact with several members of the labs. I conducted over 50 one- to three-hour interviews with all the members of the labs along with shorter follow-up interviews. I also include in my data set several thousand pages of email, pictures, lab papers, and website materials, along with hours of online video content produced by the labs.

The two AI labs map onto two key subfields within contemporary AI. The IntelliLab is an information-processing lab that focuses on information classification and retrieval, drawing on an array of AI techniques but based primarily in the subfield of case-based reasoning. The lab and its leaders were professionalized within a well-known tradition in AI science known as 'script theory.' The vast majority of its research projects are externally funded by the IT industry, the arts and entertainment industry, and venture capitalists. The co-directors of the IntelliLab maintain extensive social and professional networks within these fields.

QualGroup is a lab working on computer systems that can reason using analogy, and is based in the AI subfields of 'knowledge representation' and 'qualitative reasoning.' The QualGroup was, by far, the most well-endowed and largest CS lab on campus. It received the vast majority of its funding from the US Department of Defense, the US Naval Academy, the National Science Foundation, and the US Department of Homeland Security, and the head of the lab maintained both thick and thin ties to research scientists working at these agencies, other researchers in the field of cognitive psychology and cognitive AI, and with military commanders (some of whom were university alumni).

Simulation as an empirical process

Before moving into a discussion of how simulation shapes out in these settings, I first set out a formalized definition. Simulations are *sets of activities or techniques that members of a self-delimited group or organization mutually recognize as a simplification of some more real entity, experience, or goal state.* These simplifications operate in one of the following two distinct ways: *(1) segmented pre-enactments of the bracketed reality designed as a means-to-an-end; or (2) self-contained, self-referential experiences for knowledge exploration or entertainment that is designed as an end-in-itself.*

Simulation, as defined above, is incredibly commonplace. Cooks commonly rehearse a new recipe before preparing it for dinner guests, with the reactions of intimates serving as an impromptu simulation for more consequential tastings in the future. Adjustments in flavoring, ingredients, timing, and visual presentation are all affordances that can be manipulated within the simulation to fine-tune the model (which in this example is the recipe). Simulation technologies have become an increasingly important component of disaster and risk analysis, mobilized to prepare for hurricanes, earthquakes, deep-sea oil spills, or evacuation planning.[2] The United States military designed full-scale simulations of Iraqi villages complete with insurgents in the Mohave Desert (Filkins and Burns 2006), and the testing and maintenance of nuclear weapon stockpiles relies almost exclusively on simulation technologies (Gusterson 2001; Masco 2006). Advertising firms offer simulation techniques for product testing. Scientists use simulations to derive data on phenomena that is either cost forbidding or simply beyond the reach of traditional scientific techniques. The entire field of experimental particle physics is organized around large-scale physical and virtual simulation techniques (Traweek 1988).

A suggestive literature for understanding the social life of simulation can be found in organizational decision-making theory. For example, both the Carnegie School tradition and Mertonian-style institutional analysis demonstrated some of the mechanisms that groups and organizations use to learn from paltry precedent (March *et al.* 1991). Members of organizations either develop a deep and rich analysis of the small number of cases they have at their disposal or figure out how to imagine the wider array of possible alternative histories that could have transpired but did not yet happen. Simulation is of the latter mechanisms. Another generic reason why simulations arise is when goals are ambiguous. That is, when groups and organizations set out to accomplish something that is so complex, risky, or multivalent that information flows are slow, inefficient or costly. There are varied literatures that speak to this issue, including work on stochastic decision-making in anarchic organizations (Cohen 2007; Cohen and March 1974; Cohen *et al.* 1972), work on the normalization of risk (Heimer 1985; Perrow 1999; Vaughan 1996), or contingency theories that treat decision-making as a function of what information is available at any particular time (Stinchcombe 1990). Herbert Simon (1957) provided a nice summary of this problem when he said that goals are ambiguous when accumulating sufficient information to maximize on them would require 'powers of prescience and capacities for computation resembling those we usually attribute to God'. To be sure, simulation is not the only way that organizations manage ambiguity. Familiar ways include administrative record keeping, organizational hierarchy, the segmenting of tasks into discrete parts, quantification, and even the 'heedful interrelating' described in Weick's case studies of occupational sense-making (Weick *et al.* 2005).

Simulation adds two novel aspects to these previously identified mechanisms for managing ambiguity. First, it provides a clear focus on what we might refer to as the performative infrastructure of reality. It draws attention to the ways that actors consciously and unconsciously frame some situations as less real than others, and then derive behavioral cues from those distinctions (Bateson 2000 [1972]; Goffman 1974). This interpretive bracketing creates the situational possibilities for action that are otherwise unavailable, very much akin to the 'liminal spaces' famously identified by cultural anthropologists (Gennep 1960 [1909]; Turner 1977 [1969]). Second, simulation is an intermediary mechanism between innovation and routine, as well as between protocol and practice.

In the next section, I argue that simulations vary across three interrelated dimensions. Then I discuss how these axes can help us get analytic leverage on the central dilemmas animating boxing gyms and AI labs as well as a wide spectrum of groups and organizations in the business of reality control.

Three dimensions of simulation

Simulations imitate many different things – a complex task or game; a physical, chemical, or mental phenomenon; an exciting or evocative experience; an ecosystem, a social system, a world, a universe. For example, both climate modelers and baseball coaches regularly use simulation to make guesses about how best to predict the future. Thus, an empirical analysis of simulation requires tools that can cover both scientific forecasting and competitive sports, at the very least. To develop such tools, I argue that simulations vary on three main dimensions.[3]

Experiential modality

Perhaps the most obvious source of variation involves the visual and material interface of a simulation – whether it is physical or virtual. This is what I call the *experiential modality*, or the visual and material modality through which a user interacts with a simulated technique, technology, process, experience, or world.

At Harlien's, physical simulations include shadowboxing in front of mirrors, or hitting a range of different leather punching bags, or running through many different sorts of punch combinations and defensive tactics with a coach on punch mitts. These various simulations form a hierarchy of space and substance within the gym, so that only the most accomplished boxers have free access to all of them. Initiates are typically relegated to the peripheral zones of the gym and, for quite a long time, to sparring first their own mirror image and then the inanimate bodies of punching bags.

The most 'serious' or complex simulation, and the one that comes closest to an actual match, is a sparring session. But here too there are many variations on the theme. Some sparring matches are highly choreographed, in which one boxer is only supposed to throw a certain combination and nothing else, or mimics a coach's demonstration, or partners are told to only hit each other to the body. This forms a continuum all the way to sessions that are nearly indistinguishable from a competitive match except for the fact that the session is not scored and does not have an external audience to witness it.

In contrast to physical simulation, virtual simulation abstracts and formalizes an indexed reality in algorithmic and programming language and is represented through computer visualization. The modality is free of the constraints that govern Newtonian physics unless those constraints are programmed in. Visual representations replace physical surroundings, as in the case of virtual and 3-D environments. An example of a primarily virtual simulation discussed below is a tactical battle plan simulator that assists military commanders in battle scenarios, with an interface that mimics the plastic overlay and grease pencil-based Course of Action, or COA, diagrams used by commanders. Physical and virtual are not mutually exclusive properties as most simulations include both. We tend to forget the vast physical networks, from the chair that users sit in to the electrical circuits that undergird all virtual modalities. Thus, it is best to think of modality as an ordinal tendency, not a binary.

Referential frame

The second dimension of simulation is its *referential frame*, or the purpose of the simulation relative to the reality it indexes. The primary distinction here is between pre-enactment and self-referential simulation. Pre-enactment is a simplified mock-up that helps prepare people for some future scenario or task, such as a sparring session, or a difficult military battle scenario, or the impact of a nuclear explosion. It is a means-to-an-end.

There also exist simulations that are not so much a means-to-an-end but an experiential end-in-itself. For a mostly physical simulation, consider Civil War re-enactments. It is clear that their purpose is not to prepare people for nineteenth-century musket battle. Rather, they are done for a variety of more internal reasons – to provide a more embodied experience of war than film or games provide, to relive and reaffirm one's imagined community, or as a personal hobby.

Self-referential physical simulation, such as war re-enactments, tend to be rare. Self-referential virtual simulation, in contrast, is quite common. First-person shooter video games are a common example. Another is the IntelliLab's Murmur system, which simulates a storyteller. The AI system is not oriented to improving future storytelling. Rather, it is an attempt to create an engaging storytelling experience. This system was installed at a popular comedy club in Chicago and provided the technical infrastructure and 'life-world' for lab members to write and publish papers on the semantic properties of story generation. Many of the simulations used for scholarly inquiry are self-referential in orientation, in the sense that they are aimed at gathering knowledge about an indexed reality (often a hypothesis, model, or theory), not preparing for future events.

Perceived realism

The third dimension of simulation is their *perceived realism*, or the extent to which the audience and users of a simulation consider it an accurate representation of the reality it imitates. In Irwin's (2005) study of military training, for example, the most realistic simulations involved live ammunition, and were necessarily used sparingly. In competitive boxing, full-exchange sparring is considered the most realistic simulation of a match, with lots of degrees of freedom for how realistic it gets. In virtual simulations, the realism of the digitized environment is a key limitation, especially in terms of the disproportionate amount of visual versus tactile stimuli (a key reason why surgical simulators must rely on both virtual and physical elements, given that surgical skill is such a profoundly tactile craft).

Mapping simulations

A three-dimensional Cartesian grid can bring these three dimensions into a single heuristic space, something like Figure 21.1.

The x axis is the modality. The z axis is the referential frame – pre-enactment on one end and self-referential on the other. The y axis is the degree of perceived realism. With this grid, one can plot any given simulation along each axis across the three continuous dimensions. Take a sparring session. It is mostly physical, so would go on the far right of the x axis. It is usually oriented to pre-enactment, so, for argument's sake, we place it high on the z axis. How realistic it is involves the interpretation of those who are engaging or witnessing the event, so one would need to evaluate different perspectives before plotting it along the y axis.

The three intersecting axes yield eight different condition states of simulation. If we move left to right and top to bottom, Octant I resides at the top left position (mostly virtual, pre-enacted, and realistic), Octant II at the top right (mostly physical, pre-enacted, and realistic), Octant III in the lower left, Octant IV in the lower right. If you flip the figure around, the four octants begin with octant V (mostly physical, pre-enacted, and low realism), and so forth. Each of the eight conditions states are suggestive of rough tendencies that characterize variation across different empirical examples of simulation. One could then plot a large number of cases to create a mapping of the social organization of simulation across multiple empirical sites.

There would be, however, a significant epistemological tension embedded in that task. How do we know if and when one object is more realistic than another? Two answers are typically offered. An outcome-based analysis would make analytic choices that are reasonable,

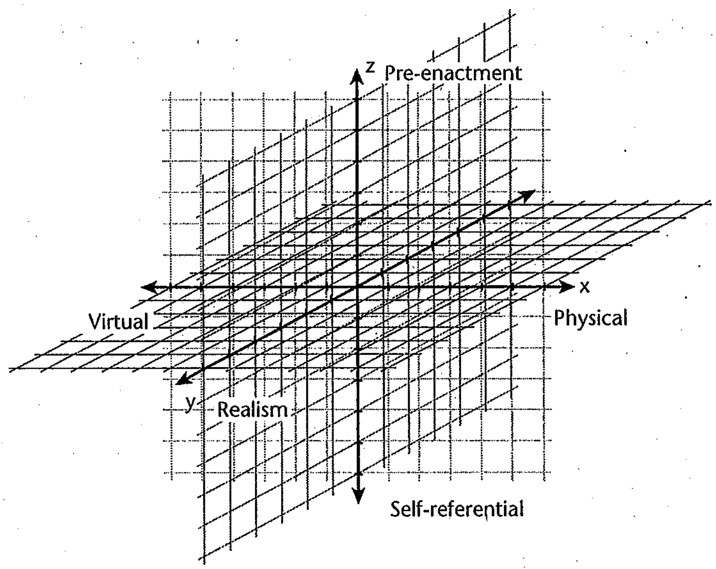

Figure 21.1 Three dimensions of simulation

logical, and behaviorally justified. The other answer, and the one I pursue for the remainder of this chapter, is to utilize epistemological uncertainties as empirical opportunities for understanding group and organizational level dilemmas wrought by simulation.

That is, it turns out that the descriptive uncertainties over empirical cases are typically mirrored in the normative uncertainties that members of groups have around what kind of simulation the case *should* be. The background knowledge and implicit rules governing the kind of interpretive conflict that occurred in the opening scenario at Harlien's Gym, I will suggest, makes sense if we understand it as an uncertainty over what octant any given simulation belongs. A tremendous amount of group and organizational effort goes into figuring out the right amount of physicality vs. virtuality to build into an AI system's interface or a boxing technique, as well as its purpose and perceived reality.

Dilemma 1: debating the modality of a newscast simulator

The single most common and recurrent dilemma I observed at the IntelliLab involved negotiations and conflicts over how much and what kinds of virtual and physical elements should be added to a developing technology's interface. Regular debates occurred around visual presentation issues, typically as follows: if a user provides too much direct input to the technology (via keyboard strokes, voice recognition interface, hand gestures), then that system might be dismissed by skeptics as getting fed the answers. If so, the computer agent will be seen as doing nothing authentically or autonomously intelligent. On the other hand, if the system is entirely self-reliant, it will probably not be interactive enough to intrigue an audience. As Latour (1995) has pointed out, when non-human technologies (e.g. hydraulic door closers) do their work reliably and well, their social agency is forgotten. Conversations about the inputs and modalities of an interface are examples of how members of the IntelliLab continually tweak computer-based utility functions in a way that balances exciting virtual capabilities with some degree of human–machine interactivity. There is no straightforward recipe for how to do this, no perfect preference set to maximize the constraints of the embedded algorithm.

An IntelliLab system called 'YourNews' provides a nice example of how this dilemma played out in practice.

YourNews automatically generates a newscast based on the top news stories of the day, using categorization and search techniques to match textual content with pictures and video, all compiled in real time. It is a virtual simulation of a newscast. Once the initial functionality and visual aspects of the system were in place, the question that continually arose at meetings involved how to get an audience to actually watch the show. The group concluded that an engaging visual representation of a newscaster was essential, but not sufficient. A human audience requires more than just captivating images to maintain its interest. An audience requires the performance to convey meaning, which, the scientist-designers of YourNews suggested, is found in the dynamic interaction between the viewer, the subject matter, and the presentational medium. It was important to get a large audience for the newscast because audience interaction would be mined and used for research publications. An input database could create a feedback loop to steadily improve the newscast as well as refine the linguistic classification schemes that provided the backbone of scientific knowledge claims coming out of the project.

One of the more creative ways the design group sought to hook in an audience was by leveraging the virtual modality of the system to playfully subvert the conventional structure of traditional newscasts. The host of YourNews is Alyx Vance, a popular avatar from the video game *Half Life*. In some of the newscasts, Vance is distracted from telling the news by invading space zombies, a bit of light-hearted whimsy. Interestingly, in one newscast I watched in real time, this stock scenario followed immediately after the system displayed a grisly image of a genocide victim in Darfur. This was not a deliberate juxtaposition on the part of the designers (the system itself 'decides' the progression and images displayed in real time). However, it does demonstrate a kind of callous if unintended randomness inherent in the sorting and classification algorithms embedded in these kinds of technologies.

YourNews can narrowcast by providing a content that is specifically tailored to individual viewers through physical input via keyboard strokes and the tracking of 'clicks.' The design team spent a lot of time debating the best interface modality for eliciting user preferences. Embedded in these interface debates were important group and organizational dilemmas: how can systems like this attract a large enough audience to create a scientifically credible database, get the positive attention of funders (in this case, the focus was on the telecommunications industry), yet also be understood as doing something credibly intelligent? It was assumed that the modality of YourNews would be mostly virtual, but the designer's work still involved figuring out how to add physical input elements to leverage the narrowcasting functionality. YourNews was, like all virtual simulations, a hybrid of virtual and physical elements. To return to Figure 21.1, one way to understand the group's dilemma is that the development team struggled to figure out where YourNews should be placed along the x axis.

Figuring this out involved a tremendous amount of negotiated and emergent sense-making. Regular group meetings and brainstorming sessions were held where prototypes were demoed and discussed. Ultimately, projects like YourNews led to the creation of a new subgenre of research within the IntelliLab roster for projects that emphasized visualization, art, and media delivery over formal knowledge representation and classification. This organizational subdivision created a lasting symbolic and material boundary, and, according to some members, a source of intra-organizational stratification that persists to this day.

Dilemma 2: representing the referential frame of a 'nerd sidekick'

I turn now to a more emotionally charged scenario involving how members of the QualGroup lab disputed the referential frame of a simulation system.

The day after a site visit from representatives of DARPA – the primary research agency of the Department of Defense and primary funder of the QualGroup's most ambitious development, the Colleague Project – lab head Keith Fender called for a post-site visit meeting to evaluate how their presentation went. Overall, Keith was not too happy. There were too many glitches in the demonstrations. While he stated that DARPA will most likely 'keep the spigot open,' meaning they would continue to fund his research team, they would need to develop better 'learning metrics.' Don, a senior graduate student, suggested that designing evaluation tools is what DARPA should do, not them. Keith replied with considerable annoyance, even disbelief, in his voice, 'Oh, no, no, nooo!' He stressed that there are 'serious dangers to turning over your evaluation scheme to the funding organization.' The QualGroup does not want to get into a relationship with DARPA where they are getting subcontracted to build a narrow or 'deployable' technology. Keith stated definitively, 'You either plan or are planned for!' He advised his lab, 'If we design our own metrics, and do it right, you can do real science and have work that is publishable, and they [DARPA representatives] are happy too.'

Keith's warning about not allowing DARPA to impose their evaluation scheme involved a concern for professional autonomy and centrally concerned an uncertainty over the purpose of their technologies. Where should the Colleague Project fall on the z axis of Figure 21.1? Is this simulation a pre-enactment or is it self-referential?

The head of the QualGroup half-jokingly refers to the Colleague Project as a 'nerd sidekick.' It is designed to have deep expertise in a couple of well-defined areas, particularly in physical geometry and tactical battle planning. The key aspect of the system that Keith does not want to give up, and that is central to his goal as a research scientist, is to build a system that continuously learns about that domain based on its interactions with human users, compiling data based on analogical reasoning techniques in real time. He does not want to build a sophisticated expert system, in other words, but rather a system that learns from the bottom up, through observation of unpredictable but patterned user behavior. What he feared about DARPA's evaluation scheme is that they would be too narrowly scoped on a single military task. He doesn't want to create a simulation that pre-enacts a single scenario. His goals are much broader, and far more ambiguous – to derive scientific understanding on the role of analogy in human-level cognition.

Keith's warning was a normative statement about the sort of simulations his lab should be building. He does not want his group to make simulations that are too far into Octant I of Figure 21.1. He wants them to be oriented to pre-enactment enough to keep his funders satisfied, but still solidly anchored in Octant III. If the Colleague Project were to simply simulate a future, well-specified task, they might lose sight of the goal of creating thinking agents that are able to respond to a complex and ever-changing world.

Dilemma 3: policing the boundaries of a 'real fight'

Some of the most salient tensions, uncertainties, and dilemmas in both boxing gyms and AI labs have to do with contested perceptions of realism. Central to the determination of realism is intersubjective perceptions of how realistic something looks. Here, especially in terms of virtual simulations, visualization is a central focus.

Realism also goes to the very heart of the most salient professional legitimacy dilemma in AI science. AI scientists have been frequently dismissed by philosophers and neuroscientists

(Dreyfus 1972; Searle 1980), social scientists (Collins and Kusch 1998), and even members of their own discipline (Weizenbaum 1976), as creators of machines that do computational tricks that do not tell us much about how human-level cognition operates. AI research continues to have a bit of the lurid quest of Dr. Frankenstein about it, perhaps reflecting the naive dream of building life from the lifeless. To be sure, this is a seductive notion that AI scientists themselves play with when they make bold predictions that non-human agents will eventually conquer human-level intelligence (Kurzweil 1999; Moravec 1988) – the kinds of predictions, many of my research subjects admitted, that are used mostly to stimulate interest and funding, not because they think they can actually accomplish them in their lifetime. Still others think that their colleagues make such predictions to the peril of the field, continually dooming the enterprise to the failure of unmet expectations.

Realism is a central problem for boxers and their coaches too. A punching bag, for example, is a horribly imperfect piece of training equipment since a bag looks nothing like a human being and cannot hit back. Boxers often forget about their defense and punch placement while hitting a bag. Heavy-bag manufacturers have attempted a variety of innovations on this front. One bag includes the outline of a human form. Another includes padded bars that protrude like zombie arms. Still another, made of thick foam, is molded into a human torso. Some trainers stand behind the bag while whipping a towel in the face and body of the athlete. Affordances are crafted and re-crafted to compensate for the native limitations of the simulation. This is simulation in empirical action – forging new social networks that meld human and non-human agency.

Now we can return to the conflict at Harlien's Gym with which I began this chapter. Recall that Reginald declared that a 'fight' had broken out between Keshawn and Lamar. After the round ends, the boys refuse to shake hands, and later Al punishes them by barring sparring for two weeks and scrubbing Lamar's upcoming match. This sparring session created an uncertainty on two of the three dimensions of Figure 21.1. First, it was unclear to members of Harlien's where to place the sparring session on the y axis. Was this just a highly realistic simulation of a boxing match, and therefore belonged within Octant II (a simulation that is mostly physical, highly pre-enacted, and very realistic)? Or did Keshawn's hard punches and Lamar's wild response actually make the sparring session too unrealistic, so that it belonged to Octant V instead (mostly physical, highly pre-enacted, but not very realistic).

It was also unclear what the purpose of the sparring session had become. Was it still oriented to cooperative training for future competition or had it transformed into an end-in-itself? Perhaps the boys were engaged in a 'fight' now, in Reginald's terms, precisely because they were no longer trying to pre-enact what might happen in the future but were rather working something out in the here and now.

This suggests an altogether different possibility. Maybe what had happened took the situation out of a simulation frame altogether. Perhaps it was no longer 'less real' than some bracketed reality outside the situation. In this sense, the conflict was not about which octant the simulation should be in, but about whether it belonged in Figure 21.1 at all. The sparring match was now, as Reginald implied, a 'hostile encounter,' in the dictionary sense of the term, which raised the stakes of the exchange by making the desired outcome more open-ended and consequential.

This may be the most accurate explanation. However, the normative violation occurred in the context of an organization in which simulations are *the* central feature of the negotiated order. On a near-daily basis, boxers are reminded of slogans like, 'your sparring partner is your friend' or that 'nobody wins or loses in here.' What happened, then, was that it was no longer clear to the observers of the sparring session whether it remained a simulation in the minds of Keshawn and Lamar. In the minds of the rest of us, and, most importantly, in the mind of authority figure Al, there was no doubt that it *should* be a simulation.

Al's attempt to get them to shake hands was an attempt to reconstitute a negotiated order that necessarily involves frequent rituals of mutual respect and masculine civility. The forced complicity with this ritual was an attempt to remind both boys, and perhaps even more importantly the audience, that the punches exchanged in the gym are not really real, even if they are just as physically or psychically damaging as the punches exchanged in a 'real fight.' Thus, Lamar's slight push was a far more egregious violation than were the much more vicious blows exchanged just seconds before. As a famous saying in amateur boxing goes, 'It is better to bleed in the gym than in the streets.' The athlete's subsequent punishment was further reminder of this principle. Cross the line of realism too far and valued group resources will be withheld.

In this sense, then, what happened between Keshawn and Lamar is that their exchange of punches became so realistic that it violated the Price is Right Rule of physical, pre-enactment simulation. That is, in physical simulations oriented toward preparation for highly risky, highly unpredictable, and highly interdependent tasks, the logic of the simulated frame involves getting as close as possible to the indexed reality without going over, just as Bob Barker instructed contestants on *The Price is Right* game show to guess a price that was as close as possible to the actual price of a consumer item, without going over.[4] The problem with Keshawn and Lamar's sparring session, then, was that it violated this iterative norm.

Interestingly, the Price is Right Rule does not govern virtual simulations, which often try to get either as close as possible to the indexed reality, or, better yet, to surpass it. YourNews is a good example of this, in which it is both an approximation of a traditional newscast, but also surpasses it in several ways. Alyx Vance can shoot down space zombies in between telling the news, the modality can lend itself to the emergence of new and problematic blurring of physical and virtual imagery, and the broadcast itself can be narrowcast to a user's specific interests – all features that enable the simulation to actually surpass the indexed reality albeit in calculated ways.

Conclusion

I have argued that simulations can be broken down into three dimensions – by modality, frame orientation, and perceived realism. Next I suggested that figuring out where to place a simulation along these dimensions is not simply an analytic problem for social inquiry but is also an opportunity to explain how and why certain kinds of group and organizational dilemmas routinely arise. I have described the simulated realities that groups engage in when they design simulations to manage ambiguous or uncertain goals. We see this playing out in the tensions between physicality and virtuality in the development of YourNews. We see it in the tension between the QualGroup's scientific goals and a fear that those goals might be compromised if DARPA is allowed to set the terms of evaluation. We also see it in the tension between training boys how to fight while making sure that they don't get in a real one. These are all ways that group members bracket out metaphysical questions around 'what exactly is our goal' and 'what is reality' and get on with everyday guesses that segment forbiddingly complex realities in more digestible bits. Simulation techniques and technologies, across its main dimensions, provide a powerful, and remarkably common, way to render the uncertain and ambiguous legible and tractable.

It is likely that simulation, especially virtual ones, will become increasingly prominent features of organizational and scientific practice throughout the twenty-first century. As noted earlier, entire professions are based on simulation techniques, from climate science to atomic energy. Simulations are also popular techniques in employee instruction. Pilot training is almost entirely a simulated enterprise and surgical training is following suit. Liberal arts classes are likely not far behind and already incorporate some elements of simulation and modeling in them (one might argue that distance learning courses are already there). Simulation techniques that can constrain uncertainty in order to prepare for risk, provide novel experiences, or engender new forms of knowledge production will be increasingly monetized, pre-packaged, and marketed as the ubiquitous technologies of 'forward looking' organizations. *Star Trek*'s fabled 'holodeck' already seems less like a fantastical dream and more a quaint forecast of the even more luminous organizational experiences of our not-so-distant future lives. All that said, we are meaning-making creatures. The bracketing of the real from the imitation that lies beneath the interpretive policing that I have documented in this chapter will not simply disappear. The distinctions will be reconfigured again and again, in a fractal nature, as computer technology continues to subvert modernity's tidy demarcations between 'nature' and 'culture' and 'representation' and the 'real.' We will continue to mark certain realities as more authentic and rich than others, forging new categories of thought as we go.

This leads me to a concluding point about interpretative inquiry, visualization, and simulation. In 'A Theory of Play and Fantasy,' Gregory Bateson (2000 [1972]) shows that the cognitive ability to recognize one set of activities as 'play' in opposition to something that is not play – 'the serious' or 'the real' – is something in which children and even chimpanzees regularly engage. He then shows us what a wondrous and far-reaching ability this is. By marking off a set of activities or an environment as related to a more real one, an unserious activity enables actors to engage with a playful representation, changing the nature and scope of the initial reality. At its most fundamental, Bateson sees this as a basis for second-order learning and meta-cognition – the ability to learn about learning. Put into contemporary methodological terms, there is an endogenous relationship between learning and meta-cognition. This points to the rather serious side of child's play.

Simulations are quite similar to moments of liminality, but, in Victor Turner's terminology, they are not instances of anti-structure. They are experimental and potentially subversive, but not anti-normative. They do not involve a total reversal of the agreed-upon rules. On the other hand, simulations are far more serious than pure game. They also involve enough experiential dimensionality that move beyond the assumed artifice of visual representation. In short, they provide a fundamental modality through which rules of interactive engagement are tentatively worked out. Calling attention to their empirical realities is, in this sense, a way of suggesting that a tremendous amount of social life has this kind of highly fragile, tentative, and provisional nature. Simulations are 'loose structures' in which the possibilities for individual and collective agency, and, by extension, innovation, are a bit more open-ended than they might otherwise be. They provide moments in which we can see social structure for what it is – never quite a Weberian iron cage, but more like the permeable, though remarkably elastic membrane of an amoeba, growing in odd directions but always re-synthesizing its forms and functions in response to its changing environment.

Humans are not much like rock-em, sock-em robots who maximize on a codified set of behavioral plans. I doubt we will ever devise a sufficient means–ends analysis, or visual schematics, that can satisfactorily capture the emergent quality of social interaction, despite the best efforts of some of my friends in AI and organizational studies alike. Yet it is also true that we do not get to reinvent the rules every time we re-enter the game. What we do instead is occasionally engage in a bit of child's play with those rules, and then incorporate traces of that play, for good or evil, into the formal set. To paraphrase Goffman (1974), a focus on processes of representation and recognition enables us to get an inkling of just how startling a thing social experience really is.

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Notes

1 What distinguishes a model from a simulation? In this chapter, I consider a model a hypothesis or a lay hunch about how an indexed reality operates or how to achieve it. This could take the form of a formalized theory, such as structure mapping theory of analogical reasoning, or a discussion of how to perform within a behavioral idiom or style (for example, it is common in boxing circles to discuss differences between 'stylish boxers' and 'brawlers'). Simulations are sets of activities that put a model in motion in a real-time process. Models, then, refer to static representations of an indexed reality and will tend to vary by their degree of formal codification and by representational idiom (written, visual, figurative, ideational, etc.). Simulations are an attempt to execute the process through which the model's indexed reality unfolds. Simulation proves particularly adept at identifying emergent processes that are unanticipated in the model or by the modeler.

2 Too often within high-risk fields simulations are put to rhetorical, not substantive, use (Clarke 1999), as was the case with the underfunded and incomplete Hurricane Pam simulation shortly before the Katrina disaster of 2005.

3 For a more elaborated discussion, see Hoffman (2006, 2007).

4 I thank Lars Jarkko for this fun and illuminating analogy.

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