Simulation and Embodiment

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Abstract

The issue of this paper is the role of human embodiment in relation to various simulation technologies. Three trajectories are followed to show how embodiment phenomena are present: (a) cinematic and flight simulations are shown to always be reductive in comparison with whole body experience; (b) similarly 'points of view' which either embody or disembody, are shown to point up the locatedness of embodiment; and (c) finally in simulations which translate phenomena beyond the reach of human sensory capacities, reveal embodiment as the goal of image 'translation' capacities towards humanly embodied experience.

Plots persist

My topic is simulation and human embodiment. While there are all sorts of simulations, ranging from modeling processes through the now pervasive computer tomographies, to imaging technologies, I shall be focusing upon the relationship between the human user and 'reader' of these simulations. In this paper I have chosen three distinct, but related, trajectories of simulation technologies, and will analyze these with respect to human embodiment.

First, however, I want to situate this analysis in a somewhat broader and often more implicit background phenomenon. I have long been struck by what could be called two interrelated traditions of interpretations of how we humans develop and use technologies. The one tradition is utopian and exemplifies a set of desires and imaginations which sees in technologies ways to get beyond our human limitations through creating machines which give us previously unknown, but wanted powers. Such dreams and desires are doubtless as ancient as humans themselves, and they were often expressed in fantasies of technologies—magic carpets which fly, cloaks which protect from weapons or which make one invisible—but in antiquity the magic helpers were just as likely or more likely to be

animal—flying horses, giant birds, or even genies in bottles. Interestingly, in the late Middle Ages, these fantasies began to more and more imagine technologies as the means for increased powers—Roger Bacon's submarines and flying machines, later drawn by Leonardo da Vinci in his technological imaginations, and up to contemporary dreams for virtual powers such as those imagined by William Gibson in *Neuromancer*.

The opposite set of plots, plots which worry about what such powers might do to us, are dystopian in form and are variations upon the theme that humans reaching beyond their set powers endanger themselves—Icarus flies too close to the Sun; Faust enters a Devil's bargain; the Golem; Frankenstein; and down to Terminator, all become human invented non-human beings who turn upon us.

As these persistent plots mutate and modify over time, they nevertheless persistently display existential themes which reverberate with our hopes, fears and desires relating to our technologies. On the one hand, these plots display our fears—if we invent technologies which challenge the gods or exceed our humanity, we are tempting fate or endangering our humanity. Here, our technologies are cast in a *dystopian* light and we fear being overcome by our own creations. Yet, on the other hand, we want our technologies to enhance our limits and give us powers we do not have. Here the *utopian* hope is for our technologies to give us what we lack.

But, ultimately, both the dystopian and utopian fears and hopes, hide the mirror images each have of the other. Because each displays the technologies used in these fantasies as being simultaneously both different from and yet the same as we ourselves. When placed in the context of embodiment, these contradictory desires are of special interest—we both want and do not want full embodiment. But, all of this is merely the instantiation of the existential contradiction in the desires we have concerning our technologies: we both want the powers we are not, and do not have, and which we dream our technologies can give us, and yet we want those technologies to be so transparent that they become our very selves, what we are, and thus we find ourselves in the contradiction of both being and non-being one with our creations. I note this background before turning to the current focus upon simulations. What is it we seek in simulations?

Simulation

To repeat, my topic is simulation and embodiment. It is a topic which often gets situated precisely within the parameters of the plots I have just outlined, at least in popular culture. The plots form the cultural background for the technological development which inhabits the foreground. Simulation, sometimes popularly linked with *virtual reality*, is hyped as a technological substitution for 'real life' which will, when fully realized, be able to challenge or even replace the mundane 'real life' which we now experience. Such claims, always based upon slippery slope arguments, engage both the utopian and dystopian plots mentioned. The utopians see in virtual reality, fictional means of fulfilling desires not possible within the limits of our present experience, and dystopians fear for the dissolution of 'real life' into fantasies which will threaten 'human nature' itself. I shall assume you are quite aware of this situation given the often full press of discussion of cyberspace, virtuality, bodies, which fill much of what occurs over the internet, the media, and even to some extent the more popular of science publications such as *Scientific American*.

My own approach will be more mundane, and definitely more phenomenological. And, it will take a sometimes hidden but always present variable of human embodiment as its fulcrum for the analysis to follow. My thesis is that human embodiment forms a sometimes explicit, but always at least implicit variant for technologies, including those used in simulations. I will develop here three trajectories, all of which reflexively point to human embodiment from within the simulation technologies. I shall begin with a trajectory which follows added sensory dimensions for its effects; then a trajectory which locates points-of-view [popularly POVs], and finally a trajectory of visual hermeneutics, all related to simulation and embodiment.

Trajectory one: adding up perceptual dimensions

Example #1: early and recent cinematic 'realism'

Cinema, or 'movies' are relatively recent examples of simulation technologies. In the very early days of movie experimentation, the Lumiere brothers developed what became known as *cinema verite*. Indeed, one of

the most striking examples was their short 'Train en Gare' sequence which showed a steam engine entering the station. The camera was placed so that the train seemed to come right down upon the virtual spectator position and when shown, reports indicated that the audience screamed and jumped as they reacted to the virtual 'realism' of the scene. Skip now nearly a century to contemporary IMAX virtual 'realism'. My own first experience of IMAX was in Japan and I was watching 'Echoes of the Sun'. One scene shows sugar molecules floating around, some of which came directly at me in full, glowing color, 3-D effects and sound enhanced motions—I admit to having jumped a little at the surprise. I reacted not very differently to my first experience of IMAX than early cinema viewers did to the 'Train en Gare'.

Now take a time-variant between the two events. When I first saw the 'Train en Gare' clip, I did not jump. The now antique-appearing movie seemed merely artifactual and curious and it seemed strange to me that viewers would have taken it as virtually 'real'. Clearly the technological distance was quite large, from grainy black and white, soundless film, one could say 'monosensory' since it was a visual only, to the audio-visual, full color and three-dimensional IMAX, the 'degrees' of virtual realism had certainly been enriched.

But before drawing any premature conclusions, allow a bit of phenomenological analysis: First, I take it that insofar as embodiment is a concern, phenomenology gives priority to what might be called 'whole body activity'. This is to say that we humans are multi-dimensioned perceptually; that kinesthetic-sensory actions are primary and implied in all our activities; and that this is the basis for what we take to be our opening or relation to a 'real' environment. In my examples, however, the virtual 'realities' of the train entering a station and the molecules flying in my face, are highly *reduced* realities.

By taking account of variations between the presented phenomena, this distance between imaged and non-imaged is clear: In the case of the Lumiere train, the imaged train is black-and-white, displayed within the frame of the screen, lacks all the dimensions of sound, smells of the smoke, etc. If this were compared to being in an actual train station, it would seem that this highly reduced image-train is quite different from

the fully embodied experience. Any reflective, critical approach should be able to show that. Yet, the early viewers reacted strongly to the imaged arrival of the train. The technological development from 1895 to 2000 and IMAX, shows an enrichment of virtuality: the sugar molecule coming to my face appears 3-D, is colored and dimensional, is located within a soundscape and is fully audio-video, and, like the early Lumiere viewer, I reacted. But, and this is important, this was my first—and I will call it a naïve—experience of IMAX. Later, in fact in the same movie, I had learned to be more critical. The molecules flying at me remained reduced—they had no tactile presence, if I raised my hand the very image was blocked, etc. And, without the goggles, the whole illusion disappears. Indeed, in a recent IMAX experience, I was so accustomed to the effect that even a shark coming straight on did little to 'scare' me.

The situation I am describing is a very complex one, but my initial point is that the technologically mediated situation is one which displays distinct differences between it and the ordinary, whole body engagement with non-imaged phenomena. The difference between Lumiere and IMAX is one of degree only. The difference between these and even ordinary situations is more than one of degree. The situation is also complicated by the need to straighten out the differences between naïve or first or early experiences of the novel situation, and later, more critical ones of the 'same' situations. In short, there is both a statics and dynamics which need to be taken into account.

And, there is also a need to take into account the social or cultural context within which the simulations are taking place. My examples above are from entertainment contexts which are designed to enhance precisely the novelty, the startling naïve experiences I have described. The shock effect of Lumiere or IMAX quickly dissipates with repeated viewing; one does not jump or twitch with later expected anticipations. Yet, only the critic is likely to come back to do the more precise analysis and learn more from the structuring of the show. Frame-by-frame analysis is done within what Paul Ricoeur calls a 'second naivete' approach. In Ricoeur's hermeneutics, first naivete is like the simple belief a religious person might have about biblical texts, taking them as literal accounts of things. A 'second naivete', however, is an informed

and critical return to the text in Ricoeur's sense, after one has learned of the historical, cultural, archeological and other dimensions which went into shaping the text.

This same movement from a first to a second 'naivete' also occurs in scientific discovery, but not by design. Examples: Galileo's 'aha' with his first sighting of Jupiter's satellites; Roentgen's 'aha' experience with his discovery of X-rays and the first image of his wife's ringed hand; Watson's 'aha' with Rosalind Franklin's X-ray crystallograph of DNA structure, are all examples with some parallelism to my Lumiere and IMAX experiences. In each of these cases, some new phenomenon was recognized within a gestalt instant. But, in science as in film criticism, what follows in 'second naivete' may be as, if not more important than, the initial 'aha'.

Example #2: flight and military simulation

In my first set of examples there was an implied trajectory concerning what I shall now call perceptual *isomorphism* and virtual 'realism'. That trajectory moved from the reduced, visual motion isomorphism of the Lumiere example, to the enriched audio-visual, 3-D isomorphism of IMAX. But both are far short of the norm of ordinary, whole body experience of an environment found in mundane life. Yet, this reduced trajectory is suggestive—could simulation be even more virtually 'realistic'? Historically, this trajectory has also been followed and developed in simulations which attempted to increase virtual isomorphism. I have in mind specific training simulators such as those developed from early flight simulation to the present pilot training simulators of the present.

Although as early as WWI it was recognized that fighter pilots, if they survived the first five flights, were likely to survive much longer, but pilot training aids did not function well. Then Edwin Link invented and patented his Link Pilot Trainer in 1931. It pitched, rolled, dived and climbed, and even had a feedback mechanism to give the controls 'feel' . But at first the military was not interested and so he sold his models primarily to amusement parks. But, after a series of accidents, five deaths in the first days of flying air mail, the Army Air Corps did buy Link Trainers and soon these were being used primarily to train for night and instrument

flight. Indeed, it was for instrument or blind flight that the trainer was primarily designed. Then, with WWII, thousands went into production and all Army Air Force cadets took blind flying instruction from Link Trainers.

One can see here that virtual simulation had now taken another step in perceptual isomorphism. To sight-motion, and to full audio-visual motion, kinesthetic and tactile dimensions were added. Today, flight simulation is standard, not only for the military, but for commercial pilots. My daughter-in-law, a 747 pilot for United Airlines, has to regularly pass simulation exams which present her with crisis situations never likely to be encountered, but for which she is trained. Researching this topic on the web, I also discovered that simulation programs for restricted areas—New York, Washington DC, etc. are now prohibited! Simulation training was, after all, part of the training undertaken by the suicide pilots of 9/11. Note an interesting irony here: perceptually isomorphic simulation in early flight simulation was primarily useful in perceptually restrictive situations—blind or instrument flight. But today's simulators produce much more isomorphic and multi-perceptual dimensions in their effects. Yet, in each case, a second naivete is one which must recognize that all such simulation is *framed*, one enters it within the special limits of the tasks assigned. Just as the early advertisements for the Link Trainer noted: no one has ever died as a result of a simulated air crash, any more than anyone has ever been hit by an IMAX sugar molecule.

Trajectory two: points of view (POV)

Example #1: embodied and disembodied positions

Although many philosophers, not only phenomenologists, have noted that we always experience the world from an unstated but reflexively locatable *perspective*, this becomes particularly interesting in simulation technologies. R.D. Laing, in his *The Divided Self* (1965), described two points of view often noted when persons describe how they experience an environment: the 'embodied' and the 'disembodied' positions. I have developed this distinction more fully in my *Bodies in Technology*, noting that only in the embodied position does one have the full, multidimensional perceptual

awareness of an experience from an experienced location. For example, in a long practice when teaching phenomenology, I asked students to describe some experience they would like to have, but in fact had never had. It turned out that some variation upon flying was the most usual and even dominant example they would choose [Icarus remains with us!]. When this was made concrete in examples such as parachute jumps, I noted that two types of descriptions emerged: most described the imagined experience in 'embodied' form, i.e., they would describe jumping from the airplane, the vertigo in one's stomach, the feel of air on one's face, the rushing appearance of the ground as one fell, the jerk of the chord with the parachute opening. But others, usually a minority, described the experience in 'disembodied' form, i.e., they would see themselves jumping from the airplane—which was 'up there' and see themselves as bodies falling, etc. In further questioning, it became clear that the 'disembodied' form was at best 'mirror-like' and called for an identification of myself with some image of myself falling. Yet, the relationship between 'embodied' and 'disembodied' perspectives is also such that the 'embodied' implied position is that from which the 'disembodied' is taken.

Turning now to my first simulation technology, video games, such POVs are often depicted in game variants. There are typically three variations upon POVs: for example the first one may be called 'embodied' in the sense that if one is on a hunt, holding a weapon, one sees a hand with a gun as if it were 'me' holding it; or, if it is an airplane simulation, I see the instrument panel as if seated immediately before it. In a 'disembodied' POV, one sees a character holding a weapon, creeping up upon a victim and 'I' have to 'identify' myself with this totem. Or, one sees the airplane in flight and while one is controlling it, one 'projects' a self into the plane. In a third—and I call it the alter-ego or piggy-back position, the objectified other is directly and closely in front of my actual seated position and the hunter or pilot is there, 'objectified' but very close to my actual position. This last is a sort of hybrid position.

Example #2: imaging technologies and *apparent distance*

I shall not here follow too deeply the implications of embodied perspective, although I would note that they may be found in all imaging technologies

and may be phenomenologically recovered in such phenomena as 'apparent distance' which accompanies all isomorphic displays. The history of telescopy shows this trajectory quite dramatically. Galileo's first sighting of Moon mountains was quite dramatic; and his experience of the closer-to-the-Moon allowed him to claim he had seen what Aristotle and the Church Fathers could not have seen. But these first sightings have today been magnified many times over. Early modern telescopes could not resolve Saturn's rings, but today's flyby probes reduce 'apparent distance' to close-ups of the multilayered details of these rings. Each implies the phenomenon being observed and the apparent position of the observer doing the observation. Imagery has made Jupiter's giant red spot and even the cracks in the ice cover of Europa, one of Jupiter's moons, familiar to most of us. Implied embodiment remains an invariant, but in this case it is reflexively implied in the phenomenon of apparent distance. At the same time note that while this type of isomorphism retains its embodiment reflexive reference, that reference is also a highly reduced one compared to the first trajectory noted. Here I have reverted to the monosensory, visual display which leaves in the background the other perceptual engagements with the world. The implied bodily position is thus located in a sort of image-produced *irreal* position which reduces the full range of motility, multidimensional perception, and, in short, the primacy of action called for in the mundane world. Yet, there is also a gain: by mediating that which is not—at least at this point in our history—what is available to an actual bodily presence, the diminished distance of apparent distance produces an appreciable epistemological gain. My point, however, is that embodiment remains an implied invariant even here.

Trajectory three: visual hermeneutics

Example: imaging beyond bodily capacities

I now come to the last of my three trajectories, this one finds its place in a relatively new set of capacities of imaging technologies. The technologies I have in mind are those which, since the mid-twentieth century, have simulated or presented phenomena which lie, strictly speaking, beyond

the ordinary and perceivable capacities of our human bodies. The first example lies in the new imaging, now common, in astronomy. Up until mid-century, astronomy was limited to optical or light-frequency imaging. But with the development of radio, and then radar, astronomers gradually became aware of celestial radiation which lies beyond optical ranges. Radio astronomy, which soon yielded radio sources as well as the cosmic background radiation, began to open astronomy to new phenomena entirely.

Although two modes of imaging were first used—auditory radio sources could be heard as a hiss on radio equipment—it was not long before the cultural practice of science to visualize was also employed and visual displays of radio sources were also imaged. But I want here to cut to the quick: for a visual display to be produced, one has once again to imply human embodiment. That which lies beyond perception is made perceivable—in the visual display. Today, what is often called the 'new astronomy' displays a whole range of emissions, from very short gamma rays through very large radio waves, far exceeding the narrowness of the optical range previously available to sighted humans with telescopes.

Imaging today, for example, can produce radiation 'slices'—X-ray, gamma-ray, radio-wave, etc. And, while I sometimes use astronomy with its best publicized imagery, the same processes have counterparts in medical imaging. There, the analogues are series of X-ray, MRI, PET processes, each of which use different techniques with different imaging results.

I want to take quick note of these new imaging technologies with respect to their simulative capacities. First, what I have referred to are mostly 'slices' which image different frequencies or image from different molecular processes to produce narrow band images. These can also be combined to produce variants upon 3-D or composite images such as composites which show brain tumors in 3-D, or galaxies in composite. This is done through computer tomography which can synthesize or produce these composite results. All of these processes are no older than mid-twentieth century and thus amount to an imaging revolution which is now already taken for granted.

But, where in all this, is embodiment? It is, as in my second trajectory, *implied*. But this time it is implied as human visual perceiver. Within the science context I have used in this trajectory, the visual display for

human perceivers is what constitutes the embodiment situation. But to make this work, scientific visualism must become *hermeneutic*. In any series of 'slices', the images are those which are technologically constructed from data to display gestalt patterns visible to the human perceiver. There is thus a double *translation*, the first from data to pattern, but also from pattern to what in fully gestalted images, one must translate that which is 'beyond color' into *false color*. Once this is done, a trained and critical, to be sure, but nevertheless still human observer can then do the embodied action of seeing-at-a-glance the various configurations which reveal the significance of the display. Human perceptual capacities are thus brought into play and embodiment is indirectly at work.

Strictly speaking, of course, what is being perceived is precisely what cannot *without technological mediation* be perceived. The simulations thus give voice or make visible what in mundane situations could not be heard or seen. Thus, once again, it is precisely through the highly reductive process that the transformation into the humanly perceivable which makes this simulation epistemologically valuable. But it is also the case that this complex set of transformations and translations implicitly takes into account human embodiment.

Plotting the trajectories

One of the tasks for philosophers is that of locating patterns. That is what I now want to do by plotting the three trajectories against the phenomenological notion of embodiment I am using. The position I have been taking is consonant with those of the earlier philosophers, the later Husserl with his mediations upon *Leib*, but even more with Merleau-Ponty and his notion of *corps vecu*. Both recognize that human embodiment is complex, multidimensioned, located in the intentional, direction arc of motility, perceptually rich, and that the motile body is the necessary condition for intelligent behavior and our 'opening' to the world.

What I have done is to have added the technological dimension which transforms and translates our embodiment into our reach through instruments, in this case imaging and simulation instruments, into what

we can experience and know of the world. It is against this backdrop that the three trajectories I have traced show some interesting patterns:

– First, in the trajectory which began with monosensory simulations and then increased its complexity of those dimensions, adding audio-visual to visual, and ultimately kinesthetic-tactile to audio-visual, one could see a trajectory towards, although not reaching whole body, motile experience. The simulation technologies remain short of full bodily, mundane experience. Yet, there are two different directions which are interesting. First, even with the reduced monosensory Lumiere example, viewers jumped as the train pulled into the station. The 'aha' phenomenon was one of motility faced with the virtual motion of the train. My account of this relates to the primacy of bodily movement as the core of embodiment—even apperceptively we respond, at least with first naivete, to motions which appear threatening. But, the second and critical direction is also to be noted. Even with the most sophisticated and multidimensional simulations, one remains short of mundane experience. Bodily motion is either restricted or in the background. In the theatre, either Lumiere or IMAX, one remains seated, and even with the most complex virtual reality engines, such as those with gloves and goggles, one's motions are in-place motion. This is part of the theatre-like *framing* which gives a clue to virtuality rather than the mundane.
– The second trajectory, even more than the first, forefronts something like a stationary or reduced bodily motility. Perspective, or POV, in theatrical, game, or imaging contexts favors reduced bodily motion. While embodiment is indeed implied, it is quite locally positioned. In the phenomenon of *apparent distance* while there is an apperceptive dimension, it remains within the context of the technological framing situation. Thus in the second trajectory again, there remains a distinct difference between the framing of the trajectory and mundane motility.
– In the third trajectory the features just noted for the second are also maintained. But in this case it is the world correlate which calls for attention. And, in this trajectory the difference between a first and second naivete is of great importance. To 'read' the images calls for

> an explicit awareness of the transforming and translation processes. The false colors reveal, but reveal in a distinctly mediating mode. I must take account of my perceptions within a hermeneutic process.

Yet, in all three trajectories, embodiment remains the invariant to which the displays are addressed. Embodiment is not necessarily foregrounded, and thus may not be obvious, but even when backgrounded, it can be seen to be what provides one set of constraints for simulation development. My contention is that by making embodiment thematic and by taking it into critical account, we are more likely to be able to develop more interesting and innovative simulations. But, equally, I am also contending that we cannot actually escape our selves, our bodily selves in this development.

Finally, although I have not attempted to answer the question about why we humans are so fascinated with simulations, I may have provided by the style of analysis undertaken, how to avoid the worst tendencies to fall into either utopian or dystopian slippery slope positions. Technologies do become embodied, but never totally nor in fully transparent ways. That is how they give us the powers and possibilities we would not otherwise have. But the price of this power entails a subtle and graded sense that while we use and even partially embody our technologies, we also ultimately remain the contingent humans we are. The very ability to step into a multiplicity of our technologies—and thus to also step out of them—is the existential indicator of this constraint for even the best simulation. It is also the point which calls for our constant need for critique.