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Replacing the Patient: The Fiction of Prosthetics in Medical Practice

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The invention of computer simulations used for practicing surgical maneuvers in a video game-like format has an ancestry in the artificial limbs of history and is reflected, grotesquely, in Edgar Allan Poe's short story, "The Man That Was Used Up " (J850). The nineteenth century worked to ensure that the incomplete body did indeed retain a sense of self by creating prostheses to mimic corporeal wholeness. Our present-day technology seems intent on doing precisely the opposite, deliberately fragmenting the body and challenging our understanding of the body and the prosthetic.

Painted on the ceiling of the Sistine Chapel is the famous image of God, the Creator, reaching out to touch the newly-formed Adam, finger to finger. This divine connection, the image suggests, gave life to an inanimate being. That God (or at least Michelangelo's vision of God) reached out to connect physically with his human creation, to touch Adam, is for many evidence of divinity in humanity. Yet importantly, the two fingers never touch in the painting; the implied connection is made explicit by us, the admiring observers. Read in a contemporary medical context, this image suggests the practice of haptics, the science of technological touch and manipulation that is now rapidly extending its reach throughout medicine. And, like Michelangelo's picture of God and Adam, haptic practice relies on a belief in an anatomical connection that does not, in fact, occur. Physicians and surgeons who previously touched real bodies with their own flesh-and-blood hands are turning increasingly to computer simulations, to virtual realities, in order to learn procedures and techniques, thus animating—in a way that suggests Shelley's Dr. Frankenstein rather than Michelangelo's God—a lifeless jumble of latex and wires.

Human bodies, of course, have long been made up of materials other than flesh, blood and bone. Both in the United States and elsewhere, these hybridized bodies—part human, part technology–were formed using artificial prostheses fashioned to create the semblance of a symmetrical body. Literary texts such as Edgar Allan Poe's mid-nineteenth century short story, "The Man That Was Used Up," portray characters who are composed of technologically-fashioned parts and, consequently, challenge the reader to consider the relationship between anatomical wholeness and human integrity, individual corporeal parts and the sum of those parts.

This act of refashioning the physical body by manufactured means has taken a remarkable turn in contemporary medicine. The invention of computer simulations used for practicing surgical maneuvers in a video game-like format has an ancestry in the artificial limbs of history and is reflected, grotesquely, in Poe's fictional version. The body is now created electronically in surgical simulations in order to allow physicians and surgeons a "body" on which to practice procedures. I find this latest version of the body, when read in the context of the history of anatomization and prosthetics, intriguing in that it both advances ideas of what constitutes a human body and simultaneously challenges their veracity. If the nineteenth century worked to ensure that the incomplete body did, indeed, retain a sense of self by creating a prosthesis to mimic corporeal wholeness, then our present-day technology seems intent on doing precisely the opposite, deliberately fragmenting the body and challenging our understanding of the body and the prosthetic. Yet what unites these two seemingly diverse movements is the same as what implicitly unites God's finger to Adam's: the human observer or medical practitioner who supplies the missing link, becomes the prosthetic, and ultimately makes the connection real.

BELIEVING IN THE FICTION OF A.B.C. SMITH

I teach American literature and thus have come to believe not only in the power of words but also in the importance of stories—both those considered to be true and some that, happily, are not. More specifically, I approach stories with the firm belief that they express the culture and social attitudes of the historical moment in which they were written. That is, I read literature in the context of its cultural history, not forging artificial connections between literature and history but believing that there are real connections to be found and that these historical links shape and animate the literary narrative. Specifically, I have long been intrigued by the connections between science and medicine and literature, an interest that manifests itself not only in my teaching of courses such as "Anatomy and American Literature" and "Literature and Medicine" but also in my scholarship examining anatomical loss in American literature of the nineteenth and twentieth centuries. Given my focus on the intersections of seemingly disparate fields, it is no surprise that I was drawn

to what I saw at the Virtual Reality Lab of Penn State's College of Medicine during a 2002 NEH Summer Institute on "Literature, Medicine, and Culture." This lab, inhabited by artificial anatomies as well as human bodies, exhibits the increasingly complicated role the prosthetic plays in the connection, completion and creation of the human.

This modern complex of issues, however, can be found much earlier in Edgar Allan Poe's account of Brevet Brigadier General A.B.C. Smith in "The Man That Was Used Up," published in 1850. This story suggests that even if one is almost entirely composed of artificial parts, humanity somehow reasserts and even improves itself; the reconstituted man becomes greater than the sum of his parts rather than simply a collection of them. Poe's story surpasses even the rhetoric of artificial limbs during this same historical era, which raved about the accomplishments of such products, guaranteeing "Mechanism in Perfection" as well as the ability to "Reproduce Nature in Art."[2]

As a means of proving these claims, artificial limb manufacturers would publish pages and pages of testimonial letters, all raving about the superior advantages of their products. Prosthetic manufacturer A. A. Marks, for example, in his 1910 Manual of Artificial Limbs, includes letters from satisfied customers. Thus Morris Force, of Somerville, New Jersey, reports in a letter dated 1887 that after losing his right arm and leg in a railroad accident, he obtained a series of artificial legs and rubber feet from the A. A. Marks Company. He gives "high praise" to the rubber foot, especially, for the durability which will "commend it to all laboring people." Force writes: "I weigh two hundred and fifty pounds and am on my feet most of the time. During the [sic] seventeen years the repairs on my artificial leg have not exceeded $10." Another letter-writer, identified only by his initials as F.A.S, describes wearing Marks's artificial legs for twenty-six years. Although he works at a bench ten hours a day and often must climb ladders, he finds that "with the rubber feet I am able to do as much as any one." In his leisure time, he walks a great deal and even plays billiards. "Sundays when at home I can be found lying on a lounge, with my legs crossed in an easy and comfortable position, reading some agreeable novel." In short, he finds no hindrance in whatever he wishes to do and feels as well off with Marks's substitutes as with those that nature gave him—indeed, he writes, "it is so long since I had my naturals that I have entirely forgotten them."[3]

By 1918, A. A. Marks's *Manual of Artificial Limbs* devoted an entire chapter to the question of the utility of prostheses. Although the *Manual* baldly claimed that "an artificial arm possesses functions comparable to those of the natural," it added more modestly that "a reasonable and a compensating amount of utility is assured." But artificial limbs served purposes other than utility: "The wholesome

[2]Douglas Bly, *Description of a New, Curious, and Important Invention* (Rochester, New York, 1860), 3.
[3]A. A. Marks, *Manual of Artificial Limbs* (New York, 1910), 223.

effect an arm has on the stump, that of keeping it in a healthy and vigorous condition, protecting it from injuries, forcing it into healthful activity, together with its ornamental aspect, are," the Manual claims, "sufficient reasons for wearing one."[4] The chapter is replete with engraved drawings of workers, such as the secretary who is able to hold and guide a pen with her rubber hand while her "natural hand" keeps the paper from sliding off the desk. Another drawing depicts a young woman cooking, her dress pulled away so that her artificial leg is exposed.

The truthfulness of these advertisements and testimonials is obviously suspect; was F.A.S., for example, so satisfied with his artificial legs that, as he says, he has "entirely forgotten" his "naturals?" More interesting are the subtler "truths" about conceptions of human selfhood and wholeness implied in these catalogs. Striking in all these testimonials is the utter conviction that physical wholeness, even if artificial, outweighs the pain and discomfort of prosthetics. What seems missing in these accounts is the "ornamental aspect" of prosthetics, the fact that they can restore an appearance of symmetry and wholeness. The writers of these testimonials value their artificial limb not for how it makes them look but what it enables them to do. The emphasis is on practical and economic utility; wearers of prosthetic limbs can once more continue to work, improving not only their financial status but also their roles as contributing members of society. In this perspective, prosthetic limbs become a more integral part of the human person than might first be supposed; the natural and the artificial—flesh and metal, bone and wood—are alike members of a functioning human body.

But just what is the relation at this historical moment between nature and artifice? The testimonial letters claim that the artificial limbs are as good as new. But a "new" what? A new artificial leg? Or a new leg made of flesh, blood and bone? Similarly, the prosthetics seem to "[fulfill] all the requirements of the natural." But what are the requirements of a natural leg? That its wearer can work? Can look whole? Can feel? That the new leg contributes to a psychological sense, for the amputee, of being an unmutilated, whole body again? Is the human being who is thus preserved the same as before? What ultimately makes a person human—the outward appearance of being human? The ability to perform human functions? The presence of all anatomical parts in their proper places? It seems that what these testimonials finally, though implicitly, admit is that the physical body is no longer central to human integrity and that its boundaries and dimensions are no longer stable or well-defined.

Edgar Allan Poe's "The Man That Was Used Up" provides a fictional commentary on these very questions—both implicit and explicit—raised by a body that is partially prosthetic. The story of General A.B.C. Smith is told by one of Poe's often agitated narrators—"constitutionally nervous," as he describes himself. The narrator is frustrated because although he has heard that Smith is a "remarkable"

[4]Ibid., 226.

fellow with a highly-decorated military record, he does not find out until he literally trips over what little of Smith remains that Smith is remarkable precisely because there is very little of him left; he is, as the title indicates, "used up."[5]

The Brevet Brigadier General's physical characteristics are particularly striking. About six feet in height, Smith possesses an "air distingue" which suggests fine breeding and hints at high birth (378). His flowing, jet black hair would do "honor to a Brutus," and his whiskers are the "handsomest pair . . . under the sun." These superlatives continue as the narrator notes "the most brilliantly white of all conceivable teeth," a voice surpassing in "clearness, melody, and strength," and eyes that are "worth a couple of the ordinary ocular organs." The narrator continues a methodical review of Smith, from the top of his head down through a pair of shoulders which would call up "a blush of conscious inferiority into the countenance of the marble Apollo" and "superb" limbs that move with "rectangular precision," creating a "dignity of colossal proportion" (379, 380). In short, all these anatomical parts have been joined together to form a person who is, as one friend says of the General's limbs, "*ne plus ultra*" (379).

Throughout most of the story, the narrator unsuccessfully seeks information about Smith from the General's friends and acquaintances. In these episodes, the word "man" recurs–a deliberate repetition that is not just humorous. We are meant to contemplate the possibility that a "man" as impressive as Smith could be created by such advanced mechanics. Smith himself displays his faith in what he calls the power of human mechanical ingenuity. "There is nothing at all like it," he boasts, "we are a wonderful people, and live in a wonderful age. . . . There is really no end to the march of invention" (381). Concurrently, we are supposed to wonder if, in fact, Smith can be a man at all, since so much of him is made of artificial parts.[6]

The narrator finally abandons hope of learning about Smith from his friends and goes at last to the source, General A.B.C. Smith himself. He enters Smith's dressing chamber but does not immediately see him. What he does spy is "an exceedingly odd-looking bundle of something" lying close by his feet, and he admits that, being ill-humored, he "gave it a kick out of the way" (386). The bundle, as it turns out, is Smith, and he is surprised by the narrator's action. "'God bless me! My dear fellow . . . what–what–what–why, what *is* the matter? I really believe you don't know me at all.'" In "inexplicable evolution" (387), the narrator notes, with an entendre that suggests the Darwinian rhetoric of natural selection, Smith carefully puts himself together: first the cork leg, then the arm, shoulders and chest, up to the wig, which is necessary because he has been scalped. Then come the teeth and eyes and finally the palate, which transforms Smith's voice from a squeak and a whistle to the deep and rich voice he commands in public. All

[5]Edgar Allan Poe, "The Man That Was Used Up," in *The Complete Stories* (New York: Alfred A. Knopf, 1992), 387.

[6]These episodes are a kind of rhetorical prosthetic meant to supply the missing piece of conviction that Smith is truly a man at precisely the moment when Smith's human integrity is about to be challenged.

the while, Smith reels off the names of the manufacturers who have supplied him with these various anatomical parts, which, according to historical sources, were real people and actual businesses (387). After witnessing this transformation, the narrator at once takes his leave, now comprehending that General A.B.C. Smith is "*the man that was used up*" (389).

The story and its characters extol the advances and wonders of the mechanical world. Yet the clearly humorous tone complicates any exact judgment. The reader is supposed to laugh at the apparent absurdity of General Smith who could never have survived such mutilation. Smith is comical because of the absurd extremes he represents, but this comic effect also depends on our knowing that such an absurdity could never actually happen and that human integrity is therefore safe and unthreatened. Even so, however, the humor in the text seems as nervous as the narrator. Not only is modern industrial society capable of manufacturing machines to look like individual parts of the body but, if multiple pieces of the human anatomy are missing, can also replace them. These artificial replacement parts allow the person to appear and function as before—much as the catalog of A. A. Marks suggests—and even more startling, enhance the whole person: Smith is now "remarkable." The perfect human body, Poe's story suggests, may not be a divine but a mechanical creation, not the handiwork of Michelangelo's creator, God, but of A. A. Marks. In fact, the perfect human may not be human at all.

THE PROSTHETIC OF BELIEF IN SIMULATED MEDICINE

Poe's comic fantasy at first seems markedly dissimilar from today's medical accounts of virtual reality simulations that mimic patient reactions. Yet the computer simulations of body parts that are used to practice surgical maneuvers or the full-size patient who is the electronically-sophisticated successor to the rubber C.P.R. dummy are direct descendants of the remarkable General Smith and of all the satisfied owners of A. A. Marks's prosthetics. Poe's text, written long before the introduction of such technology, is remarkably prescient, and its fictional status suggests the fiction embedded in simulated medicine, where characters are created to tell a story of illness and health and where reader-practitioners are responsible for bringing such virtual patient-characters to life. But unlike Poe's General Smith, whose humanity is realized only when he is put together in a complete and symmetrical whole, bodies in the scenarios of contemporary medicine are considered human despite being only simulated body fragments or having no human element at all in their electronic machinery.

What ultimately links General A.B.C. Smith with his contemporary progeny, however, is a metaphorical prosthetics. The trajectory from Poe's nineteenth-century vision to medicine today is clear. The fragmented body of Poe's General Smith needed artificial anatomical parts to complete his humanness. Smith is the partial prosthetic; there is something of flesh, blood and bone left—although

very little. With today's technology, the prosthetic has taken over entirely; nothing organic remains. Yet there is one further metaphorical prosthetic that is vital for understanding both General Smith and the bodies of virtual medicine as human. Just as the observer's gaze completes the life-giving connection between the fingers of God and man in Michelangelo's painting, so both A.B.C. Smith and his modern medical counterparts require observers—the General's friends and acquaintances, the practitioners of virtual medicine—to supply the prosthetic of belief necessary for their humanness to be fully realized.

Before this can be supplied, however, the daunting task of creating the "patient" has to be completed. Helene Hoffman and Dzung Vu explain that "The objective is to create high-fidelity 'virtual humans' that provide realistic organ deformation and bleeding of tissues, allow realistic surgical interactivity, and give tactile feedback."[7] This challenge has been met by the early generation computer simulation programs now in use by physicians, surgeons, nurses and even students. Endoscopy, colonoscopy and arthroscopy are only a few of the medical procedures now possible in this virtual world. An entire "patient" is now constructed out of rubber and wires and electrical impulses; Scott Bukatman refers to this as "hard-wired subjectivity."[8] Medical schools and hospitals are developing laboratories for these virtual bodies, which are housed in computer software, latex parts or whole body mannequins. As an anesthetist at a British university describes such labs, these rooms resemble "a cross between Madame Tussaud's and the Hunterian Museum at the Royal College of Surgeons."[9]

This is how haptics works for procedures that require threading a scope through a specific part of the body. First, a dummy scope is passed into a box with a small hole in the top, which simulates an orifice of the body. The practitioner experiences a simulation that feels like passing the instrument down the throat, through the colon or into the knee joint and, at the same time, watches a computer monitor which shows the scope threading through the virtual body part. In this virtual world, then, the practitioner can both see and feel the scope "in" the body.

The claims of realism and accuracy in contemporary promotional literature for such virtual programs bear an uncanny resemblance to the advertising for prosthetics by nineteenth-century manufacturers like A. A. Marks. Digital patients, according to the promotional literature of the company that developed one such program, "respond in a physiologically accurate manner adding to the level of realism," including "audible responses" of "discomfort or pain."[10] In the case

[7]Helene Hoffman and Dzung Vu, "Virtual reality: Teaching Tool of the Twenty-first Century?," *Academic Medicine* 72, no. 12 (December 1997): 1078.

[8]Scott Bukatman, *Terminal Identity: The Virtual Subject in Postmodern Science* (Durham, NC: Duke University Press, 1993), 244.

[9]Andrew McIndoe, "The Future Face of Medical Training: Ship-Shape and Bristol Fashion?" *British Journal of Theatre Nursing* 8, no, 8 (Nov. 1998): 6.

[10]"Endoscopy" *Immersion Medical*, 2003, *http://www.immersion.com/products/medical/endoscopy* (accessed 6 September 2003).

of virtual colonoscopy, for example, the images are "derived from actual patient data" and react "like real tissue in real time–the colon expands with air insufflation and collapses with suction." In a different module, users can identify and remove "simulated polyps" with complications such as uncontrolled bleeding when "the polyp head is guillotined."[11] In order to practice laparoscopic techniques, one computer program's visuals are based on "actual intra-abdominal images," and the simulated tissue reacts to the user's manipulations, rupturing and bleeding if mishandled. In arthroscopy of the knee, the simulator relies on a portion of an artificial leg, from the mid-thigh area through the knee and down to the foot, which the surgeon can use to adjust the bend of the knee to expose spaces between the bones and position the arthroscope to examine the structures of the knee. Clumsy manipulation of the simulator produces appropriate audio feedback, while clumsy manipulation of the scope too often does not lead to serious damage or death of the patient but, in the virtual reality world, to a flashing sign of "Game Over" on the screen.

On a larger scale, there are life-size, computer-driven mannequins that talk, breathe, move and mimic physiological changes so that health care workers can practice their skills and—especially in the case of students—experience new situations without the risk of harming a real person. One company has developed a virtual patient named "Simantha™," [12] while another company has created "Stan" (short for "standard patient"). Simantha™ is advertised as a mannequin with genuine patient reactions. "She follows instructions, such as coughing or breathing in a bag," according to the company profile, "and has the ability to respond to questions or express discomfort during the procedure." The program's motto is "See one, *sim* one, solve many."[13]

I met "Stan" in the Simulation Development and Cognitive Science Laboratory of Penn State's College of Medicine where this mannequin is used by physicians, nurses and medical students to practice techniques, enhance teamwork and develop skills necessary in time-sensitive patient care. For example, Stan can be programmed to exhibit appropriate physiological responses to various treatments. Too much anesthesia and Stan's vital signs react, requiring immediate decisions in order to stabilize the "patient." Or Stan can be programmed to have an asthma attack so that practitioners can observe the resulting physiological changes. Small holes in Stan's arms, legs and torso can be used to insert leads for intravenous fluids, and a curtain surrounding the operating table has even been painted to resemble the interior of an operating room to make the virtual experience as realistic as possible. Both Stan and Simantha™ have a "human" voice that communicates how

[11]"Lower G. I." *Immersion* Medical, 2003 *http://www.immersion.com/products/medical/endoscopy/lower_gi.php* (accessed 6 September 2003).

[12]Simantha™ is manufactured by the Medical Simulation Corporation (MSC) and is part of the SimSuite™ training System.

[13]"Case Study" *SafeNet* Consulting, 2003 *http://www.safenetconsulting.com/uploads/admin/InfiNet_MedicalSims.pdf* (accessed 6 September 2003).

each is feeling and establishes the "emotional connection" which, according to the director of Harvard's medical simulation program, "really seems to draw students in" and helps them "begin to acquire the critical skills of effectively interviewing a patient."[14]

The advantages of these simulated human bodies are enormous not only for the economics and ethics of medical practice but especially for education, since it still follows the century-old apprenticeship model exemplified by the phrase "see one, do one, teach one."[15] A shortage of patients needing a colonoscopy, for instance, would not allow aspiring medical residents or young surgeons to practice the skill. Yet without such practice, there is the possibility of more mistakes, more discomfort for future patients, more time in the operating room where cost is measured by the clock and—in worst case scenarios—dangerous, perhaps lethal failures in surgical training. At the same time, the controversy surrounding the use of animals for training and experimentation can now be avoided. As one company observes in a guide to their products: "Hands-on practice in the OR is . . . effective. . . . But there is one problem: with a live patient on the table, learning by trial and error is simply not an option. But now, there is a safe and effective alternative . . . that replaces the vulnerable patient with expendable pixels."[16]

Despite the increase in patient simulators like Stan and Simantha, however, some educators and critics worry that their use limits practitioners' time with actual patients, while others are still waiting to be convinced that practice on a virtual patient really improves actual performance. In the last few years, studies have yielded mixed conclusions about the usefulness of virtual medicine. Arthroscopy simulators seem to help surgeons develop skills and discriminate among fine motor movements.[17] A three-week course with a virtual endoscopy simulator significantly improved the skills of beginners more than practice in a clinical setting since the number of opportunities to practice technique was fewer.[18] Yet programs for simulated training in other fields, such as in minimally invasive surgery or obstetrics and gynecology, are not as well developed,[19] and it is still unclear if current technology is more effective than traditional methods of training. In a recently published study, researchers conclude that if it is the only form of training,

[14] M. J. Friedrich, "Practice Makes Perfect: Risk-Free Medical training with Patient Simulators" *Journal of American Medical Association* 288, no. 22 (December 11, 2002): 2811.

[15] "Simulation-based training, available to medical professionals at Geisinger Health System," 2003, *Virtual Medical World Monthly http://www.hoise.com/vmw/02/articles/vmw/LV-VM-12-02-28.html* (accessed 6 September 2003).

[16] "Laparoscopy" *Immersion Medical*, 2003 *http://immersion.com/medical/products/laparoscopy* (accessed 6 September 2003).

[17] R. A. Pedowitz, J. Esch, and S. Snyder, "Evaluation of a virtual reality for arthroscopy skills development," *Arthroscopy* 18.6 (July-August 2002): E29.

[18] A. Ferlitsch et al., "Evaluation of a virtual endoscopy simulator for training in gastrointestinal endoscopy," *Endoscopy* 34, no. 9 (September 2002): 727–729.

[19] A. Park and D. B. Witschke. "Training and Educational Approaches to Minimally Invasive Surgery: State of the Art," *Seminars in Laparoscopic Surgery* 9, no. 4 (December 2002): 198–205.

state-of-the-art virtual reality-based endoscopy simulation is actually inferior to traditional bedside teaching techniques.[20] What these last studies seem to suggest is that training in a virtual environment is no substitute for training in the real world.

There are, however, other criticisms, concerns and complicated theoretical questions that Simantha™, Stan and the cohort of virtual body parts raise. "Stan" has been constructed without breasts, and his name identifies him as male. Yet increasing numbers of studies indicate the importance of conducting trials for medication or treatments on both men and women, since the biological sexes differ physiologically, manifest ailments differently and have different physical and psychological responses to treatment. I cannot help but wonder whether Stan has been programmed to respond as a man (and, likewise, whether Simantha™ has been programmed to respond as a woman)—a significant question given the particular patterns that researchers find in men's and women's speech, conversational styles and emotional responses.

There are other concerns as well. L. J. Whalley concedes that initially, "Virtual reality machines will offer doctors the opportunity to use super computers without sacrificing their own primary commitment to the provision of medical care of their patients."[21] Yet Whalley also worries that the virtual environment will be "determined by the machines' programmes and not by the laws of nature. When such simulations are highly complex (as they are certain to be) the chances of error must increase," and it is "also likely that the naive user of virtual reality environments will fail to detect errors or distortions."[22] Errors in a computer program are petty annoyances that we learn to live with in our technology-dependent world while hoping that such errors do not occur at a particularly inopportune time. Yet what is the opportune time for error in a program that simulates a patient's response to anesthesia? And what if the practitioner is unable to detect that an error has occurred—only to reproduce the error on the first real patient who presents with such a complication?

Whalley further contends that problems may arise when a living patient is introduced into a virtual reality environment. Such an environment may enable a disabled or chronically ill patient to engage in activities prevented by their disability or to engage in rehabilitation after traumatic injury. However, Whalley sees a danger to patients who interact in a virtual environment with fictional characters who have no autonomy or free will, who must behave as they are programmed and who may not respond to the patient as other living persons would in real life.

Similar issues arise for students and physicians whose education and practice takes place at least partly in a virtual reality world populated by the likes of

[20]G. S. Letterie, "Medical education as a science: the quality of evidence for computer-assisted instruction," *American Journal of Obstetrics & Gynecology* 188, no. 3 (March 2003): 849–853.

[21]L. J. Whalley, "Ethical Issues in the Application of Virtual Reality to Medicine," *Computers in Biology and Medicine* 25, no. 2 (1995): 108.

[22]Ibid., 109.

Simantha™ and Stan. Simulated persons and body parts have no agency; they are programmed to display certain symptoms, react according to the decisions of the human manipulating the controls and then continue to react according to their pre-programming. What Stan cannot do is act outside the program that has been written for him; he cannot be unpredictable. What the students and physicians, then, cannot experience is a patient who thinks, acts and feels like a human being. This is, of course, an argument for why simulated patients cannot entirely take the place of real ones; real patients can refuse treatment from one day to the next, display physiological symptoms that are affected by their emotional state, believe in the power of prayer or positive thinking and respond using different language and signs even when asked the same question.

Thus, interaction with simulated patients cannot help health care practitioners develop or practice the interpersonal skills so valued in contemporary medicine because these patients are not real, lack agency and, therefore, cannot respond spontaneously or capriciously. Educators must ask how effective it is to train health care workers to care for virtual patients when their "real" patients will be—well, real. Interaction with Simantha™ or Stan, I would argue, only prepares for interaction with another virtual patient. Furthermore, the virtual environment Stan and Simantha™ inhabit omits many factors that affect real life treatment decisions. There is no family to consult, no financial limitations or insurance coverage to consider, no threat of a malpractice lawsuit. Besides these objective factors, there are the personal emotional responses that doctors and nurses—themselves very human—may have to certain illnesses or patient personalities. These more subjective factors are intimately connected with human patient care, and they may profoundly affect the decisions medical practitioners make, whether consciously or unconsciously—is it possible in the fullest sense to "care" for Stan?

The most profound difference between virtual and human patients is that Stan and Simantha™ cannot die. Suppose that Stan is programmed to simulate an asthma attack. Practitioners gather around him to diagnose his illness, note his breathing and pulse rate, and consider the severity of his symptoms. They decide on one of a range of treatment options, and Stan reacts to it, prompting them to reassess his condition and make a further decision. But what if at some point their decision is wrong? In real life, such a mistake means suffering, deterioration or death for the patient. But in the world of virtual reality where Stan is only a teaching tool, mistakes not only will occur but are also expected and perhaps even desired as a useful "teaching moment"; the health care practitioners either avert the crisis and stabilize the patient, or they fail to do so, and in either case the simulation ends. A flick of the switch can reboot the patient, and the simulation begins again. Just so, General A.B.C. Smith removes his artificial parts every night and becomes an "odd-looking bundle of something" on the floor, while every morning he puts himself together again, ready to begin another day as a "remarkable man." Nevertheless, he remains, however marginally, a man. Somewhere in this odd construct of artificial body parts, there persists something–a spark that is human and alive.

But, of course, life is precisely what is missing in Stan and Simantha™. Is it possible that knowing that the virtual patient cannot die would lead to different treatment decisions in practice simulations? Might dealing with patients who can be mechanically reanimated and used over and over again gradually make the practitioner callous or indifferent to disease symptoms, patient reactions or death itself? If these attitudes persist when practitioners move from virtual to human patients, will they not produce caregivers who are interpersonally inept, indifferent towards a patient's emotional responses and fear of dying, and motivated more by selfish considerations of reputation or profit than by an ethical concern for human suffering?

Beyond these practical and moral issues are questions that are more philosophic, even metaphysical. Stan lacks agency; he cannot react in a way that has not been anticipated and programmed by his developers. The health care practitioners, in contrast, seem autonomous and free; they can respond to Stan's symptoms in a variety of ways, ranging from doing nothing at all or simply seeking to make Stan more comfortable to more aggressive treatments such as administering drugs. Stan reacts to their decision, and they react to his reaction. With each decision, there seems to be a loss of autonomy or agency. Like Stan, the human caregivers are caught in a flow chart of treatment options, prompted by a program and mediated by the virtual patient.

In today's virtual reality simulations, I suggest, the real and the virtual mingle so that the real becomes the virtual and the virtual becomes the real. At what point, for example, do the hands of the real surgeon engaged in a virtual endoscopy become virtual themselves as they enter into a virtual surgical scenario? At what point do the simulated organs of a virtual body become real–not organs of flesh and blood but yet sufficiently real that practice on one qualifies one to practice on the other?

Even more intriguing is how both Smith and these virtual reality patients, either in part or in whole, seduce the health care practitioners around them into a particular belief about human integrity and selfhood. These computer simulations seem to require the willing suspension of belief in the distinction between real and unreal, human and not human. The novice student and the experienced surgeon both know that they are entering an artificial environment where their patient is made of latex or pixels. Yet simultaneously they need to believe that performing a surgical procedure on such a body is just as if they were performing it on an actual human body.

Jean Baudrillard, French sociologist and philosopher, offers an analogy to this paradox, drawing on a Jorge Luis Borges fable in which "the cartographers of the Empire draw up a map so detailed that it ends up covering the territory exactly." The map is both identical with the actual terrain and its copy. Today, Baudrillard argues, "Simulation is no longer that of a territory, a referential being, or a substance. It is the generation by models of a real without origin or reality: a hyperreal." The virtual "hyperreal" exactly matches the real: the picture that a practitioner views on

a computer screen is the pixellated version of what the interior of a colon or knee joint actually looks like, whether seen directly or in photographs. Yet Baudrillard draws a distinction that helps identify the way this exact simulation challenges distinctions between true and false. To "dissimulate," he defines, is "to pretend not to have what one has," whereas "to simulate is to have what one doesn't have." Thus, "whoever fakes an illness," Baudrillard explains, "can simply stay in bed and make everyone believe he is ill." But whoever simulates an illness actually "produces in himself some of the symptoms." [23]

Baudrillard's careful discrimination helps clarify the difference between the practical and metaphoric use of a prosthetic. An artificial leg or arm replaces the real, and although it is not real in the sense of flesh and blood, it does come to take the place of the real. Poe's General A.B.C. Smith is made up of artificial body parts that do the work of limbs he lost in battle. But to the degree that his friends (or he himself) believe that he is a whole man, he becomes a simulation, claiming, in Baudrillard's phrase, to "have what [he] doesn't have." The simulated virtual body parts and the whole body mannequins used in medicine today provide an even closer relationship to Baudrillard's contention about simulation's ability to produce the real. They are composed, as is the case in programs that are designed for the practice of abdominal surgery, of images of real abdomens, transformed into pixellated images displayed on a screen. Simantha™ and Stan, too, come to stand in for the real and to present to the practitioner a patient who displays the exact physiological attributes needed; in other words, to give the practitioner what she or he does not have, namely a real body on which to practice.

This alternate reality seems to challenge our belief about what makes one human and then to dismiss the whole question by substituting images on a computer screen as the surgeon or student becomes complicit in the illusion. Surgeons operating on an abdomen and students hovering over Simantha™ or Stan all enter into the same agreement, tacitly, to leave clear distinctions between human and not human outside of the simulation room and to participate in the belief that the knee is a real knee and the body composed of rubber and wires before them on the table is a real patient.

As a result of this agreement, however, just who or what is real? Who or what is the fictional character? Who or what has become the simulation, the prosthetic? In this exchange between virtual reality simulator and health care practitioner, the role of the prosthetic, originally attributed to artificial anatomy, expands to encompass the real flesh and blood practitioner. It is only by making this switch that the virtual simulators become valuable tools, that the pixellated versions of humanness become bodies real enough from which to learn and that the virtual anatomy is recognized as human. The human practitioners,

[23] Jean Baudrillard, "Simulcra and Simulation," in *Postmodern American Fiction: A Norton Anthology*, eds. Paula Geyh et al. (New York: W.W. Norton & Company, 1998), 633.

huddled over the table on which the entirely artificial anatomy is displayed, have become the prosthetics necessary for the artificial limbs and virtual patients to be human.

To return to Bukatman's phrase, medicine's use of these virtual patients and anatomical parts has created a "new hard-wired subjectivity." But just what does it mean if subjectivity, as Poe's short story suggests, is no longer predicated on flesh and blood? Computer programs, monitors and wires are now able to carry subject status if configured in a certain format. When they are arranged just so, Simantha™ reacts to anesthesia. Arranged slightly differently, Stan is a "lifeless" heap of wires and tubes. One false move, and the game of colonoscopy is over. It is as if Dr. Frankenstein's theory has come true: electricity—not the touch of God—is the animating force with the lightning bolt of a storm replaced by the switch on the keyboard and with the fleshly, corporeal self that bleeds real blood replaced with only a simulation so that the prosthetic no longer simply supplies a part of human integrity but is, in fact, now entirely human itself.