HUMAN BY DESIGN: BODILY PROSTHETICS AND THE RHETORIC OF SCIENCE FICTION COOL

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Science fiction deals with questions concerning the effects of new technologies on society. Science fiction also encompasses a mode of visual representation that depicts what the technologies of the future will look like. This dissertation argues that these images have a broader rhetorical function in popular culture, influencing the meanings, attitudes, and values associated with new technologies based on the extent to which they resemble the function and form of their imagined science fiction analogues. This *rhetoric of science fiction cool* has become prominent in the marketing for bodily prosthetics and their representations in popular culture, emphasizing the perceived similarities between advanced "bionic" prosthetic limbs and their fictional versions. In recent years, the notion of having an artificial limb has come to be portrayed as a positive—and even enviable—characteristic, centering around the potential of prosthetic limbs to be customized, decorated, and swapped out for more sophisticated versions in order to more closely resemble those featured in science fiction. Paying special attention to what happens to the rhetoric of bionic limbs when they are presented through a sci-fi lens, this dissertation examines the intimate role science fiction plays in influencing cultural attitudes towards technology as well as how the aesthetic and functional qualities of these technologies are used to frame ethical arguments about their use.

TABLE OF CONTENTS

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1.0 INTRODUCTION

In a 1998 TED Talk, a double-amputee Paralympian removes her “pretty legs,” equipped with high heels and painted toenails, and dons her record-setting carbon-fiber sprinting prostheses resembling the hind legs of a cheetah. In 2007, a retired Army sergeant who lost his lower-left arm in Iraq says that his “futuristic” new robotic hand makes him feel like “the Terminator”—his four-year-old son thinks that he is “half robot, half man.” In 2013, a researcher developing an advanced robotic arm at the Johns Hopkins University Applied Physics Laboratory declares that many of his amputee patients, mainly young men, prefer the arm’s “robotic look” to a realistic covering resembling a natural human limb. In 2015, a self-described “bionic model,” born without her right forearm, walks at New York Fashion Week wearing a futuristic armored dress—her most talked about “accessory” is her robotic prosthesis, laced with matching silver-metallic ribbons. One month later, a seven-year-old boy receives a prosthetic arm from a charity inspired by Marvel Studios’ blockbuster *Iron Man* film series—in a trans-media spectacle, the robotic gauntlet is delivered by “Iron Man” himself, actor Robert Downey Jr. In 2016, President Barack Obama shares a “fist-bump” with a quadriplegic man who skillfully operates a “mind-controlled” robotic arm that allows him to feel when each mechanical finger is being touched—according to Obama, the technology is “unbelievable” and “very cool.” Weeks later, an eleven-year-old meningitis survivor, Tilly Lockey, proudly demonstrates her “awesome” 3D-printed

robotic hand. Modeled after the cyborg protagonist in a popular science fiction video game series, she says it makes her feel "confident" and is the envy of her able-bodied friends.

What do these stories have to tell us about the social meanings attached to bodily prosthetics in the twenty-first century? Focusing on the marketing for prosthetic limbs and their representations in popular culture, this dissertation explores how, in recent years, the notion of having an artificial limb has come to be portrayed as a positive—and even enviable—characteristic. In news, advertising, and on social media, stories highlighting new developments in the world of prosthetics have elevated those who design and use these technologies to celebrity status—a wide-ranging group that includes members of the medical community, the military, athletics organizations, the fashion industry, and even homebrew tinkerers. This increasing visibility of prostheses and their users extends to the realm of entertainment, where popular science fiction-themed television programs, films, comics, and video games frequently feature protagonists with artificial limbs, extrapolating from real-world technologies in order to depict a prescient vision of a prosthetic future. "You have a metal arm? That is *awesome*, dude!" exclaims Peter Parker, the teenaged superhero "Spider-Man," as he catches a punch from the silvery left arm of "Winter Soldier" Bucky Barnes in the 2016 science fiction blockbuster *Captain America: Civil War*.[1] More than a humorous interlude, Parker/Spider-Man's admiration for his opponent's high-tech prosthesis is emblematic of a contemporary cultural fascination with artificial limbs.

Today, the most advanced prostheses are "bionic" limbs—robotic appendages designed to function similarly to natural human body parts. According to the *Oxford English Dictionary*, the term *bionic* is used to describe a "system or device designed to resemble part of a living

[1] *Captain America: Civil War. Directed by Anthony Russo and Joe Russo. Marvel Studios/Walt Disney Studios Motion Pictures, 2016. Film.*

organism," especially "one used as a prosthesis or enhancement for a human body." It also describes something "having or enhanced by such a device."[2] In prosthetics, the term generally describes a fully articulated limb or extremity with a high level of strength and dexterity, and an intuitive electronic control system that allows them to be operated almost as if they were a part of one's own body. In this way the most technologically sophisticated bionic limbs are also—paradoxically—viewed as the most "natural." From multimillion-dollar, government-funded research projects to independent startups producing low-cost, do-it-yourself alternatives, bionic limbs have become a showcase for advances in robotics, new materials science, manufacturing innovations, industrial design trends, and the latest knowledge of human physiology. Functional, fashionable, and futuristic, they are increasingly portrayed as the stuff of science fiction, and in recent years there has been an unprecedented collaboration between the prosthetics and entertainment industries, emphasizing the perceived similarities between bionic limbs and their science fiction analogues in order to market prosthetics as well as popular entertainment featuring prosthesis-equipped characters.

As the critical discourse of the future, science fiction deals with questions concerning the effects of new technologies on society. Science fiction also encompasses a mode of visual representation that depicts what the technologies of the future will look like. This dissertation argues that these images have a broader rhetorical function in popular culture, influencing the meanings, attitudes, and values associated with new technologies based on the extent to which they resemble the function and form of their imagined science fiction analogues. This *rhetoric of science fiction cool* has become prominent in the marketing for bodily prostheses, which exploits the potential of prosthetic limbs to be customized, decorated, and swapped out for more

[2] "Bionic, Adj.2." OED Online. 2016. Accessed December 11, 2016. http://www.oed.com/view/Entry/288226.

sophisticated versions in order to more closely resemble those featured in science fiction.[3] Traditionally viewed as assistive and rehabilitative devices, the marketing for prosthetic limbs increasingly portrays them as a means to enhance the functional and aesthetic capabilities of the natural human body through artificial means.

The prosthetics industry's focus on personality, individuality, choice and customization is also part of a larger discourse of personal expression and creativity through consumer technology, where cultural attitudes towards the extension of the body through technology are becoming naturalized in spite of prevailing anxieties about the essential character of the human body, individual privacy in an age of technological integration, and the use of robotic technologies for military purposes. Modifying and/or replacing the body with prosthetics is a fundamental rethinking of what it means to extend and/or express oneself through technology—not in terms of media metaphors but involving practical decisions about the desired material makeup of the body itself. Prosthetic limbs in particular are among the most personal technologies, and as the means by which their users move through and interact with the world they are intimately involved in everyday human experiences. The prosthetics industry's drive to recreate the human form through technology—to create a part of the body that is not of the body—while also offering possibilities to redesign the body itself reveals a tension between "artificialness" and "naturalness" that is central to the marketing of bionic prostheses that bridge the gap between natural body parts and high-tech artifice.

Although this dissertation focuses on the marketing and representation of bionic prosthetic limbs, the rhetoric of science fiction cool has become prominent in the marketing of

[3] I initially coined the phrase "veil of science fiction cool" to describe the use of science fiction imagery in a series of United States Air Force advertisements. See: Maradin, Nicholas R., III. "Militainment and Mechatronics: Occultatio and the Veil of Science Fiction Cool in United States Air Force Advertisements." *Ethics and Information Technology* 15, no. 2 (2013): 77-86.

technologies such as wearable electronics, self-driving automobiles, military exoskeletons, and robotic drones. This trend corresponds to an increasingly close relationship between the entertainment and technological industries, blurring the line between mass entertainment and practical technological development, especially in terms of media marketing endeavors. Using the aesthetic and thematic elements of science fiction to market technology thus sacrifices some of the more critical aspects of the genre in order to portray technologies with a distinctly futuristic ethos while simultaneously veiling any limitations—or dangers—resulting from their use. Therefore, this dissertation's examination of science fiction cool in technological discourses introduces a series of larger ethical questions: Should professional athletes be allowed to augment their bodies with technology without limit? What does it mean for a soldier to describe himself as "Iron Man?" And how are discussions concerning the use of autonomous and semiautonomous military robots shaped by their portrayal as "like science fiction?"

In *Rhetoric of Machine Aesthetics*, Barry Brummett argues that "Beyond our sensory enjoyment of machines lie the uses and effects of those aesthetic experiences. Those effects are *rhetorical*: we influence others, and they influence us, in many ways." For Brummett, "the look, feel, sound, and other sensations of machines, whether or not in real machines, is part of the machinery of rhetorical influence in contemporary culture."[4] Paying special attention to what happens to the rhetoric of bionic limbs when they are presented through a sci-fi lens, this dissertation examines the intimate role science fiction plays in influencing cultural attitudes towards technology as well as how the aesthetic and functional qualities of these technologies are used to frame ethical arguments about their use.

[4] Brummett, Barry. *Rhetoric of Machine Aesthetics*. Westport, CT: Praeger Publishers, 1999. (p. 2)

1.1 THE RHETORIC OF SCIENCE FICTION

According to scientist and science fiction author Isaac Asimov, "Science fiction is that branch of literature that deals with human responses to changes in the level of science and technology."[5] For Asimov, "It is not that science fiction predicts this particular change or that that makes it important, it is that it predicts *change*."[6] Likewise, author Ben Bova writes that "science fiction is the literature of change. Each and every story preaches from the same gospel: tomorrow will be different from today, violently different perhaps."[7] As "an extrapolation of the present"[8] that pays close attention to specific trends in science, technology, and society, a work of science fiction may successfully predict some future detail or development that comes to pass. However, Bova argues that "Science fiction writers are not in the business of predicting *the* future. They do something much more important. They try to show the many possible futures that lie open to us."[9]

As Robert Silverberg and Charles Elkins assert, "There is only one thing we know for *certain* about the future: it will be different from today."[10] As a result, the rapid pace and unpredictability of technological change can be overwhelming. Alvin Toffler defines the resulting "future shock" as "the shattering stress and disorientation that we induce in individuals by subjecting them to too much change in too short a time." In short, future shock is "the disease

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[5] Asimov, Isaac. *Asimov on Science Fiction*. Garden City, New York: Doubleday & Company, 1981. (p. 22)
[6] Ibid. (p. 19)
[7] Bova, Ben. "The Role of Science Fiction." In *Science Fiction, Today and Tomorrow: A Discursive Symposium*, edited by Reginald Bretnor, 3-16. New York: Harper & Row, 1974. (p. 13)
[8] Asimov, Isaac. *Asimov on Science Fiction*. (p. 82)
[9] Bova, Ben. "The Role of Science Fiction." (p. 4-5)
[10] Silverberg, Robert, and Charles Elkins. "Beyond Reality's Barriers: New Dimensions." In *Science Fiction: Contemporary Mythology: The SFWA-SFRA Anthology*, edited by Patricia S. Warrick, Martin Harry Greenberg, and Joseph D. Olander, 92-100. New York: Harper & Row, 1978. (p. 93)

of change."[11] As the "literature of change," science fiction can be used to mitigate the effects of this social malaise by envisioning many possible futures so that we may get to know them before they arrive. As Patricia Warrick explains, "The science fiction imagination comes to terms with the uncertainty of the future by making up stories about what it might be like when it arrives." However, for these stories to be meaningful, they must always have "an aura of plausibility."[12] In order to be believable, or relatable, they must take as their point of departure the known scientific and technological concerns of the present and extrapolate from them any number of possible deviations. According to Silverberg and Elkins, a work of science fiction is therefore "a statement using consensually validated symbols to describe possible futures." Used thusly, the genre "becomes a public form for coping with tomorrow."[13] In mediating between the technological present and an ever-changing future, science fiction explores the changes that new technologies might bring, so that humanity can "determine how to shape these changes, how to influence them and produce an environment where the changes that occur are those we want."[14]

Science fiction also explores and represents these changes through visual designs in film, television, comics and video games. Because new technologies need a form, science fiction is an exercise in industrial design and aesthetics as much as overall technological improvement. As Piers D. Britton writes, this type of "cinematic" science fiction "privileges a very particular kind of 'to-be-looked-at-ness': it is built primarily around visual phenomena which, while striking and novel, must appear to have a place in a contemporary common-sense worldview, informed by

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[11] Toffler, Alvin. *Future Shock*. New York: Random House, 1970. (p. 2)
[12] Warrick, Patricia S. "Science Fiction Myths and Their Ambiguity." In *Science Fiction: Contemporary Mythology: The SFWA-SFRA Anthology*, edited by Patricia S. Warrick, Martin Harry Greenberg, and Joseph D. Olander, 1-9. New York: Harper & Row, 1978. (p. 6)
[13] Silverberg, Robert, and Charles Elkins. "Beyond Reality's Barriers." (p. 93)
[14] Bova, Ben. "The Role of Science Fiction." (p. 13)

popular understanding of science."[15] Even the most extreme science fiction technologies have a certain degree of believability and familiarity in order to resonate legibly with audiences. In other words, the most prescient depictions of technology find inspiration in contemporary machine aesthetics, prevailing trends in industrial design, and the artistic movements of the day in order to visualize how these devices might evolve in the future as the level of technological sophistication increases.

Stanislaw Lem writes that "The main difference between today and yesterday lies in the movement which every year brings several ideas and things corresponding to them from the realm of the fantastic, empty names into the realm of real things."[16] This means that as the level of science and technology increases, many technologies that were once relegated to the domain of the imagination have the potential to become actualized in some form. When a particular technology is developed that seems to have materialized from one of these science fiction futures, a common response in the popular media is to say that it is "like science fiction." Saying that a particular technology is "like science fiction" is a mutable and somewhat paradoxical expression used to indicate the frisson of excitement caused by its seemingly unreal qualities of function and form. Either this technology appears so novel as to defy any other form of explanation, or technology seems to have finally caught up with our collective science fiction imagination. The technology becomes a material anachronism that feels out of time and place, or "ahead of its time."

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[15] Britton, Piers D. "Design For Screen SF." In *The Routledge Companion to Science Fiction,* edited by Mark Bould, Andrew M. Butler, Adam Roberts, and Sherryl Vint, 341-49. London: Routledge, 2009. (p. 342)
[16] Lem, Stanislaw. "Robots in Science Fiction." In *SF: The Other Side of Realism: Essays on Modern Fantasy and Science Fiction*, edited by Thomas D. Clareson, 307-25. Bowling Green, OH: Bowling Green University Popular Press, 1971. (p. 312)

Up until this point I have been talking about science fiction as a process for contemplating and presenting possible futures. It must also be emphasized that what we think of as "science fiction" today also comprises a collection of popular science fiction texts—visions of past and potential futures or ideas and images that we think are "futuristic." Our tendency to identify new technologies as "like science fiction" when we see them is partly because we already have some expected idea of what the near future can be or look like thanks to the diverse array of possibilities presented in popular science fiction. Of course, as technology increases, science fiction keeps pace by offering new depictions of the future. As Patricia Warrick notes, "Every advance in science and technology requires the [science fiction] writer to reinvent the future."[17]

Christine Cornea argues that "science fiction is caught between that which exists outside of the laws of a known world and that which might be read as a logical extension of the known world." In other words, "science fiction is a genre that is demonstrably located in between fantasy and reality."[18] Therefore, Tzvetan Todorov writes that "the best science fiction texts are organized analogously. … The narrative movement consists in obliging us to see how close these apparently marvelous elements are to us, to what degree they are present in our life."[19] In regards to technology, science fiction becomes the standard by which we assess the technological achievements of the present in light of the extent to which they "live up" to the more fantastic elements of our science fiction imagination.

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[17] Warrick, Patricia S. *The Cybernetic Imagination in Science Fiction*. Cambridge, MA: MIT Press, 1980. (p. 8)
[18] Cornea, Christine. *Science Fiction Cinema: Between Fantasy and Reality*. New Brunswick, NJ: Rutgers University Press, 2007. (p. 4)
[19] Todorov, Tzvetan. *The Fantastic: A Structural Approach to the Literary Genre. Translated from the French by Richard Howard. With a Foreword by Robert Scholes.* Ithaca, NY: Cornell University Press, 1975. (p. 172)

Technologies seem most remarkable when they appear to straddle this line between reality and fantasy, when our lived reality seems to temporarily align with or encroaches upon our popular visions of the future. This perceived similarity between actual technologies and their science fiction analogues is central to the representation and marketing of bionic limbs. Paradoxically, it is precisely the achievement of "making science fiction real" that grants cultural credibility—or science fiction cool—to cutting-edge bionic technologies that seem to blur the line between actual reality and popular fantasy, or are customized and decorated to appear that way. In this way, science fiction technologies and aesthetics, like prosthetics, mediates between the natural and the artificial, or the technological present and the spectacular future.

Ultimately, science fiction helps society comprehend the significance of new technologies and explore the forms that these technologies can take in the future. In prosthetics marketing, these science fiction themes and imagery are appropriated as rhetorical devices that help shape public attitudes towards new bionic technologies.

Defined broadly as the "art of persuasion," rhetoric includes not just speech but written and visual forms of communication as well. Like science fiction, rhetoric is also concerned with presenting for consideration an array of possible futures in a way that pays special attention to the qualities of timeliness, social relevance, and reasonableness. In this regard, Richard Buchanan describes rhetoric as "an art of shaping society, changing the course of individuals and communities, and setting patterns for new action."[20] Likewise, John Poulakos defines rhetoric as "the art which seeks to capture in opportune moments that which is appropriate and attempts to

[20] Buchanan, Richard. "Declaration by Design: Rhetoric, Argument, and Demonstration in Design Practice." *Design Issues* 2, no. 1 (1985): 4-22. (p. 6)

suggest that which is possible."[21] Here, rhetoric is a means for negotiating humanity's desire for the future.

For Poulakos, rhetoric takes as its starting point the notion that what drives humanity is a fundamental "desire to be other and to be elsewhere," because our "sphere of actuality always entails a lack, the absence of that which exists only in the future." As a result, "actuality frustrates man when he dreams of being other and binds him to where he already is when he wants to be elsewhere. … Even though he functions daily in the world of actuality, he often finds himself concerned with his situation not as it is here-and-now but as it could be there-and-then. Thus, he participates at once in two worlds each of which opposes the other." [22] Here, the engine of rhetoric is similar to the perceived difference between one's lived reality and the possibilities of imagined futures that makes science fiction so captivating. Philosopher David Hume similarly wrote how humanity often falls short of its own ideas of "perfect wisdom":

> Among the other excellencies of man, this is one, that he can form an idea of perfections much beyond what he has experience of in himself; and is not limited in his conception of wisdom and virtue. He can easily exalt his notions and conceive a degree of knowledge, which, when compared to his own, will make the latter appear very contemptible.[23]

The tensions Poulakos and Hume observe are central to how science fiction is used in society as a means to reconcile humanity's desire for the future with the possibilities of the present, and image a more "perfect" state of being. For Poulakos:

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[21] Poulakos, John. "Toward a Sophistic Definition of Rhetoric." *Philosophy & Rhetoric* 16, no. 1 (1983): 35-48. (p. 36)
[22] Ibid. (p. 42-43)
[23] Hume, David. *Essays: Moral, Political, and Literary*. Ed. Eugene F. Miller. Indianapolis: LibertyClassics, 1985. Print. (p. 83)

> This is where the rhetorician steps in and helps him resolve his existential dilemma. By exploiting people's proclivity to perceive themselves in the future and their readiness to thrust themselves into unknown regions, the rhetorician tells them what they could be, brings out in them futuristic versions of themselves, and sets before them both goals and the directions which lead to those goals. All this he does by creating and presenting to them that which has the potential to be, but is not.[24]

Warrick likewise describes the creation of an imagined science fiction future as an act of "transcendence" that "represents a struggle to overcome man's present limitations in time, space, and awareness; to transport himself at least mentally to places he has never been, to gain a new world for himself."[25] Warrick uses the Greek myth of Daedalus, the great inventor, to explain "man's need to escape the labyrinth of the present reality in which he finds himself trapped, and the potential of mechanical inventions to make his escape possible." [26]

In suggesting that the future is now, the presentation of bionic limbs as "science fiction made real" is a rhetorical intervention that hinges on this existential dilemma. Viewed thusly, it becomes apparent that there is great rhetorical power in being told by prosthetics marketers and the mass media that a particular technological development has brought us one step closer to realizing our dreams of a science fiction future. This science rhetoric is most potent when coupled with visual imagery, such as when a bionic limb's technological capabilities are superficially enhanced with cosmetic features designed to resemble something out of science fiction—a symbolic bridge between reality and fantasy that is powerful not only for children

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[24] Poulakos, John. "Toward a Sophistic Definition of Rhetoric." (p. 43)
[25] Warrick, Patricia S. *The Cybernetic Imagination in Science Fiction*. (p. 7-8)
[26] Ibid. (p. 232)

receiving an "Iron Man" arm but for anyone who views artificial limbs as a means to escape some of the limitations of their present world.

This bridge between the present and the future is key. Offering another science-fictional definition of rhetoric, Francis Bacon writes that "the duty and office of rhetoric is to apply reason to imagination for the better moving of the will," which is only possible "after that force of eloquence and persuasion hath made things future and remote appear as present."[27] Chaïm Perelman similarly describes how a rhetor's ability to "single out certain things for presentation … draws the attention of the audience to them and thereby gives them a *presence* that prevents them from being neglected." For Perelman, this sense of "presence" is "essential above all when it is a question of evoking realities that are distant in time and space."[28] In other words, stating that a bionic limb is futuristic or like something out of science fiction draws attention to its science fictional qualities. In bringing such a comparison into the present, it becomes the onus of the prosthetics marketer to ensure that the technology on display "lives up" to this futuristic vision technologically, aesthetically, or in regards to its perceived social impact.

Ultimately, the rhetoric of science fiction cool concerns the managing of a given technology's perceived science fictional qualities in order to make arguments about its aesthetic appeal, technological sophistication, and social value. However, depicting technologies as the real-life versions of their science fiction counterparts involves a number of conceptual limitations or difficulties. According to Kenneth Burke, "Even if any given terminology is a *reflection* of reality, by its very nature as a terminology it must be a *selection* of reality; and to this extent it must function also as a *deflection* of reality." In describing these "terministic screens," Burke

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[27] Bacon, Francis. *The Advancement of Learning*. Edited by G. W. Kitchin. 1st ed. Philadelphia: Paul Dry Books, 2001. (p. 137-138)
[28] Perelman, Chaïm. *The Realm of Rhetoric*. Notre Dame, IN: University of Notre Dame Press, 1982. (p. 35)

notes that "any nomenclature necessarily directs the attention into some channels rather than others."[29] The term "science fiction" is a potent kind of terministic screen. Describing a given technology as being "like science fiction" or "science fiction made real" can direct the attention to their popular or spectacular qualities while simultaneously foreclosing upon alternate assessments of technological virtue.

Likewise, James Carey warns that "The ideology of the future can serve as a form of 'false consciousness,' a deflection away from the substantial problems of the present, problems grounded in conflicts over wealth and status and the appropriate control of technology, toward a future in which these problems, by the very nature of the future, cannot exist."[30] For Carey, this "futurean mirage" is "the illusion of a future."[31] In prosthetics marketing, for example, depictions of bionic limbs alternate between bountiful visions of a super-abled future and the grounded reality of amputees and people with limb differences and the everyday challenges they face in acquiring, maintaining, and learning to use their prostheses (or not using them at all). Here, science fiction plays a key mediating role between the more negative—or less glamorous—aspects of bionic prosthetic technologies and their seemingly "cool" characteristics. This is heightened by the visual presentation of bionic limbs that are designed to resemble the limbs belonging to characters in popular science fiction. In recent years, bionic prosthetic limbs have come to embody this futuristic spectacle, simultaneously representing the cutting edge of human technological achievement and the potential realization of the longtime fantasy of an

[29] Burke, Kenneth. *Language as Symbolic Action: Essays on Life, Literature, and Method*. Berkeley: University of California Press, 1966. (p. 45)
[30] Carey, James W. *Communication as Culture: Essays on Media and Society*. Revised ed. New York: Routledge, 2009. (p. 138)
[31] Ibid. (p. 151)

instantaneously rehabilitated, infinitely-malleable artificial body that allows ordinary people to be transformed into super-heroic cyborgs.

A note on potentially frightening futures: as we will see, it does not matter if the type of science fiction referenced includes a negative or overall cautionary depiction of bionic technology. When prosthetics marketing uses science fiction imagery to assert the positive technological value of bionic limbs, these technologies are unavoidably weighed against depictions of intelligent robots and killer cyborgs that are so ubiquitous in popular culture. However, the most dangerous sci-fi beings with bionic limbs set similarly high standards for technological and aesthetic sophistication. After all, in popular culture, the villainous cyborg Darth Vader is just as "cool" as the heroic Luke Skywalker and his lifelike bionic hand.

1.2 THE RHETORIC OF PROSTHETICS

Science fiction has long been concerned with the interface between the human body and technology. According to J. P. Telotte,

> the image of human artifice, figured in the great array of robots, androids, and artificial beings found throughout the history of the science fiction film, is the single most important one in the genre. … this image measures out our changing attitudes toward science, technology, and reason itself, as well as the shifting foundation beneath our conceptions of the self in the twentieth century.[32]

[32] Telotte, J. P. *Replications: A Robotic History of the Science Fiction Film.* Urbana: University of Illinois Press, 1995. (p. 5)

Today, bionic prosthetic limbs and their science fiction representations are central to contemporary discussions concerning the role science and technology will play in shaping what it means to have a human body in the future. In *Body Drift: Butler, Hayles, Haraway,* Arthur Kroker argues that "Though it was anticipated that the speed and intensity of technological change would effectively marginalize concern with the body, … Images of the corporeal body are the key visual language of contemporary politics."[33] Perhaps more than any other technology, prosthetics represent the importance of having a body in society and the way in which, according to Mark Seltzer, "persons, bodies, and technologies are made and represented."[34] In recent years, the proliferation of new prosthetic technologies as well as new avenues for production and distribution has greatly expanded the means by which prosthetic technologies are available to amputees and people with limb differences. As the industry looks towards the future with an eye on able-bodied or elective limb replacement, "it's not hard to see that the *return* of the body is a central tendency in consumer culture."[35]

Bionic limbs are bodily machines designed to restore or reshape the human body, and the social implications of these devices is informed by their materiality. In the introduction to *Rhetorical Bodies,* Jack Selzer argues that "material, nonliterate practices and realities—most notably, the body, flesh, blood, and bones, and how all the material trappings of the physical are fashioned by literate practices—should come under rhetorical scrutiny."[36] Barbara Dickson defines this "material rhetoric" as "a mode of interpretation that takes as its object of study the significations of material things and corporal entities—objects that signify not through language

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[33] Kroker, Arthur. *Body Drift: Butler, Hayles, Haraway*. Minneapolis, MN: University of Minnesota Press, 2012. (p. 1)
[34] Seltzer, Mark. *Bodies and Machines*. New York: Routledge, 1992. (p. 3)
[35] Ibid. (p. 60)
[36] Selzer, Jack. "Habeas Corpus: An Introduction." In *Rhetorical Bodies*, edited by Jack Selzer and Sharon Crowley, 3-15. Madison, WI: University of Winconsin Press, 1999. (p. 10)

but through their spatial organization, mobility, mass, utility, orality, and tactility."[37] In taking a material rhetorical approach to the study of bionic limbs, I am concerned with the way in which their negotiation of function and form becomes a site and surface for generating social meaning.

In describing the "dialectical tension between form and function" in architectural design, Mary McLeod suggests that "Function brings variation and imagination to arbitrary and overly generalized abstract form, just as form brings invention and play to the mechanistic dimensions of an instrumental, codified functionalism. Each potentially challenges the stasis and hermeticism of the other."[38] The intimate relationship between function and form is also evident in the way in which new manufacturing technologies—from reinforced concrete to carbon fiber—that are developed as engineering solutions often introduce new possibilities for design experimentation. This tension between function and form is central to the social qualities of prosthetics. As Elizabeth Grosz asks,

> Should prostheses be conceived, according to a model of practical reason, as substitute organs, organs that duplicate of approximate and replace missing or impaired limbs and organs and enable the body to function according to its preestablished pattern of performance? … Or, conversely, should prostheses be understood, in terms of aesthetic reorganization and proliferation, as the consequence of an inventiveness that functions beyond and perhaps in defiance of pragmatic need?[39]

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[37] Dickson, Barbara. "Reading Maternity Materially: The Case of Demi Moore." In *Rhetorical Bodies*, edited by Jack Selzer and Sharon Crowley, 297-313. Madison, WI: University of Winconsin Press, 1999. (p. 297)
[38] McLeod, Mary. "Form and Function Today." In *The State of Architecture at the Beginning of the 21st Century*, edited by Bernard Tschumi and Irene Cheng, 50-51. New York: Monacelli Press, 2003. (p. 51)
[39] Grosz, Elizabeth. "Prosthetic Objects." In *The State of Architecture at the Beginning of the 21st Century*, edited by Bernard Tschumi and Irene Cheng, 96-97. New York: Monacelli Press, 2003. (p. 96)

While the marketing of bionic limbs primarily focuses on their technological capabilities, the aesthetic qualities of bionic limbs are often touted alongside their functionality. As John Durham Peters observes, "Technologies are never only functional: any device always has an element of social display or 'bling.'"[40] In other words, while function, fit, and durability are crucially important, how a user feels about the appearance of their prosthesis and how it is perceived by others can be a major design imperative. Furthermore, some designers are beginning to experiment with specialized limbs that deviate radically from the "preestablished pattern" of the human body, eschewing practicality entirely to create more artistic designs or creating nonhuman limb designs that perform some specialized task (of course, if one has the means, they can have it both ways, swapping between limbs as-needed).

A prosthetic limb is a material artifice that serves as part of a wearer's body that is not made *of* the body. Its artificialness grants it malleability beyond the limitations of human tissue. As a result, bionic limbs offer up new possibilities to use one's body as a canvas for material rhetorical production, allow for creative possibilities that exceed those of other body modifications such as tattooing, piercing, and cosmetic surgery, taking advantage of the "negative space" provided by a missing limb. As Grosz argues, "The body must be understood as both the object and the medium of art, and more particularly, as a means for transforming art and the ways that it is commonly understood."[41] Likewise, Katherine Hayles suggests that "On some deep level of correspondence, visual forms and ideas about embodiment evolve together."[42] Speaking in terms of art and possibility is not meant to trivialize limb loss. Rather, a focus on

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[40] Peters, John Durham. *The Marvelous Clouds: Toward a Philosophy of Elemental Media*. Chicago: University of Chicago Press, 2015. (p. 36)

[41] Grosz, Elizabeth. "Naked." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 187-202. Cambridge, MA: MIT Press, 2006. (p. 191)

[42] Hayles, N. Katherine. "Visualizing the Posthuman." *Art Journal* 59, no. 3 (fall 2000): 50-54. (p.50)

remaking oneself in prosthetics discourses reveals the double meaning at play—one can literally remake their body and in this remaking they can create something more than what was originally there.

Prosthetic limbs embody human desire, purpose, and aesthetics. As a result, they help shape and are shaped by the culture that surrounds them. According to Dickson, "material rhetoric, as a mode of interpretation, reads for the ways persons inscribe on their corporal bodies the culture that produces them and that they mutually produce."[43] On one hand, decorating a prosthetic limb to look like a science fiction character is the most literal method of "inscribing" popular culture onto one's body. However, the outwardly material nature of bionic limbs also means that they are expected to engage with the social conventions (e.g. handshakes), ergonomics (e.g. handles), and environments (e.g. stairs) of a world designed for a culture of able-bodiedness, and the extent to which they can succeed at these tasks weighs heavily on their design and marketing. Compared to other biomedical devices such as pacemakers and artificial joints, bionic limbs also have a conspicuous material presence that readily invites a multitude of visceral responses such as surprise, fear, curiosity, admiration and/or disgust. Therefore a wearer's choice to present an "artificial" or robotic look that stands out or a more "natural" appearance that aims to look indistinguishable from a human limb—or to wear a limb that looks robotic yet moves and functions very naturally—is informed by a complex set of cultural expectations and processes by which bodies are made legible and useful in contemporary society. The materiality of prosthetic limbs thus simultaneously communicates something about the technological culture that produced them, and the desires of those who use them.

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[43] Dickson, Barbara. "Reading Maternity Materially." (p. 298)

In describing the complexities surrounding the processes by which bodies are made legible in culture, Judith Butler likewise suggests that "to be a body is to be given over to others even as a body is, emphatically, 'one's own,' that over which we must claim rights of autonomy."[44] According to Butler, "Although we struggle for rights over our own bodies, the very bodies for which we struggle are not quite ever only our own. The body has its invariably public dimension; constituted as a social phenomenon in the public sphere, my body is and is not mine."[45] Although Butler's focus is on gender and sexuality, her work offers a way to account for the ways in which using a bionic limb complicates notions of ownership over the body. On one hand, prosthetic technologies grant their wearer an unprecedented amount of bodily agency, in regards to fashioning the material makeup of the body itself. However, this comes at a cost, and the wearing of a bionic limb is not only governed by the above social expectations but is supported by a complex institutional infrastructure that includes limb developers and manufacturers, hospitals and universities, insurance companies, and prosthetics clinics that prescribe and distribute the prostheses and provide patient services such as limb fittings, rehabilitation, and mechanical maintenance.

The study of bionic limbs as a material rhetorical form also has implications for the study of disability. In *Disability Rhetoric*, Jay Timothy Dolmage notes that "Bodies continue to change, as do attitudes about them, and the rhetorical entailments of these bodily transformations continue to be negotiated."[46] He argues for a "critical alliance between disability studies and rhetoric," in which "rhetoric needs disability studies as a reminder to pay critical and careful attention to the body" and "disability studies needs rhetoric to better understand and negotiate the

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[44] Butler, Judith. *Undoing Gender*. New York: Routledge, 2004. (p. 20)
[45] Ibid. (p. 21)
[46] Dolmage, Jay Timothy. *Disability Rhetoric*. Syracuse, New York: Syracuse University Press, 2014. (p. 2)

ways that discourse represents and impacts the experience of disability."[47] According to Dolmage, "The field of disability studies emphasizes the idea of the social or cultural construction of disability, while *also* insisting on the materiality of disability."[48] Likewise, Katherine Ott writes that "Prosthetic devices, as social objects with a complex set of meanings in the daily lives of people, have rarely, if ever, been understood as part of vernacular material life."[49] In "keeping prostheses attached to people," while also thinking about how prostheses and their users are framed within a variety of discourses, this dissertation aims to enlarge our understanding of how "the evolution and design of technologies of the body are intertwined with the subjective and practical needs of people."[50] Therefore, in focusing on the marketing for bionic prosthetic limbs and their representations in popular culture, this dissertation is neither a condemnation nor a celebration of these technologies and their use. It is an attempt to unravel how a complex, contradictory, and intimately *human* set of meanings, attitudes, and values becomes attached to new technologies in the digital age—how bodily prosthetics become science fiction cool.

1.3 CHAPTER PREVIEWS

This dissertation unfolds in four parts, each examining a different aspect of the marketing and representations of bionic prosthetic limbs. Chapter 1, titled "From the 'Robotic Look' to 'Near-

[47] Ibid. (p. 3)
[48] Ibid. (p. 8)
[49] Ott, Katherine. "The Sum of Its Parts: An Introduction to Modern Histories of Prosthetics." In *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*, edited by Katherine Ott, David Serlin, and Stephen Mihm, 1-42. New York: New York University Press, 2002. (p. 2)
[50] Ibid. (p. 4-5)

Natural': The Marketing of Medical-Grade Bionic Prosthetic Limbs," explores how new control systems and cutting-edge mechatronics allow bionic limbs to function as increasingly "seamless" appendages, illustrating the tension between the "artificial" and the "natural" in prosthetics marketing and contemporary media discourses surrounding the latest bionic prosthetic limbs. In focusing on medical-grade bionic arms and hands as offered by prosthetics manufacturers Touch Bionics, Ottobock, and RSLSteeper, I explore how developers and providers of prosthetics negotiate the complexities of this artificial/natural relationship in order to simultaneously market a mechanical "robotic look" and a more "natural look" as socially viable—and desirable—options for users of prostheses, while using an overall rhetoric of naturalness to describe the advanced technological features of their products and the way in which they are able to readily integrate into a human environment.

In these marketing materials, we see how notions of individual ability and disability become overlaid onto the functional and aesthetic characteristics of one's bionic limbs. As framed by their producers, these devices ultimately become incorporated into their wearer's sense of identity—fulfilling both practical as well as social needs. In prosthetics brochures, patient testimonials, and media depictions of prosthesis-equipped public figures, wearers describe their bionic limbs—both "robotic" and "natural" in appearance—as sporty, sexy, fashionable, fun, stylish, and/or cool. Ultimately, in negotiating the choice between the "robotic look" and the "natural look," their ability to take control of their appearance is represented as granting them a new agency over their disability, allowing for bodily "customization" and "personal expression." In this way, the rhetoric of science fiction cool intertwines with the discourses of personal modification that characterize contemporary "app culture," even as these

marketing materials hint at some anxieties about the relationship between technological and "natural" bodies.

In Chapter 2, titled "Refashioning the Human Body: The Marketing of 'Alternative' Prosthetic Limbs," I expand on these themes of agency, customization, and personal expression, examining how bionic limbs have come to be portrayed as fashion objects, celebrated as much for their unique capacity to be embellished with decorative features as they are for their technological sophistication and everyday usefulness. The idea that bionic limbs can—and should—be fashionable is most evident in the marketing of the "alternative" prosthetics industry, made up of a growing number of artists and inventors who utilize advanced model making procedures and 3D printing technologies to add bespoke detailing to existing medical prostheses and/or create custom limbs from scratch. Here, the word "alternative" is used by designers to signify the way in which these creations deviate radically from the "expected" function and form of mass-market medical-grade prosthetics and for the way in which they operate independent of medical, military, or other research institutions.

In focusing on the work of two alternative limb manufacturers, Bespoke Innovations and the Alternative Limb Project, I explore how the tension between "natural" and "artificial" is recast in terms of "standing out" vs. "fitting in." Here, the aesthetic qualities of alternative limbs are prioritized as much as their practical utility, with some limbs eschewing functionality entirely in order to become beautiful artistic statements. Their artificialness makes them malleable beyond the limits of the biological human body, taking advantage of the "negative space" provided by a missing limb. Most importantly, alternative prosthetic limbs challenge the notion that beautiful bodies—and prosthetics—necessarily have to look a certain way, offering an alternative to the pursuit of "naturalness" that is common in the prosthetics industry. Ultimately,

the appeal of decorative or fashionable prosthetics is so powerful that it has led to similar "prosthetic styles" being adopted by able-bodied aficionados in everyday dress and high fashion—the most popular being influenced by characters with bionic limbs depicted in contemporary science fiction.

In Chapter 3, titled "From 'Iron Man' Arms to 'Phantom' Limbs: Marketing Prosthetics as Science Fiction Cool," I explore how science fiction has provided developers of prosthetic technologies with a way to market bionic limbs, focusing on recent collaborations between makers of alternative prosthetic limbs and the entertainment industry. These science fiction-themed cross-promotions capitalize on the perceived similarities between real prosthetic technologies and analogous devices in science fiction, materializing in the form of alternative limb enhancements modeled after fictional characters with bionic limbs in science fiction-themed television programs, films, comics, and video games. This science-fictional rhetoric is in turn bolstered by the media's tendency to refer to new prosthetic technologies as "being like science fiction." Here, science fiction provides developers, users, and general audiences with a common pop-culture frame of reference for assessing the value of alternative bionic devices. In this way, science fiction continues to serve as a preeminent medium for shaping everyday discourses on the role of technology in society.

In examining the projects by alternative prosthetics startups Limbitless Solutions and Open Bionics that produced, respectively, bionic limbs inspired by Marvel Studios' *Iron Man* film series and the 2015 blockbuster videogame *Metal Gear Solid V: The Phantom Pain*, I explore how these officially-sponsored projects pair artistic and technical sophistication with rhetorically-savvy media campaigns, positioning these alternative limbs as the "real" versions of the bionic limbs worn by popular film and game characters. This brings media attention to

multiple spheres of the prosthetics industry while simultaneously marketing new entertainment properties featuring these technologically-enhanced characters.

In Chapter 4, titled "Marketing Human Augmentation: Proleptic Transhumanism and the Deus Ex Universe," I examine the prosthetics-themed marketing campaign for the science fiction-themed action role-playing video game *Deus Ex: Human Revolution* (2011) and its sequel, *Deus Ex: Mankind Divided* (2016), collectively branded as the "Deus Ex Universe." To promote *Human Revolution*, game developer Eidos-Montréal and publisher Square Enix produced an elaborate trans-media marketing campaign that highlighted the similarities between the futuristic bionic "augmentations" depicted in their fictional game world and recent developments in the world of bionic technology, focusing in particular on mechanical prosthetic limbs. Publicity for each game included viral websites and advertisements for a fictional augmentation manufacturer, a virtual anti-augmentation social movement, an officially-sponsored documentary about new and upcoming bionic technologies, and a series of fashion accessories and web apps that encouraged audiences to "try on" the prosthetic augmentations featured in the game. On social media, Eidos-Montréal and Square Enix shared news stories featuring real-world prosthetics research, positioning their depiction of augmentations in *Human Revolution* as a relevant meditation on the future of human enhancement via prosthetic technologies.

This rhetorical blending of reality and fantasy would continue with the promotion for *Mankind Divided*. To promote the release of the game, Eidos-Montréal and Square Enix partnered with PC gaming accessory company Razer, computer technology company Intel, and alternative prosthetics company Open Bionics to design and market affordable, 3D printed bionic limbs inspired by the mechanical augmentations depicted in the Deus Ex Universe—officially

bringing the science fiction world to life. This collaboration was soon followed by the "Human by Design" project, an academic symposium on the future of "transhumanism" held on August 3, 2016 at the Paley Center for Media in New York City. Co-produced by Square Enix and CNN's studio Courageous and officially sponsored by *Mankind Divided*, the live-streamed event featured an interdisciplinary panel of artists, theorists, technologists, and users involved in the development of cutting-edge bionic technologies. In designating the attendees as the "augmentation community," the contemporary conversation concerning disability and prosthetics was effectively rebranded in the futuristic terms of the Deus Ex series, portraying the Deus Ex Universe as a nexus for contemporary discussions about the technological future of humankind.

As indicated by the scope of the marketing for *Human Revolution* and *Mankind Divided*, the Deus Ex Universe features an unprecedented relationship between the entertainment and prosthetics industries. Here, the marketing of a prosthetics-themed video game series in conjunction with real-world conversations about bionic technologies blurs the ontological line between fiction and reality, pushing the limits of science fiction as a mode of representation and a tool for marketing technology. Here, the Deus Ex Universe's presentation of bionic technologies moves beyond notions of prosthetic replacement or enhancement in order to grapple with issues of *transhumanism*, or the idea that through technology, humankind will be able to radically alter its evolutionary path in the near future. In encouraging audiences to consider if they would or would not want to "augment" themselves, the series functions as a type of "proleptic transhumanism"—a present-day preview of the future of human enhancement that focuses on how the language, technology, and aesthetics of the Deus Ex Universe could manifest in the real world.

From medical-grade bionic limbs to futuristic visions of transhumanism, prosthetics marketing reflects cultural attitudes towards technology. According to Michael Schudson, marketing is "an ideology and a philosophy, a general perspective on business practice … oriented to learning the expressed or elicited needs and desires of consumers with disposable income for commercially viable products." Therefore, marketing "does not take the product for granted but may involve designing the products or modifying the products" based on those perceived needs and desires.[51] In other words, marketing aims to produce "commercially viable" products that—ideally—sell themselves by tapping into the particularities of a certain cultural moment.

For many amputees as well as people with limb differences, bionic prosthetic limbs and prosthetic limb accessories offer a range of important practical and social functions. They are also designed to fit into the unique lifestyles of their wearers, providing an unprecedented amount of flexibility and options in a time in which individuals increasingly express themselves through consumer technology. According to the Amputee Coalition, a nonprofit limb loss resource funded in part by the U.S. Department of Health and Human Services and the Centers for Disease Control and Prevention, there are about 2.1 million people in the United States living with limb loss, and over 500 Americans lose a limb each day.[52] Yet while these numbers—and the people they represent—are a significant portion of society, bionic prosthetic limbs are essentially niche products. However, the increasing circulation of prosthetics marketing through all spheres of popular culture has broader societal implications. In 1999, Lester Faigley observed that "At no time before in advanced nations have so many people of different genders,

[51] Schudson, Michael. *Advertising, the Uneasy Persuasion: Its Dubious Impact on American Society*. New York: Basic Books, 1984. (p. 31)
[52] "Limb Loss Awareness Month." Amputee Coalition. 2016. Accessed November 30, 2016. http://www.amputee-coalition.org/events-programs/limb-loss-awareness-month/.

ethnicities, age groups, and social classes participated in the altering of their bodies. … personal empowerment is expressed in terms of controlling one's body image."[53]

The marketing for bionic limbs taps into this contemporary cultural fascination with bodies that are both high-tech and custom made. Prosthetics marketing also reflects prevailing anxieties about the human condition and the role that technology plays in constructing, managing, and enhancing the body. Here, bionic prosthetic limbs epitomize the phenomenon of science fiction cool, as symbolic technologies that represent a future in which an infinitely malleable human body can be made and remade without limit. By studying prosthetics through the lens of rhetoric, this dissertation explores how these embodied technologies and technological bodies are fashioned as objects of desire in contemporary culture, where having a robotic arm is seen as "awesome" and what it means to be human is a matter of design.

[53] Faigley, Lester. "Material Literacy and Visual Design." In *Rhetorical Bodies*, edited by Jack Selzer and Sharon Crowley, 171-201. Madison, WI: University of Winconsin Press, 1999. (p. 191)

2.0 FROM THE "ROBOTIC LOOK" TO "NEAR-NATURAL": THE MARKETING OF MEDICAL-GRADE BIONIC PROSTHETIC LIMBS

In June of 2013, *CBS This Morning* aired a segment titled "Eye-Opening Breakthroughs" featuring a new bionic arm developed at the Johns Hopkins University Applied Physics Laboratory. According to the program, the arm is controlled by the brain and "works and feels just like a natural limb." The test patient featured in the segment is 57-year-old Johnny Matheny, who in 2008 had his left arm amputated above the elbow due to cancer. Doctors at Johns Hopkins located the nerves that used to travel to his hand and moved them to the healthy muscles his residual upper limb. While Matheny's brain continues to send motor signals to the reattached nerves, electrical sensors placed on his skin pick up these signals and use them to control the articulations of the lower-limb prosthesis. Additional sensors located in the robotic hand stimulate these nerves when pressure is applied and provide his brain with the sensation of touch, creating a complete feedback system that makes it feel—as affirmed by Matheny—as if his arm had "never been lost."[1] In a *CBS News* article accompanying the segment, lead designer Michael McLoughlin explains that the goal of the Johns Hopkins team is to allow anyone who needs a prosthesis "to be able to go back and just do everything they used to do before they lost their limb." Prosthetic clinician Courtney Moran likewise notes that while it still takes thought and

[1] CBS News. "Watch: Bionic Arm Can Be Controlled by Brain." Youtube. June 26, 2013. Accessed June 21, 2014. http://youtu.be/DhWNrpN9E2A.

practice to re-learn how to do functional tasks, the arm is so "natural" that people who have used it have said that "it feels immediately like they're practicing with their own arm," because "all the fingers move, all the joints move, the wrists move."[2]

As indicated by the *CBS News* coverage of the Johns Hopkins arm, a primary objective of medical prosthetics research is to develop technologies that function as a seamless part of their users' everyday lives. However, the way that the observed "seams" between body and machine are negotiated remains a central theme in media depictions of bionic limbs. As part of the *CBS This Morning* segment, McLoughlin and Moran appeared in-studio to exhibit the arm in person. They brought with them a realistic, glove-like cosmetic covering designed to make the arm look like a natural human hand, complete with artificial hair, veins, and nails. Upon inspection, co-anchor Gayle King noted that "everybody that walked in the green room jumped when they saw it," and said that she couldn't decide if it was "creepy" or "very cool." Indeed, while conventional thinking might suggest that these realistic, "natural" coverings would be overwhelmingly popular, it was discovered that many patients decline to use them. As McLoughlin explains, "there are a number of people, particularly some of the younger men we work with, that really think the robotic look is really cool, and they like it." The arm, with its sleek, black tubular cowling and silver accents, exemplifies the latest trends in industrial robot styling. Its precision-machined, high-tech appearance even comes complete with a distinct electromechanical whirr as its 26 separate joints—from elbow to fingertips—bend and rotate. However, this level of robotic cool comes at a high price. McLoughlin estimated that the

[2] CBS News. "Bionic Arm Researchers Aim for $50K to $60K Price, Product Release "in a Couple of Years"." CBS News. June 26, 2013. Accessed August 12, 2015. http://www.cbsnews.com/news/bionic-arm-researchers-aim-for-50k-to-60k-price-product-release-in-a-couple-of-years/.

prosthesis would cost between $50,000-$60,000 when it debuted, but hoped that the Department of Defense—which sponsored the research—would cover the costs for their military patients.[3]

This opening illustration demonstrates the tension between the "robotic" and the "natural" in media discourses surrounding bionic limbs. Paradoxically, the more technologically sophisticated a robotic limb becomes, the more natural it is said to be. These limbs can also be made to appear more natural on a superficial level with the simple addition of skin-like cosmetic coverings. However, as these natural coverings become more realistic, they also risk entering the "uncanny valley," becoming just close enough to human to be "creepy."

The concept of the uncanny valley was first described in 1970 by Japanese roboticist and Tokyo Institute of Technology engineering professor Masahiro Mori. According to a feature on *IEEE Spectrum*, "Mori's insight was that people would react with revulsion to humanlike robots, whose appearance resembled, but did not quite replicate, that of a real human." The "valley" refers to a chart produced by Mori that graphs how our affinity for humanlike robots begins to plunge into the negative once they approach 75% "human likeness." The only way across the uncanny valley is for a robot to achieve near 100% human likeness. While there is debate over whether or not the uncanny valley is a scientific concept, for Mori, humanoid robots exhibit "a bit of eeriness" as they become closer to humans. As a result, "researchers currently debate over whether they should try to overcome the uncanny valley or simply design robots that are more mechanical in appearance." Mori himself believes that "robots should be different from human beings," and that it is more "interesting" and "invigorating" to design robots that appear more

[3] CBS News. "Watch: Bionic Arm Can Be Controlled by Brain."

mechanical in nature.[4] Today, the concept of the uncanny valley applies to everything from wax figures to computer generated characters in film, the latter of which bear the burden of appearing completely realistic—and unnoticeable—lest audiences immediately recognize them as being somewhat "off" and similarly "creepy."

According to the Amputee Coalition, a nonprofit limb loss resource funded in part by the U.S. Department of Health and Human Services and the Centers for Disease Control and Prevention, the term *cosmesis* is used to describe "the outer, aesthetic covering of a prosthesis."[5] A cosmesis can be a simple plastic shell or a realistic, skin-like covering that resembles the skin tone and features of its wearer. All forms of cosmesis have some form of material function, such as protecting the prosthesis and providing grip or friction. A cosmesis also has important social functions, allowing wearers to choose an appearance that suits their personal style and preference for "fitting in" or "standing out." Just as advances in brain-powered control systems and cutting-edge mechatronics allow bionic limbs to function as increasingly "natural" appendages, new production technologies have made the more natural forms of cosmesis increasingly possible, seemingly able to bridge the uncanny valley. However, if what McLoughlin says is true, and there is a distinct preference among patients for the "really cool" robotic aesthetic even though a more realistic, natural likeness is available, it may indicate a new cultural affinity for mechanical forms—and the willingness to integrate and display them as part of one's own body. As scholar Vivian Sobchack—a left-leg, above-the-knee amputee who wears a prosthesis—once noted, it

[4] Kageki, Norri. "An Uncanny Mind: Masahiro Mori on the Uncanny Valley and Beyond." IEEE Spectrum. June 12, 2012. Accessed January 10, 2017. http://spectrum.ieee.org/automaton/robotics/humanoids/an-uncanny-mind-masahiro-mori-on-the-uncanny-valley.

[5] "Limb Loss Definitions." Amputee Coalition. February 2008. Accessed November 30, 2016. http://www.amputee-coalition.org/resources/limb-loss-definitions/.

might be a "shame" to hide her "glowing chartreuse green titanium" leg with a cosmetic cover, as an eleven-year old boy once cried out "Cool.…Terminator!"[6]

In *Emotional Design: Why We Love (Or Hate) Everyday Things*, cognitive scientist and usability engineer Donald Norman argues that "attractive things do work better—their attractiveness produces positive emotions, causing mental processes to be more creative, more tolerant of minor difficulties."[7] This fundamental concept is reflected not only in the marketing for bionic limbs but in resources for people with limb loss and limb differences, especially concerning issues of access and affordability. For example, an Amputee Coalition publication titled "Cosmesis Is Much More Than Appearance… It's Function," argues that:

> It is extremely important to teach all insurance carriers that appearance is very important to every amputee. It is a vital function of the prosthesis just like standing, walking, holding, and balance are to the amputee. Some amputees may choose the rugged, "black pipe" look, which is popular with many young athletes. Some may choose a very life-like aesthetic look with toes, skin-like covers and perhaps even hair on the leg or arm. Some may choose the exoskeletal prosthesis with the virtually indestructible outer shell. Finally, some may want to change the look just as they change clothing to fit their activities. The strong message needs to be that it should be the choice of the amputee — not the decision of some insurance company clerk or benefits manager.[8]

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[6] Sobchack, Vivian. "A Leg to Stand On: Prosthetics, Metaphor, and Materiality." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 17-41. Cambridge, MA: MIT Press, 2006. (p. 30)

[7] Norman, Donald A. *Emotional Design: Why We Love (or Hate) Everyday Things*. New York: Basic Books, 2004. (p. 60)

[8] Kaczkowski, Mike, and G. Edward Jeffries. "Cosmesis Is Much More Than Appearance… It's Function." Amputee Coalition. May/June 1999. Accessed December 07, 2016. http://www.amputee-coalition.org/resources/cosmesis-is-much-more/.

In other words, while function is crucially important, how a user feels about the appearance of their prosthesis can affect their attitude towards it just as much as its responsiveness, fit, durability, and so forth. As a result, while the marketing of bionic limbs emphasizes their technological capabilities, a significant amount of attention is paid to how these technologies are viewed by their wearers and society at large. Of special importance is the focus on consumer choice and agency, demonstrated by the way in which prosthetics manufacturers now offer wearers the ability to freely change the coverings on their bionic limbs, add a custom graphics, or swap between specialized hand attachments such as pincer-like "split hooks" and claws. Here, the choice between "robotic" and "natural" is at once personal, rhetorical, and—increasingly—commercialized, constrained only by one's imagination and access to material resources.

The increasing commercialization of prosthetic technologies has also led to a rhetoric of consumer technology that permeates public discourses about their use. An Amputee Coalition publication titled "Does Form Follow Function?" writes that "Aside from cost, three areas of major concern to all individuals with limb loss who want a prosthesis are comfort, functionality and appearance." The article stresses that while all three areas are important, they should be addressed in this order to prevent patient discomfort. However, "When patients have to make a choice about what the best prosthesis is for them, it can be almost like buying a car; there are so many options available. Should you get a sedan or a sports car? The standard package or deluxe options? One vehicle or more than one? Much of the decision-making for this kind of purchase is based on your needs, desires and finances."[9]

In examining how these decisions are portrayed in marketing materials for bionic limbs, this chapter explores how individual ability and disability become overlaid onto the functional

[9] Schaffer, Erik, and Phil Kreuter. "Does Form Follow Function?" Amputee Coalition. November/December 2009. Accessed December 07, 2016. http://www.amputee-coalition.org/resources/does-form-follow-function/.

and aesthetic characteristics of one's bionic limbs, as they become incorporated into their wearer's sense of identity—fulfilling both practical as well as social needs. In prosthetics brochures, patient testimonials, and media depictions of prosthesis-equipped public figures, wearers describe their bionic limbs—both "robotic" and "natural" in appearance—as sporty, sexy, fashionable, fun, stylish, and/or cool. In depicting how wearers negotiate the choice between the "robotic look" and the "natural look," their ability to take control of their appearance is represented as granting them a new agency over their disability. At the same time, the framing of bionic limbs as personalized technologies allows prosthetics manufacturers to market an increasingly homogenous array of new products and accessories that appeal to a broad range of needs and desires while also engaging in contemporary discourses about consumer choice, product customization, and personal expression through technology. As Katherine Ott observes, "A plethora of artificial body parts with interchangeable components exist in commercial medicine and produce the illusion of abundance and consumer choice."[10]

In focusing on bionic arms and hands in particular, I explore how developers and providers of prosthetics negotiate the complexities of this robotic/natural relationship in order to market both the "robotic look" and the "natural look" as socially viable—and desirable—options for users of prostheses, while using an overall rhetoric of naturalness to describe the advanced technological features of their products and the way in which they are able to readily integrate into a human environment. Paradoxically, the most technologically sophisticated bionic limbs are described as the most "natural," and the whole drive of the industry seems to be to develop movement and control systems that function as intuitively as a biological limb. However, these

[10] Ott, Katherine. "The Sum of Its Parts: An Introduction to Modern Histories of Prosthetics." In *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*, edited by Katherine Ott, David Serlin, and Stephen Mihm, 1-42. New York: New York University Press, 2002. (p. 13)

devices are also celebrated for an artificialness that allows them to be modified and customized to suit their wearers, illustrating how the criteria for "naturalness" in prosthetics marketing exists on a continuum. It is this interplay between the natural and the artificial—the potential to recreate or exceed the human form through advanced mechatronic technologies—that grants bionic prosthetic limbs an air of science fiction cool.

2.1 BIONIC LIMBS IN THE MEDIA: JOHNS HOPKINS' "BIONIC MAN"

In September of 2013, *CBS News* aired a report about the first bionic leg controlled by brainwaves, engineered by The Rehabilitation Institute of Chicago through research sponsored by the United States Army. The patient featured in the story is Zac Vawter, who had his right leg amputated above the knee after a motorcycle accident. In the video segment, research scientist Levi Hargrove explains that Vawter was "rewired," having undergone a preparatory operation to move the nerves that used to travel to his lower leg to the muscles in his remaining upper limb, allowing the electrical signals from those muscles to be picked up by sensors in the bionic prosthesis. Footage is shown of Vawter walking with the robotic leg, which features a robust silver frame embedded with motors, cables, and other electronics. He explains that the computer-controlled leg allows him to walk "seamlessly"—even while travelling up and down stairs—by simply thinking about moving along.[11] According to Vawter, "with my normal prosthetic I have to drag it behind me as I go up the stairs. … It really blew my mind the first time we did that, … It was a pretty amazing experience because I hadn't moved my ankle in a way that I could see for

[11] CBS News. "Amputee Controls Bionic Leg with Brainwaves." YouTube. September 25, 2013. Accessed June 21, 2014. http://youtu.be/w5cwnQKGe9o.

two years or whatever it was."[12] *CBS News* anchor Scott Pelley similarly described this "remarkable advance in merging man and machine" as "one of those things you have to see to believe."[13]

As indicated by Pelley's assertion that these technologies must be seen to be believed, media reporting on new prosthetic technologies is often accompanied by a sense of wonder for new breakthroughs that seem to push the limits of what was previously possible. This high-tech rhetoric also entails a celebration of the ability of bionic prostheses to restore a sense of normal motor functioning to human beings in ways that make less "seamless" technologies—such as canes or body-operated prostheses—seem awkward and outdated by comparison. The most sophisticated limbs exhibit sleek machine aesthetics and a fluid mechanical dexterity controlled by an amputee's own nervous system. Some amputees, like Sobchack, have questioned whether canes "count" and if "crutches 'hold up' in today's high-tech prosthetic imagination."[14] Likewise, Steven L. Kurzman, a scholar and below-knee amputee, reminds us that "amputees are not dysfunctional without prostheses and some people opt for crutches or wheelchairs as alternate forms of mobility."[15] These "low-tech" alternatives are also employed by those fortunate enough to receive fully-bionic limbs in those times when they must remove their prostheses for hygiene, maintenance, recharging and other tasks. As a result there are certain contradictions in these depictions, which make legible—and even desirable—a diverse range of alternative human bodies in popular media while simultaneously deflecting from less "mind-

[12] LaPook, Jonathan. "Amputee: Bionic Leg Controlled by Brainwaves "Blew My Mind"." CBS News. October 14, 2013. Accessed August 12, 2015. http://www.cbsnews.com/news/amputee-bionic-leg-controlled-by-brainwaves-blew-my-mind/.
[13] CBS News. "Amputee Controls Bionic Leg with Brainwaves."
[14] Sobchack, Vivian. "A Leg to Stand On." (p. 29-30)
[15] Kurzman, Steven L. "Presence and Prosthesis: A Response to Nelson and Wright." *Cultural Anthropology* 16, no. 3 (August 2001): 374-87. (p.376

blowing"—and technologically-enabled—images of disability and the everyday work and care that is a part of it.

In spite of these complications, in the media, prosthetics-themed news stories trend widely, and those involved in the development and testing of bionic limbs take on a celebrity status as the heralds of our technological future. For example, since the appearance of Michael McLoughlin and Courtney Moran on *CBS This Morning*, the team at Johns Hopkins has achieved significant milestones in the development of bionic arms controlled using signals from the brain. On December 16, 2014, the Johns Hopkins University Applied Physics Laboratory's *YouTube* page featured a video titled "Amputee Makes History with APL's Modular Prosthetic Limb." The video features Les Baugh, a 58-year-old Colorado man who "made history" when he "became the first bilateral shoulder-level amputee to wear and simultaneously control two of the Laboratory's Modular Prosthetic Limbs." As of August 11, 2016, the video has 2,870,561 views.

The first part of the video documents Baugh's patient preparation, explaining that he underwent "targeted muscle reinnervation" surgery at Johns Hopkins Hospital to move the nerves that used to travel to his arms to spare muscles in his chest where their electrical activity could be picked up by the arms' sensors. In the video, Dr. Albert Chi, Medical Director of the Targeted Muscle Reinnervation Program, explains that before operating the arms Baugh had to undergo extensive training using the lab's neural pattern recognition system, which analyzes the "signature or symphony" of muscle information provided by a patient's nerves and translates it into mechanical movements in a computer simulation. Next, Baugh had to be fitted with a custom-molded socket that wrapped around his body like a vest. This socket attached the arms to his body and served as the interface between his rewired nerves and the arms' electronic sensors. In the video, Baugh explains the freeing sensation of using the arms for the first time, explaining

that “Once the training sessions were complete and they released me and let me be the computer, basically, to control that arm, I just go into a whole different world.”

Baugh’s statements about “being the computer” reflect the kinds of realistic potential captured in the rhetoric of science fiction cool. As McLoughlin explains, “I think we’re just getting started at this point. It’s like the early days of the Internet. There’s just a tremendous amount of potential ahead of us, and we’ve just started down this road. And I think the next five, ten years are gonna bring some really phenomenal advancements.” Courtney Moran similarly emphasized that there is “so much more to learn,” noting what while Baugh has access to all the major degrees of motion on each arm (i.e. shoulder, elbow, wrist, and hand), he still has to think about the one he wants to use and select/position it separately, resting in between. However, Baugh explains that the promise of the “simple things” is enough for him: “Maybe I’ll be able to for once be able to put change in a pop machine and get the pop out of it. Simple things like that that most people never think of. And it’s reavailable to me.”[16]

According to an article in the *New York Times* titled “Prosthetic Limbs, Controlled by Thought,” each “Modular Prosthetic Limb” (or MPL) is manufactured by HDT Global and features 26 joints, can curl up to 45 pounds, and has over 100 sensors—as a result, some amputees have now reported being able to feel texture through the arm. The modular design means that it can be built to replace a hand or anything up to an entire arm, and can even be used by quadriplegics as a “surrogate” limb. According to Roger Armiger, project manager for amputee research at Johns Hopkins, “The long-term goal for all of this work is to have noninvasive—no extra surgeries, no extra implants—ways to control a dexterous robotic

[16] JHU Applied Physics Laboratory. "Amputee Makes History with APL's Modular Prosthetic Limb." YouTube. December 16, 2014. Accessed May 10, 2015. https://youtu.be/9NOncx2jU0Q.

device."[17] The article is accompanied by an eight-minute video feature titled "The Bionic Man." The video documents Baugh's experiences with and without the prosthetic arms, portraying him as a capable and unflappable man outside of the lab while seeming to highlight the practical inequality between his time with and without the devices.[18] As Sarah S. Jain notes, "a prosthesis can fill a gap, but it can also diminish the body and create the need for itself," and "the definitional components of the term prosthesis represent the body as a diminished thing—not complete in itself."[19] This phenomenon occurs often in depictions of new bionic technologies being used by amputees, which must simultaneously bear witness to the mettle of the individual while demonstrating just how much easier life will be for them—and for the rest of us, should the need arise—with their metal replacements.

The *New York Times* video begins with a close-up of Baugh—who we learn lost his arms at seventeen when he accidentally came into contact with a set of power lines—manipulating the Modular Prosthetic Limb's hand, overlaid onto footage of him swimming in an indoor pool. We then see him at home, in Walden, Colorado, carrying and tossing a log into his fire with his foot, and lighting a stove and wood burner with his mouth. We also see him use his mouth to cook with a spatula, prepare food for his dog, and hold a stick used to operate a button in his SUV that automatically shuts the door—he steers with a foot-operated disc on the floor. "The limbs…they are mind controlled," says Baugh, demonstrating his ability to open and close the hands, bend the elbows, raise the shoulders, pick up and move foam and wooden blocks, and even pick up a water bottle and drink from it. "It's really amazing to see him," says Moran, "If he had a chance

[17] Cott, Emma. "Prosthetic Limbs, Controlled by Thought." The New York Times. May 20, 2015. Accessed August 03, 2015. http://www.nytimes.com/2015/05/21/technology/a-bionic-approach-to-prosthetics-controlled-by-thought.html.
[18] Canepari, Zackary, Drea Cooper, and Emma Cott. "The Bionic Man." The New York Times. May 20, 2015. Accessed August 08, 2015. http://nyti.ms/1EX9Aoj.
[19] Jain, Sarah S. "The Prosthetic Imagination: Enabling and Disabling the Prosthesis Trope." *Science, Technology & Human Values* 24, no. 1 (winter, 1999): 31-54. (p. 44)

to use these more often he would be unstoppable." However, she also stresses that while "it's kind of sci-fi and cool to think of a cyborg in another context…in the context of each individual patient, the limb should become part of them, not them becoming part of the machine."

Baugh similarly reaffirms the centrality of the human experience, and the ability of prosthetics to complete the body: "It's not so much robotic as basically more back to human, being a whole person, instead of having pieces missing. You know, and not having to ask somebody 'Hey,' you know, 'can you grab this for me, can you put this in my car? I can't get it off the shelf.' It's having something else other than my mouth to do that with. Having a limb again." However, even if they are not explicitly depicted *as* science fiction, technologies such as the MPL—which represent the next closest thing—are still portrayed as futuristic cool in other ways. The video features dreamlike close-ups on the mechanical hands as they shift in and out of focus while making delicate, flowing, gestures. The haze of a soft bright light adds a heavenly glow to the scene. The presentation is cinematically beautiful, accompanied by an inspirational-sounding, low-key orchestral soundtrack.[20] This type of presentation is prevalent in spectacular depictions of bionic technologies, which feature an aesthetic framing familiar to the style of contemporary film and advertising. Here, bionic limbs such as the MPL are not something to be feared but are the epitome of technological achievement—a showcase of the future to come.

Nevertheless, in the *New York Times* feature, Moran's simultaneous recognition and tempering of the "sci-fi and cool" cyborg image reveals some of the limitations for thinking about bionic technologies as futuristic or like science fiction. For example, David Serlin writes that, "Despite ubiquitous representations of prostheses or cyborgs in late twentieth century and early twenty-first century culture, they hardly begin to understand the complex historical and

[20] Canepari, Zackary, Drea Cooper, and Emma Cott. "The Bionic Man."

technological origins of the body-machine interface for amputees and other prosthesis wearers. They also fail to give agency to the people who use prosthetic technology every day without glamour or fanfare."[21] In explaining the tendency for some users of prostheses to deny the "cyborg" or part-"robotic" identity, Kurzman declares: "I am not a cyborg simply because I wear an artificial limb. … Amputees (and other disabled people using assistive technology) are not half-human hybrids with semi-autonomous technology; we are people."[22] Likewise, Tobin Siebers, a poliomyelitis survivor and self-described "cyborg," is cautious about the way that "able-bodied people try to represent disability as a marvelous advantage," noting that in such representations "The cyborg is always more than human—and never risks to be seen as subhuman. To put it simply, the cyborg is not disabled."[23] There is a similar tension in media portrayals of users of bionic limbs, in which an attempt is made to balance technological wonder with a sense of their everyday experiences. While highlighting advances in biomedical research and accomplishments in robotics engineering, the Johns Hopkins video segments attempt to demonstrate Baugh's inherent skillfulness and determination, tempering the seamless wonder of the MPL by showing the hard work required to train oneself to be a skillful operator. Furthermore, while Baugh is labeled the "Bionic Man," he is unable to take the arms home with him, and his status as a "cyborg" is limited to his time spent in a controlled research environment.

While marketing for the Johns Hopkins MPL project touts the arm's sophisticated mechanics and lifelike feedback systems, its "naturalness" comes at a high cost, which explains

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[21] Serlin, David. *Replaceable You: Engineering the Body in Postwar America*. Chicago: University of Chicago Press, 2004. (p. 26)
[22] Kurzman, Steven L. "Presence and Prosthesis." (p. 382)
[23] Siebers, Tobin. "Disability in Theory: From Social Constructionism to the New Realism of the Body." In *The Disability Studies Reader*, edited by Lennard J. Davis, 173-83. 2nd ed. New York: Routledge, 2006. (p.178)

Baugh's part-time cyborg status. According to the *New York Times*, since 2006, the project has received $120 million from DARPA with the aim of helping wounded soldiers, but before they can be marketed, they require approval from the Food and Drug Administration. The article claims that there are only about ten fully functioning MPLs, each costing an estimated $500,000." According to McLoughlin, the MPL in its current form represents a certain luxury: "We've designed a Maserati here, but what most people will want is a good Toyota." He explains that as a research technology, the MPL "was intentionally designed to be as sophisticated as we could make it so that you could really push the state of the art, but ultimately for commercializing it, it needs to be a lower cost design."[24] One immediately wonders if the "Maserati" equivalent of a biological arm would be that of a pro baseball pitcher or a piano virtuoso, and if not, how the "Toyota" model would compare to an average human arm.

2.2 TOUCH BIONICS: "TECHNOLOGY THAT TOUCHES LIVES"

While the "Maserati"-class MPL being developed at Johns Hopkins is still in the research phase, the Edinburgh, Scotland-based company Touch Bionics has been providing medical-grade bionic prostheses to patients since 2007 when they launched the "i-limb," advertised as "the first powered prosthetic hand to incorporate articulating fingers."[25] The i-limb is the result of the company's long history developing bionic limbs. According to the National Museums Scotland, the "world's first bionic arm," the "Edinburgh Modular Arm System" (or EMAS), was developed in the 1993s by Dr. David Gow and a team of engineers at the Margaret Rose Hospital

[24] Cott, Emma. "Prosthetic Limbs, Controlled by Thought."
[25] Touch Bionics. "History." Touch Bionics. 2015. Accessed August 16, 2015. http://www.touchbionics.com/about/history.

in Edinburgh, Scotland.[26] In 1998, the arm was first fitted to Robert Campbell Aird, who had his right arm amputated due to muscular cancer, by means of a cap that fitted over his shoulder. The arm "incorporated microchips, circuitry to enable him to engage it in different positions, and a host of tiny gears, pulleys and motors, all sheathed in highly realistic artificial skin." The arm featured articulations at the shoulder, elbow, and wrist, and had fingers that could grip, and was controlled by a series of sensors in the cap, which "detected the electrical brain impulses that were being sent to the missing limb and deployed them to the bionic arm."[27] According to Touch Bionics' "History" page, in the early 2000's Gow formed a "spin out" company called Touch EMAS, named after the Edinburgh Modular Arm System, which was subsequently rebranded as Touch Bionics in 2005.[28]

The EMAS arm and the newer i-limb hand are *myoelectric* prostheses. Myoelectrics, or "muscle electronics," is "a technology used mainly in upper extremity prosthetics to control the prosthesis via muscle contraction using electrical signals from the muscles to power the prosthesis." These electromyography (EMG) sensors are generally placed inside the socket against the wearer's residual limb. In contrast, a *body-powered* prosthesis generally refers to an older type of functional arm prosthesis "powered by movement in the upper extremity portion of the body, specifically the muscles of the shoulder(s), neck and back. The motion of these movements is then captured by a harness system that generates tension in a cable, allowing a *terminal device* (such as a split hook or prosthetic hand) to open and close." Any device that uses

[26] Miller, Aileen. "EMAS: The First Bionic Arm." National Museums Scotland. Accessed December 07, 2016. http://www.nms.ac.uk/explore/stories/science-and-technology/made-in-scotland-changing-the-world/scottish-science-innovations/emas-bionic-arm/.
[27] Dimery, Rob. "1993: First Bionic Arm." Guinness World Records. August 18, 2015. Accessed December 07, 2016. http://www.guinnessworldrecords.com/news/60at60/2015/8/1993-first-bionic-arm-392887.
[28] Touch Bionics. "History."

a combination of these technologies is simply referred to as a *hybrid* prosthesis.[29][30] Myoelectric prostheses are externally powered, meaning they need to be plugged in and recharged regularly in order to operate, but "Compared with body-powered prostheses, myoelectric prostheses feature superior comfort and aesthetics, with no unsightly cables."[31]

Consumer-grade myoelectric systems are noninvasive and immediately accessible, using EMG signals generated by contractions in the healthy muscles in a patient's residual limb or in areas such as the back and shoulder (like a digital version of an old body harness). However, this means that unlike more sophisticated control methods involving targeted muscle reinnervation, "the control muscles vary according to the patient's amputation level," and "learning to isolate muscle signals is tedious, involving multiple training phases, and complex movements requiring simultaneous articulation at the fingers, wrist and elbow may not be possible."[32] In contrast, targeted muscle reinnervation utilizes all of the actual nerves that used to travel to the amputated appendage. In other words, "the resultant EMG signals of the target muscles now represent motor input to the missing limb muscles," a more "intuitive" solution that "enables patients to simultaneously move multiple joints" simply by thinking about it.[33]

According to Touch Bionics, "In medicine, bionics means the replacement or enhancement of organs or other body parts by mechanical means." [34] Most importantly, the

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[29] "Limb Loss Definitions." Amputee Coalition.
[30] For a more complete historical examination of the development of the prosthetics industry in postwar America, see: Serlin, David. *Replaceable You: Engineering the Body in Postwar America*. Chicago: University of Chicago Press, 2004. For a material and social history of prosthetic technologies, including the development of body-powered and myoelectric prostheses, see: Ott, Katherine, David Serlin, and Stephen Mihm, eds. *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*. New York: New York University Press, 2002.
[31] Zuo, Kevin J., and Jaret L. Olson. "The Evolution of Functional Hand Replacement: From Iron Prostheses to Hand Transplantation." *Plastic Surgery* 22, no. 1 (2014): 44-51. Accessed December 7, 2016. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4128433/. (p. 47)
[32] Ibid. (p. 47)
[33] Ibid. (p. 48)
[34] Touch Bionics. "History."

movement from the mechanical to the electronic is the central shift in prosthetics development that allows these technologies to become truly bionic—one of the qualities that today makes a prosthesis seem futuristic. Today, the company focuses on myoelectric lower-arm prosthesis with fully-functioning robotic hands, exemplified by their motto "technology that touches lives."[35] An examination of the company's webpage reveals how this notion of "touching lives" is reflected in advertising strategies that utilize the conventions of brand identity and lifestyle marketing schemas in the marketing of bionic limbs. In particular, the customer testimonials on the Touch Bionics website—called "Ambassador Stories"—position wearers as spokespersons for the company while establishing a connection between the individual personalities of their users and the function and appearance of their chosen prosthesis.

For example, the product page for Touch Bionics' "i-limb ultra," one of their standard prosthetic hands, declares that it was "designed for those who want more from their prosthesis." The hand "looks and moves like a natural hand," and even has a function where it automatically moves to a "natural hand position" after a set period of inactivity. The version of the hand featured most prominently on the page has a matte black finish with tubular fingers attached to a solid base. The "naturalness" of the fully-articulated hand is not just a visual effect but is essential to the functionality of the device, allowing it to "adapt to fit around the shape of the object you want to grasp." At the time it was the only prosthetic hand with the ability to gradually increase its grip strength across all fingers individually while manipulating an object, allowing patients to tie shoelaces or grip heavy objects more securely.

The i-limb ultra webpage emphasizes the ability of the user to "customize the hand for their daily needs and activities," and choose from "14 programmable grip patterns" that can be

[35] Ibid.

activated using a proprietary mobile app or even create their own custom gestures. The limb is advertised as shipping with three "i-limb skin active" coverings and four "i-limb skin natural" coverings, to customize the look and finish of the device for various activities. Photographs on the website show the hand holding a camera, a rubber ball, a plastic cup, and even a pair of eyeglasses and a small game die. A quote attributed to Alexis Maloney, an occupational therapist, claims that it is "amazing technology," that is "so far ahead of other prostheses," and that they had "never seen anything like it" in their career.[36]

Whether they are intended for laboratory research or the consumer market, artificial limbs like the Johns Hopkins MPL and the i-limb ultra are supported by a complex institutional infrastructure that includes limb developers and manufacturers, hospitals and universities, insurance companies, and prosthetics clinics that prescribe and distribute the prostheses and provide patient services such as limb fittings, rehabilitation, and mechanical maintenance. Even basic i-limb models can cost tens of thousands of dollars. For Kurzman, the notion of a cyborg likewise goes beyond one's immediate "physical interface" with technology. Instead, he views the cyborg as a "subject position" that describes the "relationships of production, delivery, and use" surrounding a prostheses:

> In other words, if I am to be interpellated as a cyborg, it is because my leg cost $11,000 and my HMO paid for it; because I had to get a job to get the health insurance; because I stand and walk with the irony that the materials and design of my leg are based in the same military technology which has blown the limbs off so many other young men.[37]

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[36] Touch Bionics. "I-limb Ultra." Touch Bionics. 2015. Accessed August 16, 2015. http://www.touchbionics.com/products/active-prostheses/i-limb-ultra.
[37] Kurzman, Steven L. "Presence and Prosthesis." (p. 382)

An example on the Touch Bionics site is the way the i-limb ultra is advertised as including "12-60 months of Touch Care Program Coverage," Touch Bionics' own extended warranty and service program.[38] According to the Touch Care informational page, the product support program includes "accidental damage coverage," regular prosthetic "health checks" to ensure proper functioning, a new i-limb skin active covering every three months, and access to free control software upgrades and apps. If a limb needs to be repaired or serviced, a "courtesy hand" will be provided to the wearer in the interim.[39]

The Touch Care program underscores how the seamlessness of a bionic hand—no matter how "natural" it is—is always conditional, its technological nature requiring continual attention and care. Ironically, this means that bionic limbs have many of the same requirements as biological ones, which sometimes require their own "health checks." Here, the wearer depends on a service relationship with their prosthetics provider that is not unlike those pacts formed between consumers and new car dealerships or mobile phone companies, which provide customers with the updates, support and maintenance necessary to continue using their products. Even at the most basic level, bionic arms, legs, hands and feet are dependent on a constant power source, usually supplied by rechargeable batteries.

Touch Bionics' marketing also documents the long history that some wearers have with the company, upgrading to the latest devices as they are released. A video featured on the i-limb ultra webpage titled "Benefits of a Prosthetic Hand" features Bertolt Meyer, a professor at the University of Chemnitz and a Touch Bionics "Ambassador." In the video, Meyer, who was born without a lower left arm, demonstrates the ability to reposition the thumb on his i-limb ultra,

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[38] Touch Bionics. "I-Limb Ultra."
[39] Touch Bionics. "Touch Care." Touch Bionics. 2016. Accessed May 06, 2016. http://www.touchbionics.com/support/touch-care.

declaring: “I’m able to clap my hands for the first time in my life, …It really tangibly improves your quality of life.”[40] According to his bio on the Touch Bionics site, Meyer was also the host of *The Incredible Bionic Man,* a documentary about prosthetic technology that premiered on the Smithsonian channel in October of 2013. In the documentary, state-of-the-art artificial body parts were combined into a single “bionic man.” The face of the “bionic man” was modeled after a 3D scan of Meyer’s face, and his hands were i-limb ultras.[41]

Meyer is described as starting with the i-limb ultra and upgradeding his prostheses throughout the years. In April of 2013 he upgraded to the “i-limb revolution,” a model described as having increased dexterity due to the addition of a powered rotating thumb, proprietary Bluetooth “grip chips” that a wearer can place around their home or office to automatically activate pre-assigned grip patterns when the hand approaches the chip, and the ability to control 36 different grip patterns using a mobile app.[42] In the summer of 2015 he upgraded to Touch Bionics’ newest device, the “i-limb quantum.” The product page for the i-limb quantum demonstrates how prosthetic devices are marketed using familiar criteria that is standard in consumer electronics rhetoric. The “Features at a glance” section breaks down the following new features:

Smarter - i-mo technology - use of simple gestures to change grips

Faster - boost digit speed by up to 30%

Stronger - up to 30% more power when needed; 50% more battery life

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[40] Touchbionics. "Benefits of a Prosthetic Hand." YouTube. July 18, 2011. Accessed August 14, 2015. https://youtu.be/lwxIY21S3Qk.
[41] Touch Bionics. "Bertolt Meyer." Touch Bionics. 2015. Accessed August 16, 2015. http://www.touchbionics.com/patients-families/patient-stories/bertolt-meyer.
[42] Touch Bionics. "I-limb Revolution." Touch Bionics. 2015. Accessed August 10, 2015. http://www.touchbionics.com/products/i-limb-revolution.

Smaller - anatomical styling now available in 3 sizes - smaller size hand suitable for women and children.[43]

The commercialization of prosthetic limbs often features a rhetoric of the "upgrade" that is common to many of the stories on the Touch Bionics site. As newer, "smarter" technologies are developed, there is an understandable desire to upgrade to the latest model, as this essentially means an upgrade to the capabilities of one's own body parts—and who can put a price on one's body? What is not discussed, however, is a feeling of being "left behind" if one is unable to upgrade. This pattern of continual upgrade and customization also offers wearers more choices and opportunities to try out new styles and functions while serving as a natural economic incentive for prosthetics manufacturers. This rhetoric of the consumer technology upgrade is reflected in the naming schemes for the technologies themselves, beginning with the trendy "i-limb" name itself and continuing with high-tech names such as "ultra" and "quantum" which suggest the epitome of technological achievement even as they will always only be the penultimate release.

A much more accessible—but equally noticeable—way that patients can upgrade their prosthesis concerns cosmetic customization. By choosing which surface coverings to use with their i-limb, wearers are afforded a degree of personality and self-expression. The "i-limb accessories" page on the Touch Bionics site declares that "coverings are very important for upper limb prosthetics" because "i-limb products are the first prosthetic hands to better imitate the movement of a human hand," and the i-limb ultra, revolution, and quantum each allow for a variety of limb covering options. The product description for the "i-limb skin active" and "i-limb skin active TS" coverings on the accessories page echo the findings of the Johns Hopkins team,

[43] Touch Bionics. "I-limb Quantum." Touch Bionics. 2015. Accessed August 08, 2015. http://www.touchbionics.com/products/active-prostheses/i-limb-quantum.

noting that “some people particularly love the robotic nature of the uncovered **i-limb** prosthesis, and prefer not to wear it with a lifelike glove.” However, it goes on to explain that the prosthesis still requires a covering to protect it from dust and water, and to provide a functional grip surface. As a result, the company has come up with various ways to accommodate a wearer’s fondness for the limb’s robotic style:

> In response to this user preference, Touch Bionics has developed **i-limb skin active** and **i-limb skin active TS.** These coverings are designed for simplicity and ease of use. They are made of a thin layer of semi-transparent, clear or black material that has been computer-modeled to accurately wrap to every contour of the hand. The **i-limb skin active TS** includes a conductive tip on the index finger, making it compatible for use with touch screen devices. Both coverings come with slip coating on the inside and back of the hand for easy donning and doffing.

Images on the website demonstrate the semi-transparent and black coverings, which have a vacuum-sealed appearance that conforms to the mechanical lines of the hand and fingers without wrinkling or creasing.

As not all prosthetic wearers prefer the robotic look, Touch Bionics also advertises the “i-limb skin natural,” a “lifelike silicone covering for those who want a more natural appearance.” This is an “off-the-shelf” covering that comes in “18 different skin shades for both male and female versions.” The most realistic covering, the “i-limb skin match,” is an individualized, “fully customized silicone covering that is hand painted to match the user's skin tone and features,” including nails and veins. Yet even this option allows for decorative, personalized embellishments, and “For patients who prefer something different, the custom design of **i-limb**

skin match can also be extended to creative, artistic designs." As evidence, an image is shown of one of the i-limb skin match's having the fingernails painted a bright pink.[44] Ultimately, consumers can choose between the i-limb skin active, the skin active TS, the skin natural, and the skin match, in various colors and textures.

In addition to the i-limb series of bionic hands, Touch Bionics also offers a type of "passive functional prosthesis" under the name "livingskin."[45] In prosthetics, the term *functional prosthesis* describes one "Designed with the primary goal of controlling an individual's anatomical function, such as providing support or stability or assisting ambulation."[46] According to the livingskin product page, a passive functional prosthesis "offers some basic function and closely resembles the natural body part it is replacing." The livingskin is "hand-crafted from high definition silicone," and is designed to replace "parts of fingers, whole fingers, hands and entire arms" and lacks the self-powered articulations of the company's more advanced limbs. However, while a livingskin prosthesis does not move on its own, it is described as offering "important functional capabilities" such as "pushing, pulling, stabilizing, supporting, light grasping and typing" actions. An image of a livingskin prosthesis on the product page shows an extraordinarily realistic looking right hand, with a lifelike skin texture, trimmed—but not perfect—fingernails, and a natural anatomical structure. The glove-like partial prosthesis features two holes at the base of the index and middle finger, allowing a patient's existing digits to poke through.

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[44] Touch Bionics. "I-limb Accessories." Touch Bionics. 2015. Accessed August 16, 2015. http://www.touchbionics.com/products/i-limb-accessories.
[45] Touch Bionics. "Livingskin." Touch Bionics. 2015. Accessed August 10, 2015. http://www.touchbionics.com/products/active-prostheses/livingskin.
[46] "Limb Loss Definitions." Amputee Coalition.

In order to be as realistic as possible, the prosthesis is molded from an impression of the wearer's "sound side." This is done at a prosthetics clinic using a mail-order kit, and requires the opposite limb to be present and complete. The wearer can also match the color of the finished prosthesis to their skin tone using the "my livingskin^{tm} Color Capture System," a photography kit that uses an iPad app to capture and send photo reference of the limb directly to Touch Bionics (the same procedure is also used to create the i-limb skin match covering). The final piece is hand-painted and customers have the option to select fine details such as nail shape, hair, freckles, veins, and even tattoos during the ordering process.

The livingskin page states that, "People who select a passive functional prosthesis are primarily looking for aesthetic rather than functional features," and that "If the appearance of your prosthesis is very important to you, then **livingskin** from Touch Bionics may be an option for you." Yet while the artisanal, finely detailed, and realistic qualities of the prosthesis are emphasized throughout, the page paradoxically declares that, "A **livingskin** prosthesis is designed to be unnoticed." The juxtaposition of phrases suggests a lurking anxiety over whether or not a wearer's realistic-style prosthesis can pass "unnoticed" as a natural body part. Like a convincing Hollywood special effect, after meticulously molding and detailing the limb, it is most successful when no one suspects it isn't real. An included "User Testimonial" by "Kim Doolan, livingskin wearer" illustrates this concern:

> I've noticed that my overall posture improves when I'm wearing my **livingskin** arm. When I was out in public, I tended to try and hide my hook to avoid unwanted attention, which resulted in poor posture. With **livingskin**, no one

knows that this isn't my real arm, so I always stand up straight when I'm wearing it... it's a confidence thing.[47]

However, while the livingskin's ability to go unnoticed at first glance may be greater than that of a split hook/claw-style prosthesis, it lacks the dynamic gesticulation and grip of the anatomically functional i-limbs. Therefore, the invisibility of a passive functional prosthesis is inevitably diminished once it is bumped or receives a handshake and fails to give the expected response of an able-bodied hand. This is contrasted with those users who embrace the robotic look, avoiding the potential uncanny valley effect of a realistic-style arm and avoiding efforts to "pass off" the prosthesis as an organic limb.

Ultimately, these examples begin to illustrate how the use of prosthetic limbs plays out as a series of tradeoffs between appearance and functionality, with different types of devices succeeding at either aspect in varying degrees. However, in each case the choice of different "skins" is one way to match the prosthesis' practical qualities with the social needs of its wearer.

2.3 TOUCH BIONICS' "AMBASSADOR STORIES"

An examination of the "Ambassador Stories" pages on the Touch Bionics site reveals how these prostheses are marketed as an extension of the people who use them. Each featured story focuses on the life experiences that motivated a particular wearer to pursue advanced prosthetics, connecting key features of their chosen prosthesis to their personal goals and values. In many of the stories, the people featured have achieved great professional and personal success before

[47] Touch Bionics. "Livingskin."

receiving their prostheses. Instead of making the wearers "whole" again, the technologies are described as bringing out what was already there, helping these individuals to continue to pursue their passions and use their talents to the fullest. In other words, it is not a bionic limb that makes a wearer a stand out; the limb is articulated as an expression—or extension—of their unique personalities. A central theme in each testimonial concerns how the prosthesis—and therefore the disability—is made socially visible or invisible depending on each wearer's choice to emphasize the "robotic" nature of their prostheses, or exhibit a more "natural" appearance. While the users represented on the Ambassador Stories pages are real people, I examine their stories through a rhetorical lens, exploring how the ethos of the "customer testimonial" is used in lifestyle marketing for prosthetic technologies. Here, these testimonials play into a larger theme of technological acceptance and portray users of Touch Bionics prostheses as people of all ages and backgrounds in order to demonstrate how their technologies are compatible with any lifestyle.

The Ambassador page featuring "Ryan Rosenow" tells us that he is a 24-year-old animation illustrator who was born missing his right hand as the result of a "congenital deficiency."[48] The term "congenital deficiency" is one of a series of terms that describes the various circumstances that can result in the use of prosthetics. According to the Amputee Coalition, the term *amputation* is generally defined as "The cutting off of a limb or part of a limb." However, there are three basic categories of amputation or limb loss: An *acquired amputation* is "The surgical removal of a limb(s) due to complications associated with disease or trauma," while a *traumatic amputation* is "An amputation that is the result of an injury." The third category, described by the medical term *amelia*, refers to "the congenital absence or partial

[48] "Ryan Rosenow." Touch Bionics. Accessed August 05, 2015. http://www.touchbionics.com/ryan-rosenow.

absence of one or more limbs at birth" and is sometimes referred to as a *congenital anomaly*.[49] Although the more inclusive term "limb difference" is often used both by individuals and the prosthetics industry, the somewhat counterintuitive terms "congenital amputation" and "congenital amputee" also appear in texts referring to amelia.

The page tells us that as a result of his limb differences, Ryan underwent three toe-to-digit transplants and multiple forearm and digit lengthening surgeries as a teenager, ultimately providing him with a thumb and two opposing digits at the age of fifteen. We are told that before he turned sixteen, he had undergone twenty-five reconstructive surgeries, yet the result is described as "disappointing to everyone involved." While the transplanted digits offered "strength and stabilization against objects," Ryan's "functional ability remained highly limited." The page then provides a quote from Ryan, who explains how he began to explore advances in available prosthetics during his junior year of college:

> I realized that maybe it wasn't too late to end up with something functional on my right limb. The i-limb looked amazing to me. I was really struck not just by the incredible functionality that I saw in the demos, but also by its beautiful aesthetic quality. As someone with a background in design, I tend to be pretty critical of that kind of thing, and the design of the i-limb really impressed me. I remember that other myoelectrics I had seen in the past were really unattractive to me because they looked like clunky medical equipment, and in contrast, the i-limb had a sleek and appealing design.

Ryan's observations illustrate the dual aspects that make the "robotic look" attractive—advanced functionality combined with appealing aesthetics. Furthermore, his background as an artist and

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[49] "Limb Loss Definitions." Amputee Coalition.

designer lends credibility to his judgment that the arm is “beautiful” to him, especially in contrast to older limbs that looked like “clunky medical equipment.” Of course, the i-limb is itself a piece of medical equipment, but his phrasing calls to mind the familiar neutral grey and beige of devices designed for comfort and efficiency instead of style—the crutches, boots, braces, and early prosthetic technologies found in every hospital and nursing home. The “sleek and appealing” i-limb is placed in sharp contrast to these devices. Ryan’s comments may also indicate a generational shift towards the acceptance of robotic-looking prostheses, due to an increasing familiarity with images of technological integration. Furthermore, the aesthetics of the i-limb line satisfy the expectation that high-tech devices are expected to have their capabilities reflected in an equally sophisticated design.

Ryan’s story is also exceptional in that he elected to reverse the reconstructive procedures done to him in order to become a candidate for a bionic hand. In 2013, he took a “tremendous leap of faith,” making the “scary” and risky decision to have another surgery to amputate his arm at wrist level in order to be fitted for a new prosthesis. In January of 2014, he received an i-limb revolution, and reflects on the changes in a second quotation:

> I have been so happy with my choice. When I first got my i-limb, I couldn’t believe how functional it was, especially in contrast to what I had been dealing with all those years. The first night I got home with it I was going around my house looking for things I could pick up and stack. It was amazing how intuitive and responsive it is and how little effort it takes to control. I didn’t even realize - in all my years growing up - all of the things I wasn’t able to do, until I started finally being able to do them.

Photos of Ryan show him wearing a sleek black covering on his i-limb revolution's forearm and hand. He is seen at work illustrating on a digital tablet, and playing a stacking-block game in a park (as if showing off the stacking skills mentioned above). We even get a peek at a tattoo on his neck,[50] a symbolic indicator—even in today's tattoo-abundant world—of a hip, alternative sensibility and a proclivity for body modification. It also reinforces Ryan's status as a creative person, evidencing how his eye for art and design extends to the way in which he adorns and displays his body. In portraying the complex ways that disability affects people of all ages and backgrounds, Ryan's story emphasizes that Touch Bionics' technologies are compatible with any lifestyle. It also helps brand medical technologies such as bionic limbs and the clinics that provide them as a nexus for high-tech hipness.

Ryan's story evidences a recent trend in medical science in which amputations are increasingly performed with the idea of prosthetics in mind. In a 2012 *New York Times* article titled "A Once-Unthinkable Choice for Amputees," Alexis Okeowo writes that "as artificial limbs are infused with increasingly sophisticated technology, many amputees are making a once-unthinkable choice. Instead of doing everything possible to preserve and live with whatever is left of their limbs, some are opting to amputate more extensively to regain something more akin to normal function." Although the medical industry has traditionally focused on saving or reconstructing damaged limbs, the remaining appendages can cause an individual pain and discomfort and limit their options for prosthetics fittings. Elective amputation allows the individual to take advantage of new prosthetic technologies such as bionic limbs.[51] For example,

[50] "Ryan Rosenow." Touch Bionics.
[51] Okeowo, Alexis. "A Once-Unthinkable Choice for Amputees." The New York Times. May 14, 2012. Accessed December 07, 2016. http://www.nytimes.com/2012/05/15/health/losing-more-to-gain-more-amputees-once-unthinkable-choice.html.

an amputation of the foot through the ankle eliminates the flexibility of that joint and makes it hard to securely attach a prosthetic foot to such a limited surface.

Likewise, a 2016 article in the *Boston Globe* titled "The Prosthetic of the Future" describes how Jim Ewing, who shattered his ankle in a mountain climbing accident, received a pioneering amputation procedure in order to prepare himself for a new bionic ankle and foot developed by the Biomechatronics research group at the Massachusetts Institute of Technology Media Lab. Although Ewing had multiple surgeries to repair his ankle and the resulting nerve damage, he was "unable to walk even 100 feet without collapsing in agony." A medical team led by Dr. Matthew Carty at Brigham and Women's Faulkner Hospital "laced together tendons at the end of Ewing's shortened leg to preserve delicate neurological connections." The surgical procedure, now called "The Ewing Amputation," was developed in collaboration with the team at MIT, led by biophysicist Hugh Herr, and will allow Ewing to operate the robotic prosthesis using signals from his brain "so that it feels like his old foot is there." According to Carty, "Traditionally, amputation has often been seen as a failure, the surgical equivalent of throwing in the towel to the ravages of trauma, disease, or just plain bad luck. By reinventing the way that amputations are performed, we hope to elevate them to another form of limb salvage, one designed to restore as much function as possible."[52] In other words, saving as much of one's natural body as possible might not be the most medically sound solution it if a more comfortable and functional prosthetic alternative is available that allows wearers to walk, run, and enjoy their lives to the fullest. This is one of a multitude of life situations accounted for in the marketing for bionic limbs.

[52] Moskowitz, Eric. "The Prosthetic of the Future." The Boston Globe. November 21, 2016. Accessed December 07, 2016. https://www.bostonglobe.com/metro/2016/11/21/the-prosthetic-future/Ld6C2rxZL4uiotc96kNyPO/story.html.

The themes of creativity, artistry, and hipness continue on the ambassador page for Claudia Breidbach, introduced here as a 43-year-old architect and "competitive sky diver" who "upgraded" to the i-limb revolution in 2013. The title of the page declares that "Claudia Breidbach jumps with both hands," even though skydiving is described thereafter as an "unusual hobby, especially for someone who was born with a dysmelia, a congenital deficiency that involves the absence of her left hand and forearm." Claudia's bio focuses on her perseverance as an amputee and her ability to overcome challenges in order to achieve her goals, including becoming a licensed skydiver. After receiving her prosthesis, she competed in the German National Skydiving Championship as part of team KARMA, "the world's first inclusive 4 way skydive team, bringing together people with and without physical disabilities to form one unified group." Claudia's story also reveals how amputees are often required to advocate on their own behalf once they decide to pursue an advanced prosthesis. She is described as being "actively involved in the insurance approval process, seeking out countless medical opinions from past and present clinicians to support her submission." Her determination and resulting success in receiving her first i-limb is portrayed as its own kind of achievement: "Her dedication soon paid off. Finally, two hands!" reads the webpage, in perhaps an ironic play on the daredevil-ish cliché, "Look, no hands!"

The images on Claudia's page show her wearing a *black i-limb hand* with a white forearm that is adorned with intricate black and white linework showcasing floral motifs, a shining star, a cupid figure tying together two hearts, and a skull and crossbones. A connection is made between her adventurous lifestyle and architectural career and the increased functionality—and artistic flourishes—provided by the i-limb. According to Claudia: "Now I can

put into practice things that, for me, were so far unimaginable. I now lead a life with two hands and I do things with both." [53]

A third Ambassador page features Stephanie Grosso, a 27-year-old woman who had four fingers and part of the pinky on her right hand amputated after a rollover car accident. In 2013 she was fitted with an "i-limb digits," a partial-hand prosthesis with articulating digits. Like Claudia, Stephanie is described as having an "active role" in receiving insurance approval for her prosthesis, and "she encourages other patients considering a prosthesis to start early and to be an advocate for themselves." This is a not-so-subtle reminder of the difficulties that many amputees face when seeking medical-grade prostheses, many of which are only sold through medical suppliers and prosthetics clinics.

The remainder of Stephanie's story focuses on her reasons for choosing a Touch Bionics device and how it fits into her day-to-day interactions as a nurse at University of Miami Hospital:

> While selecting the design, she emphasized that in her profession as a nurse, she would need a prosthesis that would not scare her patients. She also wanted a device that would help show her fun personality, so she selected a leopard print design. Stephanie was pleased with the results and has gained back a significant amount of everyday function and quality of life.

Here, the notion of others fearing the look of a—presumably less humanlike—prosthesis is introduced, and the i-limb digits is portrayed as an ideal combination of functionality and aesthetics. The fact that the i-limb digits mimics the shape and motion of biological fingers gives it a familiar appearance, and the leopard print helps add a personal touch. Stephanie describes the improvements to her life in her own words:

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[53] "Claudia Breidbach." Touch Bionics. Accessed August 05, 2015. http://www.touchbionics.com/patients-families/patient-stories/claudia-breidbach.

"I feel more independent with my prosthesis. Adjusting to it was like riding a bike. Over time it became second nature and effortless for me to meet my goals. Be patient with yourself and relax!"

According to the page, in 2014 Stephanie was fitted with a livingskin passive functional prosthesis, which she "absolutely loves" because it matches her other hand and "people can't even tell that she is wearing a prosthesis." Stephanie is also described as using both the livingskin and the i-limb digits "depending on her daily needs and activities." Stephanie is thus able to choose between the two devices, drawing upon the mechanical functionality of the leopard-print i-limb digits or the natural appearance—and invisibility—of the livingskin. Emphasizing the everyday ease of the device, a photo of Stephanie shows her laughing while putting on makeup, holding a compact in the prosthetic fingers on her right hand and a makeup brush in her left.[54]

One of the more traumatic "Ambassador Stories" is that of 27-year-old "motivational speaker" Rayna Dubose. Rayna was an athlete who accepted a full scholarship to Virginia Tech to play Division 1 Basketball. In April of 2002, during her freshman year, she was hospitalized with meningococcal meningitis, leading to the amputation of all four limbs. According to Rayna, "Being an athlete, we have a fighting spirit ingrained in us to bounce back from adversity." After a long recovery period, she received her degree in Consumer Studies in 2007 from Virginia Tech, and began a career that included founding her own motivational speaking company, receiving the "Most Courageous Award" at the Men's Final Four in New Orleans in 2003, and being honored by the Cirque du Salute at the 2011 NCAA Women's Final Four. In May of 2011, she was fitted with an early Touch Bionics device called the "i-LIMB Pulse" on her dominant

[54] "Stephanie Grosso." Touch Bionics. 2014. Accessed June 20, 2014. http://www.touchbionics.com/Stephanie.

right side and a livingskin prosthesis on her left. According to the page, prior to receiving the prostheses she expressed excitement for the "normalcy" that the "lifelike" movements of the i-limb would bring. However, she also describes the appeal of her livingskin arm as a distinctive commodity, offering the following analogy: "I liken it to able-bodied people keeping up with the latest sneakers or fashion." According to Rayna, "These are the hottest prosthetics available. I'm a real girly girl and like to get dressed up; these prosthetics help me bring my sexy back."[55] Here, Rayna's bio demonstrates how the functional and aesthetic characteristics of one's bionic limbs are portrayed as becoming incorporated into their sense of identity—fulfilling important social as well as practical needs. For Rayna, her sense of "normalcy" is also tied to the types of activities that able-bodied people can do.

Alternatively, Kim Doolan, a 48-year-old woman born congenitally missing her right arm at the elbow, was fitted with her first "body powered hook and elbow device" at age three and used variations of this technology for the next 30 years: "Once I had my hook, I never looked back. Grown ups told me that using a passive device was a waste of time as function was the all important factor... and I didn't question them." Kim's story is different in that she chooses not to use the robotic i-limb prostheses, instead favoring passive functional prostheses like the livingskin hand and traditional body-powered devices. In 1990, she worked as a "prosthetic technician" and "patient model" for a developer of myoelectric prostheses, but declined to use the technologies herself because they were "a bit too large and heavy" for her "petite" frame. In 1996, she became clinical coordinator for the Texas-based Allen Orthotics and Prosthetics (listed as her present occupation), working part-time for Touch Bionics.

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[55] "Rayna DuBose." Touch Bionics. 2014. Accessed June 20, 2014. http://www.touchbionics.com/patients-families/patient-stories/rayna-dubose.

Although the page claims that she still uses her hook for household tasks such as gardening, a statement from Kim explains how the perceived naturalness of the livingskin device provides its own kind of intuitiveness vs. more functionally capable devices:

> "It's very interesting to compare the **livingskin** device and my hook from a skill versus spontaneity standpoint," explains Kim. "On the one hand, the hook is very functional, so it scores highly from a skill perspective, but it's also quite clumsy and unattractive, so I'm less likely to use it spontaneously. Even though my LIVINGSKIN device is less functional than the hook because it doesn't allow me to actively grasp objects, the fact that it looks so realistic actually means that I am much more likely to use it without even thinking about it."

Recalling Donald Norman's argument that "attractive things work better," the arm that is described as the most aesthetically pleasing—and familiar—to Kim is the most enjoyable to use. Kim also expresses an appreciation for how the naturalness of the livingskin makes her disability "invisible":

> "To be honest, I used to get a lot more space in public when I was wearing my hook than I do when I'm wearing my **livingskin**!" adds Kim with a chuckle. "But that just shows how much I blend in now - my disability is invisible when I'm wearing it." [56]

Kim's testimony highlights how developers of prosthetic limbs market their technologies as unobtrusive, seamless components of a user's everyday life. This seamlessness is expressed through some factor of the function and form of a particular device, as well as through the personal meanings that the prosthesis takes on for its wearer—such as providing confidence

[56] "Kim Doolan." Touch Bionics. Accessed August 05, 2015. http://www.touchbionics.com/patients-families/patient-stories/kim-doolan.

and/or independence in everyday situations. For example, a bionic limb may function seamlessly through an intuitive brain-powered control system and natural mechanical motions, but may look very artificial. On the other hand, a very realistic-looking molded prosthesis that is limited in its motion may be more attractive to its wearer and simpler and easier to use, and therefore used more often—more seamlessly. Here, Kim's older body-powered hook remains a practical tool with a rugged appearance, while her livingskin device trades functionality for "invisibility" but is valued as useful in other ways.

2.4 INSPIRED BY BIOLOGY: "NATURAL" BIONIC HANDS

Paradoxically, the most advanced bionic hand designs are often described as "natural" while being celebrated as technological objects, illustrating how the criteria for "naturalness" in prosthetics marketing exists on a continuum. In some instances, a prosthetic limb's pronounced naturalness is used to signify its increased functional capabilities, as designers strive to recreate the inherent flexibility, precision, and fluidity of biological hands. One product that is advertised as blending naturalness with mechanics in this way is the "Michelangelo Prosthetic Hand" from German prosthetics company Ottobock. The website for the Hanger Clinic, one of the providers of the "Michelangelo" arm, describes it as "Prosthetic Hand Technology that is a Work of Art." Here, the device's ability to mimic human physiology is a selling point:

> True to its namesake, the Michelangelo Hand offers life-like, sculptural design. The Michelangelo Hand features an extraordinary physiological design. For example, the fingers are made of both hard and soft materials and model bones, joints, muscles and tendons. The new oval wrist adapter also appears much more

> natural and permits the pronation and supination of the wrist joint. These details, based on nature as a role model, make a major contribution towards the acceptance of the Michelangelo Hand. PVC cosmetic gloves for daily use are available in six different skin tones and complete the realistic look of the Michelangelo Hand.[57]

Although the robotic Michelangelo and i-limb have similar features such as an independently powered thumb, programmable grip patterns, and a variety of cosmetic coverings, the more "physiological" Michelangelo is designed to mimic the shape and underlying structure of a biological arm, reproducing the ovoid shape of the forearm and the feel of skin and muscle over finger bones. The name suggests that like Michelangelo the artist, Ottobock is similarly concerned with making sure that each component of their robotic hand captures human anatomy in a "sculptural" way—although like Michelangelo's masterpieces, this sculpted form is an idealized version of bodily anatomy realized through human technological skill.

According to the Michelangelo product page on the Ottobock website, "The fingertips are made of a combination of soft and hard materials to allow real precision when grasping objects," and the arm is similarly described as having "natural movement" that promotes a "healthy, natural body posture." However, for "maximum versatility, precision and power," the page also advertises a pincer-grip device with two hooked prongs called the "AxonHook," which can be swapped-in using a quick-release wrist joint. Described as the "perfect companion to the Michelangelo," it reveals some of the limitations of even the most advanced bionic hands, and that for all their dexterity, sometimes the simple solutions are more expedient. The page also shows how the Michelangelo hand fits into a variety of everyday—and natural—settings. A

[57] Hanger Clinic. "Michelangelo Prosthetic Hand." Hanger Clinic. 2015. Accessed May 16, 2016. http://hangerclinic.com/limb-loss/adult-upper-extremity/adv-tech/Pages/Michelangelo-Hand.aspx.

series of images depict what appears to be a young prosthesis-wearing man blowing bubbles in the yard with his children, having a family picnic outdoors, and splitting logs.[58] The images could very well be advertising dress pants or health insurance—a type of lifestyle marketing emphasizing the Michelangelo's seamless integration into everyday life.

Another prosthetics developer, British company RSLSteeper (or Steeper), also produces an anatomically-inspired bionic hand called the "bebionic." Advertised on one hand as "Sleek, elegant and cutting-edge in both design and technology," the company also claims that the bebionic is "the world's most lifelike, functional and easy to use myoelectric hand commercially available today."[59] The bebionic is a fully-functioning bionic prostheses with a list of features comparable to the i-limb and Michelangelo hands, including individual motors in each finger, selectable grip patterns and hand positions, precision speed control for grabbing delicate objects, and multiple wrist options such as a proprietary "Quick Disconnect" for the convenient swapping of hands and special "Multi-Flex" and "Flexion" wrists for added articulation.[60] The swappable terminal devices and various wrist articulation options highlight how even the most "natural" consumer-grade bionic limbs are unable to effectively perform all of the functions of a human hand, and that certain attachments such as split hooks can offer a stronger and more precise gripping of objects. Since human appendages are unable to be disconnected and reattached at will, it also reinforces their lack of naturalism.

Like their competitors, Steeper also offers a series of "lifelike silicone skins" designed to give the hand a "natural appearance." These glove-like coverings are available in "19 different lifelike colour shades, with a unique True Finish™ micro-pigmentation finish that makes them

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[58] Ottobock. "Michelangelo Prosthetic Hand." Ottobock USA. 2013. Accessed May 16, 2016. http://www.ottobockus.com/prosthetics/upper-limb-prosthetics/solution-overview/michelangelo-prosthetic-hand/.
[59] Steeper. "The Hand." Bebionic. 2015. Accessed August 12, 2016. http://bebionic.com/the_hand.
[60] Steeper. "Features." Bebionic. 2015. Accessed August 13, 2016. http://bebionic.com/the_hand/features.

look as authentic as possible," and "Additional detailing on the palms, knuckles, nails and joints serve to enhance the natural appearance of the hand." An image of the color system shows a series of round skin color swatches, called "Cosmetic Glove Colours," attached with a cord similar to paint samples at a home improvement store. However, also available is a "jet black shade for a more futuristic appearance."[61] Unlike the i-limb's more form-fitting black cover, the bebionic skin features natural-looking wrinkles and lines. Essentially, one would have a black "human" arm.

What is most important is the way Steeper advertises the "lifelike" qualities of the bebionic hands' anatomically-inspired design while simultaneously highlighting their mechanical features. In particular, their newest hand, the "bebionic small," is described as "small and perfectly formed," reduced in size by 30% in order to accommodate smaller body frames but with the same functionality of the larger model.[62] In a video for the bebionic small on the official "BeBionicUK" *YouTube* channel, Steeper Technical Director Ted Varley explains how the biologically-inspired prosthesis was designed using actual biometric data from average female bodies, noting that "It's strictly based on the statistics of a fifty percentile American female. So we've taken all the finger lengths from the statistic data, and loaded that into our CAD [model] and then built from that, so it's very very close." Although Varley says that it was "designed with women in mind," he notes that the hand is also intended for smaller-framed men and

[61] Steeper. "Standard Glove." Bebionic. 2015. Accessed August 12, 2016. http://bebionic.com/the_hand/standard_glove.
<http://bebionic.com/the_hand/standard_glove>.
[62] Steeper. "Bebionic Small." Bebionic. 2015. Accessed August 12, 2016. http://bebionic.com/the_hand/bebionic_small.

adolescents.[63] In what is perhaps a gendered appeal, the hand is described as weighing "approximately 390g" or "the same as a large bar of Galaxy chocolate."[64]

Likewise, an infographic for the bebionic small featuring top and side view diagrams of the device advertises that its "Human-centered profile" is "Inspired and built from the actual skeletal structure of the human hand, making bebionic the most anatomically correct prosthetic hand on the market." As parts of its simulated anatomy, the hand also features "'Bubble' finger tips," described as "The only lifelike fingertips featuring air bubbles to maximise the interaction between the wearer and the handling of objects with superior precision."[65] The hand's anatomical design is elaborated upon in a June 16, 2015 Steeper press release for the bebionic small, which states that "An accurate skeletal structure was firstly developed, with the complex technology then specifically developed to fit within this in order to maintain anatomical accuracy. In other myoelectric hands the technology is developed first, at the expense of the lifelikeness." This anatomical accuracy is paired to a system of muscle sensors and motors that "tracks and senses each finger through its every move – mimicking the functions of a real hand."[66] Ultimately, the "naturalness" of devices such as the bebionic is portrayed as directly proportional to how "high-tech" they are.

According to Ott, prosthetics involve "instances where medical cure cannot be achieved." Therefore, "success is not about cure, but about technique."[67] This is demonstrated by the way in which Steeper focuses on the technical aspects of the bebionic small, especially its ability to

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[63] BeBionicUK. "Ted Varley, Technical Director at Steeper Talks around the Bebionic Small Hand." YouTube. June 17, 2015. Accessed August 12, 2016. https://youtu.be/HlHIR9PTs0Y.
[64] Steeper. "First UK User Receives World's Most Lifelike Bionic Hand." News release, June 16, 2015. Bebionic. Accessed August 15, 2016. http://bebionic.com/uploads/files/Press_release_-_First_UK_user_fitted_with_worlds_most_lifelike_bionic_hand.pdf.
[65] Steeper. "Information Graphic: Bebionic Small." Bebionic. 2015. Accessed August 12, 2016. http://bebionic.com/uploads/files/bebionic_small_infographic.jpg.
[66] Steeper. "First UK User Receives World's Most Lifelike Bionic Hand."
[67] Ott, Katherine. "The Sum of Its Parts." (p. 16-17)

stand in for a biological human limb. As Ott observes, “In the history of technology and medicine, the human body is a design and engineering project. In this narrative, prosthetists apply themselves to solving basic problems with materials, mechanics, and hardware.[68] Here, the bebionic small’s specifications are described as being as close to human as possible. However, throughout its marketing materials, Steeper touts the fit and finish of the mechanical components that make up the hand’s artificial anatomy, and images of the product are decidedly “unnatural.” For example, according to the above press release, the development of the bebionic small utilized “Formula 1 techniques and military technology along with advanced materials including aerograde aluminum and rare Earth magnets.”[69] The bebionic small infographic elaborates on this last detail, explaining that the “rare earth magnets on each finger” are engaged by the actuators during operation and are used to “improve power” and “enhance performance.” It also emphasizes that the hand features “Formula 1 technology and Swiss watchmaking to ensure unrivalled efficiency and power.”[70] The hand’s “Formula 1 components and rare-earth magnets” would be referenced yet again in a January 27, 2016 Steeper news release touting how the “sleek, precise and perfectly formed bebionic small was developed around the accurate skeletal structure of the human anatomy.”[71]

The comparison to the style and construction of a Formula 1 car and Swiss watch in Steeper’s marketing copy is somewhat appropriate, based on the initial impression of the device. A video introducing the bebionic small shows an animated CG model of the hand in its “White

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[68] Ibid. (p. 17)
[69] Steeper. "First UK User Receives World’s Most Lifelike Bionic Hand."
[70] Steeper. "Information Graphic: Bebionic Small."
[71] Steeper. "'Bio Nicky' Supports Leonard Cheshire Disability in 2016 London Marathon." Bebionic. January 27, 2016. Accessed August 15, 2016. http://bebionic.com/latest_news/bio_nicky_supports_leonard_cheshire_disability_in_2016_london_marathon.

Kevlar" and "Black Carbon" color options.[72] Each joint exposes an intricate set of springs, actuators, and mechanical linkages in brushed silver and coppery gold, passing through the anatomically-shaped frame of each finger segment. The hand at once resembles an automobile under construction and one of the precision machines used to assemble it. When examining the marketing materials for bionic hands, it becomes apparent that the innate mechanical appeal of bionic prostheses is not unknown to their manufacturers, due in part to the readiness with which they photograph, display, and describe the components that make them work and the new materials used in their construction. As *anime* and *manga* scholar/translator Frederick Schodt notes, mechanical technologies have a "romantic, transcendent aura," evoking the "powerful appeal" of "the schematics of imaginary warrior robot mechanisms or the innards of a racing car."[73] In fact, showing a bionic arm without a covering is essential to marketing it, letting customers appreciate its robust construction and complex-looking articulations. The revealed mechanics are a statement of ethos, showing that it is in fact as high-tech and capable as it is purported to be. As the achievement of biological mimicry through technology, the bebionic hand also demonstrates how "roboticness" and "naturalness" are not necessarily mutually exclusive. Steeper uses just as many technological as well as biological metaphors to describe the device.

The bebionic small had its official UK launch in London on June 16, 2015. Nicky Ashwell, a 29-year-old congenital amputee and London resident, became the first user in the UK to receive the prosthesis. According to a Steeper news release, Ashwell is a "Product Manager at an online fashion forecasting and trend service." She describes using the hand for the first time

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[72] BeBionicUK. "Introducing Bebionic Small." YouTube. June 15, 2015. Accessed August 12, 2016. https://youtu.be/iunag8PVu6o.
[73] Schodt, Frederik L. *Inside the Robot Kingdom: Japan, Mechatronics, and the Coming Robotopia*. Tokyo and New York: Kodansha International, 1988. (p. 42)

as “an exciting and strange feeling” noting that “it immediately opened up so many more possibilities” for her. Before being fitted for the bebionic small at the London Prosthetics Center clinic, Ashwell used a nonmoving “cosmetic hand,” and after using the bebionic hand she came to the realization that she had been “making life challenging” for herself when she “didn’t need to.” According to the news release, the bebionic small now lets her do activities like ride a bike, lift weights, and carry a purse while holding hands with her boyfriend.[74] Ashwell’s story is in line with Steeper’s motto of “Creating life’s turning points, together,” [75] in reference to the way in which the adoption of a prosthesis is commonly depicted as a “turning point” that changes the life of its wearer. However, Ashwell’s description of the hand as both “exciting and strange” demonstrates the lingering technological uncanniness of bionic limbs, even as they greatly improve the lives of their wearers.

Ashwell and the bebionic small were heavily publicized in the British media. A July 11, 2015 article in *The Telegraph* described the hand, which “costs around £30,000 including fitting and training,” as a “medical miracle.”[76] Ashwell also appeared on BBC Two’s *Victoria Derbyshire Show*, giving an in-studio demonstration of the hand and discussing her experiences with it. As the two greeted each other, Derbyshire asked Ashwell “what is it like, psychologically, to be able to shake someone’s hand.” Ashwell replied that “It’s actually more rewarding than you could imagine,” explaining that the hand “takes away a lot of awkward moments.” Ashwell also brought along some of her previous cosmetic prostheses—seemingly heavy, rubbery, skin-colored arms and hands that Derbyshire calls “completely inflexible” and

[74] Steeper. "First UK User Receives World's Most Lifelike Bionic Hand." Bebionic. June 16, 2015. Accessed August 15, 2016. http://bebionic.com/latest_news/first_uk_user_receives_worlds_most_lifelike_bionic_hand.
[75] Steeper. "First UK User Receives World’s Most Lifelike Bionic Hand."
[76] Anderson, Elizabeth. "British Company behind 'world-first' Bionic Hand Developing Further 'medical Miracles'." The Telegraph. July 11, 2015. Accessed August 15, 2016. http://www.telegraph.co.uk/finance/enterprise/11732439/British-company-behind-world-first-bionic-hand-developing-further-medical-miracles.html.

"incredibly outdated in comparison." The juxtaposition of these older technologies—many of which are still used and even preferred by some amputees—with the bebionic further highlights its high-tech ethos. Towards the end of the segment, Ashwell demonstrates her ability to tie a shoe. Derbyshire comments that while it is "the most mundane task for almost everybody watching," the arm seems to make Ashwell's life "more convenient, easier, less hassle, frankly."[77] Most recently, a Steeper news release on January 27, 2016 reported that Ashwell—now known as "Bio Nicky"—was preparing for the 2016 London Marathon in support of the Leonard Cheshire Disability charity. Her bebionic hand improved her "active lifestyle" and allowed her to train both sides of her body. According to Steeper, Ashwell is now able to "encourage other people with disabilities to create their turning points,"[78] presumably by seeking out bebionic brand prostheses.

2.5 ELIMINATING THE GAP

No matter how capable a robotic limb might be, it still has to be attached in a way that is comfortable and easy to use. Thus far, the technologies discussed in this chapter involve noninvasive, external prosthetic attachments—myoelectric sensors that detect electrical nerve impulses through the skin and prosthetic limbs that use suction cups and body harnesses to hold them to the body. The problem of attaching prostheses to human bodies has existed as long as there have been prosthetics, and vintage advertisements for prosthetics providers demonstrate how certain elements have remained consistent such as a focus on fit and comfort, construction

[77] BeBionicUK. "First UK User of Bebionic Small on BBC2's Victoria Derbyshire Show." YouTube. June 19, 2015. Accessed August 15, 2016. https://youtu.be/HmXs6bdkoAM.
[78] Steeper. "'Bio Nicky' Supports Leonard Cheshire Disability in 2016 London Marathon."

and material quality, motion and functionality, and appearance and naturalness. An advertisement card for the A. A. Marks company promoting their exhibition at the 1901 Pan-American Exposition in Buffalo, New York, declares that their artificial limbs are "The most useful, durable, comfortable, the lightest and nearest approach to nature."[79] A later advertisement for the Hanger Clinic—then Hanger Artificial Legs and Arms—in the June 1938 Issue of the Texas State Journal of Medicine features a woman in a nightgown, stockings, and heeled shoes holding open her robe to show her prosthesis. The ad declares that:

> This is an actual photograph of a lady wearing the HANGER HIP CONTROL LIMB for thigh amputation, worn without suspenders. Over six thousand successful wearers of the Hip Control (copyrighted) limb.[80]

At first glance it is difficult to tell which leg is artificial, the only indicator being the belt harness around her waist with two support straps descending to her right thigh. The ad suggests that the prosthesis is designed to be invisible while maintaining ones' sex appeal, and this is due in large part to the minimal amount of equipment needed to fasten it to the body. An ad for the Johnson-Norton Artificial Limb Company, Inc. in the 1915 *Polk's Seattle City Directory* provides a list of the variety of equipment available, including traditional prosthetics equipment and other orthotic devices such as "Suspenders, Stump Hose, Trusses, Crutches, Deformity Appliances, Abdominal Supports, Elastic Hosiery, Elastic Webbing, Ankle Supports, Arch Supports, Suspensories, Shoulder Braces."[81]

Today, prosthetic sockets can also cause complications with myoelectric prostheses, as "shifting electrode positions or changing skin conditions (eg, sweating), may interfere with EMG

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[79] A. A. Marks. *Artificial Limbs with Rubber Hands and Feet*. 1901. Advertisement, New York.
[80] J. E. Hanger, Inc. "Hanger Artificial Legs and Arms." *Texas State Journal of Medicine* 34, no. 2 (1938).
[81] Johnson-Norton Artificial Limb Company, Inc. "Johnson-Norton Prosthetic Limbs." *Polk's Seattle City Directory*, 1915, 10.

signals."[82] However, recent achievements involving the surgical attachment of prosthetic limbs to patients' bodies point toward total bodily integration becoming a norm in the near-future, and this practice is described as an even more "natural" way to use a prosthetic limb. According to a press release from the Johns Hopkins University Applied Physics Laboratory, in 2015 longtime patient Johnny Matheny underwent a "pioneering" two-part surgical procedure called "osseointegration," allowing him to attach one of the lab's Modular Prosthetic Limbs directly to his skeleton. While statements previously cited in this chapter claimed that a goal for the Johns Hopkins team was to create "noninvasive" prosthetic solutions, a short metal adapter now protrudes from the stump at the end of Matheny's upper arm, and the attachment point inside his body is permanently fused to the bone in the residual limb. According to the press release, "This bone-anchoring device induced a biological response from the bone to create a strong, long-lasting connection between the implant and the bone. In other words, the implant became a part of the bone." As a result, Matheny became the first patient in the United States to receive both targeted muscle reinnervation surgery and osseointegration.

According to Michael McLoughlin, credited here as "chief engineer in APL's Research and Exploratory Development Department," the successful attachment of an MPL directly to Matheny's residual limb has "eliminated one of the biggest gaps in prosthetic development: the socket." The socket, or attachment point, is described in the press release as "the most critical component of a prosthesis" since it is the one that is in direct contact with the human body. The document explains that poorly-fitted sockets can cause medical complications and difficulty using a prosthesis, and according to clinical prosthetist Courtney Moran, "Even with well-designed sockets, patients have reported problems with heat, sweating and chafing." According

[82] Zuo, Kevin J., and Jaret L. Olson. "The Evolution of Functional Hand Replacement." (p. 47)

to Matheny himself, “It’s all natural now. Nothing is holding me down. Before, I had limited range; I couldn’t reach over my head and behind my back. Now boom, that limitation is gone.” In order to control the arm, Matheny now wears a wireless sensor band around his upper arm.[83]

In a survey of hand replacement technologies, Kevin J. Zuo and Jaret L. Olson summarize the benefits of osseointegration:

> The use of osseointegration, the direct attachment of a titanium fixture into living bone, eliminates the need for a socket and increases stability and comfort at the interface between prosthesis and residual limb. … By providing stable fixation, osseointegrated prostheses eliminate socket-related problems, such as chafing and sweating, while increasing the amputee’s range of motion. The intimate prosthesis-skeletal junction also allows users to experience improved pressure and vibratory sensation.[84]

In other words, osseointegration for a prosthesis-wearing amputee can be likened to the convenience of laser eye surgery for a glasses-wearer, multiplied by the difficulty of losing a limb, and is one way in which developers of prostheses are attempting to create truly seamless technologies that remove the last conceptual boundaries between human and machine.

Although McLoughlin describes the socket as a “gap” in prosthetics development, the actual gap between body and machine has all but been eliminated. In a video on the Johns Hopkins University Applied Physics Laboratory’s *YouTube* page accompanying the press release, Dr. Albert Chi, Medical Director of the Targeted Muscle Reinnervation Program, says that “The MPL now really is an extension of his arm. …Not only has it improved Johnny’s

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[83] The Johns Hopkins University. Applied Physics Laboratory. "APL’s Modular Prosthetic Limb Reaches New Levels of Operability." News release, January 12, 2016. The Johns Hopkins University Applied Physics Laboratory. Accessed May 20, 2016. http://www.jhuapl.edu/newscenter/pressreleases/2016/160112.asp.
[84] Zuo, Kevin J., and Jaret L. Olson. “The Evolution of Functional Hand Replacement.” (p. 48)

comfort, the aesthetic quality of the MPL itself, but also our control has been phenomenal."[85] Here, naturalness and fluidity continues to be a primary concern. However, in a Bloomberg video feature on the Modular Prosthetic Limb, Matheny says that it took "hundreds of thousands of hours" of mental control exercises to be able to control the arm fluidly, noting that patients who expect to "step right back into it" are "in for a rude awakening."

According to Matheny, "I want the ultimate arm. I want to be as near natural as a human arm as possible." In considering the future of prosthetics, he says "I'm like the Model T of cars. Or I'm the Wright Brothers of airplanes, you know. I'm the beginning. And as we progress then you're gonna see us finally move up to the Maseratis, or the, these supersonic jets. And we're gonna say, '*Back to the Future* has begun.'" Inadvertently or not, Matheny's use of metaphors for technological invention frames his pioneering fusion of the human body with technology as a new category of machine that will continue to bring new innovations in the future. Perhaps one day someone undergoing the first brain transplant or receiving the first fully-artificial body will look back and call themselves the "Johnny Matheny" of full-body cyborgs. Likewise, the report concludes that "As he moves forward, Johnny represents a future where robotics goes from being a tool we use, to actually becoming a part of us."[86] In other words, Matheny illustrates the bionic ideal of a truly "seamless" incorporation between the natural and the artificial.

On May 11, 2016, Mathney and McLoughlin visited the Pentagon to show off the MPL as part of "DARPA Demo Day." An article on the United States Army's webpage titled "DARPA's mind-controlled robotic arm does everything" explains that the MPL project was realized over a decade of work and with $120 million in military funding. According to Dr.

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[85] JHU Applied Physics Laboratory. "APL's Modular Prosthetic Limb Reaches New Levels of Operability." YouTube. January 12, 2016. Accessed May 21, 2016. https://youtu.be/-0srXvOQlu0.
[86] Bloomberg. "The Robot-Arm Prosthetic Controlled by Thought." YouTube. November 12, 2015. Accessed May 20, 2016. https://youtu.be/sk1NkWl_W2Y.

Justin C. Sanchez, director of the Biological Technologies Office at DARPA, the MPL was developed as part of DARPA's "Revolutionizing Prosthetics Program," which aimed to "restore near-natural upper extremity control to our military service members who have lost limbs in service of our country." Author C. Todd Lopez comments that "Matheny's robotic arm is completely exposed black composite material and metal. You can see how it connects to his body, and you can see how it's put together. One wonders if it will be covered one day with a material that makes it appear to be a real arm." However, a realistic cosmetic covering "hasn't been a priority" for the Johns Hopkins team, and nearly three years after his appearance on *CBS This Morning*, McLoughlin still sees the same reactions to the arm's appearance in those he works with:

> The thing they are most interested in is that it moves naturally. … A lot of them like that look. They think it's cool they have a robotic arm. It's not so much a cosmetic thing, as it is functionality. [87]

As prosthetic integration increases, the robotic look shows no sign of going out of fashion.

2.6 FITTING IN AND STANDING OUT

Ultimately, the social quality of a prosthesis—how the device interacts with others and how it acts as an extension of its user's own personality—is some factor of its functional capabilities and appearance. A key theme in this chapter has been the way that prosthetics companies attempt to allow patients a choice between being seen as someone with a prosthesis—and therefore a

[87] Lopez, C. Todd. "DARPA's Mind-controlled Robotic Arm Does Everything." The Official Homepage of the United States Army. May 11, 2016. Accessed May 21, 2016. https://www.army.mil/article/167735/DARPA_s_mind_controlled_robotic_arm_does_everything/.

disability or difference in general—and going unnoticed. This dialectical tension between artificialness and naturalness underlies the practical and aesthetic choices presented to patients in the marketing materials for bionic limbs. This social pressure to conform is taken up by Robert McRuer, who suggests that the "compulsory nature of able-bodiedness" has become naturalized in contemporary culture, "covering over, with the appearance of choice, a system in which there actually is no choice."[88] For McRuer, "A system of compulsory able-bodiedness repeatedly demands that people with disabilities embody for others an affirmative answer to the unspoken question, Yes, but in the end, wouldn't you rather be more like me?"[89] On one hand, the social and practical benefits provided by new prosthetic technologies are extremely promising, and those who lose a limb through some traumatic incident are often eager to regain that limb. However, a central tenet of the prosthetics industry concerns a desire to restore the "normal" functioning of the "natural" human body. This is particularly significant for people with limb differences who were born missing one or more limbs—or without the use of their limb(s)—who are expected to live in an able-bodied word that was already in place before their arrival. For them, this "natural" body is an idealized body that never quite resembled theirs to begin with. In other words, the choice between a "robotic" or "invisible" prosthesis in prosthetics marketing is always dependent on some pre-existing expectation of normality, with supposedly "natural" bionic limbs like the Michelangelo and bebionic hands offering a total-package solution to this functional-aesthetic dilemma.

Ultimately, manufacturers of medical-grade bionic limbs aim to replicate the "natural" body because the human form is readily integrated—mechanically and socially—into a world

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[88] McRuer, Robert. "Compulsory Able-Bodiedness and Queer/Disabled Existence." In *The Disability Studies Reader*, edited by Lennard J. Davis, 301-08. 2nd ed. New York: Routledge, 2006. (p. 303)
[89] Ibid. (p. 304)

designed by and for human appendages. In discussing the effects of integrating machines into society, Louis Mumford writes that that "a simplification of the externals of the mechanical world is almost a prerequisite for dealing with its internal complications." He suggests that our mechanical environment "must be made as neutral as possible" in order to avoid the "chaos of stimuli" created by its presence.[90] This philosophy manifests itself in the longtime goal of prosthetics developers to make their technologies "neutral" or "seamless," and even the most robotic-looking bionic limbs are advertised as having a "natural" or familiar appearance and gesture that makes them "invisible" and able to effortlessly integrate into their wearers' everyday lives. Likewise, the complexities of their internal mechanisms and computer control software are concealed behind "simplified" user-friendly surfaces, object-oriented mobile apps, and myoelectric control systems powered by the body's own nervous system. The new osseointegration procedures aim to further eliminate any "complications" created by a prosthesis. This is one reason why—whether wrapped in a realistic skin-like covering or presenting a more spartan finish—devices such as the Johns Hopkins MPL, i-limb, Michelangelo, and bebionic generally imitate the overall shape and articulations of the human body parts they are designed to replace.

For Mumford, the standardization of machines—and in this case the standardization of bodies—"has thus, in its esthetic manifestations, something of the same effect that a conventional code of manners has in social intercourse: it removes the strain of contact and adjustment."[91] In other words, a prosthesis that has an intuitive use pattern and a familiar aesthetic is one that is the easiest to adapt to for both wearer and society—one less distraction in

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[90] Mumford, Lewis. *Technics and Civilization*. First Harbinger Books ed. New York and Burlingame: Harcourt, Brace & World, 1963. (p. 357)
[91] Ibid. (p. 357)

a “chaotic” world already made complicated by technology. This is especially true for bionic arms with control systems that integrate with the wearer’s own nervous system. The idea is that when a prosthesis is designed around the evolutionarily-tested “standard” of the biological human arm, a wearer can learn to integrate it seamlessly into their everyday life and strangers can better anticipate how the device will behave and respond. As a result, depictions of bionic arms in the media inevitably include a demonstration of their wearers shaking hands with an able-bodied person—the ultimate test of “mannered” biomechanical control and human-machine interaction.

Mumford goes on to describe standardization as a “psychological shock-absorber,” a kind of social lubricant that allows everyday social interactions to take place. However, he also argues that standardization “gives small deviations and variations from the prevalent norm the psychological refreshment that would go only with much larger changes under a condition where variation was the expected mode and standardization was the exception.”[92] In other words, standardization has the effect of a social palate-cleanser, casting nonstandard elements in sharp relief and allowing their idiosyncrasies to be recognized and appreciated.

In regards to prosthetics, this tension between standard and nonstandard—or fitting in and standing out—has become central to larger questions about the design of prosthetic technologies. Essentially, the extent to which mechanical limbs do or do not look like natural human limbs begs the question as to whether or not it is “cooler” or more of a technological achievement to perfectly mimic the human body or to boldly transcend it. In an article in *The Atlantic* titled “Blueprint for a Better Human Body,” Eveleth Rose writes that:

[92] Ibid. (p. 357-358)

> More and more amputees, engineers, and prospective cyborgs are rejecting the idea that the "average" human body is a necessary blueprint for their devices. … What was once an industry bent on replicating the human body exactly, the world of prosthetics has started thinking more creatively about what the human body can be.

For example, Stefan Greiner, founder of the Berlin-based group of "body hackers" called Cyborgs eV, argues that while "We have this strong picture of us as human beings with two legs, two hands, and one head in the middle,…there's actually no reason that the human body has to look like as it has looked like for thousands of years." As Rose summarizes, the human body "can be a whole lot more than what's biologically possible."[93]

In recent years, a growing number of artists and engineers have begun to rethink the form of the human body, moving away from the biomimetic standard of the medical prosthetics industry and developing custom alternatives that challenge prevailing notions of how a prosthetic limb should look or behave. These "alternative" prosthetic limbs often feature radical new designs that push functionality and aesthetics to extremes beyond what is possible with skins, gloves, and coverings, allowing their wearers to literally re-imagine their sense of bodily identity. In the marketing for alternative prosthetic limbs, their wearers reveal a choice to *not*—to paraphrase McRuer—be "more like us." Whether they are designed for extra-human functionality or transformative aesthetics, alternative prosthetic limbs are meant to stand out and be noticed—bespoke prostheses reimagined as high-tech fashion objects. In the next chapter, I examine how the aesthetic characteristics of alternative prosthetic limbs functions as their own

[93] Eveleth, Rose. "Blueprint for a Better Human Body." The Atlantic. May 17, 2015. Accessed August 03, 2015. http://www.theatlantic.com/technology/archive/2015/05/a-blueprint-for-a-better-human-body/389655/.

kind of social “shock-absorber.” Ultimately, in a technophilic culture familiar with popular depictions of fantasy heroes with stylized mechanical limbs, the prosthetic design that is the best suited to socialization—the least “shocking” and most familiar one—may actually be the one that looks the most un-natural.

3.0 REFASHIONING THE HUMAN BODY: THE MARKETING OF "ALTERNATIVE" PROSTHETIC LIMBS

On February 15, 2015, 27-year-old model Rebekah Marine walked for designer Antonio Urzi at New York Fashion Week. The charity Models of Diversity had helped put Marine in touch with Urzi, who invited her to model his fashions. At the show, Marine appeared on the runway in a revealing dress made of rounded black gems loosely linked together with metal rings and trimmed with silver chain. The shining, armor-like dress was accented by silver body paint on her legs, head, neck and left hand. Large, metallic eyebrows pointing out like hands on a clock added to Marine's futuristic, android-like appearance. However, *NJ.com* writer Kelly Roncace noted in her coverage of the event that "Along with the futuristic dress, Marine had a very unique accessory." That "accessory" was her Touch Bionics i-limb revolution, and "During the fashion show, the bionic arm was covered with a metal glove, emblazoned with rhinestones and decorative metallic stripes, just adding to her robotic appearance."[1] The bespoke additions had transformed Marine's standard black i-limb into an armored gauntlet laced with metallic ribbons—the crown jewel of runway style.

According to her official bio, Marine was born without a right forearm. In 2011, while being fitted for her first myoelectric prosthesis, "a friend suggested she model her new

[1] Kelly Roncace. "Watch: Amputee Model Rebekah Marine Demonstrates 'bionic Arm'." NJ.com. February 24, 2015. Accessed July 26, 2016. http://www.nj.com/indulge/index.ssf/2015/02/amputee_model_rebekah_marine_walked_in_nys_fashion_week.html.

'accessory,' and it was at that moment when Rebekah realized she could turn her 'disability' into something extraordinary." Now famous as the "Bionic Model," she has, according to her own website, "defied all odds in the fashion industry and has become one of the most recognizable models in the disabled community." Marine has modeled for brands such as Tommy Hilfiger, Calvin Klein, and Nordstrom, and her work as "model, inspirational speaker and humanitarian" has been featured in publications such as *TIME*, *People Magazine*, and *Cosmopolitan*. Today, Marine wears a Touch Bionics i-limb quantum and serves as a Touch Bionics Ambassador, incorporating her bionic prosthesis into her work.[2]

On February 15, 2016, Marine again walked the runway at New York Fashion Week as part of the FTL Moda show. Participating in her third season, Marine was accompanied this time by her so-called "mini-me," 6-year-old Gianna Schiavone, who was born without her left forearm. The two held hands as they walked down the runway in coordinated Josefa Da Silva gowns. Schiavone wore no prosthesis, while Marina's i-limb was wrapped in a series of intricately-decorated silvery-white plates with geometric cutouts and seashell-like detailing. In an interview with *People* after the show, Marine said that she is "trying to push the boundaries in the fashion industry" and "open doors for people like Gianna in the future."[3] According to her "Ambassador Stories" page on the Touch Bionics website, Marine believes that "We should be celebrating uniqueness."[4] Her ultimate message is that fashion should be accessible to everyone.

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[2] "Her Story." Rebekah Marine: Bionic Model. 2016. Accessed July 26, 2016. http://www.rebekahmarine.com/#!about/cgox.
[3] Adams, Char. "Model with Bionic Arm Walks NYFW with Little Girl Born the Same Way: 'She's My Mini Me!'" PEOPLE.com. February 18, 2016. Accessed July 26, 2016. http://www.people.com/article/rebekah-marine-bionic-model-nyfw-fashion-week-mini-me.
[4] Touch Bionics. "Rebekah Marine." Touch Bionics. 2016. Accessed July 22, 2016. http://www.touchbionics.com/users-families/ambassador-stories/rebekah-marine.

On February 16, 2016, Marine posted an *Instagram* photo of Schiavone and herself confidently stepping down the runway, declaring that "This is the future of fashion."[5]

Although Marine has embraced—and trademarked— the "Bionic Model" label, the first thing one notices when exploring her online portfolio is how conventional it appears. While her "bionic" status will always be a characteristic feature, the professional photographs on display don't necessarily highlight or hide her prosthesis—usually depicted with a stock black and silver covering—or portray it as a gimmick.[6] In general, this is an encouraging sign that models with limb differences like Marine are beginning to receive equal representation in shoots for clothing manufacturers. However, in her appearances at Fashion Week, Marine's i-limb becomes transformed into a one-of-a-kind objet d'art—prosthetic technology and haute couture combined in a spectacular ensemble. This combination of technology, artistry, and beauty demands attention: Below a photo of Marine's decorated arm at the 9/11 Memorial posted to her *Instagram* on the day of the 2016 Fashion Week show, user comments alternate between promises to "never forget" and a fascination with the "truly beautiful design work."[7]

Recently, Marine and her Touch Bionics i-limb were featured in an ad for the UK government's "GREAT Britain" campaign, which aims to promote the innovations of British companies worldwide. The full-page ad, which appears in a January 2017 issue of *The Economist*, introduces Touch Bionics as "the British brains transforming lives." According to the caption: "Always striving for smarter, faster, stronger and smaller bionic arms, Touch Bionics puts the user's need for better functionality first. The world's first multi-articulating bionic hand

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[5] Rebekahmarine. "Instagram Photo by Rebekah Marine • Feb 16, 2016 at 4:24pm UTC." Instagram. February 16, 2016. Accessed August 18, 2016. https://www.instagram.com/p/BB2pAVku7zW/.
[6] "Portfolio." Rebekah Marine: Bionic Model. 2016. Accessed July 26, 2016. http://www.rebekahmarine.com/#!portfolio/wpun3.
[7] Rebekahmarine. "Instagram Photo by Rebekah Marine • Feb 15, 2016 at 5:47pm UTC." Instagram. February 15, 2016. Accessed July 26, 2016. https://www.instagram.com/p/BB0Nsl2O7xa/.

helps people do those everyday tasks we take for granted." In the ad, Marine is shown leaning on a countertop in front of a Hollywood-style lighted vanity mirror, a line of makeup brushes laid out before her as if she is preparing for a photo shoot. Engaged in the "everyday" yet delicate task of applying mascara, she effortlessly holds the brush to her eye with her uncovered black i-limb quantum, its silvery-grey arm attachment complementing her shimmering black top.[8] The copy says little about the scene before us, yet the image of Marine—looking at once glamorous, high-tech, and confident—sends a message that amputees and people with limb differences, and their bionic prostheses, are undeniably fashionable.

Today, bionic limbs are increasingly portrayed as fashion objects, celebrated as much for their unique capacity to be embellished with decorative features as they are for their technological sophistication and everyday usefulness. Whether they appear on the runway or on the sidewalk, they are depicted as an opportunity for their wearers to stand out from the crowd in distinctly positive ways. According to Ann Ferebee, "There is a direct ratio between the importance of the modern artifact and the extent to which it is decorated."[9] The trend towards decoration in the prosthetics industry can therefore be viewed as a statement on the cultural significance of bionic limbs, as the apotheosis of biomechanical technologies in contemporary visual culture and the most personal of material artifacts. As both an extension of the wearer's body and something that is worn, a bionic limb also embodies certain qualities of fashionable dress. Georg Simmel defines fashion as one of the many ways in which we "seek to combine in uniform spheres of activity the tendency towards social equalization with the desire for

[8] GREAT Britain. Advertisement. *The Economist*, January 21-27, 2017, 2.
[9] Ferebee, Ann. *A History of Design from the Victorian Era to the Present: A Survey of the Modern Style in Architecture, Interior Design, Industrial Design, Graphic Design, and Photography*. New York: Van Nostrand Reinhold, 1970. (p. 99)

individual differentiation and change."[10] Likewise, in *Adorned in Dreams*, Elizabeth Wilson writes that "To dress fashionably is both to stand out and to merge with the crowd, to lay claim to the exclusive and to follow the herd."[11] Fashion, like the wearing of a prosthesis, is always somewhere between fitting in and standing out—involving certain cultural rules and expectations, as well as characteristics of passing vs. marked difference.

The idea that bionic limbs can—and should—be fashionable is most evident in the marketing of the "alternative" prosthetics industry, made up of a growing number of artists and inventors who utilize advanced model making procedures and "3D printing" technologies to add bespoke detailing to existing medical prostheses and/or create custom limbs from scratch. Here, the word "alternative" is used by designers to signify the way in which these creations deviate radically from the "expected" function and form of mass-market prosthetics—from a chrome and leather leg built to match a wearer's motorcycle to one embedded with Swarovski crystals worn by the "Ice Queen" at the London 2012 Paralympic Games Closing Ceremony. The term also describes the way that many of these companies operate independent of medical, military, or other research institutions. Here, the aesthetic qualities of alternative limbs are prioritized as much as their practical utility, with some limbs eschewing functionality entirely in order to become beautiful artistic statements. As Alphonso Lingis writes, "nothing demonstrates the demiurgic power of art more than the ingenuity and artifice that go into fabricating prostheses."[12] Their artificialness makes them malleable beyond the limits of the biological human body, taking advantage of the "negative space" provided by a missing limb. As a result, alternative prosthetic

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[10] Simmel, Georg. "Fashion." *American Journal of Sociology* 62, no. 6 (1957): 541-58. (p. 543)
[11] Wilson, Elizabeth. *Adorned in Dreams: Fashion and Modernity*. New Brunswick, NJ: Rutgers University Press, 2003. (p. 6)
[12] Lingis, Alphonso. "The Physiology of Art." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 73-89. Cambridge, MA: MIT Press, 2006. (p. 77)

limbs allow for creative possibilities that exceed those of other body modifications such as tattooing and cosmetic surgery.

Most importantly, alternative prosthetic limbs challenge the notion that beautiful bodies—and prosthetics—necessarily have to look a certain way, offering an alternative to the pursuit of "naturalness" that is common in the prosthetics industry. This is central to their function as works of art. According to Tobin Siebers, "disability acquires aesthetic value because it represents for makers of art a critical resource for thinking about what a human being is." In modern art, "disability enlarges our vision of human variation and difference, and puts forward perspectives that test presuppositions dear to the history of aesthetics."[13] Likewise, Elizabeth Grosz suggests that "Good art, as much as good science, presents us with the possibilities of bodies that are barely conceivable, that challenge and problematize the very stability and givenness of bodies, that force us to rethink our presumptions and our understandings of what bodies are."[14] And Norbert Wiener, inventor of the field of "cybernetics," detached bodily identity from fixed physical matter when he noted that the "individuality of the body is that of a flame rather than that of a stone, of a form rather than of a bit of substance."[15]

An examination of the media discourses surrounding alternative prosthetic limbs reveals how these devices are marketed as personalized objects of high fashion while simultaneously resonating with wider pop-culture sensibilities regarding science fiction cyborgs. Furthermore, these custom limbs are often described as being more fully incorporated into the bodily identity of their wearers, allowing them to reclaim a new type of agency over their disability and literally

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[13] Siebers, Tobin. *Disability Aesthetics*. Ann Arbor: University of Michigan Press, 2010. (p. 3)
[14] Grosz, Elizabeth. "Naked." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 187-202. Cambridge, MA: MIT Press, 2006. (p. 193)
[15] Wiener, Norbert. *The Human Use of Human Beings: Cybernetics and Society*. New York: Avon Books, 1967. (p. 139)

re-construct or re-fashion their sense of personal identity. In some media depictions, their users even claim that their able-bodied friends and family members are envious of their alternative limbs. Coincidentally, the designer prosthetics movement has emerged alongside futuristic runway fashion trends and mass-market clothing made to look like robotic limbs and sci-fi cyborgs, allowing able-bodied individuals to participate in a fully-commodified "bionic fashion" of their own. This brings attention to bionic prosthetics and ultimately reveals how themes of science fiction cool have granted these devices—and their wearers—a high-tech chic in contemporary culture.

3.1 FROM IMITATION TO IMAGINATION

Throughout her well-documented career as a Paralympian, fashion model, film star, speaker, writer, and activist, Aimee Mullins has used her celebrity status to promote the alternative possibilities of prosthetic technologies and serve as a public role model for amputees. According to her website bio, Mullins was born without fibulae in both legs, and her doctors decided to amputate each leg below the knee on her first birthday. She then learned to walk on prosthetic legs by the time she was two, and "spent her childhood doing the usual athletic activities of her peers." While at the University of Georgetown's School of Foreign Service on a full academic scholarship from the Department of Defense, she joined the university's Division 1 track and field team and became the first amputee to compete in the NCAA. At the time, she was the first athlete to use the now-iconic cheetah-inspired carbon-fiber sprinting legs that are now a standard

design in sports prosthetics, setting World Records in the 100 meter, 200 meter, and long jump events at the 1996 Paralympic Games in Atlanta.[16]

In her first TED Talk from 1998 titled "Changing My Legs – and My Mindset," Mullins, then a college senior, showed off what she called her "pretty legs" for the audience:

> These are my cosmetic legs, actually, and they're absolutely beautiful. You've got to come up and see them. There are hair follicles on them, and I can paint my toenails. And, seriously, like, I can wear heels. Like, you guys don't understand what that's like to be able to just go into a shoe store and buy whatever you want. …I got to pick my height.

In the video, Mullins then puts on her carbon graphite "sprinting legs," made by the San Diego company Flex-Foot. After donning the legs, she stands with one arm on moderator Sheryl Shade, who notes that "She can't really stand on these legs. She has to be moving." Mullins then elaborates, to audience applause:

> Yeah, I definitely have to be moving, and balance is a little bit of an art in them. …And so, I run on these, and have shocked half the world on these. These are supposed to simulate the actual form of a sprinter when they run. If you ever watch a sprinter, the ball of their foot is the only thing that ever hits the track. So when I stand in these legs, my hamstring and my glutes are contracted, as they would be had I had feet and were standing on the ball of my feet.[17]

The basic design of the springing legs, which look like two J-shaped blades with small footpads on the bottom, is still used today, and they are commonly called "cheetah" legs or "blades" due

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[16] Mullins, Aimee. "Biography." Aimee Mullins. Accessed June 19, 2014. http://www.aimeemullins.com/about.php.
[17] Mullins, Aimee. "Changing My Legs - and My Mindset." TED. February 1998. Accessed June 19, 2014. http://www.ted.com/talks/aimee_mullins_on_running.

to their shape. Vivian Sobchack has noted that Mullins' "highly specialized technological enhancement of human motion and speed in sprinting paradoxically foregrounds the human costs of such technologically achieved and focused animal power. Thus, what is gained on one side is lost on the other."[18] Here, Mullins embodies the extremes of alternative-style prostheses. Her high-tech sprinting legs are portrayed as awkward to use unless they are in the state of perpetual animal-inspired motion that they were designed for. Likewise, her realistic-looking "pretty legs" have valued cosmetic properties—even allowing her to choose her height—but they are pre-shaped to be worn with heels. The "human cost" described by Sobchack serves to amplify the degree to which Mullins' limbs are a radical departure from the ethos of standard medical-grade prosthetic limbs, which emphasize versatility in everyday situations. Mullins' limbs are designed not for general use but are intended to be swapped in as-needed to perform their highly specialized functions—merely two choices among an infinite series of possible bodily configurations.

Years before the widespread commercialization of customizable bionic limbs, Mullins challenged the notion that artificial limbs should ideally replace and replicate the form and function of the biological human body, opening up possibilities for imaginative alternatives. In a second TED talk from 2009 titled "My 12 Pairs of Legs," Mullins displays and discusses the various alternative prostheses that she has worn throughout her career as a model, from a pair of "glass legs" made out of clear polyurethane, to wooden boots carved from ash by runway fashion designer Alexander McQueen. A pair of polyurethane "jellyfish legs," made in collaboration with artist Matthew Barney for his film *The Cremaster Cycle*, were designed to "provoke the

[18] Sobchack, Vivian. "A Leg to Stand On: Prosthetics, Metaphor, and Materiality." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 17-41. Cambridge, MA: MIT Press, 2006. (p. 35)

senses and ignite the imagination," having no practical function apart from their appearance in the film. According to Mullins, "This is where it really hit home for me -- that my legs could be wearable sculpture. And even at this point, I started to move away from the need to replicate human-ness as the only aesthetic ideal."[19]

In her second talk, Mullins again discusses her ability to change her height. Most notably, she describes how her ability to modify her legs attracted the envy of her able-bodied friends:

> I have a variable of five different heights. Today, I'm 6'1". And I had these legs made a little over a year ago at Dorset Orthopedic in England and when I brought them home to Manhattan, my first night out on the town, I went to a very fancy party. And a girl was there who has known me for years at my normal 5'8". Her mouth dropped open when she saw me, and she went, "But you're so tall!" And I said, "I know. Isn't it fun?" …And she looked at me, and she said, "But, Aimee, that's not fair." And the incredible thing was she really meant it. It's not fair that you can change your height, as you want it.

In reference to the measure of bodily customizability afforded by her prostheses—and ultimately her amputations—and the envious responses of her friends, the *YouTube* version of Mullins' talk is appropriately titled "It's Not Fair Having 12 Pairs of Legs."[20]

Mullins' presentations reveal another way that the use of prosthetic limbs can take on characteristics of fashion. According to Wilson, "Fashion is dress in which the key feature is rapid and continual changing of styles. Fashion, in a sense, *is* change, and in modern western

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[19] Mullins, Aimee. "My 12 Pairs of Legs." TED. February 2009. Accessed June 19, 2014. http://www.ted.com/talks/aimee_mullins_prosthetic_aesthetics.
[20] TED. "Aimee Mullins: It's Not Fair Having 12 Pairs of Legs." YouTube. March 11, 2009. Accessed June 19, 2014. http://youtu.be/JQ0iMulicgg.

societies no clothes are outside fashion."[21]As exemplified by Mullins, the ability to change one's legs like a pair of shoes—alternating between various cosmetic legs and sprinting legs—makes them similarly fashionable. A prosthesis allows for change, and change is a fact of life for many amputees, who go through life constantly being fitted and refitted for new prostheses and upgrading to the latest technologies.

For Mullins, this encounter with her envious friend signaled a shift in the social conversation about prosthetics:

> It is no longer a conversation about overcoming deficiency. It's a conversation about augmentation. It's a conversation about potential. A prosthetic limb doesn't represent the need to replace loss anymore. It can stand as a symbol that the wearer has the power to create whatever it is that they want to create in that space. So people that society once considered to be disabled can now become the architects of their own identities and indeed continue to change those identities by designing their bodies from a place of empowerment.[22]

For Mullins, the space left by an amputation is its own kind of opportunity, offering unique possibilities for self-expression through the refashioning of one's body. When recounting a situation in which she asked a group of elementary-aged schoolchildren to imagine the kinds of legs they would build to help her "jump over a house," she notes a similar predisposition towards invention and imagination:

> And immediately a voice shouted, "Kangaroo!" "No, no, no! Should be a frog!" "No. It should be Go Go Gadget!" "No, no, no! It should be the Incredibles." And other things that I don't -- aren't familiar with. And then, one eight-year-old said,

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[21] Wilson, Elizabeth. *Adorned in Dreams*. (p. 3)
[22] Mullins, Aimee. "My 12 Pairs of Legs."

> "Hey, why wouldn't you want to fly too?" And the whole room, including me, was like, "Yeah." And just like that, I went from being a woman that these kids would have been trained to see as "disabled" to somebody that had potential that their bodies didn't have yet. Somebody that might even be super-abled.[23]

Here, Mullins' story demonstrates the ability of prosthetics to be a canvas for the imagination. Her example also introduces the question of whether or not we should strive for enhancement instead of replacement when designing human prostheses. In other words, if a body part is already missing, why not take the opportunity to rebuild it better than it was before? Prosthetics are ultimately limited by the strength and durability of the human body that they are attached to, yet when untethered from human limitations, they may one day allow us to become "super-abled."

In a *Gizmodo* article titled "Normal Was Never Cool: Inception of Perception," Mullins argues that there is a generational shift towards the acceptance of altering one's body through technology:

> The generation of children growing up today has a distinct advantage in this realm of identity, thanks to their daily interaction with the internet and video games. It's commonplace for them to create avatars and parallel representations of themselves, and they see their ability to change, transform, and augment those bodies to best suit their surroundings as beneficial.[24]

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[23] Ibid.
[24] Mullins, Aimee. "Normal Was Never Cool: Inception of Perception." Gizmodo. November 14, 2009. Accessed June 19, 2014. http://gizmodo.com/5404227/normal-was-never-cool-inception-of-perception.

Mullins believes that children are generally accustomed to the notion of alternative bodies, and a negative response to disability and prostheses is a socially learned disposition—often imposed on them by adults:

> I've noticed a progression from how kids used to respond to my wooden legs to responses toward a prosthetic limb today. Quite simply, the fear-as-first-response has all but disappeared; I do not experience children who are afraid to meet me and in fact, I haven't recently met any child who, when I'm sporting obvious prosthetics like the RoboCop legs, wasn't drawn like a magnet to them, accompanied by a list of very astute questions. For the most part, it's adults who rein kids in, in an attempt to not have them stare or offend with their natural curiosity. But curiosity is necessary; it is the foundation of imagination and innovation. [25]

In a May 2015 interview in *The Atlantic*, Mullins says that children "see a rebuilt body as something powerful. If I'm walking around in carbon fiber or titanium or bionics, standing on a street corner, and some little kid is walking by, they presume power. They want to know if I can fly, how fast I can run."[26] These qualities of curiosity, imagination, and personal reinvention are central themes in depictions of alternative prosthetics.

These cultural shifts have also led to some prosthetics designers describing notions of disability and ability in regards to technological—as opposed to human—limitations, where any bodily lack in performance is reframed as a problem of engineering. One of the pioneers of this approach is biophysicist Hugh Herr, director of the Biomechatronics research group at MIT

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[25] Ibid.
[26] Eveleth, Rose. "Blueprint for a Better Human Body." The Atlantic. May 17, 2015. Accessed August 03, 2015. http://www.theatlantic.com/technology/archive/2015/05/a-blueprint-for-a-better-human-body/389655/.

Media Lab. In a TED Talk from March 2014 titled “The new bionics that let us run, climb and dance,” Herr discusses the “the next generation of bionic limbs, robotic prosthetics inspired by nature's own [nonhuman] designs.” In the video of his talk, we see that Herr is himself a double amputee. His suit pants are rolled up at the knees, revealing two lower-limb prostheses on which he walks nonchalantly. The heavy-duty-looking robotic ankles and feet (which end in flattened spring-like footpads) display visible wires, gears, struts, and mechanical connections in a variety of materials and finishes. In his talk, Herr explains that after losing both legs to frostbite in a climbing accident, he began to develop “specialized limbs”:

> I began by developing specialized limbs that allowed me to return to the vertical world of rock and ice climbing. I quickly realized that the artificial part of my body is malleable; able to take on any form, any function -- a blank slate for which to create, perhaps, structures that could extend beyond biological capability. I made my height adjustable. I could be as short as five feet or as tall as I'd like.

Like Mullins, Herr describes amputation in terms of an opportunity for new bodily potential—a “blank slate.” He also views the development of these types of “data-driven” bionic technologies as an important step to ensuring that everyone has the basic human right to live their life without disability, if they so choose. According to Herr, “A person can never be broken. Our built environment, our technologies, are broken and disabled. We the people need not accept our limitations, but can transcend disability through technological innovation.”[27]

Herr’s comments are a technologist’s approach to the language of the disability rights movement, which generally maintains that we should think of our social and material

[27] Herr, Hugh. "The New Bionics That Let Us Run, Climb and Dance." TED. March 2014. Accessed June 19, 2014. https://www.ted.com/talks/hugh_herr_the_new_bionics_that_let_us_run_climb_and_dance.

environment—not the people within it—as "disabled." According to Jay Timothy Dolmage, "The field of disability studies emphasizes the idea of the social or cultural construction of disability, while *also* insisting on the materiality of disability."[28] Likewise, Tobin Siebers writes that "Social constructionism makes it possible to see disability as the effect of an environment hostile to some bodies and not to others, requiring advances in social justice rather than medicine."[29] Rosemarie Garland-Thomson similarly offers a "socially contextualized view of disability," defining it as "the attribution of corporeal deviance—not so much a property of bodies as a product of cultural rules about what bodies should be or do."[30] And David T. Mitchell and Sharon L. Snyder argue that "the prosthesizing of a body…carries with it ideological assumptions about what is aberrant. The judgment that a mechanism is faulty is always already profoundly social. The need to restore a disabled body to some semblance of an originary wholeness is the key to a false recognition: that disabilities extract one from a social norm or average of bodies and their corresponding (social) expectations."[31] Disability is also social in the sense that the built environment is designed in a particular way that defaults to a so-called "able" body.

For Herr, what becomes "aberrant" or "faulty" is not the person but the limits of the technology that is available to them. His comments suggest that the "constructedness" of this environment means that we can choose to recreate it in a fashion that is more livable for all people. Here, the body itself is just another part of our social environment, able to be modified and adapted to suit human needs and desires—and overcome challenges from walking to rock

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[28] Dolmage, Jay Timothy. *Disability Rhetoric*. Syracuse, New York: Syracuse University Press, 2014. (p. 8)
[29] Siebers, Tobin. "Disability in Theory: From Social Constructionism to the New Realism of the Body." In *The Disability Studies Reader*, edited by Lennard J. Davis, 173-83. 2nd ed. New York: Routledge, 2006. (p.173)
[30] Garland-Thomson, Rosemarie. *Extraordinary Bodies: Figuring Physical Disability in American Culture and Literature*. New York: Columbia University Press, 1997. (p. 6)
[31] Mitchell, David T., and Sharon L. Snyder. *Narrative Prosthesis: Disability and the Dependencies of Discourse*. Ann Arbor: University of Michigan Press, 2003. (p. 6)

climbing. In rhetorical terms, Herr's public status as a celebrity developer-amputee—someone who has embraced technological augmentation and literally re-fashioned his sense of self—lends a unique ethos to his perspective and complicates critiques of social constructions of disability. In his own way, Herr is challenging the "cultural rules" concerning what bodies are expected to be, championing the benefits of prosthetic technology while simultaneously reaffirming and re-centralizing the human spirit that inspires their design and use. As James L. Cherney concludes in his analysis of the cochlear implant debate, "It does not matter that the body has been altered, for the central quality that defines human existence lies in the experiences of growing, developing relationships, and facing the challenges of life."[32] In other words, the choice of individuals to use new biomedical technologies does not necessarily diminish the central values at stake in discussions of disability. Ultimately, it is individual choice itself that is most important when it comes to adopting technologies of the body, whether those technologies are used to make one feel more "normal" or to stand out as something different. More than just overcoming a technological deficiency, advocates such as Mullins and Herr view the use of advanced prosthetic technologies not as creating some predetermined sense of "wholeness" but as creating whatever the individual wants to be.

The work of public figures such as Mullins and Herr to change societal attitudes concerning the expected human body image has coincided in recent years with the mechanical design of bionic prosthetic limbs being embraced as its own type of visual aesthetic. In her 2009 article for *Gizmodo* titled "Is Choosing a Prosthesis So Different than Picking a Pair of Glasses?," Mullins describes her Össur brand carbon fiber sprinting legs as "the prosthetic leg version of a motorcycle jacket," explaining that she has "embraced the sci-fi aesthetic of the

[32] Cherney, James L. "Deaf Culture and the Cochlear Implant Debate: Cyborg Politics and the Identity of People with Disabilities." *Argumentation and Advocacy* 36 (summer 1999): 22-34. (p. 24)

sleek black carbon fiber, the WD-40 glistening on the shock absorber" and feels "rather cool wearing them."[33] This "coolness" has led to some amputees wanting to show off their high-tech limbs. In a 2015 *New York Times* article surveying recent trends in prosthetics, Eveleth Rose concludes that "while function is still crucially important, …there are more and more amputees who are going without the cosmetic covers, who are showing the machinery behind the leg, the hinges and the carbon fiber and the metal."[34]

In *Rhetoric of Machine Aesthetics*, Barry Brummett describes the interplay between function and style as a form of "classic machine aesthetics" that he terms *mechtech*.[35] For Brummett, "The dimensionality of mechtech involves an awareness of both surface and depth of the outer hull of the machine and its inner workings. The tension between the two is central to mechtech aesthetics."[36] In describing 1960s style hot rods with chrome scoops and absent panels that expose the engine, Brummett explains that "Mechtech dimensionality is *the machine in context*, gears and pistons within the frame of their housing, the dialectic between them being a part of the aesthetic."[37] In regards to bodily prosthetics, this dialectical tension adds interest to their design, allowing people to see inside and through them and offering a unique effect of bodily interiority that showcases their precision-machined "organs." It also illustrates the unique interplay between the "natural" and the "artificial" in bodily prosthetics, as silvery mechanical joints and attachment points peek out at the seams between cosmetic coverings and clothing.

This visual recognition—and celebration—of the mechanical nature of artificial limbs has also been taken up by advocacy groups such as the Amputee Coalition, which has designated

[33] Mullins, Aimee. "Is Choosing a Prosthesis So Different than Picking a Pair of Glasses?" Gizmodo. November 10, 2009. Accessed June 19, 2014. http://gizmodo.com/5401408/is-choosing-a-prosthesis-so-different-than-picking-a-pair-of-glasses.
[34] Eveleth, Rose. "Blueprint for a Better Human Body."
[35] Brummett, Barry. *Rhetoric of Machine Aesthetics*. Westport, CT: Praeger Publishers, 1999. (p. 28)
[36] Ibid. (p. 33)
[37] Ibid. (p. 34)

each April "Limb Loss Awareness Month," dedicated to "raising awareness about the limb loss community and empowering people affected by limb loss to achieve their full potential." Each year, one day of Limb Loss Awareness Month is declared to be "Show Your Mettle Day," and amputees are encouraged to "proudly wear and show their devices (prosthetic and/or assistive) on this day." According to the website: "The concept is simple – to show your 'mettle,' the ability to cope well with difficulties or to face a demanding situation in a spirited and resilient way, by showing your 'metal' prosthetic device or wheelchair." Amputees are also encouraged to post a photograph of themselves with or without their prosthesis, wheelchair, and/or other assistive devices, and share those images across *Facebook*, *Instagram*, and *Twitter* with the hashtag "#ShowYourMettle."[38]

The Amputee Coalition website features anecdotal stories about wearers embracing the mechtech style of their prostheses, especially leg devices which usually feature a robust tubular pylon or strut connecting the socket or knee to the foot. In an article by Cindy Charlton, a bilateral below-knee amputee, she recalls telling another patient with "finished" cosmetic coverings "I kind of like the high-tech robotic look." For Charlton, choosing to reveal her self-described "robot parts" is a not only an opportunity to raise awareness and teach others but is a source of pride: "Plain and simple, I want people to know that I wear prostheses. And, as much as I hate to admit it, it comes from a sense of pride, almost like being proud of some sort of accomplishment. … I want people to know that the human spirit is formidable, that any adversity and challenge is not too great to conquer."[39] In another article, above-knee amputee Scott Moltzan, says that while he used to cover his prosthetic leg with a realistic cosmesis for

[38] "Limb Loss Awareness Month." Amputee Coalition. 2016. Accessed November 30, 2016. http://www.amputee-coalition.org/events-programs/limb-loss-awareness-month/.
[39] Charlton, Cindy. "To Finish or Not to Finish (That Is the Question)." Amputee Coalition. March/April 2010. Accessed December 07, 2016. http://www.amputee-coalition.org/resources/to-finish-or-not/.

"emotional" reasons, the "cost, weight and the limiting nature" of the covering led him to embrace the mechanical look: "I finally said, 'Look, I have this prosthesis, and it's metal, and it looks pretty cool. …So I'm proud of the technology, and on top of that, the leg looks great. It's black and silver – it looks kind of European."[40] However, Mullins herself recognizes that some people aren't necessarily "thrilled about looking like the Terminator," and that ultimately their choice as consumers should be "respected." For Mullins, choice is important, and she argues that "a consumer of a prosthetic is the same consumer buying an iPod or glasses or a couch for their house. You want options."[41]

This impulse towards technological "options" is one way in which mass-market goods are able to satisfy a consumer penchant for fashionable self-expression. This practice has already been adopted to some degree by the medical prosthetics industry, and we have seen previously how companies such as Touch Bionics, Ottobock, and Steeper offer a standard range of "options" to customize one's mass-produced prosthesis with a certain color, design, or texture, or use proprietary software to add "individual" details to artificial skin-like coverings. This results in bionic limbs being marketed as extensions of a user's individual personality. This rhetoric of fashion and customization has also been adopted by advocacy groups such as the Amputee Coalition. In an article titled "Prosthetic FAQs for the New Amputee," the organization declares that:

> A prosthesis can look however you want it to. From the purely functional look of the mechanical parts to a cosmetic cover that looks like a natural limb, your options are endless. If you want to make a fashion statement, you can have your

[40] McNutt, Scott. "The Naked Prosthesis." Amputee Coalition. November/December 2009. Accessed December 07, 2016. http://www.amputee-coalition.org/resources/the-naked-prosthesis/.
[41] Mullins, Aimee. "Is Choosing a Prosthesis So Different than Picking a Pair of Glasses?"

> socket covered in your favorite team's logo or accessorize it with your favorite color or pattern. The prosthesis is an extension of you and your style – wear it proudly![42]

In an effort to provide prosthesis-wearing consumers with a wider range of options, a number of companies have begun to offer "alternative" aftermarket cosmetic coverings and modifications for medical-grade prosthetic limbs. Utilizing advanced 3D modeling and printing technologies combined with hand-crafted detailing, these companies allow wearers to personalize their limbs to the highest degree, expressing their individual sense of style. Owing to the standardized construction of medical-grade bionic limbs, these attachments let wearers swap their coverings as easily as they do the cases on their laptops and mobile phones, while also turning prosthetics limbs into a kind of luxury good—beyond their already high cost—where their appearance is only limited by their wearer's imagination and access to material resources.

The notion of radically customizing a prosthetic limb to suit one's personal taste is part of a long history of customization that has always been a central part of the prosthetics industry, from the crucially important comfort of a custom-molded socket that conforms to one's residual limb to the artful matching of skin tones and anatomical features. However, as Katherine Ott observes, "Once function has been produced, everything that comes after it is value-added flourish."[43] Allowing individuals to customize prosthetic limbs with additional "flourish" is also part of a larger cultural movement towards personalized consumer goods. For example, a November 2013 *Forbes* article from business consulting firm Bain Insights titled "Having It

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[42] "Prosthetic FAQs for the New Amputee." Amputee Coalition. May 2015. Accessed December 07, 2016. http://www.amputee-coalition.org/resources/prosthetic-faqs-for-the-new-amputee/.

[43] Ott, Katherine. "The Sum of Its Parts: An Introduction to Modern Histories of Prosthetics." In *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*, edited by Katherine Ott, David Serlin, and Stephen Mihm, 1-42. New York: New York University Press, 2002. (p. 6)

Their Way: The Big Opportunity In Personalized Products" declares that "Sellers of everything from dress shirts to handbags and even consumer packaged goods are discovering the value of letting customers create their own unique products."[44] Likewise, a 2016 white paper by the consulting firm Unity Marketing describes an "emotional drive for self-expression" that is central to the contemporary marketing of luxury goods. The report argues that millennial consumers in particular "are a generation raised on self-expression about everything, including their own skin, which has become a canvas for personal expression and creativity in the form of tattoos."[45] As a new generation of prosthesis users emerges, it is evident that prosthetics are becoming another "canvas for personal expression."

These findings dovetail with the emergence of a contemporary "maker" culture centered on new direct-to-consumer 3D printing technologies and services. A September 2016 *Forbes* article observes that "retailers are betting on 3D-printing as one path to personalization, a big industry push these days." For example, in New York City, Lowe's began testing an in-store 3D scanning and printing station called "Bespoke Designs" that allows customers to "design and produce customized products, from lamps to doorknobs, and hard-to-find replacement parts." This "personalization trend" stems from a contemporary "maker movement" in which "An appreciation for one-of-a-kind product coincides with the digital landscape's dizzying array of shopping choices and a backlash against cookie-cutter, mass-produced merchandise."[46]

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[44] Spaulding, Elizabeth, and Christopher Perry. "Having It Their Way: The Big Opportunity In Personalized Products." Forbes. November 05, 2013. Accessed January 08, 2017. http://www.forbes.com/sites/baininsights/2013/11/05/having-it-their-way-the-big-opportunity-in-personalized-products/#2d0cb9537036.

[45] Danziger, Pamela N. *What Do HENRYs Want? Your Guide to Reaching the Most Important Affluent Demographic — High-Earners-Not-Rich-Yet*. Third ed. Dayton, OH: Hilltop Communications, 2016. (p. 17)

[46] Thau, Barbara. "Make It Yourself: Lowe's Tests Profit Potential Of 3D-Printed, Personalized Products." Forbes. September 12, 2016. Accessed January 08, 2017. http://www.forbes.com/sites/barbarathau/2016/09/08/make-it-yourself-lowes-tests-profit-potential-of-3d-printed-personalized-products/#359b163496d2.

At the center of this "maker movement" is 3D printing service Shapeways, which allows "consumers and professionals alike the ability to create, customize and/or repair products" using a web-based platform to create, upload, and produce 3D printed objects in a variety of materials such as plastic, ceramic, and metal using the company's array of industrial-grade 3D printers. According to Shapeways, 3D printing is a type of "additive manufacturing" technology that uses a 3D computer model of an object as a "blueprint" to build that object by "adding layer-upon-layer of material" in a machine called a 3D printer.[47] 3D printing offers a dramatic increase in speed, flexibility, and affordability compared to traditional prototyping and manufacturing processes and mass-produced parts can be quickly tweaked and customized in a computer modeling program without having to make new molds or reset production lines. The democratic nature of the technology makes it a natural fit for the prosthetics industry, which is increasingly oriented towards individual experimentation. And like bionic prosthetics, 3D printing is often portrayed as a technology of the future, making the marriage of the two central to media coverage of high-tech cool.

3.2 BESPOKE INNOVATIONS: "BEAUTIFUL ARTIFICIAL LIMBS"

Founded in 2009 by industrial designer Scott Summit and orthopedic surgeon Kenneth Trauner, Bespoke Innovations utilizes 3D scanning, modeling and printing technologies to produce aftermarket plastic casings for prosthetic legs that are adapted to each wearer's body and personal style. A September 2010 *New York Times* article characterizes the company's "designer

[47] "Additive Manufacturing." Shapeways. 2016. Accessed January 08, 2017. http://www.shapeways.com/additive-manufacturing.

body parts" as emblematic of a "manufacturing revolution" brought about by 3D printing. In an interview with Summit, he explains that he "wanted to create a leg that had a level of humanity," seeming to suggest that although his products are of high-tech origins the individuality of their human wearers is considered at stage of production. In reference to mass-produced prostheses, Summit says that "It's unfortunate that people have had a product that's such a major part of their lives that was so underdesigned." To remedy this, Summit wants "people to have input and pick out their options," and the company can create prosthetic coverings with "a midcentury modern or a Harley aesthetic if that's what someone wants." Referencing a similar shift from standardization to personalization in the automobile industry, Summit declares that "It's about going from the Model T to something like a Mini that has 10 million permutations." Some of the options mentioned in the article include casings wrapped in materials such as "an old bomber jacket or a trusty boot"—evidence of the "humanity" touted by Summit. The company's experiments with fully scratch-built legs also illustrates the relative affordability of 3D printed prosthetics, which will ultimately lead to these technologies being available to more people in the future. In describing prototypes of complete legs with articulated knees and ankles, Summit claims that "It costs $5,000 to $6,000 to print one of these legs, and it has features that aren't even found in legs that cost $60,000 today."[48]

In a November 2011 *TEDx* talk titled "Beautiful Artificial Limbs," Summit suggests that the advanced mechanical functionality of modern prosthetics is not enough for some people, arguing for the important—and very human—role that beauty plays in designing for the human body:

[48] Vance, Ashlee. "3-D Printing Spurs a Manufacturing Revolution." The New York Times. September 13, 2010. Accessed January 08, 2017. http://www.nytimes.com/2010/09/14/technology/14print.html.

> The first thing you see about prosthetic limbs is that they are engineering brilliance. They can do amazing things. They can return all kinds of functionality and performance back to somebody's life. But from the vantage of an industrial designer, they're not quite there. What we don't see is the sculpture, or the beauty, or the individual qualities, or the uniqueness, or the elegance to them. They are brilliant, mechanical, utilitarian, devices. And that's great except for a lot of people that doesn't work.

For Summit, much like Mullins and Herr, the "humanity" in prostheses goes beyond their role as extensions of the human body that approximate the general shape and function of biological limbs. It is also the way that they embody the human drive to create and express oneself:

> The body to us is not a mechanical entity where mechanical-only solutions can address them. It's our personal sculpture. It's our kinematic sculpture. It is our canvas. It represents not just our physicality, but also a lot of our personality as well.[49]

The combination of beauty and functionality has gained Bespoke Innovations popular media attention. On May 15, 2013, Rollie Williams of viral content curator *Upworthy* shared the above video and declared that Summit's customized prostheses were "Artificial Limbs That Look 100% Badass."[50]

On the Bespoke Innovations website, the "badass" custom prosthetic accessories produced by the company are officially marketed as "Fairings":

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[49] Summit, Scott. "Beautiful Artificial Limbs." TED. November 2011. Accessed August 17, 2015. http://www.ted.com/talks/scott_summit_beautiful_artificial_limbs.

[50] Williams, Rollie. "Artificial Limbs That Look 100% Badass - And These Are Just The Beginning." Upworthy. May 15, 2013. Accessed June 18, 2014. http://www.upworthy.com/artificial-limbs-that-look-100-badass-and-these-are-just-the-beginning-2.

> Bespoke Fairings™ are specialized coverings that surround an existing prosthetic leg, accurately recreating the body form through a process that uses three-dimensional scanning to capture the unique leg shape. But Fairings not only return the lost contour, they invite an expression of **personality** and **individuality** that has never before been possible.

The brand's identity is based on five main characteristics: "a positive experience," "customized," "modular," "durable," and "lightweight." Modular, quickly and easily swappable, and even washable, they are made to suit a variety of lifestyles and daily activities from sports such as soccer to a "night on the town." The website claims that this represents the "opposite of 'one-size-fits-all'" production methods, and that the needs and tastes of the user are paramount:

> Fairings infuse the individual's lifestyle and taste into the design from the start. But to make this an even more personal part of the prosthetic leg, Fairings can be enhanced with patterns, graphics, and materials—including leather, ballistic nylon fabric, chrome plating, and even tattoos. By creating a unique custom form that presents the individual, Bespoke Innovations hopes to change the way the world thinks of prostheses.

However, while Bespoke Innovations lower-leg Fairings are not "one-size-fits-all," they can be easily adapted to fit on any mass-produced prosthetic leg model, most of which generally feature the same central tubular pylon connecting knee to ankle. Therefore, the very homogeneity that gives rise to Bespoke Innovations Fairings also contributes to their modularity and ease of use. Here, Bespoke Innovations revitalizes the handicraft tradition of bespoke tailoring and artisan goods in the spirit of the digital age, where mass-produced technologies such as mobile phones can be customized—through apps and accessories—even though they are basically the same.

This tension between the mechanical (or mass-produced) and the individual (or bespoke) is also central to the fashion industry. According to Wilson, "Mass fashion, which becomes a form of popular aesthetics, can often be successful in helping individuals to express and define their individuality." [51] In other words, mass-market goods are not outside of the discourse of fashion, and they can be used and modified by individuals to express themselves regardless of their class or artistic talents.

Bespoke Innovations also emphasizes the rehabilitative benefits of the custom Fairings, which "express confidence, creativity and individuality," helping to "erase the wall of awkwardness that can disconnect the amputee from the world around." The Bespoke Innovations site focuses primarily on the added aesthetic benefits of their Fairings, and how their appearance can better re-integrate the wearer's prosthesis—and body—back into the social world, recoupling the private and the public dimensions of embodiment. According to the page, "Fairings invite interest, but for all the right reasons. An uncomfortable glance is now an admiring gaze."[52]

Here, the viewer is left to imagine what the "right reasons" are: a child's curiosity about the leg's superhuman qualities—as in Mullins' encounter with schoolchildren—or the fetishization of disabled and/or technologically augmented bodies. As Siebers notes, "Disabled bodies are so unusual and bend the rules of representation to such extremes that they must mean something extraordinary. They quickly become sources of fear and fascination for able-bodied people, who cannot bear to look at the unruly sight before them but also cannot bear not to look."[53] Furthermore, the exact qualities of a prosthesis or assistive technology—or lack thereof—that would cause discomfort in onlookers is also left to the imagination. This is a

[51] Wilson, Elizabeth. *Adorned in Dreams*. (p. 12)
[52] Bespoke Innovations. "What Is a Fairing?" Bespoke Innovations. Accessed June 20, 2014. http://www.bespokeinnovations.com/content/what-fairing.
[53] Siebers, Tobin. "Disability in Theory." (p. 178)

category of representation that traditionally includes the visible terminus of the amputation itself, an empty space in the expected body envelope, or the appearance of useful but ungainly body-powered prostheses. This kind of hidden-fear appeal markets an alternative limb covering as a social shock absorber that is able to alleviate the mutual discomfort experienced by both wearer and onlooker by recasting one's prosthesis/disability as a conversation piece. If one reformulates the Bespoke Innovations copy through the language of Siebers, their custom fairings claim to tame the "unruly sight" of a missing limb and are so eye-catching that one "cannot bear not to look"—the wearer also cannot bear not to show it off.

Here, fashion theory is again illuminating. A Wilson notes, "An intense interest in fashion and one's appearance is, contrary to the common view that it arises from vanity, as likely to be a form of compensation, the result of shyness and self-doubt, for fashionable dress or a striking appearance provides an armour against the world."[54] Likewise, Simmel notes that fashion is "a product of social demands, even though the individual object which it creates or recreates may represent a more or less individual need."[55] In engaging with these discourses, Bespoke Innovations' Fairings attempt to fill the "social demands" of making one's body "whole" and pleasing to look at while expressing the individual needs and personality of the wearer. As a literal kind of "armor," they are described as covering up what is undesirable and transforming self-consciousness about one's body or prosthesis into pride about one's appearance. Ultimately, the prosthetics industry, like fashion, is always heavily invested in ideas about wearing something confidently.

Like the Touch Bionics "Ambassador Stories" pages, The Bespoke Innovations website offers three "Case Studies," each focusing on a different client and explaining how the custom

[54] Wilson, Elizabeth. *Adorned in Dreams*. (p. vii)
[55] Simmel, Georg. "Fashion." (p. 544)

Fairings integrate into their lives as objects that are both functional and fashionable. The first case study, titled “Chad,” features the subtitle “Survivor” and focuses on his athletic lifestyle and pro-active attitude towards prosthetics:

> At age 33 Chad, an avid athlete in the prime of his life, was diagnosed with synovial sarcoma on the bottom of his right foot. Faced with the choice of either losing a large section of his foot, having a limp and the chance of cancer still being in his limb, or losing his leg mid-shin and being fitted with a prosthetic leg, he made the difficult decision to amputate. He figured that a prosthesis would allow him more normality in his athletic and daily life. Seven years later, Chad now epitomizes the same resilience, optimism and strong human spirit he had prior to the amputation.

Here, the case study for Chad features common elements of prosthetics testimonials—the life pre-amputation, the cause of amputation, the choice to use a prosthesis, and the way in which the prosthesis provides for an active and successful life post-amputation. Also important is the way in which the wearer’s preexisting determination carried them through the entire process. The testimonial also emphasizes the interchangeability of Fairings, and their ability to steer curiosity about Chad’s leg towards its unique design while matching the rest of his wardrobe:

> “I love my Fairing because it’s a conversation piece. When I go out, people will tend to ask me about my leg,” said Chad. “There are also endless options for what you can do with the Fairings. What I didn’t expect are the practical uses for it. Like, when I wear pants, they hang perfectly. Without the Fairing they hung awkwardly. Now, people might not know I have a prosthetic leg. Also, when I wear my snowboard boots I don’t have to stuff them with foam anymore. I like

> leather in general and the look of the Fairing, and on a practical level it goes with the stuff that I wear." Chad also has a special Sport Fairing for playing soccer, which is designed to mimic his other leg with a built-in shin guard. [56]

The "Sport Fairing" designed to imitate the shape of a built-in shin guard also demonstrates how the fairings are a combination of practical and aesthetic functions. An artificial leg doesn't require the protection of a shin guard, yet the Fairing helps to fill out Chad's overall appearance and convert his tubular medical prosthesis into the expected shape for soccer—possibly serving the reverse function of protecting others from the underlying metal prosthesis. In other words, whether your legs are natural or artificial, wearing shin guards is part of "fitting in" when playing soccer.

The subtitle for the second case study featuring "Deborah" is "Legs Meant to be Seen." According to the webpage, Deborah lost her lower leg in a motorcycle accident. Although her prosthetic leg "returned much of the mobility and activity to her life, the titanium hardware and mechanical fittings comprising the new leg simply could not represent her individuality or uniqueness." In 2010, Bespoke Innovations worked with Deborah to produce a custom Fairing that "recreates Deborah's unique body shape, while allowing her to express her personal style and fashion sense." According to the case study:

> Deborah now selects from several Fairings to match her mood or complement her attire. Her Fairings include a set in black lace and chrome, another that suggests fishnet stockings, one appearing as white lace, and still another wrapped with

[56] Bespoke Innovations. "Case Studies - Chad." Bespoke Innovations. Accessed June 20, 2014. http://www.bespokeinnovations.com/content/chad.

> tattooed leather. She now wears skirts at every opportunity to show the world her custom legs. [57]

Here, the description illustrates the wide variety of textures, styles, and fashions made possible with the custom Fairings. Furthermore, Deborah's testimonial also reveals what the "right kind" of attention might be:

> The response from the world around her has suddenly changed from uncomfortable curiosity to admiration. "I've just got to tell you that's the coolest leg ever," came from a TSA airport security agent, confirming the transformation that the Fairings triggered. People began to comment on the leg, calling it 'cool' and 'sexy' - words rarely used to describe prosthetic limbs.

The webpage goes on to describe how this kind of "admiration" was key to Deborah being able to fully return to life before amputation:

> "People finally got it," she said. "Instead of trying to blend in and be like everyone else, now I really go out of my way to show off my leg. I'm coming back more to myself and being creative with my outfits. I try to match the leg to my outfit. With the chrome leg you can do a lot of cool 80's things like matching it to leather jackets with grommets and leather boots with accents. It's taken me all of this time to get my confidence back and to be a whole person again."

Here, Deborah's case study focuses on her dissatisfaction with conventional prostheses, and the way in which her custom Fairing becomes another fashion accessory to match her wardrobe to. She also describes it in terms of "symmetry," filling out the shape of her body in such a way that her clothing can hang optimally. A photo of Deborah shows her seated at an outdoor cafe, in a

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[57] Bespoke Innovations. "Case Studies - Deborah." Bespoke Innovations. Accessed June 20, 2014. http://www.bespokeinnovations.com/content/deborah.

khaki skirt and denim jacket. The sleek chrome and white covering on her right leg has an elegant appearance and almost seems to match the coffee mugs and place setting on the table.[58]

The third case study features "James," and the subtitle reads "Body Meets Bike." After losing his leg in a motorcycle accident, James was using a "generic prosthetic leg, which has been all function and no form." Together with Bespoke Innovations, they worked together to "create a Fairing that expresses his image, fashion, style of dress and, of course, his motorcycle. Wanting to create a Fairing that complemented his tattoos and his Harley, he chose a nickel and black Fairing, which was embossed with tattoos similar to those on his arm." James is quoted saying: "I hated that you could only get legs in one color, now my leg is black carbon fiber and is pretty cool. But it's even cooler with a Bespoke Fairing covering the prosthetic." According to James, "When I wear the Fairing it looks perfect…it looks better than the bare pylon, not just a little bit better, a lot better—like I'm wearing a piece of art. It's custom engineering!" For James, the custom nature of the Fairing is one of its most appealing features:

> The Bespoke Fairing's 'cool' factor is what James likes the most. Though he has had to live with a prosthetic limb for decades, he is now energized by wearing the personalized Fairing that reflects his style and form. "I like the fact that it's totally fabricated for me, it's not something someone can go into a store and buy. It is something that was made just for me. It suits my lifestyle and me. It really makes it feel like it is part of me."
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> …
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> "I like the design, I like to wear it, I like how it feels with pants and I like to show it off for people." [59]

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[58] Ibid.

The three "Case Studies" on the Bespoke Innovations webpage help to market the kinds of experiences offered by the brand. They also continue another trend in prosthetics marketing: an emphasis on wearers with some sort of active or otherwise creative lifestyle and the way in which their prosthesis embodies the qualities of that lifestyle. In particular, alternative limb accessories are described as a way to further coordinate one's prosthesis with their lifestyle. Chad plays soccer, Deborah is described as someone who runs marathons, and both she and James lost their limbs in a motorcycle accident, and have chosen designs that incorporate their artificial legs into a coherent overall body-machine aesthetic.

For example, On March 29, 2013, Brian Federal, a self-described filmmaker who "documents the ways in which advanced 3D printing technologies are changing the world," posted a feature on Scott Summit titled "Designing Confidence" on his *YouTube* page. In describing the custom leg Fairing produced for Deborah, Summit says that "the whole idea was just 'How beautiful can we make it?'" According to Summit, Deborah shared with him how strangers would stop and "tell her what a cool leg she had." In discussing Chad's leg, he notes that "he reached down and felt this leg and he kind of paused, and he said 'Wow I, I haven't felt that shape in eight years.' And that was this amazing thing, cause it wasn't just that we're creating something that looks cool, we're recreating a sense of self."[60]

The idea of recreating one's sense of self—quite literally—reveals the complex ways in which prosthetics developers want wearers—and the world—to think about the connection between prosthetics and one's sense of self, and how prostheses can become incorporated into the personhood of their wearers. As Steven L. Kurzman argues, "On the level of individual

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[59] Bespoke Innovations. "Case Studies - James." Bespoke Innovations. Accessed June 20, 2014. http://www.bespokeinnovations.com/james.
[60] Brian Federal. "Designing Confidence." YouTube. March 29, 2013. Accessed June 18, 2014. http://youtu.be/6wnnNk91EMs.

interface, artificial limbs do not possess autonomy. They are phenomonologically [sic] incorporated into one's body and, ideally, are nearly as transparent as organic body parts."[61] However, like fashion, prosthetics function as artificial extensions of the body, and the boundaries between the body and its extensions are often unclear. As Wilson notes, "Clothing marks an unclear boundary ambiguously, and unclear boundaries disturb us."[62] Furthermore:

> If the body with its open orifices is itself dangerously ambiguous, then dress, which is an extension of the body yet not quite part of it, not only links that body to the social world, but also more clearly separates the two. Dress is the frontier between the self and the not-self. [63]

Marshall McLuhan has similarly written about the way in which "Clothing, as an extension of the skin, can be seen both as a heat-control mechanism and as a means of defining the self socially."[64] Similarly, a prosthesis is a functional device that has an aesthetic or social dimension, and the fact that a prosthesis is an extension of the body that is not made *of* the body opens up new possibilities for self-expression through art and technology. The focus on remaking oneself in alternative limb marketing reveals the double meaning at play—one can literally remake their body and in this remaking they can create something more than what was originally there.

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[61] Kurzman, Steven L. "Presence and Prosthesis: A Response to Nelson and Wright." *Cultural Anthropology* 16, no. 3 (August 2001): 374-87. (p.378)
[62] Wilson, Elizabeth. *Adorned in Dreams*. (p. 2)
[63] Ibid. (p. 3)
[64] McLuhan, Marshall. *Understanding Media: The Extensions of Man (Critical Edition)*. Edited by W. Terrence Gordon. Berkeley, CA: Gingko Press, 2003. (p. 163)

3.3 THE ALTERNATIVE LIMB PROJECT

Another maker of alternative prosthetic limbs is the Alternative Limb Project, founded by Sophie de Oliveira Barata. According to the "About" page on the Alternative Limb Project website, the company uses "the unique medium of prosthetics to create highly stylised art pieces." Instead of swappable "Fairings," de Oliveira Barata's limbs are more elaborate additions, using "various specialists in fields such as 3D modelling, electronics, and cutting edge technology to create each piece of art." Not only does de Oliveira Barata conceive of her limbs as works of art, they are also described as fashion:

> As with fashion, where physical appearance becomes a form of self-expression, Sophie sees the potential of prosthetics as a [sic] extension of the wearer's personality. Merging the latest technology with traditional crafts, Sophie's creations explore themes of body image, modification, evolution and transhumanism, whilst promoting positive conversations around disability and celebrating body diversity.[65]

An earlier version of The Alternative Limb Project's homepage states that the company "offers a personal and friendly bespoke service, which provides unique prosthetics to blend in with the body or stand out as a unique piece of art, reflecting the wearer's imagination, personality and interests."[66] This choice between "blending in" and "standing out" is re-emphasized in a profile on de Oliveira Barata and her company titled "The Art of Designer Artificial Limbs," featured in *The Atlantic* on January 15, 2014. According to the article, de

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[65] "The Alternative Limb Project." The Alternative Limb Project. 2015. Accessed July 28, 2016. http://www.thealternativelimbproject.com/about/the-alternative-limb-project/.
[66] "The Alternative Limb Project - Home." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/.

Oliveira Barata's studio is able to create extremely realistic, custom-molded prosthetic limbs with hand-painted veins and real human hairs which allow her customers to "conceal their absences and blend in." However, they also cater to "amputees wanting to stand out," allowing them to "imagine the missing parts of their bodies as fantastical works of art." As de Oliveira Barata explains, "Instead of seeing what's missing, you see what's there." [67]

De Oliveira Barata began her career as a special effects make-up artist in the film industry before working for a company that made custom, realistic limbs for amputees. She reveals that she was inspired to start her alternative limb company by a young girl who lost her leg. As the young girl grew up, she visited de Oliveira Barata each year to receive a new leg, asking for "something a bit different" each time such as "little pigs that were riding bicycles and eating ice creams" or "a Christmas scene around the top of her leg." According to de Oliveira Barata, this was its own kind of privilege:

> I could see that every year she was getting really excited about coming in. And, it wasn't something she *had* to do that other people didn't, it was something she *got* to do that other people didn't. It was a nice event for her psychologically. [68]

The Alternative Limb Project website features a collection of "Alternative Limbs," each with its own page that includes a brief description of the limb and/or a client testimonial. The portfolio presents a wide range of styles and tastes, from the traditional to the more abstract.[69]

An alternative limb called the "Stereo Leg" was built for singer/songwriter and performing artist Viktoria Modesta Moskalova. In a provided testimonial, Moskalova says that

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[67] Morin, Roc. "The Art of Designer Artificial Limbs." The Atlantic. January 15, 2014. Accessed June 18, 2014. http://www.theatlantic.com/health/archive/2014/01/the-art-of-designer-artificial-limbs/282800/.
[68] Ibid.
[69] "The Alternative Limb Project - Alternative Limbs." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/#/alternative-limbs/4569103979.

while she originally wanted a prosthetic leg that would "provide balance" to her body shape, she later "saw it as an opportunity to regard the leg as a fashion item and an art project which seemed rather fun and exciting." As a "self confessed fashionista," she explains that "It's a special piece that needs to be exposed only in special circumstances to be fully appreciated, meaning on stage, on film or as part of an art installation." The dark-brown lower-leg socket is studded with rhinestones, spikes, and other sparkling elements, and it prominently features two embedded speakers on the front. The connection to the ankle features a series of mechanical struts, fittings, and geared rings, attached to a black and white foot pre-arched to fit into heels. It is simultaneously high-tech while also giving a nod to a "futuristic" past commonly featured in steampunk art and fashion. Moskalova also describes the highly-decorated limb in terms of power and agency, espousing a "strong belief that it's important to take control of your own body and most importantly improve it or reflect your personality through altered body image."

> The first time I wore a limb that was so obviously BIONIC, it gave me a total sense of uniqueness and feeling of mutant human in the best way possible. It was really fascinating watching people's reactions because most of them were speechless. Some had never stood next to a person with a prosthetic limb and the ideas they might have of what an amputee might look or act like is, in most cases, negative. So when they do clock my appearance and then see the leg, it is very challenging for them. Most importantly when the limb is attached and I'm walking with it in my full composure it has a power that is beyond something that can be described.[70]

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[70] "The Alternative Limb Project - Alternative Limbs - Stereo Leg." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/#/stereo-leg/4569199807.

The “Crystallized Leg,” sponsored by Swarovski, was also worn by Victoria Modesta in her role as the Ice Queen at the London 2012 Paralympic Games Closing Ceremony. This shimmering, silvery leg is encrusted with countless crystals, jewels, sequins and mirrored shards, and features a boot-like white foot embroidered with fine floral patterns. The leg’s central support pylon is wrapped in a pearlescent material, protruding from the center of the leg and making it seem as if the top and bottom halves are two floating pillars of ice.[71]

Another limb, the “Oriental Leg with Secret Drawers,” is a lower-leg piece in blue with ornate white reliefs that look like they are carved into wood, bone, ivory or jade. The entire leg uses various brown paint washes to create an aged and antique look, with bony, sculptural toes protruding from a molded cloth foot wrap. As its name suggests, the leg even houses two secret drawers.[72]A third limb, called the “Floral Leg” is worn by Kiera Roche, chairperson for the charity Limb Power. According to Roche:

> In the first few years my focus was on trying to be normal, wearing clothes that hid the fact that I was an amputee, but over the years I have become more comfortable with who I am and I now embrace having different legs for different activities and different occasions.
>
> …
>
> I love wearing the leg that Sophie designed for me, although at first, the same fear of being different does enter your head, but it’s being different in a positive way. It’s personal, it’s a fashion statement not a political statement and I love that. I’ve

[71] "The Alternative Limb Project - Alternative Limbs - Crystallized Leg." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/#/crystallized-leg/4570775453.
[72] "The Alternative Limb Project - Alternative Limbs - Oriental Leg With Secret Drawers." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/#/oriental-leg/4581905428.

had an incredible response to the leg from other amputees and able-bodied people.

I just wish I had more opportunities to wear it. I need to go to more parties!

In describing her custom limb as "fashion statement" instead of a "political statement," Roche's testimony seems to suggest a social hierarchy where attention-getting fashion is paradoxically less noticeable—and easier to talk about—than one's disability, even if the fashionable object in question is an artificial limb worn as the result of an amputation. This is further reinforced by a focus on confidence and self-esteem:

> I think losing a limb has a massive impact on one's self esteem and body image. Having a beautifully crafted limb designed for your makes you feel special and worthy. Attending a photo shoot, having your hair and make-up done by a professional and having your photos taken by a professional, is a wonderful experience and rebuilds self confidence and self esteem. It's something that I think could help new amputees in coming to terms with their loss. [73]

Roche's entry emphasizes the psychological benefits of her custom prosthesis, noting that it is "different in a positive way" and is able to help amputees manage their disability in a way that extends beyond the functional benefits offered by a prosthesis. Roche's full leg prosthesis has an overall human shape, complete with individual toes. It begins as a light bluish-jade color at the foot and gradually fades into a glossy white at the top. The entire leg is covered in a colorful arrangement of realistically painted plants and flowers. The floral motif is further represented by the thigh socket, which is actually shaped like the overlapping petals of a white tulip-like flower in bloom, shaded lightly to bring out its contours. The leg has a semi-translucent finish and has the overall look of a fine porcelain or china flower vase. One image of Roche shows her in

[73] "The Alternative Limb Project - Alternative Limbs - Floral Leg." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/#/floral-leg/4569111149.

matching undergarments holding a large hoop behind her back, evoking to some degree the vintage advertisements discussed in the previous chapter that emphasize elegance, femininity, and sexuality.

A page for one of the more elaborately-constructed custom prosthetic limbs featured on the site is titled "Removable Muscles." The limb was made for Ryan Seary, a soldier from the UK who had his left leg amputated above the knee and his left arm amputated above the elbow. According to the page, while he was on tour, Seary often discussed potential injuries with his fellow soldiers, recognizing that losing a limb was a realistic possibility due to the nature of their job. He said that these conversations with his team members "mentally prepared" him for the injuries he received, and made it "relatively easy" for him to come to terms with his amputee status. This included envisioning possible ways to express himself through his prostheses:

> Since I began to walk with basic technique my mind drifted to different ways I could decorate or stylize my limbs to have anything from extra functions, such as a bottle opener to lights, different textures or patterns. The other amputees I have met like these ideas and have some of their own. I think 99% of the amputees I have met would like an alternative limb as we tend to think of our prosthetics more as items of clothing like extended shoes or accessories of which everyone has their own individual style, much like people who choose not to have a tattoo. Someone might like a butterfly and someone else would prefer the grim reaper.
>
> …
>
> The central pole of my leg has been designed to look like my tibia, this bone look continues down to my foot where the top of it is just bones but the bottom of the

> foot and the toes and nails look 100% real (like my right foot). On top of this bone are different muscle sections which like the bone are anatomically correct.

Seary also describes the universal appeal and envy generated by alternative limbs, suggesting that "able-bodied people want to be amputees so they can customise their limbs too!"[74] This sense of envy resonates with the "mental preparation" Seary describes above—the idea that in today's world able-bodied individuals might see these limbs and imagine what theirs would be like should they ever need one. It also suggests how artificial limbs have reached a certain level of "cool" in the public imagination, where even the traumatic potential of a war injury can have a grim upside in the ability to recreate a new limb of one's choosing.

The "Oriental Leg," "Floral Leg," and exploded musculature of Seary's "Removable Muscles" leg demonstrates the popularity of *skeuomorphs* in alternative limb design. According to Nicholas Gessler, "yesterday's functional features become today's stylistic decorations." These features, called skeuomorphs, are "material metaphors instantiated through our technologies in artifacts."[75] The *Oxford English Dictionary* defines a skeuomorph as an "ornament or ornamental design on an artefact resulting from the nature of the material used or the method of working it," or an "object or feature copying the design of a similar artefact in another material."[76] Katherine Hayles similarly defines the skeuomorph as "a design feature that is no longer functional in itself but that refers back to a feature that was functional at an earlier time." The skeuomorph "looks to past and future, simultaneously reinforcing and undermining both. It calls into a play a psychodynamic that finds the new more acceptable when it recalls the

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[74] "The Alternative Limb Project - Alternative Limbs - Removable Muscles." The Alternative Limb Project. Accessed June 18, 2014. http://www.thealternativelimbproject.com/#/removable-muscles/4573291001.
[75] Gessler, Nicholas. "Skeuomorphs and Cultural Algorithms." In *Evolutionary Programming VII: 7th International Conference, EP98, San Diego, California, USA, March 25-27, 1998: Proceedings*, edited by V. W. Porto, N. Saravanan, D. Waagen, and A. E. Eiben, 229-38. Vol. 1447. Lecture Notes in Computer Science. Berlin Heidelberg: Springer, 1998. (p. 229)
[76] "Skeuomorph, N." OED Online. June 2014. Accessed June 17, 2014. http://www.oed.com/view/Entry/180780.

old that it is in the process of displacing and finds the traditional more comfortable when it is presented in a context that reminds us we can escape from it into the new."[77] In a March 1969 interview in *Playboy*, Marshall McLuhan evokes skeuomorphism in regards to the recycling of old media as contemporary art forms: "Because we are benumbed by any new technology — which in turn creates a totally new environment — we tend to make the old environment more visible; we do so by turning it into an art form and by attaching ourselves to the objects and atmosphere that characterized it."[78] And in describing the cyclical nature of fashion, Simmel similarly points out that "As soon as an earlier fashion has partially been forgotten there is no reason why it should not be allowed to return to favor and why the charm of difference, which constitutes its very essence, should not be permitted to exercise an influence similar to that which it exerted conversely some time before."[79]

One of the most famous examples of the "charm" of skeuomorphism is the appearance of natural or simulated wood grain paneling on "woodie" automobiles in the 70s and 80s—functionally useless but recalling the material history of their antecedents. And while electronics with wood paneling were popular during this time, the material has made a comeback as handmade natural wood veneers and cases for laptops and mobile phones. Even in the age of bionic technology, there is a certain nostalgia for the handicraft of the past—styles that are, ironically, made possible by new material technologies. After all, a leg made out of actual glass or porcelain, like the above mentioned "Floral Leg," would be completely impractical as an everyday prosthesis, but artistic mimicry makes the effect possible and gives the limb a surreal

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[77] Hayles, N. Katherine. *How We Became Posthuman: Virtual Bodies in Cybernetics, Literature, and Informatics*. Chicago, IL: University of Chicago Press, 1999. (p. 17)
[78] McLuhan, Marshall. "Playboy Interview: A Candid Conversation With The High Priest of Popcult and Metaphysician of Media." In *Essential McLuhan*, edited by Eric McLuhan and Frank Zingrone, 233-69. New York, NY: Basic Books, 1995. (p. 238)
[79] Simmel, Georg. "Fashion." (p. 557)

quality. This allows for interesting plays between the old material environment of the human body and new environment of the artificial limb. The concept of the skeuomorph also applies to prosthetics that incorporate wood, leather, lacey lattices, nonfunctional mechanical parts and even artificial human skin. Here, familiar textures and forms—what Ferebee calls "ornamental idioms"[80]—are re-appropriated as decoration.

In Seary's case, the "functional" elements represented here are human bone and muscle. What were once the structural components of the human leg have become decoration—artificial musculature boldly transformed into a sculptural work of art. Overall, Seary's alternative limb has a unique mixed-media appearance, and looks almost as if it's in a constant state of explosion. The leg begins with a near perfectly realistic-looking foot that wraps around the bottom of the prosthesis like a slipper. The surface of the "sock" area features a black and white drawing of what would be the underlying foot anatomy. Moving upward from the mechanical ankle joint, the lower leg strut is decorated in a bonelike covering, teased out in a weblike manner. Appearing to hover around this central strut are several panels shaped like human leg muscles, painted in various shades of blue with bright reddish-orange interior surfaces. The front of the leg features a white tibia-shaped plate that runs from knee to ankle like a strip or armor. The panels have a slightly translucent quality, and their shaded, textured finishes appear like fine pieces of stained glass when struck by the light. The mechanical knee joint features a sculpted bonelike cover with the details "drawn on" like on the foot, making it seem as if Seary's leg is slowly fading out of existence, layer by layer, like H. G. Wells' "Dr. Griffin" in the 1987 *The Invisible Man*. Only small bits of the original prosthesis, which is attached to a shimmering blue thigh socket, reveal themselves in the seams of the alternative covering.

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[80] Ferebee, Ann. *A History of Design from the Victorian Era to the Present*. (p. 8)

One of the newest works featured on the site is called the "Bloomsbury Droid." The removable covering, worn by above-the-knee amputee Veronika Pete over her Genium Microprocessor Leg, is made of "3D printed nylon, stainless steel, Lacquer and hydro dip film."[81] Out of all of the limbs on the site, it is the most "futuristic" looking, with precise, architectural lines and curves that give off the appearance of precision machinery. The leg features a silver and gunmetal finish with black accents, broken only by the continuous panel-lines and circular details that trace across its smooth surface. Pete herself is seen in all black with a charcoal skirt, demonstrating the leg's overall elegant appearance while letting it stand out as a focal point.

In describing the "spectacular construction" of prosthetic technologies, Sandy Stone writes that "The traditional approach to representations of technology in popular culture…is technology as sleek, gleaming, seamless, efficient." According to Stone, this creates "a phantasmatic interiority in tension with the perspicuous surface," in which the "interior space of technology is heightened in its mystery and allure."[82] This tension between surface and the interior is seen in photographs of Pete modeling the leg, where the mechanical joints of the underlying prosthesis are exposed by the gaps in the alternative covering. While these gaps are necessary to maintain full articulation, this tension between smooth carapace and articulating innards adds mystery and gives it a mechy appearance that seems right out of popular science fiction or Japanese animation. Furthermore, the back of the leg has a little panel that opens to revealing a compartment, evoking a transforming thruster on a fantasy robot.

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[81] "Bloomsbury Droid." The Alternative Limb Project. 2014. Accessed August 10, 2015. http://www.thealternativelimbproject.com/project/bloomsbury-droid/.

[82] Stone, Sandy. "Split Subjects, Not Atoms; Or, How I Fell in Love with My Prosthesis." In *The Cyborg Handbook*, edited by Chris Hables Gray, Steven Mentor, and Heidi J. Figueroa-Sarriera, 393-406. New York, NY: Routledge, 1995. (p. 398)

A video detailing Pete and her leg is featured on the *YouTube* page for Cybersalon, an organization dedicated to thinking about the future of technology. As she describes the design and construction of the leg, we see footage of all of the various stages of design, manufacturing, and assembly: "It's going to be very much cyborg-inspired. It'll be a nice metallic finish. It will have a nice little secret compartment, and a little button that allows it to light up, so I'm going for the very futuristic, cyborg look." According to Pete, she didn't want to pretend that it was her own leg. The alternative covers allowed the electronic leg to be "completely true to itself" as an "electronic leg," although "a very cool one, and a very futuristic one." For Pete, the cosmetic additions therefore become:

> "… a way of expressing yourself, and a way of expressing perhaps your confidence about the leg. And the fact that you're not, you don't want to hide it, you want to show it off. And it's a piece of body art, really."[83]

The concept of the "Bloomsbury" leg at once being "true to itself" and a form of personal expression also suggests a certain double-*physiognomy* at play. The *Oxford English Dictionary* generally defines physiognomy as "the study of appearance," specifically "the features of the face, or of the form of the body generally, as being supposedly indicative of character."[84] In *Bodies and Machines*, Mark Seltzer also describes physiognomy as a "natural 'fit' between outer face and private interior…that effectively coordinates outside and inside, public and private, such that each points to the other."[85] Thus, the high-tech electronic leg underneath—amazing in its functional ability—must look suitably futuristic on the outside, in turn matching the way in which Pete sees herself in futuristic terms, rebranded as an enhanced cyborg.

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[83] CybrSalon. "Veronika Pete - Human 2.0 (27 February 2014)." YouTube. March 13, 2014. Accessed August 10, 2015. https://youtu.be/xzCFRVeM1yk.
[84] "Physiognomy, N." OED Online. June 2014. Accessed June 22, 2014. http://www.oed.com/view/Entry/143159.
[85] Seltzer, Mark. *Bodies and Machines*. New York: Routledge, 1992. (p. 76)

This trend of embracing mechanical style in alternative limb design also exemplifies a "super" category of machine aesthetics that Brummett calls *functionalism*, "a feeling that form (or the appearance and feel of the machine) should follow function (or what it is that the machine was designed to do)." Here, "that which is functional is beautiful." However, while this is a basic tenet of technological development in general, Brummett notes that functionalism has itself become an aesthetic convention:

> The idea of functionalism was embraced but altered somewhat by many proponents of machine aesthetics in the nineteenth century who intentionally designed machines to ensure that their form, or appearance, suggested their function. This was true even when, paradoxically, there was no practical reason to do so. The aesthetic of functionalism thus became more important than functional qualities themselves.[86]

In describing functionalism as a kind of machine skeumorphism, Brummett notes that an object can still be mechanically or functionally beautiful "if it *appears* to suggest a certain aesthetically pleasing function rather than if it actually reveals its true function," such as in the case of "streamlining" everyday objects that are stationary and do not need to be aerodynamic.[87] A functionalist aesthetic therefore tends to makes prosthetic limbs look more "functional" than they are. This element of implied functionality–the use of machine aesthetics to suggest technological capabilities—is what draws out the science fictional quality of designer prosthetic limbs like the "Bloomsbury" leg, allowing onlookers to imagine the purpose of every detail. Although the wearer won't fly away like a superhero, what's important to Pete and onlookers is that the leg *looks* like it is about to transform and sprout thrusters—because maybe one day it will.

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[86] Brummett, Barry. *Rhetoric of Machine Aesthetics.* (p. 16)
[87] Ibid. (p. 17)

At a Cybersalon event on February 27, 2014 called "Human 2.0 – Technologies of Enhancement," Pete demonstrated the work done to her leg to the public for the first time, explaining that "we are really looking to go into the cyborg look, and I'm fully embracing the fact that I'm kind of becoming a cyborg. It's definitely a better alternative to being disabled," a term that she thinks needs a "rebranding." She argues that thinking of oneself as "enhanced" or a "cyborg" helps with one's confidence as an amputee, focusing on one's capabilities. When asked if it was an "enhancement" or about the "aesthetics" she said that "it definitely gives you choices as an amputee." When asked how she's going to deal with the responses of audience members who are "desperate to look at the leg," she says that the attention is a "good thing."[88] Here, Pete fully embraces her status as a cyborg, and the idea that her prosthesis can allow her to become something super-human—a notion that disability scholars such as Kurzman and Siebers have previously been cautious about embracing. The readiness with which amputees such as Pete take up the cyborg label may indicate the generational shift towards the acceptance of technology as described by Mullins, or it may be the fact that prosthetic technology has advanced to such a degree that new limbs are increasingly closing the gap between actual reality and the imagined cyborg ideal.

3.4 ALTERNATIVE PROSTHETIC STYLE FOR THE ABLE-BODIED

In discussing the influence of alternative limb celebrities like Mullins, Eveleth Rose notes that "even if not every amputee gets or wants a spike leg or a feathery suit of armor or even the

[88] CybrSalon. "Veronika Pete - Human 2.0 (27 February 2014)."

curved cheetah leg, the fact that people see these alternative bodies out in the world seems to have helped push a cultural shift in how people think about normalcy."[89] However, as these types of "alternative" images arguably increase the acceptance and visibility of prosthetic limbs, they may also deflect attention from other representations of disability, and some scholars have argued that the increased visibility of alternative prosthesis-wearing celebrities can be counter-intuitive to the acceptance of people with disabilities in general. In discussing the media attention Mullins received for her modeling work, Marquard Smith argues that "her "becoming visible" as an eroticized Cyborgian sex kitten, while significant for the public presence of differently abled bodies in our visual culture takes place at the expense of her identity as an amputee, in fact requires the very negation of her figural condition as an amputee."[90] For Smith, "these images simply feed our culture's fascination with spectacles of difference, even if they do so in new ways.[91] In discussing normative ways of representing what she calls "extraordinary bodies," Rosemarie Garland-Thomson similarly notes that "Representation thus simultaneously buttresses an embodied version of normative identity and shapes a narrative of corporeal difference that excludes those whose bodies or behaviors do not conform."[92] These images may also create a new alternative "normal" in which those with the most advanced bionic limbs and stylish accessories are socially privileged over those who choose not to or cannot afford to wear them. Furthermore, as the disability rights movement maintains that one's physical body doesn't necessarily define one's inner sense of self, a central tenet of alternative prosthetics is that with

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[89] Eveleth, Rose. "Blueprint for a Better Human Body."
[90] Smith, Marquard. "The Vulnerable Articulate: James Gillingham, Aimee Mullins, and Matthew Barney." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 43-72. Cambridge, MA: MIT Press, 2006. (p. 47)
[91] Ibid. (p. 59)
[92] Garland-Thomson, Rosemarie. *Extraordinary Bodies.* (p. 7)

the help of new technologies we can refashion our bodies to our liking and present a "truer" sense of self.

While these competing discourses continue to play out in representations of alternative prosthetic technologies, they are further complicated—for better or worse—by the adoption of alternative limb fashions by able-bodied individuals. Throughout this chapter, various individuals involved with alternative prosthetics have described the "envious" nature of able-bodied audiences. As Sophie de Oliveira Barata herself notes in recounting how she used to experiment with her own prosthetic costume pieces, "I had a bit of envy, you know. I thought, why should it just be amputees that have prostheses?"[93] Coincidentally, the designer prosthetics movement, which has transformed prosthetic limbs into objects of high-fashion and pop-culture cool, has developed alongside cyborg-themed fashion and everyday clothing made to look like robotic limbs. As a result, the influence of prosthetics-as-fashion includes the able-bodied, and able-bodied individuals can adopt bionic styles even when there is no actual prosthetic technology present.

For example, on May 2, 2016, the 46th Metropolitan Museum of Art Costume Institute Benefit was held at the Metropolitan Museum of Art in New York City. Commonly known as the "Met Gala," the annual event is held to raise money for the Costume Institute and open the new spring exhibition. This year, tickets were $30,000 apiece, and over $12.5 million was raised for the museum. Known as the "party of the year," the invitation-only event features celebrity guests who pose for crowds of photographers on the red carpet (after which social media is

[93] Morin, Roc. "The Art of Designer Artificial Limbs."

banned). Celebrity attendees are often invited by a particular brand, wearing their clothes and serving as a kind of "advertisement."[94]

The theme of the 2016 exhibition was "Manus x Machina: Fashion In An Age Of Technology." According to the museum's webpage, the exhibition "explores how fashion designers are reconciling the handmade and the machine-made in the creation of haute couture and avant-garde ready-to-wear."[95] Attendees are encouraged—but not required—to dress according to the theme, resulting in some literal interpretations incorporating technological motifs. According to Vanessa Friedman's review in *The New York Times*, "Apparently, when designers think fashion and technology, they think Mr. Roboto. The predominant color of the evening was silver, and the predominant pattern was circuitry."[96] In the spirit of the theme, former One Direction member Zayn Malik appeared at the Met Gala wearing shining chrome "robot arms" over a black Versace suit. His girlfriend, supermodel Gigi Hadid, wore a Tommy Hilfilger gown with a metallic silver corset and similarly armored finger rings. According to Seamus Duff in the UK tabloid *Metro*, Malik "fully embraced the futuristic theme for the annual high fashion knees-up, appearing on the red carpet in a Versace suit complete with bionic arms," and caused a "complete meltdown" on the Internet.[97]

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[94] Friedman, Vanessa. "What Is the Met Gala, and Who Gets to Go?" The New York Times. May 02, 2016. Accessed July 28, 2016. http://www.nytimes.com/2016/05/03/fashion/what-is-the-met-gala-and-who-gets-to-go.html.
[95] "Manus X Machina." The Metropolitan Museum of Art. 2016. Accessed July 28, 2016. http://www.metmuseum.org/exhibitions/listings/2016/manus-x-machina.
[96] Friedman, Vanessa. "Reviewing the Met Gala Runway: 'Manus vs. Machina'." The New York Times. May 3, 2016. Accessed July 28, 2016. http://www.nytimes.com/2016/05/03/fashion/fashion-met-gala.html.
[97] Duff, Seamus. "Everyone Went into Complete Meltdown over Zayn Malik's Met Gala Robot Arms." Metro. May 03, 2016. Accessed July 30, 2016. http://metro.co.uk/2016/05/03/everyone-went-into-complete-meltdown-over-zayn-maliks-met-gala-robot-arms-5855732/.

According to Wilson, fashion is "a cultural phenomenon," or "an aesthetic medium for the expression of ideas, desires and beliefs circulating in society."[98] Likewise, Ferebee notes that designers combine "form, line, color, texture, and material" into stylistic "statements" that "provide a key to understanding the culture from which they emerge."[99] In the case of Malik, his armored arms are representative of a cultural obsession with depictions of technologically-enhanced bodies. On social media, images of the couple at the Gala trended immediately, with most fans comparing Malik to super-heroic cyborgs with robotic arms in popular culture. According to *Twitter* user "Meghan Camarena" (@Strawburry17), "Zayn went Full Metal Alchemist at the #MetGala AND I LOVE IT [heart eyes face] [hands raised emoji] but I think he needed shoulder pads too [blushing face]," a reference to Edward Elric, the titular cyborg character from the popular *Fullmetal Alchemist* manga and anime series.[100] User "luka fallback sabbat" (@whoisluka) juxtaposed photos of Malik with images of Genos, the full-body cyborg superhero from *One-Punch Man*, another popular manga and anime series, noting that "Zayn wanna be the lone cyborg so bad."[101] User "Amy" (@niamssalute) posted a picture of Malik alongside Bucky Barnes, the cybernetic silver-armed "Winter Soldier" in the "Marvel Cinematic Universe," asking their followers to vote for "Who wore it better"[102]—the "it," of course, referring to their shining metal arms. Likewise, "-¸` wiss ¸´-" (@HAVWKEYE) asked "is zayn trying to be the winter soldier or iron man."[103] Even the Bionic Model™ herself, Rebekah

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[98] Wilson, Elizabeth. *Adorned in Dreams: Fashion and Modernity*. (p. 9)
[99] Ferebee, Ann. *A History of Design from the Victorian Era to the Present*. (p. 8)
[100] Meghan Camarena (@Strawburry17). "Twitter Post." Twitter. May 02, 2016. Accessed July 30, 2016. https://twitter.com/Strawburry17/status/727336613018112000.
[101] Luka Fallback Sabbat (@whoisluka). "Twitter Post." Twitter. May 02, 2016. Accessed July 30, 2016. https://twitter.com/whoisluka/status/727346327252774913.
[102] Amy (@niamssalute). "Twitter Post." Twitter. May 02, 2016. Accessed July 30, 2016. https://twitter.com/niamssalute/status/727360755146723328.
[103] -¸` Wiss ¸´- (@HAVWKEYE). "Twitter Post." Twitter. May 02, 2016. Accessed July 30, 2016. https://twitter.com/HAVWKEYE/status/727321174561140736.

Marine, joked on *Instagram* that she was "Pretty sure @zayn is trying to steal my look from #NYFW 😂."[104]

Others pointed out that Malik looked like the character Jax from the popular *Mortal Kombat* fighting video game series, whose trademark characteristic is his powerful silver bionic arms. *Twitter* user "EMINIK OFFICIAL" (@EminikOfficial) declared "ZAYN IS OUR JAX FROM MORTAL KOMBAT #MetGala."[105] In an interview with *Dazed*, Malik explained how he came up with the idea for the costume himself, admitting that he was indeed inspired by the Jax character:

> "I wasn't really sure what to expect," says Malik. "I know it's a big deal in the fashion industry. Anna Wintour obviously runs the whole thing so it was an honour to even get to go. I was asked to design my own costume by Donatella Versace!" He lets out a laugh. "It was cool. I had seen a few people hitting me online, saying negative things about it. But I enjoyed it because they were saying I looked like a dude from *Mortal Kombat*, and it was actually based on a character (from the video game series), called Jax. He had metal arms, and the theme was technology, so I just took it from him... It's a bit easy to just dress up in a suit. I like to do things that are a bit outside of that."[106]

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[104] Rebekahmarine. "Instagram Photo by Rebekah Marine • May 2, 2016 at 2:03am UTC." Instagram. May 2, 2016. Accessed July 30, 2016. https://www.instagram.com/p/BE7XmQAO7-H/.
[105] EMINIK OFFICIAL (@EminikOfficial). "Twitter Post." Twitter. May 02, 2016. Accessed July 30, 2016. https://twitter.com/EminikOfficial/status/727290926125711361.
[106] Sandberg, Patrik. "Zayn Malik: Feel the Heat!" Dazed Digital. June 14, 2016. Accessed July 30, 2016. http://www.dazeddigital.com/music/article/31434/1/zayn-malik-collier-schorr-summer-issue.

An article on E! Online would later declare: "The Internet Was Right: Zayn Malik *Was* Trying to Look Like That Guy From Mortal Kombat at the Met Gala."[107]

Off the runway and the red carpet, mass-market products inspired by futuristic bionic limbs allow everyone to participate in the full commodification of custom prosthetic styles. For example, in 2014, Mitmunk, a Vancouver-based designed studio that specializes in printed clothing and accessories,[108] offered a line of "Bionic Leggings" featuring a metallic, robotic-themed design on their official Etsy shop. The leggings resembled the sci-fi machine aesthetics of a form-fitting suit of robotic armor, and came in a variety of colors and sizes for all body types, genders, and styles. For example, the product page for the "Siren Red" legs reads:

> Get your superhero on with MITMUNK's Bionic Leggings! The artwork is beautifully rendered and printed onto the fabric by the artist himself. Exposed wire, metal, and plastic are covered by vividly coloured armour plates. Reticulated steel is jointed together in a column down the back of the leg. The metal is masterfully shaded, making your bionic legs look long, sexy and shiny. A little bit Transformers, a touch of Iron Man, and a nod to the Power Rangers—but completely and uniquely MITMUNK. Create your own character and be the snazziest robot-human hybrid in these Bionic Leggings. Spectacular as a costume, and comfortable enough for activewear and bicycling. The online shop has

[107] Rankin, Seija. "The Internet Was Right: Zayn Malik *Was Trying to Look Like That Guy From Mortal Kombat at the Met Gala*." E! Online. June 14, 2016. Accessed July 30, 2016. http://www.eonline.com/news/772711/the-internet-was-right-zayn-malik-was-trying-to-look-like-that-guy-from-mortal-kombat-at-the-met-gala.
[108] MITMUNK. "About." MITMUNK. Accessed June 17, 2014. http://www.mitmunk.com/about/.

> categories for women's, men's, and unisex wear that these leggings are put into, but they can be worn by anyone who fancies the look![109]

As Wilson notes, fashion "can be a way of intellectualizing visually about individual desires and social aspirations."[110] Here, the Mitmunk leggings offer a means to fulfill one's desire to be the "snazziest robot-human hybrid," an answer to that often-cited phenomenon of able-bodied "envy" that appears in prosthetics marketing testimonials. With the Mitmunk leggings, the average person—who lacks the resources of a popular celebrity—can use mass fashion to partake in the chic style of designer prosthetic limbs without being a prosthesis-wearing amputee.

This type of "bionic fashion" is found in the Spring/Summer 2016 advertising campaign for German fashion designer Philipp Plein's eponymous "Philipp Plein" luxury brand. According to a description on the campaign's website, "With a focus on the futuristic and grungy elements of his mega production #PleinPunk fashion shows, PHILIPP PLEIN brings to life an abandoned, post-apocalyptic laboratory, complete with robot arms, strip lighting and Sci-Fi heroines." The gallery of promotional images features models wearing armor-like studded outfits that mix punk rock aesthetics with a futuristic monochrome sheen. Some of the images feature a model wearing a pair of mechanical arm extensions that fit over their hands like high-tech graspers. Resembling oversized bionic arms, the shining black and silver devices end in oversized mechanical hands, and the overall effect looks like the skeletal structure of the titular "Terminator" from the 1984 film. Out of the back of each arm, dozens of flowing cables connect to a generator-like backpack that resembles the exposed innards of a home computer. According

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[109] Mitmunk. "Bionic Leggings - Size S Siren Red - Printed Metal Robot Tights." Etsy. Accessed June 17, 2014. https://www.etsy.com/listing/153959466/bionic-leggings-size-s-siren-red-printed?ref=shop_home_active_6.
[110] Wilson, Elizabeth. *Adorned in Dreams: Fashion and Modernity*. (p. 9)

to a quote by campaign director and photographer Steven Klein, "The PHILIPP PLEIN Campaign this season is about the future as now, a new world of digital youth who transverse between one reality and another through attitude and apps."[111] Combining the aesthetics of the past, present, and sci-fi future, the fashion shoot reflects our contemporary fascination with bionic technologies and the tensions that arise at the intersection of bodies and machines.

However, while bionic aesthetics may have a universal cultural appeal, divorcing these technologies from disability can come into conflict with the actual experiences of amputees and people with limb differences. For example, in a December 2016 *Twitter* post, user "Grace Mandeville★" (@GraceMandeville), a London, UK-based lifestyle blogger and *YouTube* star with one hand shared photographs of an advertisement for the campaign, commenting: "How about you use a model with missing limbs, rather than sticking robot hands on someone with two hands."[112] Mandeville—who incidentally has a twin sister named Amelia—was born with her right arm ending just below the elbow, and is an advocate for people with limb differences. In March of 2015, she wore a custom-fitted 3D printed myoelectric arm studded with Swarovski crystal to the London "Wearable Technology Show." According to Mandeville, "being able to wear a creative prosthetic that shows who I am seems awesome- it's like a one off accessory that nobody else can wear, basically like vintage Chanel."[113] In response to Mandeville's *Twitter*

[111] "#PLEINPUNK PHILIPP PLEIN SPRING/SUMMER 2016 CAMPAIGN." Philipp Plein - Official Website. Accessed January 22, 2017. http://world.philipp-plein.com/en/philipp-plein-universe-campaign/4709/-pleinpunk-philipp-plein-spring-summer-2016-campaign.
[112] Grace Mandeville★ (@GraceMandeville). "Twitter Post." Twitter. December 12, 2016. Accessed January 22, 2017. https://twitter.com/GraceMandeville/status/808258977205288961.
[113] "A Bionic Model Is Born." Open Bionics. November 4, 2015. Accessed January 31, 2017. https://www.openbionics.com/blog/a-bionic-model-is-born.

post, bionic model Rebekah Marine (@rebekahmarine) retweeted it to Philipp Plein, describing the campaign as "horrible."[114]

These types of responses from public figures with limb differences—actual "bionic models"—reveal the meanings at stake in these types of depictions. On one hand, the oversized, futuristic arm props featured in the Philipp Plein campaign function less like bodily prostheses and more like armored exoskeletal extensions meant to be grasped like tools or weapons. The effect is to dramatically enlarge and expand rather than "fill in" the body envelope with artificial replacements, and the props in the campaign photos would arguably look much the same on amputees or people with limb differences—especially if they were wearing bionic arms and hands. However, the responses of people such as Mandeville and Marine indicate that for some amputees—and especially bionic models—bionic limbs have an intrinsic connection to disability and limb differences. Therefore, any attempt to divorce the two may be read as threatening to undo the meaningful work of people like Marine who challenge the bodily norms of the fashion industry. It also reveals how images of bionic prosthetic limbs and their users have become so ubiquitous in contemporary visual culture that they have become a symbolic form that can be read onto everything from leggings to an armored jacket to giant metallic hand sculptures.

Ultimately, this relationship between alternative prosthetic technologies and science fiction has not gone unnoticed by both makers of prosthetic limbs and the entertainment industry. In the next chapter, I examine key collaborations between makers of alternative prosthetic limbs and the entertainment industry. These science fiction-themed cross-promotions capitalize on the perceived similarities between real prosthetic technologies and analogous devices in science

[114] Rebekah Marine (@rebekahmarine). "Twitter Post." Twitter. December 12, 2016. Accessed January 23, 2017. https://twitter.com/rebekahmarine/status/808309598499258368.

fiction, creating alternative limb enhancements “fashioned” after fictional characters with bionic limbs in film, comics, and video games. This brings media attention to the alternative prosthetics industry while simultaneously marketing new entertainment properties featuring these technologically-enhanced characters.

4.0 FROM "IRON MAN" ARMS TO "PHANTOM" LIMBS: MARKETING PROSTHETICS AS SCIENCE FICTION COOL

Science fiction has often served as a way for writers to help make sense of technological developments. It has also provided developers of prosthetic technologies with a way to market advanced bionic limbs. In 2007, when Scottish prosthetics company Touch Bionics launched the i-limb, it was advertised as "the world's first bionic hand."[1] On July 25, 2007, *USA Today* featured an article about one of the first recipients of the prosthesis, retired United States Army sergeant Juan Arredondo. According to the story, Arredondo lost his lower-left arm on Feb. 28, 2005 after a roadside bomb tore through the left side of his vehicle while on patrol in Iraq. The United States Department of Defense paid for Arredondo's $65,000 i-Limb prosthesis, which was provided by Hanger Prosthetics and Orthotics (now called the Hanger Clinic). Arredondo's first generation i-limb was equipped with myoelectric sensors that translated electrical signals from the nerves in his upper arm into smooth motor movement, operating the five fully-articulated digits on the robotic hand. After seeing the hand—which sported a green and khaki digital camouflage arm attachment—Arredondo's four-year-old son Diego reportedly told his

[1] Touchbionics. "Terminator Hand Hits North America." YouTube. July 18, 2007. Accessed June 20, 2014. http://youtu.be/5MkJk6797mI.

father that he was "half robot, half man," and both Diego and his ten-year-old sister Rose were said to delight in the robotic hand's ability to safely remove snakes from the backyard.[2]

In a promotional video from the Hanger Clinic, Arrendondo says that when he first saw the hand move he thought that it looked and sounded like the titular cyborg from the 1984 film *The Terminator*, adding that it "really looks futuristic."[3] A version of the interview featured on Touch Bionics' own *YouTube* page is appropriately titled "Terminator Hand Hits North America," an official endorsement of the i-limb's science fictional qualities. In response, user "FluffyFooFookins" notes in the video's comments section: "You know if they one day manage to perfect terminator esque hands. People will probably be chopping their real hands off to get one." However, user "diongwi" takes a more critical tone, sarcastically commenting: "lose a limb during an oil war? no problem here's a stronger faster one now get back out there!"[4] Here, the functional and aesthetic characteristics of the real-world i-limb are compared to similar devices depicted in popular science fiction, highlighting its futuristic and extra-ordinary—and potentially dangerous—qualities. On one hand, the i-limb is presented as the material realization of what used to be science fiction—an achievement of human imagination combined with technological prowess. Yet its uncanny resemblance to certain science fiction technologies also makes it appear more unreal or "futuristic," seeming to exist on the edge of reality and fantasy. In other words, science fiction cool.

These themes are prevalent in media coverage of new bionic technologies, which regularly includes references to their supposed science fiction-ness. For example, in an article on

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[2] Yahalom, Yali. "Iraq War Amputee's Bionic Hand Moves All Five Fingers." USA Today. July 25, 2007. Accessed June 20, 2014. http://usatoday30.usatoday.com/tech/news/techinnovations/2007-07-19-bionic-hand-amputee_N.htm?csp=34.
[3] Hanger News. "Hanger Clinic Patient Juan Arredondo Using the ILimb Prosthesis." YouTube. March 29, 2012. Accessed June 20, 2014. http://youtu.be/i2tK2yAOQgU.
[4] Touchbionics. "Terminator Hand Hits North America."

The Daily Beast on April 16, 2016 surveying new advances in bionic technologies, author Joelle Renstrom declares that "Cyborgs Aren't Just for Sci-Fi Anymore."[5] And in a May 4, 2016 article on science news site *Phys.org*, a new computer control system for bionic hands being developed at Simon Fraser University is said to be part of a new generation of prostheses that were "once the stuff of science fiction."[6] Likewise, a May 12, 2016 article on *Gizmodo* titled "DARPA's Mind-Controlled Arm Will Make You Wish You Were a Cyborg" discussing Johnny Matheny's work with the Modular Prosthetic Limb developed by the Johns Hopkins Applied Physics Laboratory and DARPA notes that "Pairing an artificial limb with a [sic] organic brain is a dream straight out of science fiction, something DARPA proudly acknowledges."[7]

Due to their extra-human functionalities, imaginative designs, and/or association with other "futuristic" technologies such as 3D modeling/printing and new materials, alternative prosthetic limbs readily invite comparisons to science fiction. For example, on January 7, 2015, *Wired.com* featured an article on New York designer William Root and his alternative limb concept called "Exo." In the article, titled "3-D Printed Prosthetics That Look Fit for a Sci-Fi Warrior," Joseph Flaherty notes that Root's Exo concept "brings video game styling to the design of prosthetics," creating "super-lightweight prosthetic legs with stealth styling."

According to Root, "With prostheses you are essentially designing a person, their body already dictates the form," and he believes that "Each leg needs to be as unique as its owner." According to the article, his method uses advanced body-scanning technologies to first create a custom-fit socket and then "extrapolate a 3-D model of patient's full leg which is turned into a

[5] Renstrom , Joelle. "Cyborgs Aren't Just for Sci-Fi Anymore." The Daily Beast. April 16, 2016. Accessed July 12, 2016. http://www.thedailybeast.com/articles/2016/04/16/cyborgs-aren-t-just-for-sci-fi-anymore.html.
[6] "Researchers Build a Better Bionic Hand." Phys.org. May 4, 2016. Accessed July 12, 2016. http://phys.org/news/2016-05-bionic.html.
[7] Stone, Maddie. "DARPA's Mind-Controlled Arm Will Make You Wish You Were a Cyborg." Gizmodo. May 12, 2016. Accessed January 13, 2017. http://gizmodo.com/darpas-mind-controlled-arm-will-make-you-wish-you-were-1776130193.

triangulated mesh." The resulting model is printed out of metal or high-strength plastic, and according to Root, "It has the maximum strength for the least amount of material with the added benefit of looking really slick."

Root's approach to design emphasizes the intimate and personal nature of prosthetic limbs while also promoting the benefits of alternative aesthetics. According to Root, "Prostheses are not aesthetically pleasing, extremely expensive, and difficult to produce." Furthermore, "Prosthetic limbs are stigmatized because they are so inhuman; most aftermarket companies that try to address this problem attempt to create a realistic-looking leg, which crosses into the uncanny valley." His solution is a unique combination of naturalness and science fiction-inspired design that is based on the wearer's own anatomy yet makes no effort to replicate a human-looking limb.

A photograph provided by Root illustrates one of his designs—a black wireframe scaffolding in the approximate shape of a low-polygon lower left leg that bridges the space between a specialized knee and ankle joint. With no central pylon running through the center of the leg, the open space in the middle of the limb makes it look as if one is hovering above the ground. The design appears functional yet perilous at the same time, and Root notes that further development is needed to ensure that the prostheses can support the full weight of their wearer. According to Flaherty, "The result is a jet black prosthetic made from sintered titanium powder or high-strength plastic that makes the wearer look as if they're materializing from a video game."[8]

[8] Flaherty, Joseph. "3-D Printed Prosthetics That Look Fit for a Sci-Fi Warrior." Wired.com. January 7, 2015. Accessed July 12, 2016. http://www.wired.com/2015/01/3-d-printed-prosthetics-look-fit-sci-fi-warrior/.

In recent years, this science fiction rhetoric has coincided with a number of direct collaborations between makers of alternative prosthetic limbs and the entertainment industry. These science fiction-themed cross-promotions capitalize on the perceived similarities between real prosthetic technologies and analogous devices in science fiction, "materializing" in the form of alternative limb enhancements modeled after fictional characters with bionic limbs in film, comics, and video games. These officially-sponsored projects pair artistic and technical sophistication with rhetorically-savvy media campaigns, positioning these alternative limbs as the "real" versions of the bionic limbs worn by popular film and game characters. This brings media attention to multiple spheres of the prosthetics industry while simultaneously marketing new entertainment properties featuring these technologically-enhanced characters.

However, it is important to consider the limits to thinking about prosthetic technologies as science fiction, since these limitations raise a series of questions: What does it mean for human prostheses—and a human body—to be "futuristic?" Or, at what point at the intersection of form and function is one suitably similar to the Terminator? And just how can morally ambivalent depictions of technology—such as those found in *The Terminator*—still be utilized to articulate an overall positive outlook on advanced prosthetic technology? After all, there is an inherent contradiction in comparing a new robotic hand that dramatically increases the user's quality of life to a cybernetic organism designed to hunt down and destroy human targets or the military gear worn by a video game mercenary.

In the previous chapter, I discussed how alternative limbs such as the "Bloomsbury Droid" incorporated elements of science fiction aesthetics into their design. In this chapter, I examine two well-publicized collaborations between prosthetics manufacturers and the entertainment industry in order to market prosthetic limbs as science fiction cool. Ultimately, I

explore how science fiction provides developers, users, and general audiences with a common pop-culture frame of reference for assessing the value of alternative bionic devices. In this way, science fiction continues to serve as a preeminent medium for shaping everyday discourses on the role of technology in society. This merging of science fiction and prosthetics reveals how technology is increasingly understood in terms of science fiction metaphors, and how images of high-tech bodies are constructed as objects of desire in the media.

4.1 "BUILDING IRON MAN": MAKING SCIENCE FICTION REAL

First appearing in 1963's *Tales of Suspense* #39, the Marvel Comics superhero "Iron Man" has become a symbol of cutting-edge robotic technology in popular culture. According to the character's official *Marvel Universe Wiki* page, Iron Man's alter ego, Anthony Edward "Tony" Stark is "'a cool exec with a heart of steel'" who becomes "the invincible Iron Man, fighting for justice as a modern day knight in high-tech armor."[9] The *Marvel.com* bio for Iron Man briefly summarizes the character's origin story:

> Wounded, captured and forced to build a weapon by his enemies, billionaire industrialist Tony Stark instead created an advanced suit of armor to save his life and escape captivity. Now with a new outlook on life, Tony uses his money and intelligence to make the world a safer, better place as Iron Man.[10]

Stark's transformation into the super-heroic Iron Man is the product of medical technology. While in captivity, he first develops an electromagnetic device to prevent metal shrapnel in his

[9] "Iron Man (Anthony Stark)." Marvel Universe Wiki. Accessed August 18, 2015. http://marvel.com/universe/Iron_Man_(Anthony_Stark).
[10] "Iron Man." Marvel.com. Accessed August 18, 2015. http://marvel.com/characters/29/iron_man.

chest from penetrating his heart—a supercharged reactor that serves as the literal "heart of steel" powering his robotic suit of armor. As a superhero without superpowers, Tony Stark continues to utilize his expert knowledge of computers and mechatronics—and access to vast material resources—to construct increasingly sophisticated robotic suits of armor that aid him in his fight to protect the world.

Iron Man/Tony Stark made his cinematic debut in the self-titled *Iron Man* (2008), with actor Robert Downey Jr. in the lead role. The film was followed by two sequels, *Iron Man 2* (2010) and *Iron Man 3* (2013), and the "Iron Man" franchise has collectively grossed over $2 billion worldwide. Today, Iron Man is known internationally as a central pillar of the "Marvel Cinematic Universe" (MCU), the crossover film series produced by Marvel Studios based on Marvel's own comic book properties. The character has subsequently been featured in the team-up movie *The Avengers (2012)* and its sequel *Avengers: Age of Ultron* (2015), and most recently appeared in a feature role in *Captain America: Civil War* (2016).[11]

As "A Self-Made Superhero"[12] embodying the entrepreneurial spirit of the independent inventor, Iron Man/Tony Stark serves as a recurring metaphor for technological innovation, especially in the area of robotics. For example, on February 25, 2014, at a White House event celebrating innovations in manufacturing, President Barack Obama compared these developments to the super-heroic technologies featured in popular comic books, playfully declaring:

> Today I am joined by researchers who invent some of the most advanced metals on the planet, designers who are modeling prototypes in the digital cloud, folks

[11] Grauso, Alisha. "On This Day Eight Years Ago 'Iron Man' Was Released, Changing Marvel Studios Forever." Forbes. May 2, 2016. Accessed July 14, 2016. http://www.forbes.com/sites/alishagrauso/2016/05/02/on-this-day-8-years-ago-iron-man-was-released-to-change-marvel-studios-forever/#6b0fe5651beb.
[12] "Iron Man (Anthony Stark)." *Marvel Universe Wiki*.

> from the Pentagon who help to support their work. Basically I'm here to announce that we're building Iron Man. I'm gonna blast off in a second.[13]

Similarly, in a March 4, 2014 article in *Nature* titled "Iron Man-like exosuit could expand ocean exploration," Larry Greenemeier reports on a new fully-articulated "Iron Man-like cast aluminum alloy dive suit" designed to offer deep-sea divers "a freedom of movement impossible to achieve in even the most nimble submersible."[14] In a May 13, 2016 article on *CNET* titled "Hyundai is building a real-life Iron Man suit, minus boot jets and hand repulsors," Gael Fashingbauer Cooper details a new wearable robotic exoskeleton developed by Hyundai for "factory workers, soldiers, and people with disabilities." While "the suit has none of Tony Stark's sass and style," she declares that "Iron Man-style wearable robot suits are coming."[15] Likewise, in an August 1, 2016 *ABC News* story on a computer-controlled exoskeleton developed by biophysicist Hugh Herr, author Justine Quart writes that "While it might not have the flash and bulk of Iron Man's suit, the exoskeleton can easily be worn outside of clothing and enables the user to run or walk with less energy through novel electromechanics." Quart concludes that "what seems like science fiction today could be our reality tomorrow." To complete the metaphor, a video segment that accompanies the article is advertised with the headline: "Does Our Future Look Like A Scene From 'Iron Man'?"[16] And an October 25, 2016 article in the *New*

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[13] CNN. "Obama: 'We're Building Iron Man'." YouTube. February 25, 2014. Accessed August 18, 2015. https://youtu.be/77pnVFLkUjM.

[14] Greenemeier, Larry. "Iron Man-like Exosuit Could Expand Ocean Exploration." Nature.com. March 4, 2014. Accessed August 03, 2016. http://www.nature.com/news/iron-man-like-exosuit-could-expand-ocean-exploration-1.14822.

[15] Cooper, Gael Fashingbauer. "Hyundai Is Building a Real-life Iron Man Suit, minus Boot Jets and Hand Repulsors." CNET. May 13, 2016. Accessed July 13, 2016. http://www.cnet.com/news/hyundai-is-building-a-real-life-iron-man-suit-though-with-no-boot-jets-or-hand-repulsors/.

[16] Quart, Justine. "The New Bionic Man: How Hugh Herr Is Changing Lives." ABC News. August 1, 2016. Accessed January 13, 2017. http://abcnews.go.com/Technology/bionic-man-hugh-herr-changing-lives/story?id=38824719. See also: ABC News. "Meet the Double Amputee Building the New Bionic Man." YouTube. October 01, 2016. Accessed January 13, 2017. https://youtu.be/vcBI_OusRJ8.

York Times covering the Pentagon's development of new "autonomous and semiautonomous" robotic weapons writes that "The weapons, in the Pentagon's vision, would be less like the Terminator and more like the comic-book superhero Iron Man," referencing an interview statement by deputy defense secretary Robert O. Work. According to the article, this would be "an arsenal stocked with the kind of weaponry that until now has existed only in Hollywood movies and science fiction."[17] E. Paul Zehr, Professor of Kinesiology & Neuroscience at the University of Victoria, British Columbia has even written a book titled *Inventing Iron Man: The Possibility of a Human Machine*, a "fun, direct, and parallel comparison of comic book science fiction with modern science" in which he "physically deconstructs Iron Man to find out how we could use modern-day technology to create a suit of armor similar to the one Stark made."[18]

Today, Iron Man serves as a fictional version of what Barry Brummett calls a "benchmark" machine. These are a culture's "paradigmatic machines" that "facilitate the experience of machine aesthetics."[19] When viewed as a paradigm of machine aesthetics, it explains why many technologies are often described as the "real-life" Iron Man—today's popular standard for high-tech robotics design. Iron Man's filmic appearances have become an imagined "benchmark" for what robotic technology can achieve in the future, influencing everything from Hollywood production design to the style of real-world technologies. The machine sensations that make Iron Man so celebrated include—thanks to a team of talented designers and special effects artists—the streamlined sheen of his polished metallic armor, the continually shifting joint panels and control flaps that make its hardened surface feel alive, the

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[17] Rosenberg, Matthew, and John Markoff. "The Pentagon's 'Terminator Conundrum': Robots That Could Kill on Their Own." The New York Times. October 25, 2016. Accessed January 13, 2017. https://www.nytimes.com/2016/10/26/us/pentagon-artificial-intelligence-terminator.html.
[18] Zehr, E. Paul. "The Book - Inventing Iron Man." Inventing Iron Man. Accessed July 15, 2016. http://www.inventingironman.com/.
[19] Brummett, Barry. *Rhetoric of Machine Aesthetics.* Westport, CT: Praeger Publishers, 1999. (p. 10-11)

mechtech tension between the suit's exterior plating and its complex inner mechanisms, and the augmented power and speed that transforms Tony Stark into a near-invincible superhero. This is guided by the advanced artificial intelligence and bionic control systems that make the armor respond as a seamless extension of his body. Like prosthetics that are simultaneously artificial yet phenomenologically incorporated into one's body, Tony Stark is Iron Man, and Iron Man is Tony Stark.

According to Brummett, "The rhetorical potency of the machine and its representations goes far beyond the cinema, of course. That potency is all around us."[20] Today, this more true than ever, as real-world machines increasingly resemble their science fiction counterparts. In other words, while it is the nature of science fiction to reference and expand upon the latest real-world technological developments, this is a reciprocal relationship, and science fiction often inspires the development of actual machines. For example, the U.S. Military has long utilized Iron Man in recruitment and public relations efforts involving the marketing of wearable robotic technologies. On September 27, 2010, defense contractor Raytheon Company issued a press release declaring that it had "unveiled its second generation Exoskeleton (XOS 2) at its research facility in Salt Lake City, Utah, during a demonstration with Paramount Home Entertainment." According to the document, "The XOS 2 was unveiled to coincide with September 28th release of *Iron Man 2* on Blu-ray and DVD from Paramount Home Entertainment."[21]

Iron Man 2 actor Clark Gregg, who plays Agent Phil Coulson in the film series, attended the demonstration. A video of the event on the Raytheon Company's official *YouTube* page is

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[20] Ibid. (p. 3)
[21] Raytheon Company. "Raytheon Unveils Lighter, Faster, Stronger Second Generation Exoskeleton Robotic Suit: Unveiling Coincides with Release of Marvel Studios' Iron Man 2 on Blu-ray and DVD." News release, September 27, 2010. Raytheon News Release Archive. Accessed August 04, 2016. http://raytheon.mediaroom.com/index.php?s=43&item=1652.

titled “Raytheon Company - Agent Phil Coulson Meets XOS 2.” The video opens with a montage of footage of Tony Stark donning one of his “Iron Man” armors from the film, intercut with close-ups of the exoskeleton’s articulating limbs and shots of it being operated by a human pilot. A title graphic slams onto the screen, declaring that this is “The Real *Iron Man 2*: Raytheon XOS2 Suit” in the film’s own font. The remaining minute and a half is a mini-documentary about the XOS 2 project, mixing together scenes from the film with shots of the XOS2 in action and Gregg’s own commentary as he stands in front of the machine:

> I think what appealed to a lot of people about *Iron Man* is that it feels within reach. A lot of the stuff that he's doing and is capable of, it feels like it can’t be too long until something that looks very very much like the Mark IV/Mark V armor is available. …I’m really excited about the kind of next level of this where you can kind of, run after somebody and then take flight.

The short video ends with an ad for *Iron Man 2* on home video, and a shot of Gregg donning the suit for the first time as he gives an effortless robotic flex for the camera—emphasizing that this is the “real-life” Iron Man.[22] The intended message of the video—which would be included with the film’s extra features—is echoed in the Raytheon press release, which notes that “Raytheon's Exoskeleton has been called the real ‘Iron Man’ suit because of its ability to enhance the wearer's strength and endurance in a way that is reminiscent of Tony Stark's high-tech suit in the films.”[23]

As a science fiction benchmark that has come to symbolize heroism through cutting-edge robotic technology, Iron Man also functions rhetorically as a key pop-culture enthymeme. According to Cara A. Finnegan, enthymemes are “arguments in which one or more premises are

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[22] Raytheon. "Raytheon Company - Agent Phil Coulson Meets XOS 2." YouTube. July 17, 2012. Accessed August 18, 2015. https://youtu.be/Ymlnk_PDwnc.
[23] Raytheon Company. *Raytheon Unveils Lighter, Faster, Stronger Second Generation Exoskeleton Robotic Suit*.

suppressed or assumed." Enthymemes rely on an audience's "tacit social knowledge," something that "everybody knows."[24] J. Anthony Blair notes that visual arguments in particular are usually enthymemes, or "arguments with gaps left to be filled in by the participation of the audience."[25] Therefore, when the president, military contractor, or celebrity actor suggests that something is "like Iron Man," the statement—especially if it's accompanied by a visual comparison—capitalizes on the fact that "everybody knows" of Iron Man's technological sophistication, slick aesthetics, self-made ethos, and moral virtue.

It is no surprise then that Iron Man's cultural influence extends to the world of custom prosthetics, where the self-made nature of Tony Stark's exoskeletal armor—originally designed as assistive technology—serves as a fitting sci-fi benchmark for wearable robotic technology. For example, in a February 1, 2013 article on *CNN.com* titled "The bionic hand with the human touch," George Webster asks: "What do will.i.am and Iron Man have in common? They're both rather partial to bionic limbs." In describing will.i.am's futuristic-themed music video for "Scream and Shout," which features a clearly-labeled black i-limb ultra, Webster notes that "a human hand can be glimpsed clasping what appears to be a sophisticated robot hand stolen from the set of a high-budget sci-fi film."[26] And according to Sophie de Oliveira Barata from the Alternative Limb Project, "A lot of the men want to look like some kind of superhero—loads of Iron Man requests."[27]

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[24] Finnegan, Cara A. "Recognizing Lincoln: Image Vernaculars in Nineteenth-Century Visual Culture." In*Visual Rhetoric: A Reader in Communication and American Culture*, edited by Lester C. Olson, Cara A. Finnegan, and Diane S. Hope, 61-78. Los Angeles: Sage Publications, 2008. (p. 63)

[25] Blair, J. Anthony. "The Rhetoric of Visual Arguments." In *Defining Visual Rhetorics*, by Charles A. Hill and Marguerite H. Helmers, 41-61. Mahwah, NJ: Lawrence Erlbaum, 2004. (p. 52)

[26] Webster, George. "The Bionic Hand with the Human Touch." CNN. February 1, 2013. Accessed August 20, 2016. http://www.cnn.com/2013/02/01/tech/bionic-hand-ilimb-prosthetic/.

[27] Morin, Roc. "The Art of Designer Artificial Limbs." The Atlantic. January 15, 2014. Accessed June 18, 2014. http://www.theatlantic.com/health/archive/2014/01/the-art-of-designer-artificial-limbs/282800/.

A recent engagement between the Iron Man character and the world of alternative prosthetics dramatically demonstrates the rhetorical power of science fiction enthymemes. In 2014, Albert Manero, a Fulbright scholar and doctoral student in mechanical engineering at the University of Central Florida, founded Limbitless Solutions to build "affordable, bionic, 3D-printed arms" and then make the designs available for others to use for free.[28] According to their mission statement, "Limbitless Solutions is a non-profit organization devoted to bringing volunteers and technology to the kids who need it most." They "use additive manufacturing to advance personalized bionics and solutions for disabilities" and "believe that no family should have to pay for their child to receive an arm."[29] In 2015, the volunteer group partnered with Microsoft's Collective Project, a media series "Empowered by Microsoft's OneNote" that showcases "students working together to improve the world" and "celebrates the journey of ideas into action, with ways for people to learn more and get involved." [30] The goal of the project was to design and build a custom 3D printed Iron Man-inspired prosthetic arm, which would then be presented to a child by "Iron Man" himself, actor Robert Downey Jr. According an official news post on *Marvel.com* titled "Robert Downey, Jr. & Limbitless Solutions Deliver Iron Man-Inspired Bionic Arm":

> The folks at Microsoft OneNote, the Collective Project, and Limbitless Solutions have brought a piece of the Marvel Cinematic Universe to life with the creation of

[28] Ho, Vanessa. "The Collective Project: Changing the World with Bionic Arms for Kids." The Fire Hose. February 18, 2015. Accessed May 10, 2015. http://blogs.microsoft.com/firehose/2015/02/18/the-collective-project-changing-the-world-with-bionic-arms-for-kids/.
[29] Limbitless Solutions. "Mission - Limbitless." Limbitless Solutions. Accessed August 04, 2016. http://limbitless-solutions.org/index.php/mission/.
[30] Ho, Vanessa. "The Collective Project."

> a fully-functional 3D printed bionic arm modeled on Iron Man's own gauntlet--and one lucky kid met with Robert Downey, Jr. to receive the arm for himself.[31]

That "lucky kid" was seven year old Alex Pring, and on March 12, 2015 at 9:00 AM, Downey Jr. posted on his *Twitter* account that he was: "Honored to present a bionic #IronMan arm to Alex through @MSOneNote's #CollectiveProject. Check the Bowtie. #dapper."[32] Embedded in Downey Jr.'s post is a video produced for Collective Project documenting the event. The video, titled "The Collective Project: Robert Downey Jr. Delivers a Real Bionic Arm," was hosted on the official Microsoft Office *YouTube* channel. According to the description, "Robert Downey Jr. and Albert Manero, a #CollectiveProject student who founded Limbitless, surprised a very special child with a new bionic 3D printed arm at no cost to the family." The video begins with Downey Jr. waiting in a hotel room, dressed in a blue pinstriped suit with thick-rimmed glasses—in character as Tony Stark from the *Iron Man* film series.

A title card at the beginning of the video invites the viewer to "Meet Alex, a seven-year-old boy who loves superheroes and riding his bike. He was also born with a partially developed right arm." We see Alex stepping off of the elevator with his family, with a curious and excited expression on his face. Three additional intertitles continue the story: "And Albert Manero, a college student who builds and donates low-cost, 3D-printed bionic limbs to kids around the world."; "For the last two weeks, Albert has been asking for support as part of the #CollectiveProject."; "A leading bionics expert heard his story and wanted to help." Of course, this "bionics expert" is Downey Jr. as Tony Stark, aka The Invincible Iron Man.

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[31] Strom, Marc. "Robert Downey, Jr. & Limbitless Solutions Deliver Iron Man-Inspired Bionic Arm." Marvel.com. March 12, 2015. Accessed April 29, 2016. http://marvel.com/news/movies/24248/robert_downey_jr_limbitless_solutions_deliver_iron_man-inspired_bionic_arm.

[32] Robert Downey Jr (@RobertDowneyJr). "Honored to Present a Bionic #IronMan Arm to Alex through @MSOneNote's #CollectiveProject. Check the Bowtie. #dapper Https://t.co/lhLG5g1RP8." Twitter. March 12, 2015. Accessed May 10, 2015. https://twitter.com/RobertDowneyJr/status/576050125983739904.

When Alex enters the room, Downey Jr., in character as the eccentric inventor, greets the child with a handshake: “Hey Alex, how are ya? Pleasure to meet you. I’m another bionics expert on hands so I thought I’d drop by.” A stunned Alex replies “Thank you,” to which Downey Jr. replies: “Yeah, it’s a pleasure. Nice bow tie, by the way.” After a brief greeting, Downey Jr. presents the Limbitless arm to Alex, maintaining the theatricality of the encounter: “Well, I thought I’d bring uh, one of my gauntlets, and match it up with yours, and uh, see if everything’s copacetic. You wanna have a look?” “Sure,” says Alex, and Downey Jr. sits next to him on a sofa. In front of each of them is a large, silver case branded with the “Stark Industries” logo.

Downey Jr. is shown opening the cases, revealing Alex’s new arm on the right, and a prop arm from an *Iron Man* movie suit on the left. “Each one looks the same,” notes Alex.” To which Downey Jr. comments: “Actually, I think yours might be better than mine. What do you say we um, we both try em on, do a progress report?” Alex agrees, and we then see a shot of him turning to his family, with Downey Jr.’s hand on his shoulder. Both are smiling. “Do you know who that is?,” asks someone from off-screen. “Iron Man,” replies Alex, as Downey Jr. gives a small fist-pump celebration in the background. We then see Alex wearing his “Iron Man” arm as the hand closes with a mechanical whirr. “God, dude, it’s even cooler than I thought,” comments Downey Jr., as his sits down next to Alex, wearing his own prop mechanical arm. “I’m having a technical glitch,” he says, waving his costumed hand around as a light in the palm blinks off and on, “Um, as you can see, my light isn’t working.” Here, Downey Jr. offers a subtle gesture of encouragement that seems to suggest the difficulties Alex may encounter with prosthetics in the future, describing these challenges in terms of the malfunctions he (Tony Stark) often encounters while developing his “own” technologies: “Half the time, you know, I design one of these, it

winds up breaking on me, but what I do is I keep workin on it, kind of like you're workin on it with Albert." "He keeps workin and workin until he gets it right," responds Alex. Stark then begins to explain why Alex's arm is superior: "Yeah. I think yours is still a little bit more right than mine, because at least, you know…" "The lights work," finishes Alex." "Your light works, yeah," says Downey Jr., defeated by the child's wit.

As the two reach out and hold their robotic hands together, Downey Jr. comments: "Ah, look at that then, it's a marriage of robotic technologies." The video ends with Downey Jr. giving Alex a fist bump, declaring: "Bang, nailed it. Love it." Downey Jr. congratulates Albert for making the technology "so affordable" (the limb cost only $350 in materials), joking that this is much cheaper than the cost of one of his Iron Man suits, which are—in fictional values—about "a billion and a half dollars."[33]

Like in the Raytheon video for *Iron Man 2*, it doesn't matter that the technology being presented isn't as capable as the fictional version. What is important is the symbolic value of Iron Man and what devices such as the Limbitless arm mean to their wearers. For Alex, there is a sense of pride in his new arm, made even better by the ability to meet one of his heroes and bond over their shared love of technology—even though their relationship to their respective "Iron Man" arms differs on a fundamental level. For Limbitless Solutions, it is an incredible opportunity to promote their volunteer work, demonstrating how alternative prosthetic limbs need not always be expensive haute couture—they are quite literally more affordable "alternatives" to traditional prosthetic limbs that cost tens of thousands of dollars. Furthermore, these types of emotional stories that include children, prosthetics, and pop culture tend to trend widely, contributing to the visibility of alternative limbs. As of August 4, 2016, Robert Downey

[33] Officevideos. "The Collective Project: Robert Downey Jr. Delivers a Real Bionic Arm." YouTube. March 12, 2015. Accessed May 10, 2015. https://youtu.be/oEx5lmbCKtY.

Jr.'s original *Twitter* post has 37,573 retweets and 42,185 favorites.[34] A similar post promoting the project on Robert Downey Jr.'s *Facebook* page has received over one million likes, 926,175 shares, and the embedded video has been viewed over 43 million times. In his post, Downey Jr. thanks Manero, OneNote, and the Collective Project "for their work making artificial limbs like this more affordable for families with kids who want to show the playground how badass they are."[35] The scene presented in the video is undeniably touching, and groups such as Limbitless Solutions do important work in offering children the option of affordable, customized bionic limbs. However, this combination of sentimentality, celebrity, and "badass" technological innovation demonstrates the rhetorical potency of science fiction as a means to elevate depictions of prosthetics to the mainstream.

4.2 "METAL GEAR MAN": THE METAL GEAR SOLID V PHANTOM LIMB PROJECT

According to Ann Ferebee, "The modern industrial designer decorates everyday consumer goods with symbols in order to express the aspirations of today's culture."[36] In recent years, these aspirations have included the desire for prosthetic technologies to be more like popular science fiction. As a result, the Limbitless Solutions/Microsoft "Iron Man arm" project is just one example in a series of recent collaborations between prosthetics manufacturers and the

[34] Robert Downey Jr (@RobertDowneyJr). "Honored to Present a Bionic #IronMan Arm to Alex.
[35] Downey, Robert, Jr. "Facebook Post." Facebook. March 12, 2015. Accessed August 20, 2015. https://www.facebook.com/robertdowneyjr/videos/406208302880974/.
[36] Ferebee, Ann. *A History of Design from the Victorian Era to the Present: A Survey of the Modern Style in Architecture, Interior Design, Industrial Design, Graphic Design, and Photography*. New York: Van Nostrand Reinhold, 1970. (p. 99)

entertainment industry intended to make science fiction "real." In 2015, video game publisher Konami Digital Entertainment partnered with Sophie de Oliveira Barata and her company, the Alternative Limb Project, on the jointly-produced "Phantom Limb Project." The goal of the project, which was initiated by Konami, was to design and build an alternative prosthetic limb inspired by the one worn by the main character in Konami's 2015 blockbuster video game, *Metal Gear Solid V: The Phantom Pain*. According to an official Konami press release announcing the collaboration, Konami would work with de Oliveira Barata and "and a team of engineers, roboticists and product designers, to produce a highly stylized and multi-functional limb for 25-year-old James Young, drawing from the Metal Gear Solid aesthetic." Young, who lost an arm and leg in a train accident, is described as an "amputee gamer" who is "extremely adept at playing games one-handed, and was carefully selected by Sophie as a candidate comfortable with the idea of an eye-catching alternative limb and who would benefit from the capabilities it offered."[37]

On September 1, 2015 (September 2 in Japan), *Metal Gear Solid V: The Phantom Pain* was released worldwide for Microsoft Windows and the PlayStation 3, PlayStation 4, Xbox 360, and Xbox One video game consoles. Developed by Kojima Productions and published by Konami Digital Entertainment, the game is an open-world, action-adventure title and the final installment of the popular *Metal Gear Solid* video game series. Amputation and prosthetics are central to the game's themes, and some explanation of the game's story is necessary in order to understand the inter-textual significance of the Phantom Limb Project.

[37] Konami Digital Entertainment, Inc. "KONAMI WORKING WITH LEADING PROSTHETICS ARTIST TO PRODUCE BESPOKE LIMB FOR AMPUTEE GAMER." News release, November 10, 2015. Konami Digital Entertainment, Inc. Accessed August 05, 2016. https://us.konami.com/news/konami-working-with-leading-prosthetics-artist-to-produce-bespoke-limb-for-amputee-gamer/.

In the game, the protagonist, known by the code names “Big Boss” and “Venom Snake” (or “Snake” for short), is first introduced while confined to a bed in a hospital, having just awakened from a nine-year coma. In first-person view, the player is subject to an explanation of how Snake was injured in an attack, leaving shrapnel embedded in his head and resulting in the amputation of his lower left arm. He is given a minimally-functional “claw” type prosthesis shortly before the hospital is attacked by a special forces-styled military unit. Another patient helps him escape, and in third-person view, Snake is seen to stumble and crawl slowly as he tries to regain the use of his atrophied legs. Here, the player experiences the frustration of the character’s weakened condition through the gameplay—Snake moves slowly, the controls are sluggish, and he periodically stumbles to the ground. However, despite his missing hand and basic prosthesis, Snake—known as a legendary soldier—manages to acquire and fire a gun to defend himself against his would-be assassins.

When this sequence is completed, he is rescued by compatriots—the mercenary company “Diamond Dogs”—who give him a more fully-functional bionic arm with human-like fingers. The game is set in 1984 and blends historical technologies with science fiction embellishments—as is typical of the *Metal Gear Solid* series. The new arm is initially seen in a dull, sterile grey and has only two fingers and a thumb, but by the time the player is allowed to control Snake again, it's been replaced by an arm in black and blood-red crimson with five fully-articulated digits. The red arm stands out visually against Snake’s camouflage outfits, and is the one point of bright color on the player character, unless the player chooses to customize their weapons in bright colors. The arm itself can be customized as a weapon, changing it in color to match its

abilities—bright yellow for an arm that delivers taser-like electric shocks, and smoky grey for an arm that can launch like a rocket to attack enemies directly.[38]

In the game, Snake exhibits a transition from the vulnerability of waking up without an arm, to receiving a basic body-powered prosthesis, to wearing bionic arm and, ultimately, incorporating weaponized hands with special abilities into his arsenal as a soldier and the commander of the Diamond Dogs. This is central to the game's theming—throughout the game, the player becomes stronger and more capable, upgrading Snake's weapons and rebuilding the Diamond Dogs mercenary company in their quest to become a powerful independent military force. Furthermore, the game's title has a double-meaning, referring to both the traumatic memories that haunt Snake throughout his career as a soldier as well as the "phantom pain" experienced by actual amputees suffering from phantom limb syndrome. This is referenced in the original Konami Phantom Limb Project press release, which states that James Young, as a "huge fan" of the series, "is aware how many of the themes in the game parallel the challenges and opportunities he faces."[39]

As a symbol of the game's themes of loss and rebuilding, Snake's prosthetic arm is featured heavily in marketing and promotional materials for the game. The North American "PlayStation 4 Collector's Edition" included a half-sized replica of the bionic arm, while the Japanese "Premium Package" included a larger full-sized version.[40] Konami Japan even released a short video ad for the arm on their official *YouTube* channel, showing off animated glamour

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[38] Kojima Productions. Metal Gear Solid V: The Phantom Pain. Computer software. Konami Digital Entertainment, 2015.
[39] Konami Digital Entertainment, Inc. "KONAMI WORKING WITH LEADING PROSTHETICS ARTIST."
[40] "Versions and Collector's Editions for Metal Gear Solid V: The Phantom Pain Unveiled." Metal Gear Informer. March 04, 2015. Accessed February 09, 2016. http://www.metalgearinformer.com/?p=18299.

shots of the collectible set to dramatic music.[41] In November of 2015, a Japanese arm replica was made available separate from the "Premium Package," and could be pre-ordered direct from the manufacturer for two-hundred dollars. The product page for the arm emphasizes its realistic detail and fidelity to the character model:

> From 'METAL GEAR SOLID V:THE PHANTOM PAIN' comes a 1/1 scale (life-size) replica of 'Bionic Arm' which the player character "Venom Snake" actually equips in the game. With the fully articulated fingers, the hand has high posability so you may easily strike various poses, such as the gesture Venom Snake made on the key visual! Also, arm folding and hand rotation is possible.
>
> The fingers perform well on load carrying, allow fans to enjoy grabbing all sorts of small thing with it![42]

As a fan of the series, I had the privilege of acquiring one of these arms for my personal collection. Inside the cardboard shipping carton, the arm is packaged in a box that resembles an actual "Diamond Dogs" shipping crate from the game, and the arm itself features meticulously reproduced in-universe labels. One area of molded raised text on the base of the thumb reads "CAUTION Overhaul must be done at a designated workshop." Another near "Fieldstripping fastener B" reads: "Do not use molybdenum lubricants." The arm sits upright on a stand, and there is something very appealing about the ability to bend and pose the hand and wrist in an attempt to reproduce various gestures. Most important is the novelty of being able to purchase a life-size replica of a fictional character's dismembered bionic arm. The concept of selling nonfunctional replicas of a cool-looking, fictional prosthesis is another way of catering to that

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[41] KONAMI公式. "【公式】 バイオニックアーム （1/1スケール リアルサイズ） ※コナミスタイル限定 | MGSV:TPP | KONAMI." YouTube. March 10, 2015. Accessed February 09, 2016. https://youtu.be/vHpuHpjmM6s.
[42] "METAL GEAR SOLID V:THE PHANTOM PAIN 1/1 BIONIC ARM." D4toys.com. 2016. Accessed February 9, 2016. http://www.d4toys.com/index.php?route=product/product&product_id=140.

kind of able-bodied envy that creates a desire for a secondhand bionic experience—such as through fashion—without enduring any sort of amputation or disability.

This desire is directly reflected in a post on the official Konami blog about the Phantom Limb Project titled "Amputee Gamer Gets MGSVTPP-Inspired Prosthetic Arm!," in which author Luke Burns asks audiences to imagine what it would be like to have Snake's arm:

> If you are a *Metal Gear Solid* fan, you'll be very familiar with Snake's iconic bionic arm from *Metal Gear Solid V: The Phantom Pain*. Imagine how insanely cool it would be if this arm… was actually *your arm*! This dream is a reality for 25-year-old amputee gamer James Young, who now may as well change his name by deed poll to Big Boss.[43]

As another benchmark of bionic cool, it is no surprise that Snake's arm has inspired the production of alternative prosthetic limbs used in the marketing of the game.

In 2015, a blog-style website was established to document each step of the Phantom Limb Project. According to the first post on October 6, 2015 titled "The Project," written by Konami PR representative Su-Yina Farmer:

> The Phantom Limb Project was born out of a desire to create something innovative, on the cusp of future technology, which would explore the themes present within the series and more specifically, the themes and ideas referenced in the latest incarnation: Metal Gear Solid V: The Phantom Pain. We also wanted to tell an uplifting human story of what it means to be an amputee, to feel phantom

[43] Burns, Luke. "Amputee Gamer Gets MGSVTPP-Inspired Prosthetic Arm!" Konami Blog. November 10, 2015. Accessed January 30, 2016. https://uk-blog.konami-europe.com/2015/11/10/amputee-gamer-gets-real-mgsvtpp-bionic-arm/.

> pain, to overcome loss and how technology can change our perceptions of 'disability'.[44]

Again, the project is closely connected to the game's themes of technological enhancement. In planning the design of the arm, the team even referred to the artwork produced by *Metal Gear Solid* concept artist Yoji Shinkawa, noting that "many characters in the series embodied human, animal, machine and weapon traits – a fascinating hybridisation in which it was unclear where the human ended and the machine began."[45]

According to Phantom Limb Project concept artist Neal Petty, the arm needed to "marry the practical and comfort aspects without losing the desired cool and futuristic look," combining function and aesthetics in a coherent design:

> Sophie had asked me to keep in mind that – while the outer shell had its functional aspects – she wanted it to entwine it with the inside structure. This was perhaps the biggest challenge of my work – to ensure the overall impression was neither militarist nor weapons orientated but remains futuristic, organic, practical and personal in essence.[46]

The need for the arm to be "neither militarist nor weapons orientated" is ironic considering that it is inspired by a soldier's high-tech–albeit fictional—weapons technology.

A post on October 6, 2015 titled "Sophie," explains the involvement of Sophie de Oliveira Barata and her company, the Alternative Limb Project. Of particular note is the way in which de Oliveira Barata is said to have been inspired by "amputees who wanted something a bit

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[44] Farmer, Su-Yina. "The Project." The Phantom Limb Project. October 6, 2015. Accessed January 30, 2016. http://thephantomlimbproject.com/2015/10/the-project/.
[45] Farmer, Su-Yina. "Initial Design Thoughts." The Phantom Limb Project. November 27, 2015. Accessed January 30, 2016. http://thephantomlimbproject.com/2015/11/initial-design-thoughts/.
[46] Phantomlimb573. "Neal Petty." The Phantom Limb Project. January 2016. Accessed February 06, 2016. http://thephantomlimbproject.com/2016/01/neal-petty/.

different; a prosthetic that didn't pretend to be real, something that reflected their personality and would invite people to actually look in its direction rather than away." Here, she would be "creating a bespoke prosthetic limb, inspired by the game, for a gamer,"[47] emphasizing the connection between James' personality and his choice of prosthetic. According to a post on November 9, 2015 titled "Finding James," "The ideal candidate would have to be an avid gamer, someone with an imagination, unafraid to stand out and express themselves, open to ideas and experimentation, with an interest in future technologies and its aesthetic." After soliciting "hundreds of applications," they decided on James, whose "photos of him adventuring in Iceland" and "enthusiasm and excitement" impressed Sophie. According to the post:

> James had brought with him his current prosthetic arm, a heavy plastic arm with a mechanical claw at the end, which he was not wearing because it was cumbersome and uncomfortable. We could never replace the arm that he lost, but maybe we could provide something that was a bit more 'him', something that he could potentially see as an extension of his body, and something he was proud to have on show.[48]

In a post on November 19, 2015 titled "How I Found the Phantom Limb Project," James, who is from London, explains his motivation for applying to the project in regards to his dissatisfaction with traditional medical prostheses:

> This came at a time where I had tried a clunky NHS prosthetic and was upset at the lack of individuality of them. They appear only as assistive clinical devices and don't represent a part of one's body. I had even read at that time, something

[47] Farmer, Su-Yina. "Sophie." The Phantom Limb Project. October 6, 2015. Accessed January 30, 2016. http://thephantomlimbproject.com/2015/10/sophie/.
[48] Farmer, Su-Yina. "Finding James." The Phantom Limb Project. November 9, 2015. Accessed January 30, 2016. http://thephantomlimbproject.com/2015/11/finding-james/.

> which stuck in my head, a great line on a website where a prosthetic user said 'I want to take off my limb and leave it in a room, and people will recognise it and know that belongs to me. It reflects part of my personality'.

In describing the connection between the project and his own personality, James, notes that while filling out the application "It used words that describe my interests in science fiction, technology and gaming and I was certain Sophie was ready to work on something awesome."[49]

Because James' limb would be constructed from the ground-up, the project arranged for custom prosthetics developer Open Bionics to provide the limb's internal mechanics and myoelectric control system—operated using the shoulder muscles on James' back. A January 2016 post declares that Open Bionics wanted to "help bring something so creatively dreamed of to life," and company co-founder and COO Samantha Payne explained that James' arm would be both a "cyborg masterpiece" and a "limb of the future."[50]

Based at the Bristol Robotics Laboratory in the UK, Open Bionics uses 3D scanning and printing technologies to design open source bionic arms for amputees that can be downloaded and constructed anywhere in the world, at a fraction of the cost of conventional medical-grade prostheses. Each custom-fit limb takes only three days to build, is fully tailored to its wearer, and is equipped with a series of myoelectric sensors that detect electrical impulses in the wearer's arm muscles and use those signals to control the movement of a fully-articulated robotic hand.[51] According to their webpage, Open Bionics develops and markets their "affordable bionic hands" with the goal of increasing the availability of these technologies for the "estimated 2 million

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[49] Young, James. "How I Found the Phantom Limb Project." The Phantom Limb Project. November 19, 2015. Accessed January 30, 2016. http://thephantomlimbproject.com/2015/11/how-i-joined-the-phantom-limb-project/.
[50] Phantomlimb573. "Open Bionics." The Phantom Limb Project. January 2016. Accessed February 06, 2016. http://thephantomlimbproject.com/2016/01/open-bionics/.
[51] WIRED UK. "WIRED Next Generation 2016: This Code Can Be Used by Anyone to Create Their Own Bionic Limbs." YouTube. November 24, 2016. Accessed December 10, 2016. https://youtu.be/NtIR2xBvGEE.

hand amputees worldwide." An infographic on their "About" page notes that "Most amputees have no prosthesis," "Some have hooks," and "A few have robotic hands,"[52] indicating the progressively increasing costs associated with the latter two technologies while implying that bionic hands are at the top of this progressively more high-tech hierarchy.

The standard model available in the Open Bionics web shop is the "Ada Hand Kit," and a disclaimer notes that "This is not a medical device." The 3D printed, articulated plastic hand costs £569.00, can be ordered in left/right versions in white or black, and the open-source software allows it to be programmed by its user. According to the product page, it "can be assembled in around 1 hour using standard tools" and is not only useful for amputees but is "perfect for anyone that is doing a project with robotic hands or wants a neat, light, and functional robotic hand for use with a humanoid robot."[53] In this way, affordable bionic limbs are increasingly marketed to able-bodied individuals as well, as tools—and high-tech toys—for teaching and experimentation.

Open Bionics also offers a line of officially-licensed below-the-elbow prostheses for children based on the fantasy worlds of Disney properties such as *Iron Man*, *Frozen*, and *Star Wars*. According to the Open Bionics homepage announcing these devices as "the next generation of bionic hands," the company offers an "Iron Man hand" that is "hot out of Tony Stark's workshop," a "Star Wars lightsaber hand" that is "inspired by Lightsabers," and a "Snowflake hand" that is "inspired by Queen Elsa." The webpage markets these alternative-style limbs—which feature intricate sculpting and paintwork as well as light-up features—as a means to get children to think more positively about prosthetics:

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[52] Open Bionics. "About." Open Bionics. 2016. Accessed August 06, 2016. http://www.openbionics.com/about/.
[53] Open Bionics. "Ada Hand Kit." Open Bionics. 2016. Accessed August 06, 2016. http://www.openbionics.com/shop/ada.

> Now kids can get excited about their prosthetics. They won't have to do boring physical therapy, they'll train to become heroes. They're not just getting medical devices, they're getting bionic hands inspired by their favorite characters. The Walt Disney Company is generously donating the time of its creative teams and providing royalty free licenses. More designs coming soon![54]

As *Wired UK* columnist Matthew Reynolds notes, "When a child picks their bionic arm, choosing to become Iron Man, Princess Elsa or Mace Windu, they're taking control of their own identity."[55] In this spirit of personal empowerment, Payne wants to use prosthetic technologies to "turn children who have limb differences into bionic superheroes."[56]

As with the Limbitless "Iron Man" arm, the marketing for custom prosthetic limbs emphasizes their affordability and how these fantasy-inspired designs have their own kind of rehabilitative properties—making those who wear them into "superheroes" and presumably attracting the "right kind" of attention from their peers. The involvement of Open Bionics in the Phantom Limb Project also emphasizes the non-medical, non-institutional nature of the prosthesis being constructed, in spite of its corporate sponsorship. However there is a huge gap between the functionality and overall quality of these types of "homemade" limbs, and the more expensive medical-grade prostheses such as the i-limb—which Konami could have also provided for James with arguably the same level of publicity. This is exacerbated by the odd fact that James' arm doesn't really look anything like Snake's arm from the game, in design or color.

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[54] Open Bionics. "Home." Open Bionics. 2016. Accessed August 06, 2016. http://www.openbionics.com/.
[55] Reynolds, Matthew. "Print Your Own Prosthetic: This Code Can Be Used by Anyone to Create Their Own Bionic Limbs." WIRED UK. November 5, 2016. Accessed December 07, 2016. http://www.wired.co.uk/article/samantha-payne-bionic-arm-builder.
[56] WIRED UK. "WIRED Next Generation 2016."

James' arm is attached to his body with a sleek leather and plastic body harness. It features a shoulder attachment with a detachable joint at the base of the deltoid area, allowing him to remove the rest of the arm with a quick rotation when it gets "in the way" or becomes "too heavy after hours of wear."[57] This also allows for easy demonstrations. After James received his arm, he took to social media to share his experiences with it. In a *Twitter* post on March 11, 2016, James posted a picture of his arm being held by others at a bar with the message "My #metalgearsolid ARM @thePhantom_Limb Is Being Passed around in the Pub! Thanks @Konami for Funding It!." The arm's array of bluish-white LEDs glows brightly in the dark bar, as a curious trio inspects the finished result and takes photographs with their phones and cameras.[58] The social nature of the limb is emphasized on de Oliveira Barata's own Alternative Limb Project site. The page for the "Phantom Limb" features official press photographs of James' arm, along with a full list of the arm's features. Notable is the "Social Space," a magnetized compartment inside a removable shoulder panel that can hold small electronics. According to the page, fans can download a 3D model of the Social Space schematics in order to design components for James. Currently, the social space is able to house a Mobulair brand "bespoke quadrotor" which James can fly using a "bespoke one-handed controller" and a pair of first-person goggles,[59] emphasizing the arm's connections to James' interests in gaming. In addition to the thematic qualities of these high-tech prosthetic accessories, they make James into a full-spectrum nexus for high-tech hip: bionics, drones, virtual reality, and video games.

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[57] Phantomlimb573. "Neal Petty."
[58] James Young (@jamesahyoung). "My #metalgearsolid ARM @thePhantom_Limb Is Being Passed around in the Pub! Thanks @Konami for Funding It! Pic.twitter.com/7hsycRzXbK." Twitter. March 11, 2016. Accessed April 29, 2016. https://twitter.com/jamesahyoung/status/708390471652024321.
[59] The Alternative Limb Project. "Phantom Limb." The Alternative Limb Project. 2015. Accessed August 08, 2016. http://www.thealternativelimbproject.com/project/phantom-limb/.

Recently, BBC Three produced a two-part video documentary about the Phantom Limb Project titled *Bodyhack: Metal Gear Man*. On May 18, 2016, the feature was posted to their *YouTube* channel in two parts. The documentary covers each step of the project, from the initial meetings with James to the unveiling of the arm at the inaugural 2016 BodyHacking Con in Austin, Texas, and features intimate behind-the-scenes style footage. Blending game footage with exclusive interviews, the documentary is a kind of pseudo-advertisement for both the Phantom Limb Project and *Metal Gear Solid V*. For example, part 1 of the documentary begins with a quote from James as mixed footage of the game plays: "In two months' time, I'm transforming. I'll be hacked with a bionic arm, like the famous video game character Snake." As James describes his initial reaction to waking up after his accident and realizing that he was missing his left arm and leg, parallel game footage of Snake waking up in a hospital inspecting his amputated left arm and panicking is shown. We then see a shot of James sitting on his couch, without any prostheses, with a game controller sits on his leg as the game cutscene continues to play in the background on his television. As he watches the scene, he notes: "I guess Snake has the same problems as me, with my arm, because he's full of shrapnel, and my arm is full of grit and train oils and dirt so they just couldn't save it." As mentioned previously, this perceived parallel between James and Snake is one of the major themes of the project and one of the key ways in which the ethos of the project centers on the close association between prosthetic technology and science fiction.

As on the blog, James' status as a gamer is emphasized: "I love gaming, because basically you get to live in an alternative universe." … "I remember lying in bed like just thinking 'How am I gonna game?' It was the thing that really pissed me off in the hospital." Black and white intertitles explains that: "A year ago James saw an advert. The billion dollar

gaming company Konami. …The makers of Metal Gear Solid. …Were advertising for an amputee. …To turn into Snake." Much of the footage used here focuses on the more explosive, action-oriented aspects of the game, evoking the editing of a game trailer or television advertisement, which is in sharp contrast to the documentary's depiction of James' more limited—but capable—mobility without his prostheses.

In commenting on his current equipment, James echoes the common dichotomy between the most basic old-style prosthetics and newer, more comfortable and more capable technologies: "I couldn't really believe it when I saw the advert. Because I was just thinking, how many amputee gamers are there, and the chance to have an arm that is in like a sci-fi gaming universe is just incredible. Instead of this peachy nightmare that I have today." This "peachy nightmare" is a beige colored, non-bionic body-powered prosthesis with a black claw/hook-style attachment. According to James, "I think this is an awesome opportunity just for me to build a part of my body again, and I'm really excited to have the control."

The documentary intertitles then note that "James has never discussed the accident with his family," prompting another instance of the documentary's odd tonal shifts. We see James with his sister, reading a diary his mother kept describing the events immediately following James' accident. He then breaks down into tears, as he discusses for the camera how sorry he is for the sadness he's caused his family, saying "I was walking too close to the edge of a train platform. I mean, that's a stupid thing to do." Reflecting on the routineness of something that he and many people do each day without even realizing the danger they're in, James urges viewers to ""Just take a moment, to think about it. Cause you can't get it back just now." After this moving scene, the documentary then cuts to gameplay footage of Snake sneaking up on a group of soldiers in the night and raining lightning down upon them with an electrically-charged bionic

hand, as the intertitles explain that “The hardest part of the transformation to get right. Is the 3D printed bionic hand.”

The documentary follows each stage of the Phantom Limb Project’s development. Interviews with James and the team members continue to be intercut with footage of the game in an almost advertisement-like fashion. According to de Oliveira Barata, she wants to give James “Not just an arm like before, but something more than that.” However, in order to “set his expectations to a kind of reasonable level,” de Oliveira Barata had him meet with a former client, singer and model Viktoria Modesta (discussed in the previous chapter). According to the documentary’s text, “Singer Viktoria Modesta has made a feature of her disability.” As Modesta speaks about her own experiences with custom prosthetics, she notes the way in which they can often heighten the very effects of their use: “You then become quite aware that you’re super-relying on technical stuff, and if anything goes wrong, your superpowers kind of like wither. So you know, you could go between a superhero and a kind of, a person who can’t walk very quickly.”

As Konami’s official press reveal looms, the team works to finish the arm on time, creating added drama in the narrative. According to James, his mom doesn’t want to attend the event because she is concerned that his new arm will “draw attention” to his disability. As James explains that “She doesn’t want to crush my dream of it being amazing, potentially,” we see a shot of Snake smashing his prosthesis into a mirror bearing his reflection as dramatic music from the game’s ending plays. This continues over shots of James travelling to de Oliveira Barata’s studio, where cameras are being set up. Although James has been involved with each step of the design process, the first part of the documentary ends with him expressing feelings of nervousness about the big reveal: “I’m going to be meeting part of myself for the first time. And

I don't know if it's gonna like, fit with the rest of me." James' anxiety reveals some of the strangeness about the experience of designing technology that will eventually be incorporated into one's own body, and the process of getting to know oneself all over again.[60]

In the second part of the documentary, James is finally presented with the arm, with his sister and father in attendance. He notes that it "looks so roboty and bionicy." However, while James thinks that the arm "looks amazing," excitement turns to marked disappointment on everyone's faces as the specifications aren't quite right, and James notes that "it's not quite anatomically aligned" with the arm appearing a bit bigger and longer than it should. Furthermore, the electrodes in the harness aren't quite working, and James has difficulty getting the arm to move under his control—in fact the hand sometimes moves by itself. A frustrated de Oliveira Barata asks if they should "just do the photo shoot." We see the official press photos being taken, as James says: "The fact that the arm looks so great is very, like it's very promising, but it's not really doing a great deal." De Oliveira Barata says that they will take a look at the sensors, but a frustrated James notes that: "The whole thing about designing one that represents a bit of my personality is that I have control. It's something that I've got control over. But now, when I put this on, I don't have control. Literally, I don't have control of it. And so it's been a bit of a like, a step back, and it's made me just go 'oh, like I'm still powerless, to like, sort myself out, basically.'" While the documentary is orchestrated to create drama, this scene abruptly interjects the topic of disability back into the narrative. In discussing the difference between embodied technologies such as prosthetics and cultural depictions of cyborgs, Katherine Ott notes that "A dusting of disability on the technology ends the beauty pageant. Cyborgs are

[60] BBC Three. "Bodyhack | Metal Gear Man - PART 1." YouTube. May 18, 2016. Accessed August 8, 2016. https://youtu.be/NZNFkMW9uFg.

divorced of disability and are commissioned by needs other than physiological."[61] In other words, scenes such as this disrupt the presentation of James as a science fiction cyborg brought to life, revealing some of the limitations of experimental bionic prosthetic limbs while simultaneously highlighting the extent to which they often fall short of their science fiction analogues.

As part of the Phantom Limb Project, James has been asked to be a key speaker at the inaugural 2016 BodyHacking Con (or BDYHAX), held from February 19-21 in Austin, Texas. The webpage for BodyHacking Con invites visitors to "Join us as bodyhackers from all walks of life share philosophies, technologies, and maybe the occasional cocktail, all in the name of altering the human body as its owner sees fit."[62] According to the conference homepage, a "bodyhacker" is "someone who has made the choice to actively change their body or mind to better reflect what they believe their ideal self to be." Bodyhacking is therefore a broad category of activities that includes everything from bodybuilding, meditation, wearable tech and tattooing to prosthetics, cosmetic surgery and bodily implants. For bodyhackers, "The body is a vehicle to be tuned, modified, added to, taken away from, painted, tweaked, and customized."[63] Although James did not choose to be an amputee, his choice to pursue a prosthetic of his own design fits with the conference narrative of bodily customization and is therefore an ideal place to film—and market—a documentary about a bespoke bionic limb.

As James travels to the conference, the intertitles note that "Konami PR is joining James to capitalize on the arm's popularity." Here, Su-Yina Farmer, the Konami PR rep who authored

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[61] Ott, Katherine. "The Sum of Its Parts: An Introduction to Modern Histories of Prosthetics." In *Artificial Parts, Practical Lives: Modern Histories of Prosthetics*, edited by Katherine Ott, David Serlin, and Stephen Mihm, 1-42. New York: New York University Press, 2002. (p. 21)
[62] "Conference." BodyHacking Con. 2015. Accessed January 24, 2017. http://bodyhackingcon.com/conference.
[63] "2016." BodyHacking Con. 2015. Accessed January 24, 2017. https://bodyhackingcon.com/.

many of the articles on the Phantom Limb Project website, accompanies James. A series of intertitles explains that “Since James’ arrival last night. He’s become concerned about presenting the arm,” as some of the components still aren’t functioning properly. As James gets the arm ready for the show, it continues to malfunction, cycling through various gesture patterns on its own. According to James: “I’m just kind of hoping now that people like it, and they don’t think it’s really awful and lame.” Farmer responds with: “I mean, you know, if it doesn’t work, we’ll just have to say there’s a few [unclear] problems.” James periodically complains about how heavy the shoulder socket and arm is, as it continues to move as if it has a mind of its own. Before James’ talk, one of the conference organizers tries to reassure him by saying that “well it’s tech, I mean it happens, it’s new stuff.” And that “worst case, it’s going to be hilarious.” He also notes that he thinks the arm “looks badass.” As James takes the stage, he appears nervous and has trouble quickly detaching the arm from the socket. He says “I think this thing has come out slightly big.”

The documentary then shifts to the UK, where the team has been reworking the arm, adding features such as a flashlight and laser pointer. However, James notes that he broke the middle finger “picking up a shopping basket with two bottles of cider in it,” and it now sticks up permanently—a feature he jokingly demonstrates for the camera. This also demonstrates the limits of 3D-printed alternative limbs vs. medical-grade prostheses with custom modifications, such as many of the samples on the Bespoke Innovations and Alternative Limb Project webpages. Here, the dramatic decrease in cost and increase in do-it-yourself flexibility comes at the price of ruggedness and strength. This also reveals the project’s focus on multiple specialists coming together to build a prosthetic limb from the ground-up. Konami could have arguably

received the same amount of publicity by sponsoring a real medical grade bionic limb, and decorating it to look like Snake's actual arm.

James notes that: "I hope the arm is gonna transform the way people look at me, and the way people respond to me as a person." The documentary ends with James taking the arm out into public. According to the intertitles, "James is going on his first pubic outing." This, it seems, would be the true test as to whether or not the arm would really change how people viewed James. First, James meets a childhood friend, Kieran, and shows off his arm. A notably awestruck bystander stops and asks James' if his arm is "real." James tells him that it's part of his body, and asks him what he thinks of it, to which the stranger responds: "I think it's cool. I think it's cool, you're Iron Man. …This is inspiring. You should really just go everywhere." We then see more and more people, of all ages and types, approach James with a great curiosity about his arm. Some gesture excitedly in the background, others take photos and videos with their phones. One woman taking pictures says "my nephew would love this."[64] Incidentally, a video story on James Young posted to *BBC News* on May 18, 2016 is titled "Amputee gamer shows off 'Iron Man arm'" in reference to the stranger's quote above, noting the ease with which the Iron Man metaphor is used even when the documentary being reported on clearly indicates that the prosthesis is based on another character altogether.[65]

One of the emotional highlights of the documentary is when James meets fellow bionic celebrity Angel Giuffria after his presentation, and the two compare the relative sizes of their prosthetic hands. As a bionic actress, Angel has become recognized for roles in films such as *The Hunger Games: Mockingjay Part 1* (2014), the popularity of her *Vine* and *Twitter* accounts, and

[64] BBC Three. "Bodyhack | Metal Gear Man - PART 2." YouTube. May 18, 2016. Accessed August 08, 2016. https://youtu.be/kRxV0qw7rJg.
[65] BBC. "Amputee Gamer Shows off 'Iron Man Arm'." BBC News. May 18, 2016. Accessed August 7, 2016. http://www.bbc.com/news/health-36319970.

her promotional work for prosthetics company RSLSteeper and their "bebionic" brand of bionic hands. In an interview with *Popular Science,* Angel reveals that she has a similar interest in "cool" looking prosthetics:

> I love my prosthetics, I love my bionic arm, I like being referred to as a cyborg, I think it's so much fun and I don't think I would ever sacrifice the idea of playing up the differences. So I think I'm always going to want some cool technology—you know, a cybernetic arm—rather than going for, you know, the boring fleshy arm.[66]

In an *Instagram* post on June 21, 2016, Angel shared an image of herself practicing archery with her bebionic arm, playfully declaring that she is "Just your average weaponized #amputee/#cyborg. Cast me in your movies fighting crime!"[67]

At the end, we see James having video chats with Angel, with whom he seems to have developed a close friendship or possibly a romantic relationship. He notes that: "It's kind of about finding these people, and connecting to these people, rather than putting on this arm." However, according to James: "I feel like it's part of a game, like it's a fantasy that's come to reality." Footage from the game showing Snake with his romantic interest, the silent sniper character Quiet, plays. James then says that: "It's pretty much a one in a million chance that I could've met someone like Angel." The final shot of the documentary is both of their arms laying side-by-side on a table in James' hotel room in an almost romantic technological embrace.[68]

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[66] Sharpe, Levi. "'Hunger Games' Actress Angel Giuffria Talks Life As A Cyborg." Popular Science. June 29, 2015. Accessed August 10, 2016. http://www.popsci.com/hunger-games-actress-angel-giuffiria-talks-life-cyborg.
[67] Aannggeellll. "Instagram Photo by Angel Giuffria • Jun 21, 2016 at 6:35pm UTC." Instagram. June 21, 2016. Accessed August 10, 2016. https://www.instagram.com/p/BG7UJ8NITfD/.
[68]BBC Three. "Bodyhack | Metal Gear Man - PART 2."

Ultimately, the way in which James's struggles are paralleled in Snake's story reveals some of the ways in which depictions of prosthetics in fiction don't quite align with real-world experiences. David Mitchell and Sharon Snyder use the term *narrative prosthesis* to describe the "perpetual discursive dependency upon disability" in literature, noting that disability is often utilized as "a stock feature of characterization" and "as an opportunistic metaphorical device."[69] While the documentary does show James' ability to live independently and take care of himself, it portrays his custom limb as the first step to symbolically closing the gap between real-world amputees and science fiction cyborgs like Snake. The mundaneness of James wheeling himself across his kitchen in a swivel-chair, contrasted with the exploits of the antihero Snake, seems to contradict the very similarities the Phantom Limb Project attempts to portray. While the opening hospital chapter in *Metal Gear Solid V* is notable for its attempt to allow players to "play" a disabled character, Snake is generally not portrayed as "disabled" in the game, despite his use of a prosthetic arm and the fact that he only has one eye (as a result of events in a previous game). As seen in the game footage used in the documentary, Snake's effectiveness as a soldier—in both gameplay and cinematics—is unhindered, and his continually-upgraded prosthesis actually offers almost supernatural advantages in combat.

In describing the "mediating role of the external body with respect to internal subjectivity," Mitchell and Snyder also note how "Either the 'deviant' body deforms subjectivity, or 'deviant' subjectivity violently erupts upon the surface of its bodily container." [70] In *Disability Rhetoric*, Jay Timothy Dolmage similarly isolates particular recurring "myths" featured in depictions of disability. In describing the myth of "Physical Deformity as Sign of Internal Flaw,"

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[69] Mitchell, David, and Sharon Snyder. "Narrative Prosthesis and the Materiality of Metaphor." In *The Disability Studies Reader*, edited by Lennard J. Davis, 205-16. 2nd ed. New York: Routledge, 2006. (p. 205)
[70] Ibid. (p. 211-212)

he notes that bodily difference is often used to facilitate "insinuations of internal deviance or lack," especially mental or psychological problems.[71] We see this in the way in which shrapnel in Snake's forehead literally erupts, or protrudes from his forehead in a horn-like manner. This demonic "horn" symbolically grows larger as the player performs bloodier deeds. Furthermore, Snake's arm often explodes in intense displays of smoke, electricity, and weaponized projectiles.

According to Dolmage, the myth of "Disability as Isolating and Individuated" also portrays disability as "a personal tragedy, or even a punishment delivered to one individual, and not the product of either chance or of social processes."[72] We see this trope enacted quite literally in an early trailer for *Metal Gear Solid V*, which introduces Snake as "Punished Snake: A Fallen Legend," declaring that "Men become Demons" as Snake shoots at the camera.[73] The "Punished" moniker is also seen in the in-game credits before and after each mission. This trope is further reinforced by the character of Kazuhira Miller, Snake's friend and subcommander who lost his right arm and left leg in a military ambush. When Miller is offered the chance to acquire a prosthetic arm like Snake's during a conversation in an in-game audio recording, he replies: "I've no intention of relying on bionics. Right now I need to keep the pain fresh in my mind." Miller refers to the "phantom pain" of his missing limbs as a reminder of the dead comrades he lost, guiding him towards vengeance. In this way, each characters' desire for revenge is written onto their bodily disfigurements—Snake's represented by his new prosthesis and Miller by the empty spaces left behind.[74]

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[71] Dolmage, Jay Timothy. *Disability Rhetoric*. Syracuse, New York: Syracuse University Press, 2014. (p. 41)
[72] Ibid. (p. 43)
[73] KONAMI公式. ""Metal Gear Solid V: The Phantom Pain" E3 2013 RED BAND Trailer (Extended Director's Cut)." YouTube. June 11, 2013. Accessed August 10, 2016. https://youtu.be/UMyoCr2MnpM.
[74] Kojima Productions. Metal Gear Solid V: The Phantom Pain.

In a presentation at the "Wired Next Generation" conference, held on November 5, 2016 in London, UK, Open Bionics co-founder and COO Samantha Payne declared that bionic limbs "previously existed in science fiction, but are today a reality."[75] However, the Phantom Limb Project demonstrates the rhetorical complexities of using science fiction as a means to market prosthetics. Science fiction can inspire prosthetics makers to pursue new functional and aesthetic features beyond what is currently available, and offer amputee aficionados with an opportunity to create something in the spirit of their favorite science fiction characters. Science fiction also bestows upon these technologies a certain cultural cool that brings new visibility to prosthetics as well as the people who use them, ultimately reframing the "disabled" body as something potentially "badass." This is its own kind of benefit, beyond the practical usefulness of the prosthesis itself. However, as the Phantom Limb Project documentary reveals, the realities of these bionic technologies often falls short of their science fiction depictions. The expectations created by these types of depictions can be unrealistic, leading to disappointment. Furthermore, James's experiences emphasizes the crucial importance of prosthetic comfort and functionality, and that even the most "badass" bionic limb is literal dead weight if it does not work as expected.

4.3 WOUNDED WARRIORS

The appeal of alternative bionic limbs—and the notion that even able-bodied people want them—can be explained in part by the preponderance of images of prosthesis-wearing characters featured prominently in popular science fiction. The number of contemporary stories, films,

[75]WIRED UK. "WIRED Next Generation 2016."

cartoons, comics, and video games featuring cyborg characters is great, each one extrapolating upon the latest prosthetic developments in spectacular and relevant displays of human-technology pairings. However, the most prominent science-fiction themed alternative limb collaborations generally feature militarized analogs. While Iron Man and Snake are characterized as—sometimes conflicted—heroes in their own universes, they all fight with weaponized versions of prosthetic technologies. The fact that both characters use bionic technologies developed by military researchers is perhaps fitting, as many of the top-level bionic research programs are sponsored by military institutions such as the Pentagon's Defense Advanced Research Projects Agency (DARPA) in conjunction with programs such as the Wounded Warrior Project—programs designed to greatly enhance the lives of wounded veterans while also promising the possibility that they might one day return to action. According to Levi Hargrove, a research scientist at The Rehabilitation Institute of Chicago who helped create the first bionic leg controlled by brainwaves, "We [are] really trying to make these advanced devices that will allow them to get back to active duty or later in life allow them to move around their home and remain independent longer. That's one of the primary goals of this research."[76]

As science fiction becomes more sophisticated, real-world technology strives to keep pace. Due to their greater funding and development in top research facilities, military-sponsored robotic limbs and their bionic control systems are generally some of the most sophisticated prosthetic technologies in existence. In describing the reciprocal relationship between science fiction and military technology, Lev Manovich has suggested that "We can only guess about how far such research has already advanced in military labs. (Is it possible that much twenty-century

[76] LaPook, Jonathan. "Amputee: Bionic Leg Controlled by Brainwaves "Blew My Mind"." CBS News. October 14, 2013. Accessed August 12, 2015. http://www.cbsnews.com/news/amputee-bionic-leg-controlled-by-brainwaves-blew-my-mind/.

science fiction was not about the future but simply an accurate description of contemporary military research?)."[77]

For example, in 2006 DARPA launched the "Revolutionizing Prosthetics" program, which led to the development of the "Gen-3 Arm System" developed by DEKA Integrated Solutions Corporation as well as research on brain control systems utilizing the Modular Prosthetic Limb developed at the Johns Hopkins University Applied Physics Lab. According to a DARPA press release, "The Revolutionizing Prosthetics program is ongoing and aims to continue increasing functionality of the DARPA arm systems so servicemembers with arm loss may one day have the option of choosing to return to duty. Additionally, the dexterous hand capabilities developed under the program have already been applied to small robotic systems used in manipulating unexploded ordnance, thus keeping soldiers out of situations that have led to limb loss."[78] The involvement of the military in the development of prosthetic technologies therefore has implications for the battlefield of the future, in addition to helping veteran and civilian amputees.

The DEKA arm itself has its own science fiction connection, and was named the "Luke Arm" by its creators in reference to Luke Skywalker's advanced bionic hand from *Star Wars: The Empire Strikes Back* (1980).[79] In 2014, the "DEKA Arm System" became the first bionic arm to receive FDA approval "that can perform multiple, simultaneous powered movements

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[77] Manovich, Lev. "Visual Technologies as Cognitive Prostheses: A Short History of the Externalization of the Mind." In *The Prosthetic Impulse: From a Posthuman Present to a Biocultural Future*, edited by Marquard Smith and Joanne Morra, 203-19. Cambridge, MA: MIT Press, 2006. (p. 215-216)
[78] Sanchez, Justin. "Revolutionizing Prosthetics." DARPA. 2016. Accessed August 21, 2016. http://www.darpa.mil/program/revolutionizing-prosthetics.
[79] Guizzo, Erico. "Dean Kamen's "Luke Arm" Prosthesis Receives FDA Approval." IEEE Spectrum. May 13, 2014. Accessed August 21, 2016. http://spectrum.ieee.org/automaton/biomedical/bionics/dean-kamen-luke-arm-prosthesis-receives-fda-approval.

controlled by electrical signals from electromyogram (EMG) electrodes."[80] As a result, the military-developed arm will be made available commercially in late 2016. The arm will be manufactured by Universal Instruments Corporation and marketed to patients by Moebius Bionics. According to a Moebius Bionics press release, the arm is designed to "change the game for amputees" and provide "greater functionality and independence to our wounded warriors and other amputees."[81] Moebius Bionics has thusly rebranded the "LUKE" name as an acronym for "Life Under Kinetic Evolution."[82]

Another DARPA-sponsored prosthetics project includes the "Reliable Neural-Interface Technology (RE-NET)" program, launched in 2010 to "directly address the need for high-performance neural interfaces to control the dexterous functions made possible by DARPA's advanced prosthetic limbs" so that they can "achieve their full potential to improve quality of life for wounded troops."[83] The most recent DARPA projects involve the development of neural technologies that connect bionic limbs to electrodes implanted directly into the sensory cortex of a patient's brain. The research is being performed at the Johns Hopkins University Applied Physics Laboratory utilizing the Modular Prosthetic Limb. The arm's bionic hand is equipped with specialized torque sensors in the joints that are able to detect pressure applied to each finger. The resulting electrical signals are converted into a "Near-Natural Sense of Touch,"

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[80] U.S. Food and Drug Administration. "FDA Allows Marketing of First Prosthetic Arm That Translates Signals from Person's Muscles to Perform Complex Tasks." News release, May 9, 2014. FDA. Accessed August 21, 2016. http://www.fda.gov/NewsEvents/Newsroom/PressAnnouncements/ucm396688.htm.

[81] Mobius Bionics LLC. "Mobius Bionics to Bring DEKA's LUKE Prosthetic Arm to Market." News release, July 8, 2016. Business Wire. Accessed August 21, 2016. http://www.businesswire.com/news/home/20160708005511/en/Mobius-Bionics-Bring-DEKA's-LUKE-Prosthetic-Arm.

[82] Mobius Bionics. "Mobius Bionics Home Page." Mobius Bionics. 2016. Accessed August 21, 2016. http://www.mobiusbionics.com/home.html.

[83] Weber, Douglas. "Reliable Neural-Interface Technology (RE-NET)." DARPA. 2016. Accessed August 21, 2016. http://www.darpa.mil/program/re-net-reliable-peripheral-interfaces.

allowing blindfolded patients to "report with nearly 100 percent accuracy which mechanical finger was being touched."[84]

These government-sponsored prosthetics research projects are often promoted through science fiction-themed collaborations between the military and the entertainment industry. For example, on January 27, 2016, Marvel Comics released *Venom: Space Knight* #3, a new science-fiction comic series that focuses on the adventures of double amputee Eugene "Flash" Thompson. The character first appeared in 1962 as the high-school bully tormenting Spider-Man's alter-ego, Peter Parker. Since then, he has appeared in numerous *Spider-Man* comic, cartoon, and film adaptations as bully, friend, hero and villain. In this latest iteration, Flash Thompson is an Iraq War veteran and Medal of Honor recipient who had both legs amputated below the knee as a result of injuries sustained in combat. Enticed by the possibility of walking again, Thompson agrees to takes part in a government project to create "Super Soldiers," and is bonded to the alien parasite "Venom." The symbiotic, shapeshifting alien envelops Thompson's body like a living costume, granting him powers similar to Spider-Man and allowing him to recreate his legs using the creature's own biomass. He begins working as a hero for the military, and later travels the universe as "an intergalactic ambassador of Earth and an Agent of the Cosmos."[85]

The covers for *Venom: Space Knight* #3 and #6 feature Thompson swinging into battle—visibly without legs—as the symbiote follows behind him. On the covers to issues #8 and #9, his

[84] Outreach@darpa.mil. "Neurotechnology Provides Near-Natural Sense of Touch." DARPA. September 11, 2015. Accessed August 21, 2016. http://www.darpa.mil/news-events/2015-09-11.
[85] "Venom: Space Knight (2015) #1." Marvel.com. Accessed June 29, 2016. http://marvel.com/comics/issue/57288/venom_space_knight_2015_1.

legs have been upgraded to resemble the spring-like blades of modern sprinting prostheses.[86] In issue #3 of the *Venom* series, Thompson—who is often depicted without his symbiote legs—receives his first mechanical prostheses built by his robotic companion, "803."[87] According to an article in *The Washington Post* by Michael Cavna titled "Marvel gave its amputee superhero prosthetic legs — with the help of an Iraq War vet," Marvel reached out to the Wounded Warrior Project in order to "make sure the character's change had the ring of realism." Marvel associate editor Jake Thomas is quoting saying that the company "wanted to do right by both the character and the fans." Jeremy Chwat, the Wounded Warrior Project's "chief strategy officer," is quoted saying that his organization "sees this opportunity with Marvel Comics as a chance to reach a unique audience with the challenges wounded veterans face every day." To achieve these goals, Marvel collaborated with Army staff sergeant Dan Nevins, a Wounded Warrior Project spokesman who had both legs amputated below the knee after he was wounded in an IED explosion in Iraq in 2004. According to the article, Nevins provided *Venom* writer Robbie Thompson with details about life as an amputee, such as the way that one loses their sense of being "grounded" and how "every step becomes a thought."[88] Throughout the story, Thompson—who shares a similar background with Nevins—is uncertain and unstable as he attempts to get used to his new prostheses.

In co-promoting the work being done by the Wounded Warrior Project to help soldiers injured in battle, the science fiction-themed *Venom: Space Knight* collaboration also underscores

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[86] "Venom: Space Knight (2015 - Present)." Marvel.com. Accessed June 29, 2016. http://marvel.com/comics/series/20896/venom_space_knight_2015_-_present.
[87] "Venom: Space Knight (2015) #3." Marvel.com. Accessed June 29, 2016. http://marvel.com/comics/issue/57292/venom_space_knight_2015_3.
[88] Cavna, Michael. "Marvel Gave Its Amputee Superhero Prosthetic Legs — with the Help of an Iraq War Vet." The Washington Post. January 26, 2016. Accessed June 29, 2016. https://www.washingtonpost.com/news/comic-riffs/wp/2016/01/26/marvel-gave-its-amputee-superhero-prosthetic-legs-with-the-help-of-an-iraq-war-vet/.

the intimate involvement of the military in all aspects of the prosthetics industry, from research and development to marketing. It also demonstrates how an increasingly close relationship between the entertainment and technological industries blurs the line between mass entertainment and actual reality in these media marketing endeavors. Using the aesthetic and thematic elements of science fiction to market technology—whether "Iron Man" arms or "Phantom" limbs—ultimately sacrifices some of the more critical aspects of the genre in order to portray technologies with a distinctly futuristic ethos while simultaneously veiling any limitations—or dangers—resulting from their use. At best, it may give audiences a false impression of what available prosthetic technologies are currently capable of. At worst, it risks disability and prosthetics use being understood only in relation to the most glamorous images of science fiction cool.

5.0 A "HUMAN REVOLUTION": PROLEPTIC TRANSHUMANISM AND THE MARKETING OF THE DEUS EX UNIVERSE

On August 23, 2011, *Deus Ex: Human Revolution* was released in North America for Microsoft Windows and the PlayStation 3 and Xbox 360 video game consoles. Developed by Eidos-Montréal and published by Square Enix, *Human Revolution* is a science fiction-themed action role-playing video game and a prequel to the critically-acclaimed *Deus Ex* (2000) and its sequel, *Deus Ex: Invisible War* (2003). Set in the year 2027, the game depicts a near-future dystopia where controversial biomechanical technologies called "augmentations" are regularly used to enhance or replace human body parts. Surgically implanted into the body and directly interfacing with the central nervous system, augmentations are portrayed as the inevitable future of real-world prosthetics research and development.

To promote *Human Revolution*, Eidos-Montréal and Square Enix produced an elaborate trans-media marketing campaign that highlighted the similarities between the futuristic augmentations depicted in the game and contemporary bionic technologies, focusing in particular on mechanical prosthetic limbs. This campaign included viral websites and advertisements for a fictional augmentation manufacturer, a virtual anti-augmentation social movement, an officially-sponsored documentary about new and upcoming bionic technologies, and a series of fashion accessories and web apps that encouraged audiences to "try on" the augmentations featured in the game world. On social media, Eidos-Montréal and Square Enix also shared news stories

featuring real-world prosthetics research and development, highlighting their similarities to the fictional augmentations featured in *Human Revolution* and positioning the game as a relevant meditation on the future of human enhancement via prosthetic technologies.

This rhetorical blending of reality and fantasy continued in the years following the game's release. On October 22, 2013, an updated and expanded "director's cut" version of *Human Revolution* was released, and the franchise was subsequently rebranded as the "Deus Ex Universe." Using the director's cut of *Human Revolution* as a launching point, Square Enix aimed to create a stylistically consistent, "ongoing, expanding and connected game world."[1][2] The first release in the new Deus Ex Universe, *Deus Ex: Mankind Divided*, was a direct sequel to *Human Revolution* and was released worldwide on August 23, 2016 for Microsoft Windows, macOS, and Linux platforms as well as the PlayStation 4 and Xbox One video game consoles. Like *Human Revolution*, *Mankind Divided* also featured an elaborate prosthetics-themed marketing campaign focusing on the perceived similarities between the series' fictional augmentations and actual bionic technologies. To promote the release of the game, Eidos-Montréal and Square Enix partnered with PC gaming accessory company Razer, computer technology company Intel, and alternative prosthetics company Open Bionics to design and market affordable, 3D printed bionic limbs inspired by the mechanical augmentations depicted in the Deus Ex Universe—officially bringing their science fiction world to life.

This collaboration was soon followed by the "Human by Design" project, an academic symposium on the future of human augmentation held on August 3, 2016 at the Paley Center for Media in New York City. Co-produced by Square Enix and CNN's studio Courageous and

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[1] Anfossi, David. "The Future Vision for Deus Ex." Eidos Montreal: Community. October 2, 2013. Accessed September 17, 2016. https://community.eidosmontreal.com/blogs/Future-Vision-for-Deus-ex.
[2] *Deus Ex Universe. 2016. Accessed August 28, 2016. https://www.deusex.com/.*

officially sponsored by *Mankind Divided*, the live-streamed event featured an interdisciplinary panel of artists, theorists, technologists, and users involved in the development of cutting-edge bionic technologies, from robotic exoskeletons to sensory-enhancing implants. In designating the attendees as the "augmentation community," the contemporary conversation concerning disability and prosthetics was effectively rebranded in the futuristic terms of the Deus Ex Universe. In addition to the seven-hour conference itself, Courageous and Square Enix also produced a thirty-minute documentary on human augmentation featuring many of the panelists from the conference. Titled *Human by Design - Presented by Deus Ex: Mankind Divided*, it began streaming exclusively on *Amazon Video* on August 8, 2016.

As indicated by the scope of the marketing for *Human Revolution* and *Mankind Divided*, the Deus Ex Universe features an unprecedented relationship between the entertainment and prosthetics industries. Here, the marketing of a science-fiction themed video game series in conjunction with real-world conversations about bionic technologies blurs the line between fiction and reality, pushing the limits of science fiction as a mode of representation and an advertising tool. On one hand, real prosthetic technologies are made to appear more *futuristic* through a superficial similarity to their science fiction analogs—they are portrayed as the symbolic first steps towards the sci-fi future depicted in the Deus Ex Universe that will inevitably result from continued research and development. Conversely, the fictional world of human augmentations presented in the Deus Ex Universe is made out to be more credible—as a well-researched and prescient vision of the future—or *possible* through its meticulous rhetorical and material engagements with the prosthetics industry.

The cultural relevance of the Deus Ex Universe's science fiction setting was a driving force behind its development. In an interview with *Human Revolution*'s Narrative Designer &

Lead Writer Mary DeMarle on the official Eidos-Montréal *YouTube* page, DeMarle states that "The whole beauty of science fiction, I think, is that it allows us to explore relevant themes and issues in a safe context. … And one of the things that we really want to do with the story in *Deus Ex* is deal with a very relevant issue—where is technology and science taking us?" Likewise, *Human Revolution* Art Director Jonathan Jacques-Belletête notes that he has "always seen science fiction, great science fiction as a metaphor for stuff that happens in contemporary life. They use it as almost as an excuse, as a vehicle to explain those things."[3]

As a vehicle to explore questions concerning the future of technology and culture, the series takes on the qualities of what Josh Smicker calls a "proleptic history." In discussing contemporary military-themed video game series such as *Rainbow Six, Ghost Recon,* and *Splinter Cell,* Smicker argues that these games:

> function by promising the gamer an opportunity to play a realistic version of the future before it arrives. Although particular plot lines may be unlikely or even far-fetched, the guarantor of authenticity lies in the way the military and warfare are presented—the games, and the publicity around them, emphasize that they are a preview of the actual future of the military.[4]

Likewise, James Phelan argues that "prolepsis partly depends on the principle that in order to understand the present one needs to project a future."[5] Therefore, in depicting the effects of human augmentation on society, the Deus Ex Universe imagines what the world will look like once bionic enhancements are widely available and freely implemented. The series explores

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[3] EidosMontreal. "Ask JJB - How Are Questions of Personal Ethics Tackled in DX:HR? | Deus Ex: Human Revolution." YouTube. April 8, 2011. Accessed June 16, 2014. http://youtu.be/oY2tmOwHXFI.
[4] Smicker, Josh. "Future Combat, Combating Futures: Temporalities of War Video Games and ThePerformance of Proleptic Histories." In *Joystick Soldiers: The Politics of Play in Military Video Games*, edited by Nina Huntemann and Matthew Thomas. Payne, 106-21. New York: Routledge, 2010. (p. 107)
[5] Phelan, James. "Analepsis / Prolepsis." In *Time: A Vocabulary of the Present*, edited by Joel Burges and Amy J. Elias, 240-54. New York: New York University Press, 2016.

themes of bodily autonomy, the emergence of a technocratic social order, and the controversies surrounding the use of augmentations for radical—and oftentimes super-human—enhancement in civilian and military arenas, and invites players to decide which augmentations—if any—their character will adopt as they progress through each game's main narrative. As a result, the proleptic nature of *Human Revolution* and *Mankind Divided* has earned the series widespread praise from critics and the gaming media.[6] However, less attention has been paid to analyzing the series' futuristic engagements with prosthetics marketing, the scope of which demonstrates a multifaceted investment in contemporary discourses concerning bionic technologies. In this proleptic marketing campaign, audiences are both encouraged to consider the reasons they would or would not want to augment themselves in the future, and offered a "preview" of how the language, technology, and aesthetics of the Deus Ex Universe could manifest in the real world.

In exploring the complex role that science fiction plays in framing contemporary discourses about prosthetic technology, I first examine the marketing for *Deus Ex: Human Revolution*, focusing on its adoption of the rhetorical conventions of the prosthetics industry in order to position the game's fictional augmentations as a prescient vision of the near future. I then examine the series of multimedia collaborations surrounding the recent release of *Deus Ex: Mankind Divided*, focusing on how these projects present the Deus Ex Universe as a nexus for contemporary conversations about the future of human technological enhancement. Ultimately, the marketing for the Deus Ex Universe demonstrates how the increasing commercialization of consumer prosthetic technologies is closely linked to depictions of bionic technologies in popular culture—depictions that, paradoxically, often question or challenge their use. Here, a rhetoric of

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[6] See: "Deus Ex: Human Revolution (PC)." Metacritic. 2011. Accessed November 21, 2016. http://www.metacritic.com/game/pc/deus-ex-human-revolution/critic-reviews.
"Deus Ex: Mankind Divided (PC)." Metacritic. 2016. Accessed November 21, 2016. http://www.metacritic.com/game/pc/deus-ex-mankind-divided/critic-reviews.

science fiction cool is used to mitigate critiques levied against a particular technology or practice by promising a real-life version of a high-tech future.

5.1 PROLEPTIC TRANSHUMANISM AND THE DEUS EX UNIVERSE

In exploring a future where bionic technologies are freely used to alter or enhance the human body, the Deus Ex Universe deals with themes of *transhumanism*, or the idea that through technology, humankind will be able to radically alter its evolutionary path in the near future. A summary of *Human Revolution*'s setting in the official game manual illustrates this point:

> Humanity is changing and battle lines are being drawn between flesh and machine. The new technologies of cybernetic implants are creating a new class divide. On one side, the 'Naturals' -- humans who eschew implants because they are either morally opposed to the technology, too poor to afford it, or afflicted with a rare rejection syndrome that renders their bodies permanently incompatible with it. On the other side are the 'Augs' -- humans augmented with cybernetic implants -- and with approximately one-twentieth of humanity possessing augmentations by 2027, these people are slowly becoming the new face of Mankind.[7]

In a game development interview, Mary DeMarle discusses how the central conflict between "Naturals" and "Augs" in *Human Revolution* is intended to make audiences consider the social implications of transhumanism:

[7] Eidos Montréal. Deus Ex: Human Revolution – Director's Cut. Computer software. Square Enix, 2013.

> I think what we were trying to strive for here is we want through the story and through the game to explore the whole concept of transhumanism and of technology and biology, and where is the merging taking us. And one of our goals was really to get you thinking about that issue, and questioning it.[8]

As Jonathan Jacques-Belletête summarizes, the *Human Revolution* team "decided to take transhumanism and make it the core pillar of what we wanted to do." [9]

As a result, *Human Revolution*—and the subsequent Deus Ex Universe—takes on the features of what I will call "proleptic transhumanism," allowing audiences to engage with the politics and aesthetics of a near-future transhumanist society. This is done in two ways: by juxtaposing conflicts resulting from widespread human augmentation in the game world alongside contemporary real-world debates concerning the ethics of radical human enhancement, and by visualizing how transhumanist technologies will radically alter how we view the human body. Before discussing how this is presented in *Human Revolution* and its marketing campaign, I will briefly outline some of the key tenets of transhumanist thought and the major arguments—or hesitations—against it.

In the introduction to *Designer Evolution: A Transhumanist Manifesto*, Simon Young defines transhumanism as "the belief in overcoming human limitations through reason, science, and technology." According to Young:

> Despite the enormous pleasure involved in living, ultimately death and biological limitation make life a tragedy. I find it impossible to blindly accept the suffering imposed upon us by our biological condition. Why must we age and die? Why

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[8] EidosMontreal. "Ask JJB - Will Augmenting Adam Impact the Storyline? | Deus Ex: Human Revolution." YouTube. March 29, 2011. Accessed June 16, 2014. http://youtu.be/BT7zoTpO0qc.
[9] DeusEx. "Deus Ex: Mankind Divided Presents Human by Design." Twitch. August 3, 2016. Accessed August 29, 2016. https://www.twitch.tv/deusex/v/81526366.

> must our brains and bodies be so fragile, subject to inevitable decay—programmed for self-destruction? I believe in seeking to overcome the mental and physical limitations that restrict our freedom.[10]

Young believes twenty-first century scientists should use advanced biotechnology that he calls "Superbiology," asserting that "To increase our ability to survive we must evolve."[11] This moral imperative stems from the seeming disparity between humankind's potential for intellectual and technological achievement and the relative ephemerality of our natural bodies. Here, transhumanism is the extension of human agency, as a means to take a more active role in the future of humanity and ensure that all people have the opportunity to live a meaningful life of their own choosing.

The notion that science and technology will allow society to direct the course of human evolution in the future is also found in the work of futurist, inventor, and computer scientist Ray Kurzweil. In *The Singularity is Near: When Humans Transcend Biology*, Kurzweil writes of an approaching "Singularity," defined as "a future period during which the pace of technological change will be so rapid, its impact so deep, that human life will be irreversibly transformed."[12] He proposes that "within several decades, information-based technologies will encompass all human knowledge and proficiency, ultimately including the pattern-recognition powers, problem-solving skills, and emotional and moral intelligence of the human brain itself."[13] As a result, he argues, "by the end of this century, the nonbiological portion of our intelligence will be

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[10] Young, Simon. *Designer Evolution: A Transhumanist Manifesto*. Amherst, NY: Prometheus Books, 2006. (p. 15)
[11] Ibid. (p. 15-16)
[12] Kurzweil, Ray. *The Singularity Is Near: When Humans Transcend Biology*. First ed. New York: Viking Penguin, 2005. (p. 7)
[13] Ibid. (p. 8)

trillions of trillions of times more powerful than unaided human intelligence."[14] Like Young, Kurzweil describes a transhumanist vision of transcending the limitations of the natural body, allowing us to become the architects of our own future. For those who ascribe to the Singularity, this may also mean the end of the biological body as we know it.

Still, the basic philosophy of transhumanism suggests that a broad range of radical biological, intellectual, and psychological enhancements are necessary for the future survival of humankind. These enhancements will be made possible by rapid scientific and technological developments in fields such as genetics, neurology, gerontology, artificial intelligence, and even "bodily" technologies such as bionics. Transhumanism maintains that these developments are not only possible but inevitable, owing in part to the fact that "technological change is exponential" and "the rate of exponential growth (that is, the exponent) is itself growing exponentially."[15] Transhumanism also argues that society has a moral and ethical imperative to save human lives by curing major diseases, greatly extending life or reversing the aging process altogether. Paramount is the belief in the individual freedom to radically extend one's physical, intellectual, and aesthetic capacities as a human being through technology—part of an ongoing process of evolution that has occurred since the appearance of our species and perhaps the beginning of time. Within this context, proponents of transhumanism sometimes describe their adversaries as "bio-Luddites."[16]

In *Humanity's End: Why We Should Reject Radical Enhancement*, ethics professor Nicholas Agar presents a counterargument to the transhumanist idea of "radical enhancement." According to Agar, "Radical enhancement involves improving significant human attributes and

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[14] Ibid. (p. 9)
[15] Ibid. (p. 12)
[16] Young, Simon. *Designer Evolution*. (p. 17)

abilities to levels that greatly exceed what is currently possible for human beings."[17] Agar believes that the transhumanist vision of the future "threatens to turn us into fundamentally different kinds of beings, so different that we will no longer deserve to be called human. It will make us 'posthuman.'"[18] As Agar explains:

> I conjecture that the most dramatic means of enhancing our cognitive powers could in fact kill us; that the radical extension of our life spans could eliminate experiences of great value from our lives; and that a situation in which some humans are radically enhanced while others are not could lead to a tyranny of posthumans over humans.[19]

Agar's vision of a transhumanist future is not unlike the one presented in *Human Revolution*, which imagines a society in which the benefits of human augmentation are offset by greater social inequality resulting from a—literal—technological arms race. However, in offering a "precautionary approach"[20] to radical enhancement, Agar warns that the continuing extension of human lifespans and intellectual capacities also "presents the prospect of never having any mature interests and attachments," diminishing our commitment to the values, activities, and relationships that make us distinctive. [21] Agar also argues that our limitations are what give meaning to human desire and achievement, using the example of athletics to describe how "unenhanced human spectators are drawn to the achievements of unenhanced human competitors because we recognize them as pushing up against the limits of our own activities."[22] Thus: "To

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[17] Agar, Nicholas. *Humanity's End: Why We Should Reject Radical Enhancement*. Cambridge, MA: MIT Press, 2010. (p. 1)
[18] Ibid. (p. 2)
[19] Ibid. (p. 11)
[20] Ibid. (p. 12)
[21] Ibid. (p. 186)
[22] Ibid. (p. 193)

paraphrase the 1992 Gatorade commercial featuring the basketball legend Michael Jordan, for us to want to try to 'be like Mike,' Mike has to be sufficiently like us."[23]

However, in *Better than Human*: *The Promises and Perils of Enhancing Ourselves*, bioethicist Alex Buchanan argues that "It's too late to 'just say no' to biomedical enhancements: They're already here and more are on the way."[24] For Buchanan, an "enhancement" is broadly defined as "an intervention—a human action of any kind—that improves some capacity (or characteristic) that normal human beings ordinarily have or, more radically, that produces a new one." He defines a "biomedical enhancement" as an enhancement that "uses biotechnology to cause an improvement of an existing capacity by acting directly on the body (including the brain)."[25] Biomedical enhancements therefore include everything from drugs that enhance cognitive performance to technologies that enhance the senses such as sight or hearing.

In regards to the potential for social inequality brought about by a new class divide between unenhanced/enhanced individuals (or "Naturals" and "Augs" in *Human Revolution*'s terms), Buchanan argues that "We already live in a world where some are enhanced and some aren't," due to differences in the availability of resources such as nutrition, medicine, and education. In other words, the world is a "heartless social lottery" in which "Whether you live or die or live well or miserable depends in great part on the kind of society you happen to be born into." [26] In order to avoid a situation where biomedical enhancement technologies will lead to even greater inequalities, Buchanan suggests that "we need to learn how to monitor emerging technologies, in order to determine when they're diffusing so slowly as to create a risk of

[23] Ibid. (p. 196)
[24] Buchanan, Allen E. *Better than Human: The Promise and Perils of Enhancing Ourselves*. New York: Oxford University Press, 2011. (p. 3)
[25] Ibid. (p. 5)
[26] Ibid. (p. 105)

domination or exclusion" as well as "devise ways to speed up diffusion to reduce the risk of domination and exclusion and to alleviate deprivation."[27] Still, this is itself a kind of technological solution. Buchanan notes that "Regarding biomedical enhancement as a legitimate social aim doesn't imply that all individuals are expected to agree that it *is* an appropriate aim for social policy." Therefore, it follows that "Engaging in the enhancement enterprise means giving individuals considerable freedom *not* to pursue enhancements."[28] Ultimately, transhumanism, much like prosthetics, involves questions about freedom: The freedom gained through the use of prosthetic technology (i.e. mobility, dexterity, independence), the freedom to choose which prosthetic technologies to use, and the freedom to live in a society where it is possible to have a meaningful life without them.

These existential questions are central to the proleptic transhumanism of *Human Revolution*. In a video blog posted to the official Eidos-Montréal *YouTube* page on January 12, 2011, Jonathan Jacques-Belletête responded to a fan-submitted question asking about his personal stance on transhumanism, and whether or not it's a blessing or a curse. In the spirit of the Deus Ex Universe, his response is somewhat ambivalent yet contains the transhumanist ethos of an inevitable human evolution through technology. Jacques-Belletête says that he thinks "it's great that very soon, and it's already begun, we'll take control of our own evolution through technology." However, while he sees transhumanism as a natural and inevitable process, he cautions that "we're gonna have to be careful. I mean it's like anything, it can be bad, it can be good … There are gonna be some mistakes, there are gonna be some bad stuff, just like with

[27] Ibid. (p. 115-116)
[28] Ibid. (p. 180)

anything, but there will be some great stuff as well.[29] This dual nature of transhumanism—it's "pros and cons"—is reflected in the treatment of human augmentation in the marketing for *Human Revolution*, which taps into contemporary discourses surrounding the use of prosthetic technology to expanding bodily capabilities: The medical prosthetics industry's rhetoric of self-actualization through technological upgrades, the "super-abled" future of technologically-enhanced evolution espoused by Aimee Mullins and Hugh Herr, and the radical do-it-yourself ethos of the alternative prosthetics industry.

A final point about the relationship between prosthetics and transhumanism: Compared to the transhumanist futures presented by Young, Kurzweil, Agar and Buchanan, the bodily prosthetics and other bionic technologies—whether real or fantasy—discussed in this dissertation may already seem outdated compared to the promise of an immortal future where the very nature of humanity is subject to the free play of our—exponentially enhanced—mental faculties. However, no one can know for certain what the future will hold. In the meantime, these devices are generally viewed as a present-day embodiment of the transhumanist ethos of transcending biological limitations and the freedom of choice granted by technological invention. This is the very nature of science fiction cool, or the rhetorical process by which possible futures are made present.

[29] EidosMontreal. "Ask JJB - What's Your Personal Stance on Transhumanism? | Deus Ex: Human Revolution." YouTube. January 12, 2011. Accessed June 16, 2014. http://youtu.be/ZQsT9X8-4xM.

5.2 MARKETING HUMAN AUGMENTATIONS: SARIF INDUSTRIES

Deus Ex: Human Revolution is set in the year 2027, a near-future dystopia where biomechanical implants called “augmentations” are increasingly used to replace or enhance human body parts. In the game world, augmentations are developed for both civilian and military applications, and range from mechanical limbs and electronic eye prostheses to computerized brain enhancements and synthetic organs—however, it is the visually dynamic, mechanical prosthetic augmentations that are featured most prominently in the game’s marketing. In general, augmentations are acquired for therapeutic reasons—such as treating injury and disease—or are adopted electively by otherwise healthy persons for professional and recreational purposes. The procedure is usually performed at a local “LIMB clinic,” one of a global network of mechanical augmentation clinics operated by the fictional “Liberty In Mind and Body International” (or LIMB International) corporation—a futuristic, transhumanist version of contemporary prosthetics clinics that offer fitting and maintenance services to users of actual bionic limbs.

In *Human Revolution*, the proliferation of human augmentation across all spheres of society has led to a technological arms race in which competing biotechnology companies have become powerful megacorporations, wielding an unprecedented socioeconomic influence and maintaining private security forces of augmented soldiers that rival the armies of nations. As a result, the megacities that surround these firms have developed into economically dependent corporate fiefdoms. Chief among these megacorporations is “Sarif Industries” (or Sarif), a fictional American biotechnology company headquartered in Detroit, Michigan. According to the game’s lore, Sarif Industries was founded in 2007 by philanthropist and CEO David Sarif, and

the company is one of the most advanced manufacturers of custom mechanical augmentations for military and civilian use.[30]

Sarif Industries is also the central entity in an elaborate trans-media viral marketing campaign for *Human Revolution* that presents the company as an actual manufacturer of prosthetic technologies. In addition to serving as a creative way to market a blockbuster video game, the subsequent blending of fiction and reality adopts many of the rhetorical conventions of prosthetics industry marketing in order to position Sarif Industries as a possible future version of commercial bionic limb companies such as Touch Bionics, Ottobock, Mobius Bionics, and RSL Steeper, while also highlighting prevailing themes of futurism and transhumanism in popular discourses surrounding advanced bionic technologies.

The sophisticated trans-media presentation includes websites, product pages, news reports, press releases, documentary films and video advertisements that situate Sarif Industries' fictitious company background within the historical context of actual biotechnology milestones, offering enough real-world authenticity to smuggle in believable-sounding falsehoods. However, it does not matter if the viewer knows that the viral advertisements are "real" or not—many viewers only find out about viral marketing campaigns after news sites or official sources reveal their existence. The rhetorical significance of the Sarif Industries campaign is the way in which it extrapolates upon current prosthetics marketing trends in order to envision how bionic technologies will be marketed in the future, capitalizing on the perceived closeness between the fictional messages and actual reality in its overall presentation. This reflection of the prosthetic present reinforces *Human Revolution*'s ethos as a relevant or proleptic vision of the future,

[30] Eidos Montréal. Deus Ex: Human Revolution – Director's Cut.

portraying the Deus Ex Universe as a nexus for contemporary discussions about the kind of future possibilities available to humankind.

In examining the marketing for Sarif Industries, the name "Sarif" itself initially evokes a polysemy of meanings. According to the *Oxford English Dictionary*, the term *serif* most commonly refers to "any of the cross-strokes or finishing strokes at the end of a principal stroke of a letter." These were "first used by ancient stonecutters to define the limits of the chiselled principal strokes of Roman letters more clearly, and were later added by pen to written texts to give weight and clarity to the ends of the strokes." A Sarif Industries augmentation is likewise marketed as the finishing touch that accentuates the human body, allowing one to stand out and re-define their sense of self. The etymology of serif also includes the Latvian *skrīpāt*, meaning "to cut, to score, to engrave."[31] To utilize an augmentation, the original body part that it is replacing must be cut away, and the body is literally re-inscribed with the scars of technological integration. Today, we think of the term serif in regards to digital typeface, in which the term *sanserif* has come to mean a typeface devoid of extra ornamentation.[32] However, this is also its own kind of design statement, indicating a sleek, modern look. The name Sarif also suggests the term *seraph*, one of the Biblical *seraphim*, a being of the highest rank in Christian angelic hierarchy that is described as having "six wings, hands and feet" and "hovering above the throne of God."[33] This interpretation reflects founder David Sarif's portrayal as a technological prophet, as well as Sarif Industries' goal of facilitating the highest stages in human evolution. These themes of style and accent, bodily agency through reconstruction, and human enlightenment are featured heavily in the proleptic transhumanist marketing for the fictional company.

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[31] "Serif, N. and Adj." OED Online. June 2014. Accessed June 17, 2014. http://www.oed.com/view/Entry/176459.
[32] "Sanserif, N." OED Online. June 2014. Accessed June 17, 2014. http://www.oed.com/view/Entry/170744.
[33] "Seraphim | ˈseraphin, N." OED Online. 2016. Accessed September 13, 2016. http://www.oed.com.pitt.idm.oclc.org/view/Entry/176348.

On November 30, 2010, video game news site *G4* reported that a "viral teaser site" for Sarif Industries had been discovered as part of the ad campaign for *Human Revolution*.[34] In typical viral media fashion, the "www.sarifindustries.com" website portrays Sarif Industries as a real biotechnology company, with facsimile press releases and news articles about the company and informational pages about their products. [35] For example, the "Augmentations" section of the site features product pages with images and information about five major categories of augmentations provided by the company: "Vison," "Power," "Insight," "Speed," and "Durability." Each sub-page features 3D artwork and renderings of the corresponding augmentation and a schematic diagram with interactive rollover elements that provide technical specifications about the device. For example, the "Cybernetic Arm Prosthesis" listed under the "Power" category is a "Mechanical Arm Replacement" that allows you to "Replace your organic arm with a vastly stronger mechanical one that will never tire, ache, or fail you." The explanation of "How it works" uses real-world technical jargon to add to its realistic-yet-futuristic presentation: "Built on a lightweight framework of advanced polymers, liquid buffers, and micro-motors, the prosthesis replaces organic musculature with myomers (electro-stimulated cables) that mimic the actions of muscle tissue, but to a greatly strengthened degree." Likewise, the "Cybernetic Leg Prosthesis" under the "Speed" category is a "Mechanical Leg Replacement" that allows the user to "Move with the grace, precision, and power only afforded by the most advanced technology ever conceived." According to the "How it works" section, "The prosthesis replaces your cumbersome organic limbs with a casing of lightweight polymers that protect an

[34] Gaskill, Jake. "Deus Ex: Human Revolution's Sarif Industries Gets Super Exy Viral Site." G4. November 30, 2010. Accessed August 26, 2016. http://www.g4tv.com/thefeed/blog/post/708917/deus-ex-human-revolutions-sarif-industries-gets-super-exy-viral-site/.

[35] Sarif Industries. 2010. Accessed August 10, 2016. http://www.sarifindustries.com/.

interior of myomers (electro-stimulated cables), allowing you to run faster, jump higher, and move without making a sound." These "fake" depictions of Sarif Industries augmentations offer up background information on the technology and lore featured in the game. They also allow one to view each technology outside of the context of the game itself, as disembodied appendages hovering in virtual space.

In an interview about the inspiration for the design of the prosthetic technologies featured in the game, *Human Revolution* Art Director Jonathan Jacques-Belletête explains that:

> We mostly decided to go with our own direction, in the sense that we bought a lot of books, we spoke to a lot of people that are in those technological fields, and basically we tried to make sure that we knew where technology was going for the next ten, fifteen, twenty, thirty years and base the technology in *Human Revolution* on those things. I think it was really about doing our homeworks to make sure that our futuristic anticipation was right, and at the same time, well, it's a video game, it's an entertainment product, so, you know, we over-exaggerate it once in a while because we want to have fun while creating those things.[36]

The augmentations featured are decidedly anthropomorphic, having a natural shape that mimics human anatomical structure and musculature. However, their surfaces are broken up with various panels, ports, roundels, and other sculptural and technological embellishments, evidencing the highest level of contemporary science fiction design aesthetics. In spite of their futuristic appearance, all augmentations are shown in various shades of glossy white and black, imitating the traditional color palette of the medical prosthetics industry. As they gently float onscreen on

[36] EidosMontreal. "Ask JJB - How Did You Make Things Look Less Advanced than the Original? | Deus Ex: Human Revolution." YouTube. January 14, 2011. Accessed June 16, 2014. http://youtu.be/-gCJBQJ3Qjw.

the website, it is the disembodied limbs themselves—not the people wearing them—that are emphasized.

In finding the proper balance between technological accuracy and stylistic "exaggeration," the Sarif Industries augmentations featured in the game are grounded in reality yet offer the future promise of something greater. This embellishment of actual reality with imagination is found across the Sarif Industries website. A section of the Sarif Industries site called "The Road to Here" encourages visitors to "Explore the Evolution of Augmentation" and "Take Your Place In History," and includes an interactive "Timeline to Augmentation" featuring milestones in human augmentation, organized by decade. Each decade of the timeline alternates between actual developments in the history of biotechnology and fictional events from the game world. For example, the first entry for 1961 titled "MIT Gives a Hand" describes the development of the "MH-1" computer-controlled mechanical hand at the Massachusetts Institute of Technology.[37] Similarly, a 1998 entry titled "Me, Myself and Electrode" describes research done at the Emory University School of Medicine using a brain implant device called a "neurotrophic electrode" in which a paralyzed and speech-impaired patient was able to communicate by moving a cursor on a computer screen to select phrases and letters.[38]

These are followed by more ambiguous yet plausible-sounding fictional entries, such as 2004's "New Arms for U.S. Military," which proclaims that "Development begins for Project Phoenix, a new initiative implemented by the U.S. Military inviting amputee soldiers serving in the two Persian Gulf Conflicts to volunteer for advanced prosthetics research." Although no such

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[37] Ernst, Heinrich Arnold. "MH-1, a Computer-operated Mechanical Hand." Master's thesis, Massachusetts Institute of Technology, 1962. Accessed September 21, 2016. https://dspace.mit.edu/handle/1721.1/15735.

[38] Emory University. The Robert W. Woodruff Health Sciences Center. "EMORY NEUROSCIENTISTS USE BRAIN IMPLANT TO HELP PARALYZED AND SPEECH-IMPAIRED PATIENTS COMMUNICATE VIA COMPUTER." News release, February 23, 1998. Woodruff Health Sciences Center Newsroom. Accessed September 21, 2016. http://www.whsc.emory.edu/_releases/1999february/022399brain.html.

project exists, the description bears close similarity to the actual Wounded Warrior Project, founded in 2003 in support of military veterans wounded after September 11, 2001. This is followed by a 2009 entry titled "Congress Calls Upon Sarif," which details the passing of the fictional "Recycle Military Bill, financing free prosthetics for any wounded veteran who re-enlists." According to the description, in 2009 Sarif Industries wins the "lucrative prosthetic manufacturing contract and becomes the number one prosthetic manufacturer in America."

Leaping ahead to 2021, an entry titled "The Right to Bear New Arms" describes a U.S. Supreme Court ruling "declaring it constitutional for people to have the right to choose to mechanically augment themselves," and a 2027 entry titled "Prosthetics' New Star" describes a performance by "African pop star NyAshia Akim" who wears "beautifully crafted" Sarif augmentations after being "severely injured in a terrorist attack in Lagos in 2025." This latest entry is accompanied by a photograph of an elegant-looking woman holding a microphone with a Sarif prosthesis superimposed onto her left arm and shoulder. The thirty-four entries in total cover fictional topics such as developing labor disputes concerning the hiring of augmented workers, the adoption of augmented soldiers into the U.S. military, and the rise of anti-augmentation protest groups, blending real and fictional histories together into a seamless narrative that demonstrates how *Human Revolution* could theoretically exist within the timeline of our world. In fact, due to the brevity of the descriptions provided on the website, even the actual historical milestones necessitated additional research to verify their authenticity.

In addition to the interactive timeline, the "The Road to Here" section also includes a list of "Links to Progress" which feature "Augmentation on the Web." These are a collection of news stories featuring actual developments in the world of prosthetics and biotechnology occurring during the years the game was in development. Unlike the stories referenced on the

timeline, these articles are fully cited, and clicking on one of the links brings up a window with the title, author, and a brief summary, with an external link to the full article. Articles include an April 21, 2009 article on *Engadget* about a new powered knee prosthesis from Össur[39] as well as an April 2, 2010 article on *Wired* about a new bionic eye implant from Bionic Vision Australia designed to help patients suffering from degenerative vision loss.[40]

This pseudo-realism extends to the "Sarif Industries" section of the Sarif Industries site, which provides general information about the company, their mission, related press and news, investor information, and even entries for career opportunities and ethical guidelines. The information under the redundantly-named "Sarif Industries" heading describes the working philosophy of the company and its founder and CEO, David Sarif:

> No one should ever have to give up a normal life because of a random incident, or indeed, lose a dream over a physical limitation. So believes David Sarif, idealist, philanthropist, founder and CEO of Sarif Industries. …Today, we at Sarif Industries share David's passion. We believe that human augmentation will give people every opportunity to improve themselves, making the world a better place to live.

Here, Sarif's ideology resembles that of real-life prosthetics inventors and entrepreneurs such as Hugh Herr, who often speak about the enabling potential of new bionic technologies in democratic terms. The information under the "What We Do" heading similarly imitates the

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[39] Flatley, Joseph L. "Ossur's New POWER KNEE Prosthesis Sports A.I., Motorized Actuators." Engadget. April 21, 2009. Accessed September 21, 2016. https://www.engadget.com/2009/04/21/ossurs-new-power-knee-prosthesis-sports-motorized-actuators-ai/.

[40] Ganapati, Priya. "Bionic Eye Attempts to Restore Vision." Wired.com. April 2, 2010. Accessed September 21, 2016. https://www.wired.com/2010/04/australian-bionic-eye/.

marketing language of prosthetics manufacturers and providers, which emphasize individualized, patient-oriented service and care:

> Sarif Industries specializes in the design and manufacture of advanced mechanical augmentations for human implantation. The company distinguishes itself from its competitors by working with clients to create progressive, forward-thinking, custom augmentations that answer specific challenges and needs. …Sarif maintains an in-house staff of doctors and nurses in addition to HET (Human Enhancement Technologies) scientists and researchers, who are trained to work with clients to determine individual needs.

The description recalls the language of the "custom" cosmetic accessories provided by companies such as Touch Bionics and the type of individual fitting, financing, and maintenance programs provided by clinics such as Hanger.

The proleptic nature of Sarif Industries is further emphasized in the information under the "News" heading of the "Sarif Industries" section, which features a brief list of news headlines dating from 2007-2009. Here, headlines that refer to actual events in the world of prosthetics are juxtaposed with headlines describing story elements from the game world. Unlike the "Links to Progress" featured in the "Road to Here" section, there is no direct link or citation for the specific real-world stories being referenced and only a headline is provided. For example, a cursory investigation reveals that the three headlines titled "Double Leg Amputee Breaks 100M World Record," "The International Association of Athletics Federation Bans Prosthetics in Abled-body Competitions," and "Court of Arbitration for Sport overrules IAAF Ban on Prosthetics in Able-bodied Competitions" are referencing the career of now-disgraced South African double-amputee sprinter Oscar Pistorius and his efforts to become eligible for able-

bodied athletic events—and ultimately qualify for the 2008 Olympic Games in Beijing.[41] In this way the website leans on the audience's familiarity with current events, using them as a present-day foundation or tether to the proleptic vision of the future it wants visitors to entertain.

In addition to the website itself, an in-universe promotional video for Sarif Industries titled "Sarif Industries: Testimonials" was produced by the Vancouver, Canada based Goldtooth Creative Agency and directed by Kody Sabourin.[42] The video, which normally plays when one first visits the Sarif Industries site, was published on the official Eidos-Montréal *YouTube* page on May 17, 2011 as "Sarif Industries: Augmentation Testimonials." The "Augmentation Testimonials" ad is one of the most prominent pieces of viral media produced for the campaign, and portions of it continue to be used in current promotions for the Deus Ex Universe. Functioning simultaneously as an advertisement for both a video game and a fictional prosthetics company, the video features themes and imagery common to the patient testimonials featured on the websites of real prosthetics manufacturers and providers. In particular, the ad demonstrates how Sarif's augmentations allow users to reclaim their sense of bodily agency, pursue their interests and passions, and express their individual personalities.

The video advertisement features a combination of live actors with Sarif augmentations digitally superimposed onto their body as CGI effects. The description for the video reads: "Putting a face and voice to human augmentation, Sarif Industries invites you to hear the latest stories of those improving their lives through cybernetic enhancements." There are three "stories" featured in the video: Robyn, age 25, a concert pianist from New York City with prosthetic hand augmentations; Andre, age 31, an adventurer from Los Angeles, California with

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[41] "Pistorius Eligible for Olympics." BBC News. May 16, 2008. Accessed September 21, 2016. http://news.bbc.co.uk/sport2/hi/olympics/athletics/7243481.stm.
[42] "DEUS EX: HUMAN REVOLUTION." Goldtooth Creative. Accessed November 01, 2016. http://goldtoothcreative.com/work/deus-ex-human-revolution/#.

prosthetic eye augmentations that allow him to take pictures; and Trevor, age 44, a father and former football player from Vancouver, British Columbia with a complete right arm and shoulder augmentation.

The ad begins with a close-up of Robyn playing piano on a digital monitor in the foreground, while a camera crew is seen filming her in the background. This act of self-filming enhances the overall illusion of realism by giving a "behind the scenes" glimpse at the filming of the ad—it is as if a news crew had stepped onto the set. As Robyn plays the delicate piano composition that serves as the ad's soundtrack, she says "It's changed my life. It's enabled me to do my craft, to do my one passion in life." It isn't explained whether or not Robyn elected to replace her otherwise healthy hands with the—presumably superior—white Sarif prostheses, or if she did so as the result of a disability.

The willingness to augment oneself is clearly expressed by Andre, who remarks: "Taking pictures, easy as blinking my eye." We then see Andre, hiking to the top of a hillside at sunset, pronouncing that: "Now when I take chances, when I take risks, the whole world gets to see what I see. I wanted to be better. I want to be best of the best, part of the elite." We see a brief glimpse of what Andre "sees," showing the graphical overlays and targeting software that provides him with location data and camera options. A close-up of his right eye reveals a series of concentric yellow and black mechanical rings circling his pupil and iris as they rotate and focus like a camera lens.

The third character, Trevor, is shown holding a football on an outdoor field, his augmented right arm hidden from view. "Football's always been a big part of my life. And after what happened, I didn't think I was gonna get to play ball with my son. And, to be able to come out here and play ball with him, it's like a new life." The exact incident that caused Trevor to

lose his right arm is unspecified. However, his role as a former athlete with a desire to play again is a familiar narrative in prosthetics marketing. In describing his father's new arm, Trevor's son exclaims: "It's super cool. Now when we play football, he can like throw way further." His comments echo the reaction of Juan Arredondo's own son to his early i-limb (discussed in the previous chapter). With the aid of seamless digital effects, Trevor is shown joyfully throwing the ball to his son as artificial muscles ripple across the sleek, silvery Sarif arm augmentation.

As indicated by Trevor's son, the notion that augmentations are enhancements pervades the advertisement. According to the more competitive Andre, "Run faster, jump higher. If I want to be the best, then that's what I gotta do." Trevor says "I actually can feel things. When I pick up the football, I can feel the pigskin on my fingers." Similarly, Robyn touts the improved capabilities of her new hands, explaining: "I play the piano a million times more than I ever played it. It's easier, I'm enjoying it more, and that's why everyone knows me, for my Sarif augmentations."

In the final act of the ad, Andre says: "Thanks to Sarif's augmentation, I see the world in a whole new light. I see it like I've never seen it before." Trevor, offering similar praise, declares: "It just feels like a real arm, but better. You know, you feel like a pro athlete with it on. It's been really, a revelation." Finally, "It truly, truly has changed my life," says Robin with a smile. The ad ends with the Sarif logo and a voiceover inviting the viewer to visit the Sarif Industries webpage.[43]

The scenes in the ad are clean and dreamlike, indicating that while Sarif augmentations are widely available, their recreational use is reserved primarily for the upper-class elite. However, like actual prosthetics advertisements, they focus on "everyday" situations—a piano

[43] EidosMontreal. "Sarif Industries: Augmentation Testimonials." YouTube. May 17, 2011. Accessed June 16, 2014. http://youtu.be/UWmeBeRb1RY.

studio, a forested hillside, a school football field—locating new technology within familiar spaces. The testimonials' focus on desire, individuality, and the ability of the augmentations to restore confidence and a sense of normalcy is also similar to the narratives seen in the presumably real patient testimonials discussed in previous chapters. They are depicted as complementing, or facilitating the preexisting interests, desires, and personalities of each user. Furthermore, Sarif augmentations, especially their mechanical limbs, are also decidedly robotic-looking even if they feature a sculptured artificial musculature that loosely resembles human anatomy. We can presume that in a world where technology has advanced to the point of bionic eyes, computer-enhanced brains, and prosthetic hands that are fluid enough to play the piano, it would be simple enough to make them look and feel like human body parts. However, just as there is a trend towards sculptural forms in prosthetics today, *Human Revolution*'s augmented society of 2027 is one in which an individual uses prosthetics to stand out—or stand above.

Like the Sarif Industries website, it does not matter if the viewer knows that the testimonials are fake. The importance is in demonstrating that the game's developers and marketing are paying attention to real-world prosthetic developments—a sign of the game world's proleptic relevance. It also demonstrates that these depictions of augmentations are a natural extension of current social discourses concerning prosthetic technology.

Ultimately, the overall presentation of Sarif Industries was so convincing that in 2013 British tabloid *The Sun* famously mistook Sarif Industries to be a real company. In a section describing real-world examples of the use of "cybernetic implants" such as Canadian filmmaker Rob Spence, an actual person who replaced his glass eye with a wireless camera, the paper also noted that "US firm Sarif Industries has developed an eyeball implant." The section is

accompanied by a render of an eye augmentation from the Sarif Industries website.[44] In an August 3, 2016 presentation at The Paley Center for Media in New York City reflecting on the development of *Human Revolution*, Jonathan Jacques-Belletête noted that although this was "probably just very very bad journalism," it was "still funny that a bad journalist still thought that this was real." According to Jacques-Belletête:

> We put so much energy in inventing these things, that some people almost started thinking…that this is what we made for real. People sometimes thought we were a cybernetics company, which is really really weird.[45]

In revealing *Human Revolution*'s "really weird" ability to seemingly fool less scrupulous journalists with its convincing presentation of Sarif Industries' augmentations, Jacques-Belletête's joking reference belies the extent to which the designers aimed to create the most believable world possible. Furthermore, Eidos-Montréal and Square Enix would ultimately enter the "cybernetics" business through a series of efforts to build real-life prosthetics inspired by the Sarif Industries augmentations featured in the game.

5.3 "DOUBLE VISIONS" IN DEUS EX: ADAM JENSEN

As a science fiction-themed video game, *Human Revolution* is part of a cinematic tradition that "privileges a very particular kind of 'to-be-looked-at-ness'… informed by popular understanding

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[44] Tuffcub. "The Sun Mistakes Sarif Industries From Deus Ex As A Real Company." TheSixthAxis.com. October 16, 2013. Accessed June 17, 2014. http://www.thesixthaxis.com/2013/10/16/the-sun-mistakes-sarif-industries-from-deus-ex-as-a-real-company/.

[45] DeusEx. "Deus Ex: Mankind Divided Presents Human by Design."

of science."[46] As a result, the series' augmentations are sophisticated spectacles of science fiction technology that take inspiration from observed real-world trends in industrial design. The game and its marketing are deeply invested in the visual appeal of mechanical augmentations, depicted as powerful, sculptural, and aesthetically beautiful. This technological imagery also seems to align naturally with the ethos of the contemporary alternative limb industry, which privileges the appearance of prosthetic limbs as much as their functionality.

However, while augmentations are designed to be attractive and visually stimulating, the series often features more ambivalent and destructive depictions of human augmentation, questioning both the practice and its appeal even as audiences are offered the chance to symbolically "augment" themselves through immersive gameplay, wearable fashions, digital apps, and—ultimately—actual open-source prosthetics. The contradictions bound up in these depictions of technology are central to the way in which the game attempts to grapple with themes of transhumanism.

The most prominent "user" of Sarif Industries' augmentations is Adam Jensen, the main protagonist of the Deus Ex Universe. Featured heavily in the series' marketing, Jensen's most conspicuous augmentation is a pair of sleek black mechanical arms. Since Jensen's first appearance in *Human Revolution*, his Sarif Industries arms have become a premier pop-culture benchmark inspiring the development of real-world alternative prosthetics. Like the Terminator, Iron Man, and Venom Snake, Jensen also reveals a pattern of using seemingly ambivalent—and at times violent—presentations of science fiction technology—and transhumanism—to market the appeal of real-world bionic limbs. At this juncture, details about Jensen's role in *Human*

[46] Britton, Piers D. "Design For Screen SF." In *The Routledge Companion to Science Fiction*, edited by Mark Bould, Andrew M. Butler, Adam Roberts, and Sherryl Vint, 341-49. London: Routledge, 2009. (p. 342)

Revolution's story are necessary to help illustrate future points about the series of contradictions that arise from his usage in prosthetics marketing.

In *Human Revolution*, Jensen is a former Detroit Police Department SWAT commander who was hired by David Sarif to serve as chief of security for Sarif Industries—a measure that reflects the competitive, controversial, and high-profile nature of Sarif's proprietary augmentation research. The game begins with an attack on Sarif Industries' laboratories by augmented special-forces soldiers secretly sponsored by rival Hong Kong-based pharmaceutical and biotechnology company VersaLife Corporation. According to the game's lore, VersaLife produces the proprietary anti-rejection drug Neuropozyne (colloquially known as No-Poz or Nu-Poz). This highly expensive and closely controlled substance is designed to prevent the buildup of glial scar tissue around the juncture between cybernetic implants and human nervous tissue, which can block the transmission of electrical signals between the body and its augmentations. Neuropozyne must be taken regularly by anyone with augmentations to prevent mental and physical complications and ultimately the complete failure of their artificial body parts.

Playing out in a sequence of gameplay segments intercut with cinematic cutscenes, the surprise attack comes on the eve of Sarif Industries' announcement of an alternative to Neuropozyne, developed by Sarif's top neurologist—and Jensen's ex-girlfriend—Megan Reed. This technology would revolutionize the augmentation industry by completely eliminating the human immune system's rejection of neurological implants and the subsequent reliance on Neuropozyne. It is revealed later in the game that Jensen has a unique genetic signature that allows him to fully integrate with augmentations without suffering the effects of rejection, and that an analysis of Jensen's DNA was the basis for Megan Reed's medical breakthrough. However, Reed's data is stolen and she is seemingly killed in the attack along with four other

lead researchers. In his attempts to protect Megan, Jensen—un-augmented at this point in the game—is severely beaten by a fully-augmented soldier, thrown through a plate glass wall, shot in the head with a .357 magnum, and left for dead. After the incident, Jensen, now in critical condition, is recovered by David Sarif. Sarif, taking advantage of a clause in Jensen's employment contract, implants—without Jensen's consent—all of Sarif Industries' experimental military-grade augmentations in an effort to save his life.

Jensen's transformation is depicted in the game's opening credits in a sequence created by Goldtooth Creative Agency. A common practice in the development of blockbuster video games is to subcontract key cinematic sequences and trailers to various advertising agencies and special effects studios. The title cinematic produced by Goldtooth Creative utilizes a combination of live action footage, practical effects, and CGI set to a score by game composer Michael McCann in order to depict the mortally wounded Jensen's transformation into the augmented Sarif Industries agent the player controls throughout the game.[47] An article documenting the creation of the sequence featured on *Art of the Title*, a publication dedicated to creators of title and credits sequences for film and video games, summarizes the scene's concept:

> Adam Jensen is dying. The blinding lights of an operating theater melt away in a mechanical fever dream of pleading voices, surgical tools, and rent flesh. Memories of lost love flash between images of a broken and dissected form, while shattered limbs and failing organs — the embodiment of Jensen's flawed humanity — are replaced with the cold perfection of carbon fiber and silicon. A body restored, a soul fractured — but what remains of the man? A corporate thrall

[47] Goldtooth Creative. "Deus Ex: Human Revolution - Opening Credits." Vimeo. September 6, 2011. Accessed June 18, 2014. http://vimeo.com/28676639.

> bound to unseen masters or a transcendent being gifted with the power to change everything?

According to Jean-François Dugas, Game Director on *Human Revolution*, Eidos-Montréal "wanted a sequence that would tell the story of Adam Jensen's life being saved on an operating table." The goal was to "convey a kind of dream-like quality for the sequence as if Jensen lost consciousness and then partially woke up," as memories of his relationship with Megan Reed fade in and out. In an interview with Goldtooth Creative's Paul Furminger, the title sequence's director, he explains that:

> Central to the game is the exploration of the murky boundary between man and machine in a technological age. In the opening scene, Adam Jensen, the first-person protagonist, is attacked and left for dead. Without consent, his employer reconstructs his body, saving his life but changing him forever. It was this reconstruction that we needed to depict in the opening title sequence — to show machinery slowly taking over Adam's body and, more importantly, to show his body accepting the augmentations, using them to become stronger, to become something more than human.

According to Furminger, the title sequence depicts key imagery such as "the heart covered with Sarif-owned circuitry, the gears driving augmentations deep into Jensen's body, and the robotic arm splayed out on the operating table."[48] During the sequence we see an armless Jensen lying on an operating table, writhing in pain as a series of surgical robotic arms install and adjust his new Sarif-branded bodily augmentations, revealing the mechanical sockets on his shoulders that evidence a more elaborate mechanical framework embedded throughout his torso. As a bit of

[48] Perkins, Will. "Deus Ex: Human Revolution." Art of the Title. January 30, 2012. Accessed June 18, 2014. http://www.artofthetitle.com/title/deus-ex-human-revolution/.

dark humor that highlights the stakes of Jensen's transformation, an accessible in-game email on the computer of Vera Marcovic, a doctor in Detroit's LIMB clinic, explains that Jensen underwent "full replacement of chest cavity and left arm; right arm and legs replaced at behest of employer, authority granted under terms of employment contract." While augmentations were needed to save Jensen's life, David Sarif requested amputations and modifications beyond what was necessary.[49]

In discussing the so-called "murky boundary between man and machine in a technological age," the sci-fi world of *Human Revolution* simultaneously presents visions of technological utopia within a global dystopia. Becoming an augmented human is therefore depicted with what J. P. Telotte refers to as a "double vision that typifies the genre."[50] According to Telotte, "Our creations—the products of science, the shapes of technology, the images conjured by our reason, especially those of a human artifice—are both alluring and potentially dangerous."[51] Likewise, Isaac Asimov notes that "From the start, then, the machine has faced mankind with a double aspect. … The simplest and most obvious fear is that of the possible harm that comes from machinery out of control. In fact, any technological advance, however fundamental, has this double aspect of good/harm and, in response, is viewed with a double aspect of love/fear."[52] In depicting science and technology with a series of double visions, Ben Bova similarly suggests that science fiction is itself "a two-edged weapon, … It is necessary to warn as well as evangelize. Science can kill as well as create; technology can deaden the human

[49] Eidos Montréal. Deus Ex: Human Revolution – Director's Cut.
[50] Telotte, J. P. *Replications: A Robotic History of the Science Fiction Film*. Urbana: University of Illinois Press, 1995. (p. 126)
[51] Ibid. (p. 126-127)
[52] Asimov, Isaac. *Asimov on Science Fiction*. Garden City, New York: Doubleday & Company, 1981. (p.156)

spirit or lift it to the farthermost corners of our imaginations."[53] In this simultaneous effort to "warn" and "evangelize," many of *Human Revolution*'s double visions play out in the presentation of Adam Jensen's augmentation-laced body, which is ultimately—and paradoxically—designed to be a highly marketable object of technological desire in spite of the series of bodily violations that led to his augmented state. Jensen's struggle to understand his own humanity—even as his sleek Sarif augmentations transform and burst into an array of blades, projectiles, and explosive weaponry—is central to the game's themes but also reveals some of the contradictions in science fiction-based prosthetics marketing.

These conflicting depictions of human augmentation are made clear in a television advertisement produced for *Human Revolution* by the DDB LA agency, featuring the art direction of Jaclyn Yuan and post production work by Goldtooth Creative. In this ad, titled "I Never Asked for This," Jensen's voiceover declares: "I never asked for this. I never asked to be shown how human I was — or how much more I could become." The ad features a montage of the above scenes of Jensen's violent transformation and subsequent rebirth. His physical and emotional pain makes him vulnerable, yet at the end of the ad, Jensen is seen with a smile on his face, as he uses his new augmented eyes to spot a soldier through a concrete wall before using his new mechanical arms to smash through and incapacitate him.[54]

These contradictions also play out in the opening to an extended trailer for *Human Revolution* produced by Goldtooth Creative and directed by Kody Sabourin.[55] The trailer begins with a recreation of the scene from Rembrandt's iconic 1632 painting "The Anatomy Lesson of

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[53] Bova, Ben. "The Role of Science Fiction." In *Science Fiction, Today and Tomorrow: A Discursive Symposium*, edited by Reginald Bretnor, 3-16. New York: Harper & Row, 1974. (p. 14)
[54] Yuan, Jaclyn. "Deus Ex: Human Revolution "I Never Asked For This"." Vimeo. August 29, 2011. Accessed June 16, 2014. http://vimeo.com/28312344.
[55] EidosMontreal. "Deus Ex: Human Revolution - Extended Cut Trailer." YouTube. June 4, 2012. Accessed June 16, 2014. http://youtu.be/jsJM8nwwyew.

Dr Nicolaes Tulp." The painting depicts a dissection demonstration performed by Tulp in January 1632 on behalf of the Amsterdam Guild of Surgeons.[56] Here, the body on the demonstration table is that of Jensen, the skin on each arm carefully removed, with the dark musculature beneath resembling the sleeve-like appearance of his Sarif Industries augmentations. As Tulp demonstrates to a crowd of observers how the muscles of the arm are attached, Jensen suddenly dissipates in a cloud of yellow mist, rising above the table as his arms transform into enormous white-feathered wings. Bursting from the auditorium and flying towards the sun, his wings burn up like those of the ill-fated Icarus, and he falls back to earth. The juxtaposition of Tulp's dissection with the myth of Icarus reveals an essential double-vision at play: While Tulp's dissection evidences *Human Revolution*'s central "Renaissance analogy"[57] of progress and enlightenment through the study and deconstruction of the body, the Greek myth of Icarus is a reminder that technological hubris can have dire consequences. It also demonstrates the tension between the natural and artificial that runs through the history of prosthetics, where art and artifice imitates life while also aiming to transcend it.

Upon waking from his nightmare, Jensen sits up suddenly to find that the armored cowling of his arms has burst open, revealing the slick black carbon fiber musculature below. As the sculpted plates shift and slide back into place flush among the surface of the prostheses, Jensen takes a drink, and the glass begins to crack in his hand. Just as learning to use a bionic hand to perform even simple tasks takes practice in the real world, the advanced augmentations in *Human Revolution* require a similar adjustment period. In describing Jensen's lack of control

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[56] "The Anatomy Lesson of Dr Nicolaes Tulp." Museum Het Rembrandthuis. Accessed October 31, 2016. http://www.rembrandthuis.nl/en/rembrandt-2/rembrandt-the-artist/most-important-works/the-anatomy-lesson-of-dr-nicolaes-tulp/.

[57] EidosMontreal. "Ask JJB - Are the Geometrical Patterns Linked to the Story in Any Way? | Deus Ex: Human Revolution." YouTube. January 10, 2011. Accessed June 16, 2014. http://youtu.be/5N0CJYJkntg.

over his augmentations, Mary DeMarle notes that "at the beginning of the story he's lost control of a fundamental choice in his life, and he's driven to find out why, and to regain control."[58] This "control" is also enacted by player choices about which augmentations to activate throughout the game, allowing for stealth and nonlethal approaches to problem solving in addition to traditional run-and-gun gameplay.[59] In addition to serving as a gameplay device, this notion of control and player choice is also crucial to cultural attitudes about the role of technology and its ability to enhance or limit human agency.

However, regardless of the player's choices, Jensen's most recognizable feature is his Sarif Industries arm augmentations, and imagery of the arms is featured heavily in the marketing for the game—demonstrating a continued trend in marketing the bionic arms of popular characters even at the expense of the characters themselves. For example, in order to promote the release of *Human Revolution*, video game retailer *Gamestop* ran a contest titled the "Augment Your Room Sweepstakes" for customers who pre-ordered the game from July 8 to August 30, 2011. In addition to "over $20,000 of cutting edge electronics and prizes," the winner of the "augmented living room" would receive the "Deus Ex: Human Revolution Statue Showpiece – a scale replica of Adam Jensen's bionic arm."[60] A post on the official Deus Ex Universe franchise *Tumblr* titled "Armed and Dangerous - The Official Adam Jensen Arm" showed off another full-scale replica of Jensen's arm that was built for display at gaming conventions and trade shows.[61]

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[58] EidosMontreal. "Ask JJB - What Themes Are in the Game besides Transhumanism? | Deus Ex: Human Revolution." YouTube. April 6, 2011. Accessed June 16, 2014. http://youtu.be/040a5tz-Zog.
[59] EidosMontreal. "Deus Ex: Human Revolution - "Three Ways to Play" Trailer." YouTube. March 25, 2011. Accessed June 16, 2014. http://youtu.be/9_LcUiJbjLA.
[60] "PowerUp Rewards - Deus Ex: Human Revolution Augment Your Room Sweepstakes." Gamestop.com. 2013. Accessed June 18, 2014. https://www.gamestop.com/poweruprewards/PUR/Index/Augment.
[61] DeusEx. "Armed and Dangerous - The Official Adam Jensen Arm." Tumblr. February 18, 2013. Accessed August 29, 2016. http://deusex.tumblr.com/post/43424621023/armed-and-dangerous-the-official-adam-jensen.

A post two days later included even more images of the arm, citing an overwhelming fan response.[62]

The post links to a video documentary on the official Eidos-Montréal *YouTube* page detailing the process used to create the model of Jensen's arm. Many of the steps are similar to those used to make actual wearable alternative prostheses, such as using 3D modeling and printing to produce a prototype and using artisan techniques to hand-mold and refine the final piece—which in this case is finished off with an automotive clear-coat to evoke the shiny look from the game. This is evidence of how digital technologies have helped actual and fictional/virtual prosthetics to converge, while also reintroducing hand-craftsmanship or "analog" methods to prosthetics production. According to the narrator, "After all these steps are completed, the cyber arm gets put inside of its custom-made Plexiglas display case, and its name plate gets set alongside the arm so that visitors can look at the arm and imagine it a real cybernetic prosthesis that they might perhaps put on themselves."[63]

In an effort to let fans actually "put on" Jensen's arms, Eidos-Montréal and Square Enix released wearable arm sleeves printed to look like Jensen's augmentations from the game. Available in black and white versions, these were handed out at gaming conventions and also made available through the now-defunct Eidos-Montréal store. The product page for the black and grey version of the $11.99 "DXHR Augmented Arm Sleeve" declares: "Before you show your guns, augment your arms! Note: available in black military design only, very limited

[62] DeusEx. "More Photo's of the Official Adam Jensen Arm! Check out the Official Making-of Video Here." Tumblr. February 20, 2013. Accessed August 29, 2016. http://deusex.tumblr.com/post/43583571004/more-photos-of-the-official-adam-jensen-arm.
[63] EidosMontreal. "Building Adam Jensen's Arm." YouTube. February 18, 2013. Accessed June 16, 2014. http://youtu.be/DqfYyPLW7W8.

quantities!"[64] These sleeves were also included in the official *Deus Ex: Human Revolution* press kit, sent out to game journalists ahead of the game's release. The arm comes in a sealed plastic packet featuring the Sarif Industries logo and a design schematic of an augmented arm, designed to resemble the sterile medical packaging of augmentations featured in the game. The package reads: "ENVISIONING A NEW FUTURE: Sarif Industries crafts the most advanced and innovative line of Human Augmentation products the world has to offer. We enhance lives. We create a stronger, faster, better you."[65] The arms resemble the protective sleeves worn by athletes, or those made to look like fake tattoos. With these sleeves, fans of the game were able to participate in a type of Adam Jensen-inspired augmented fashion without the need for actual prosthetics—and life-changing surgery.

These themes of augmentation envy also appear in a separate section of the Sarif Industries webpage titled "Experience Augmentation," where visitors can use their webcam and a built-in browser app to take photographs of themselves with renders of various Sarif Industries hand and arm augmentations digitally superimposed onto their bodies. These images can then be uploaded to a public gallery, and/or shared online via social media—such as *Twitter* and *Facebook*—or direct links to the images. Here, visitors can not only "try on" prosthetic augmentations but also use them to express their particular sense of bionic style and an affinity for sci-fi-inspired technological forms. In this way the wearing of prosthetic limbs—or at least imagining what it would be like to have them in the future—becomes a social activity.

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[64] "DEUS EX 3 Arm Sleeve; Black and Grey." Eidos-Montréal Online Store. December 28, 2011. Accessed June 18, 2014. http://web.archive.org/web/20111228102725/http://www.eidosmontreal.com/store. [Archived version acquired using Internet Archive's "Wayback Machine." Snapshot from December 28, 2011.]
[65] Parrish, Robin. "Deus Ex Presskit Unboxing." ForeverGeek. August 23, 2011. Accessed June 18, 2014. http://www.forevergeek.com/2011/08/deus-ex-presskit-unboxing/.

When accessing the site, the visitor is first asked to "Select Your Augment" from a rotating menu of "Consumer" and "Military" augmentations. Each item is a digital render of a Sarif Industries hand or a complete arm in black or white, modeled after Adam Jensen's and featuring poses such as bicep flexes, a peace sign gesture, outstretched hands, and even extending arm blades. However, as one cycles through the rotating menu of augmentations, the label seems to be arbitrary as similar augmentations are featured in both categories—even the weaponized ones. As one browses the selection, the website reads "Thank you for your interest in Sarif Industries. You are one step closer to becoming a better version of you. To further your progress, please select from the options below:"

The Experience Augmentation page also features an immense photomosaic of Adam Jensen and the game's title created from hundreds of "augmented" images taken by fans. By moving around the page and zooming in, visitors can view individual images, which include persons representing a diverse range of demographics taking photographs at home and also during conventions such as E3. Referencing the game's ever-prevalent themes of transhumanism, the top of the mosaic page reads "WHO WE ARE IS BUT A STEPPING STONE TO WHAT WE CAN BECOME…"[66] As another example of a prosthetic style in action, the site allows able-bodied individuals to participate in the culture of augmentation, and try on—and show off—their new mechanical limbs, remaking the self technologically but also presumably becoming a more "authentic" version of oneself that realizes their true desires or potential.

The appeal of Jensen's augmented look even extended to the world of fashion photography. On January 25, 2012, Dark Stars Photography published a photoset titled "FEM

[66] "Experience Augmentation." Sarif Industries. 2010. Accessed August 10, 2016. http://sarifindustries.com/experienceaugmentation/#/home.

EX," featuring model Diana Brownie dressed as Adam Jensen.[67] The images recreate one of the most iconic pieces of concept artwork for *Human Revolution*, depicting Adam Jensen at home in his futuristic apartment, contemplating his new augmentations as he struggles to get used to them and come to terms with his mechanically-integrated body. In the image, Jensen is reclining on a Renaissance-inspired sofa, wisps of smoke billowing from a cigarette in his left hand, and a small glass of amber liquor in his right. Depicted shirtless, his torso is wrapped in large white medical bandages, and an array of circular mechanical ports run across his upper chest, evidence of the cybernetic machinery buried deep inside his body. His shining black Sarif Industries arms, his most conspicuous augmentations, feature sculpted exterior coverings and thick pads of artificial muscle that wrap around his shoulders. Sleek and powerful looking, they have an overall svelte and humanlike proportion with natural-looking hands. With a high-tech assault rifle on his lap and a high-caliber pistol on his left, he is the epitome of futuristic masculine cool.[68] As Claudia Springer notes, science fiction texts often "represent a future where human bodies are on the verge of becoming obsolete but sexuality nevertheless prevails."[69] However, the malleability of the body presented by the future offers new possibilities for bodily aesthetics.

Although Brownie is topless, her bare breasts are covered over with makeup and/or digital effects. Other adornments include medical patches on her torso, and bits of circular mechanical ports poking through her skin. She wears black pants studded with chrome silver spikes, and her arms are decorated to resemble Jensen's sleek black Sarif Industries augmentations. At her side is a high-tech looking rifle. The whole scene utilizes heavy shadows

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[67] "FEM EX." Darkstarsphoto.com. January 25, 2012. Accessed June 17, 2014. http://darkstarsphoto.com/fem-ex.
[68] "Deus Ex : Human Revolution - Media - Images." Deus Ex : Human Revolution. Accessed June 17, 2014. http://www.deusex.com/media/images.
[69] Springer, Claudia. *Electronic Eros: Bodies and Desire in the Postindustrial Age*. Austin: University of Texas Press, 1996. (p. 51)

and golden lighting, as well as an ornate sofa with luxurious flower upholstery to bring to life the game's Renaissance-inspired, retro-futuristic setting. Furthermore, the gender-swapped cosplay is simultaneously feminine yet evocative of an androgynous aesthetic typically seen in cyberpunk films such as *Blade Runner* (1982) and *The Matrix* (1999), where technology has made the commitment to gendered bodies increasingly flexible and to a large degree unimportant. It also emphasizes the relative androgyny of Sarif augmentation aesthetics, which, like actual bionic limbs, are essentially marketed as "unisex" technologies.[70] Ultimately, the "Experience Augmentation" site and the "FEM EX" photo shoot exemplify the broad appeal of *Human Revolution*'s augmented bodies via Adam Jensen and the continued interest that able-bodied fans have in pretending to be characters with bionic limbs.

5.4 STAYING HUMAN: SARIF INDUSTRIES VS. HUMANITY FRONT/PURITY FIRST

Conflicting perspectives on technological transformation continued to play out in a pair of video advertisements for *Human Revolution*. A television and web advertisement for *Human Revolution*, officially titled "It All Leads to Adam," takes up the pro-transhumanist perspective in a direct fashion. The ad was produced by the DDB LA agency under the art direction of Jaclyn Yuan.[71] This "TV Trailer," which was also featured on the official Eidos Montréal *YouTube* page, depicts transhumanist themes of change and survival told through the metaphor of

[70] "FEM EX." Darkstarsphoto.com.
[71] Yuan, Jaclyn. "Deus Ex: Human Revolution "It All Leads to Adam"." Vimeo. August 25, 2011. Accessed June 16, 2014. http://vimeo.com/28179152.

biological evolution.[72] Like most of the marketing for *Human Revolution*, the ad blends reality and fantasy into a proleptic vision, beginning with a voiceover that states: "Darwin said, it is not the strongest of the species that survives, nor the most intelligent, it is the one that is the most adaptable to change." The ad uses a sequence of CGI imagery from the game juxtaposed with found footage in order to trace the past and future of human evolutionary development. It begins with microscope footage of the first cell divisions of a human embryo, followed by a jellyfish swimming. Next we see footage of a baby bird hatching in a nest of eggs, followed by a large mammal attacking and eating a flamingo, and a monkey smashing a nut against a tree. Then we see a CGI closeup of a heart beating, primitive drawings of animals on a rock face, a preserved human skull. This is followed by a diagram of a human brain scan from the *Human Revolution* world, and a shot of a Sarif Industries arm augmentation under construction, splayed open and revealing a complex network of artificial nerves, muscles, and mechanical linkages.

A fire burns, and the silhouette of a human baby stands, followed by images of stonehenge, an x-ray image of a developing human foot, and a doctor holding a crying newborn. We then see black and white footage of a young child in a grassy yard. The child, who appears to be missing both arms, is using an early mechanical arm prosthesis and his foot to grasp an object. The effect looks like an old mid-20th century home movie and it is unclear whether or not it is actual archival footage. This is juxtaposed with stock renders of Sarif Industries hand and eye augmentations, followed by shots of Adam Jensen's augmentations being installed in the title sequence of *Human Revolution*, making the previous scene appear primitive in comparison. The ad ends with an oft-repeated shot of Jensen defiantly running towards a wall and smashing through it with his augmented arms, and cuts to a scene of him falling to the ground and landing

[72] EidosMontreal. "Deus Ex: Human Revolution TV Trailer." YouTube. August 15, 2011. Accessed June 16, 2014. http://youtu.be/RHz8oSpcyuA.

dramatically in a ball of yellow electricity before revealing the game's title/logo and the tagline "The truth will change you." The theme song is "My World," by The Transmissions, a song created for the game's promotional materials that focuses on the theme of crafting the world in the image of one's own desire. Featuring little footage of the game itself, the theme of the ad is change, and the ability to adapt and overcome through the adoption of new technologies that extend the body. All of evolution has led to "Adam," reborn as the ideal "first man" of Sarif Industries' transhumanist society.

In *Human Revolution*, the "opposing" perspective to human augmentation and Sarif Industries' transhumanist optimism is most emphatically represented by the pro-human political organization "Humanity Front," as well as the more radical anti-augmentation group known as "Purity First," which uses more extreme measures—including violence—to accomplish their goals. On July 21, 2011, the Sarif Industries website was "hacked" by Purity First, altering its look and functionality. The website was placed in a state of digital disarray, with bursts of static interrupting the usual theme music, and areas of pulsating horizontal black lines that make it appear as if the corrupted page is being eaten away, or forcibly censored. The breakdowns in site functionality are indicated with scrolling security alerts that read "BREACH LEVEL CRITICAL," as the Purity First logo flickers in the background. Under the "Sarif Industries" logo in the top-left corner are the words "NO RETURN." Likewise, the latter half of the "WELCOME TO SARIF INDUSTRIES: ENVISIONING A NEW FUTURE" greeting on the front page is overwritten with black bars and gold text that reads "WE PLAY GOD," and below that is a similarly styled anti-transhumanist message with the words "BE HUMAN REMAIN HUMAN."

Each section of the site has been similarly altered. For example, the "Eye-See Vision Enhancement Package" featured under the "Vision" augmentation category now features animated, stylized digital "graffiti" over the image of the eye prosthesis, and the message "YOU SEE WHAT THEY WANT YOU TO SEE." The image of the white "Cybernetic Arm Prosthesis" listed under the "Power" category has been similarly replaced with a digital render of one of Adam Jensen's black and gold military-grade augmentations with its trademark nano-blade weapon fully extended. The image is accompanied by a detailed list of technical specifications for the arm, as if Purity First is revealing secret knowledge it acquired about Sarif's top-secret military projects. The caption here reads "MILITARY AUGMENTATIONS ARE WEAPONS AGAINST GOD." Likewise, the "The Road to Here" section now features a sequence of images charting human evolution, with the final image being an illustration of a skeleton collapsed on the ground. The accompanying text reads "THEY ARE TRYING TO CONTROL EVOLUTION" and "HUMAN AUGMENTATION WILL BE THE END OF MANKIND."

Throughout the hacked website are also various audio files that one can click on, featuring recordings from "Lazarus," an anonymous conspiracy theorist who operates an underground radio show in *Human Revolution*. In the first recording, titled "LAZ_001," the Lazarus character angrily encourages visitors to the hacked site to realize that they are being deceived by companies like Sarif Industries:

> Now, if you've browsed round this website, you might be under the impression that Sarif Industries is a company making an honest attempt to improve our lifestyles, help out wounded vets, and ultimately make our oh-so-difficult way of life easier. You'll never again have to suffer the inconsolable horror of losing your

> cell phone because you can now have one implanted in your arm! You're on this site right now, perhaps asking yourself the question: “Will a robot arm enhance my life? Would I see better with a mechanical sensor in my eye, and if I get one, is it morally responsible of me?” Well let me give you the answers right now, truth seekers. The answer is: run for your fuckin' lives man! If you can't see the signs on this one, you may need to check into corporate propaganda rehab. But fear not seekers, that's why I've hijacked this Sarif-slave-state.com here. That's right, thanks to my head hacker homeboy Steve over here, I'm taking on the corporate techno-tyrant himself; David Sarif right in his own crib. Yeah, YOU Davey-boy, I'm calling you out.

As a major anti-augmentation voice in the Deus Ex Universe, Lazarus espouses anti-transhumanism viewpoints that question the necessity of radical technological enhancement. Here, in his address to the viewer, the Lazarus character espouses the belief that the adoption of technological implants can have unforeseen future consequences:

> See, I look at this site and I don't see a techno-paradise at our fingertips. You may see a future with happy, smiley amputees living a full life, I see our babies with chips in their eyeballs. You see sunshine and green grass, I see darkness and a police state run by super-soldiers. You see human enhancement, I see chains, shackles, cell doors, fire and fucking brimstone. Yes, the future is looking mighty grim my friends.

Another recording, “LAZ_002,” even makes reference to the characters in the Sarif Industries “Augmentation Testimonials” ad, demonstrating the intricate, self-referential nature of the viral marketing campaign:

> Sarif may be a corporate slime-ball and a minor league despot waiting for the call-up, but he's no dummy. He knows he's not gonna make crazy loot on the mechanical prosthetics biz by marketing towards pop star wannabes and one-time high school quarterbacks in mid-life crises. No sir, he's gonna do what all shameless, self-serving, dishonest scientists and engineers do: go straight to the military and sell out the future of humanity for the prettiest, blood-soakiest penny.[73]

The overall effect is memorable, disrupting the normally pro-augmentation presentation and calling into question the benefits of unchecked transhumanism. Furthermore, the entire scenario lends a sense of urgency to the constantly-evolving marketing campaign, playing out the entire lifespan of an online resistance movement and giving the illusion that a cultural conversation is taking place. However, the fact that these arguments play out in the context of a marketing campaign for the fictional Deus Ex Universe also reveals how this type of self-criticism adds to the allure of the technology on display—its seemingly dangerous, world-altering qualities intensifying the stakes of the game.

In addition to the "hacked" additions, the Sarif Industries "Augmentation Testimonials" advertisement that normally appears when one visits the site has been replaced by a new documentary-style anti-augmentation video "released" by Purity First. Officially produced by Goldtooth Creative and directed by Kody Sabourin, the video was posted to the official Deus Ex *YouTube* page on the same day. The viral video is done in the style of a dramatic underground-style expose that intercuts footage of the game and Sarif Industries' marketing materials with images of explosions, violent riots, protestors clashing with armored police and being beaten,

[73] Sarif Industries. 2010. http://www.sarifindustries.com/.

and bloody protestors, simulated news broadcasts, and dramatized testimonials of medical experts and activists. The footage is a mixture of filmed live action enhanced with special effects, giving the overall presentation a sense of realism and urgency.

At the beginning of the video, a shadowy figure with a distorted voice declares: "Integrating technology with human evolution? Seems like such a good sell for man. You're building a better you. But the fact is, it's just simply not true." Appearing later in the video, he comments on Sarif's secret projects for the military: "I know that they are creating mass quantities of military-grade augmentations. I've seen testing on them and it's very scary. Very scary types of alterations." His comments are played over fictionalized test footage of a military arm augmentation transforming into a small minigun and firing at an off-screen target.

An actress playing "Dr. Maria Gonzalez" from the "World Health Network" appears to offer a stern condemnation: "At no point have they thought about the consequences of their actions. They actively encourage you to exchange your perfectly functional body parts for upgraded augmentations. What they are doing is ethically and morally wrong, and they should be brought to justice." Likewise, a news report declares that a growing number of people are experiencing side effects caused by their augmentations. A woman's voice says: "They want to systematically turn us into machines, and pump us full of their drugs." We see a series of images of syringes, DNA visualizations, doctors at work, and other flashes of medical iconography. A male voiceover states: "You have to take Neuropozyne, one of the most dangerous and addictive drugs that exists in the world today." According to the shadowy narrator:

> You'll have to take this drug for the rest of your life. If you don't, your body will reject your augmentations. It's a drug that's priced so highly that we're now seeing cases of high-profile people who are now out on the streets. They are

> begging. They are begging for drugs. They'll have their technology in your body. They could have the power to turn off your limbs. The potential to turn off your eyes. They'll be able to send messages to your brain, and control your thoughts, as if they have the power of God.

Throughout this, we footage of beggars on the street—mostly younger men and women who look to be in their twenties and thirties—with Sarif Industries augmentations on their legs and arms. These shots use a combination of real actors and CGI. They sleep on cardboard on the street, with damaged Sarif prostheses peeking out under blankets. A disheveled looking man in a suit with his right arm ending in a broken mechanical stump with wires hanging from it begs for help with his mechanical left hand. A dirty and desperate-looking woman with Sarif leg augmentations—each ending in two large white mechanical toes like the ones on the website—is sitting on a set of stairs, reaching out towards the camera. Intertitles throughout the video read: "DECEPTION," "DISASTERS ARE COMING," "THEY CONTROL YOU WITH TECHNOLOGY," "THEY POISON YOU WITH DRUGS," "THEY ACT LIKE GODS," "HUMAN AUGMENTATION IS ENSLAVING US ALL," "BE HUMAN; REMAIN HUMAN" and "WE'VE HACKED THEIR SITE," ending with an invitation for the viewer to "DISCOVER THE TRUTH BEHIND www.sarifindustries.com." [74]

The images are haunting, the music is tense, and an effort was made to depict a wide range of ages, genders, races and ethnicities, as well as class perspectives, showing that human augmentation is a global issue that affects all demographics—and as a consequence that global audiences are recognized in the game's proleptic vision of the future. However, the act of playing and immersing oneself in the fictional world of a videogame, itself a form of

[74] Deus Ex. "Deus Ex: Human Revolution - Purity First." YouTube. July 21, 2011. Accessed June 16, 2014. http://youtu.be/akaos1U8Rto.

technological extension or augmentation, is likely not the target of these kinds of anti-transhumanism statements. As a consequence, technological ambivalence is employed in the service of selling a technology.

The Purity First video also resonates with the issue of the high cost of medical-grade mechanical prostheses. In the world of *Human Revolution*, even the upper classes are susceptible to the extremely high cost of the highly-controlled anti-rejection drug Neuropozyne. As maintenance become extraordinarily expensive, there are dire consequences if one is no longer able to afford to keep up, such as sickness and the malfunctioning or shutting down of one's own body parts

The depiction of human augmentation and transhumanism within a series of double-visions continued into the marketing of *Deus Ex: Mankind Divided*. Set in 2029, two years after the events of the previous game, *Mankind Divided* is a direct continuation of Adam Jensen's story. Following the events of *Human Revolution*, mechanically augmented humans have become social outcasts, viewed as dangerous and potentially uncontrollable due to their extensive technological enhancements. As a result, special laws have been enacted that segregate the Augs from the Naturals. A specially-produced "live-action" trailer describes it as an era of "mechanical apartheid."[75] However, in 2016 the hashtag #CantKillProgress was being used to promote the Deus Ex Universe brand on social media,[76] continuing the series' association with the transhumanist spirit.

[75] Deus Ex. "Deus Ex: Mankind Divided - The Mechanical Apartheid." YouTube. May 26, 2016. Accessed November 16, 2016. https://youtu.be/D7XCAgj0TtI.
[76] Deus Ex (@DeusEx). Twitter. April 2009. Accessed November 16, 2016. https://twitter.com/deusex.

5.5 AUGMENTED REALITY: ENGAGEMENTS WITH THE PROSTHETICS INDUSTRY

Throughout *Human Revolution*'s marketing campaign, Eidos-Montréal and Square Enix attempted to more directly connect the Deus Ex Universe's science fiction setting to contemporary developments in the prosthetics industry, using documentary filmmaking and engagements on social media to emphasize the contemporary cultural salience of the game's themes and the perceived "this-can-happen-ness" of Sarif's augmentation technology. For example, to promote the launch of *Human Revolution*, Square Enix commissioned the creation of a short documentary to "investigate prosthetics, cybernetics and human augmentation." Titled *The Eyeborg Documentary*, the nearly twelve-minute video was posted to their official *YouTube* page on August 26, 2011. The documentary was produced by Canadian filmmaker Rob Spence (mentioned in *The Sun* story above), a "self proclaimed cyborg" nicknamed the "Eyeborg" who wears a built-in wireless video camera in his prosthetic right eye—some of the documentary footage was actually recorded using this device.

As the documentary begins, Spence introduces himself in voiceover: "My name is Rob Spence, and I'm a cyborg." Spence then says "This is Adam Jensen, the main character from the video game *Deus Ex: Human Revolution*," over footage of a game cinematic of Adam Jensen making a dramatic entrance, crashing to the ground in an electrified explosion. We then see footage of Jensen examining his augmented arm, as Spence explains that "He's also a cyborg, but from the year 2027." According to Spence, "He's got a camera eye as well, and, some other high-level augmentations." Spence's comments are juxtaposed with close-ups of Jensen's glowing electronic eyes, as well as footage of him taking down armed guards using melee weapons built-in to his powerful augmented arms. As in the *Phantom Limb Project*, the

comparison is generally symbolic, and the footage shown for comparison features many of the action-packed shots heavily featured in trailers and ads for the game.

Spence then explains the purpose of the documentary, getting at the heart of the fantasy/reality connection that the game developers want to portray: “I recently traveled around the globe, to meet some of today’s most advanced cyborgs. I wanted to find out how far off we are now, from Adam Jensen’s prosthetic technology.” The documentary cuts back-and-forth between users with real bionic arms and legs—walking, running, sharing drinks, and performing other daily activities—and science fictional depictions from the game world, accompanied by dramatic music from the game. When weighed against its science fiction analogs in a direct way, current bionic technology seems to be in its infancy, far from the technical sophistication and sleek aesthetics depicted in *Human Revolution*. However, in showing how current research is taking the first necessary steps towards greater technological advances, this documentary attempts to legitimize *Human Revolution* as a possible—although imagined—bionic future in a world in which prosthetic technology increases dramatically each year.

The documentary focuses on some of the major categories of augmentations that Jensen uses in the game, including bionic legs, arms, hands, and eyes. Each technology discussed in the documentary is introduced with footage of analogous technology from *Human Revolution*, which is then intercut with demonstrations of the actual prosthetic technologies as well as interviews with their users and developers.

Beginning with eyes, Spence notes that while his own eye is a self-contained wireless camera, the digital eyes in *Human Revolution* are directly connected to the brain. Spence then interviews Miikka Terho, a blind man who “actually had such a connection.” Terho had a chip implanted underneath his retina, connected to his optic nerve. Using special glasses he was able

to first make out the rough shapes of fruit on a table, displayed as white silhouettes on a black background. Spence then notes that "Adam's eyes don't just restore vision, they also add situational data, known as augmented reality. Also called 'Terminator vision.'" We see footage of Jensen peering through a wall to see the outline of an enemy on the other side. Spence then interviews Joseph Junke, President and CEO of Tanagram Partners, which is developing augmented reality visors for firefighters that will provide environmental data as well as a virtual computer display operated with simple hand gestures. After a brief demonstration of the technology, Spence concludes that taken together, these three technologies constitute the foundation for the eye prostheses seen in *Human Revolution*:

> Adam's eye is a combination of a video prosthetic that replaces his eyeball, like my own, that is connected to his optic nerve, like Miika's retinal chip, and that incorporates augmented reality, like Tanagram Partners' fire mask. It would appear that we have the building blocks for Adam's prosthetic eye today.

Spence then asks, "But what about prosthetic arms?" In voiceover, Spence notes that "Prosthetic arms in the world of *Deus Ex* are much stronger than human arms, and they have more options. They're more accurate, and they even help you play piano better." Game footage shows augmentations with transforming weapons such as miniaturized autocannons and extendable blades, and Jensen smashing through a wall bare-handed. We also see scenes from the Sarif Industries augmentation advertisement produced for the game.

Spence then interviews Jason Henderson, who lost both of his arms in a fireworks accident, and Keiron McCammon, who lost his left arm in a paragliding accident. Each wears early i-limbs with myoelectric sensors. As they demonstrate them for the camera, Spence comments that "I am now filming your bionic hand with my bionic eye."

In discussing Jensen's augmented legs, Spence asks "Where are we with prosthetic legs today?" Spence meets with Staff Sgt. Heath Calhoun, who lost both legs while on duty and now skiis for the United States disabled ski team. We see footage of Calhoun walking on his everyday prostheses—which have hydraulic knees controlled by sensors and microprocessors in the leg—and running capably on blade-style sprinting legs. In an interview with David Jönsson, a prosthetics engineer at Icelandic prosthetics company Össur and amputee who lost his right leg to cancer, Jönsson demonstrates the Power Knee, which allows wearers to more naturally traverse stairs. According to Jönsson, "At the moment it's more a matter of what you can imagine. I mean, who says that a normal human leg is the optimal thing for you." However, according to Spence, "Prosthetic arms and legs are beginning to approximate the functionality of our natural limbs. Current bionic technology uses external and kinetic sensors. We're only just beginning to experiment with neural prosthetics, like those of Adam Jensen."

Towards the end of the documentary, Spence asks Junke, developer of the augmented reality visor for firefighters, if the technology that Adam Jensen uses is possible by the year 2027. Junke responds "Absolutely. Absolutely will we get there," noting that the real challenge is interfacing the technologies with the unique and ever-changing structure of our individual human brains.

McCammon notes that the decision to choose to remove one's limb and install a superior bionic replacement will ultimately involve debates about medical ethics. However, throughout the documentary, the speed and exponential rate of prosthetics development is emphasized. As Jönsson notes, "I think technology moves quicker than we imagine." A shot of Spence's silhouetted figure smoking a cigarette at sunset transitions to an iconic cinematic of Jensen lighting a cigarette in his apartment, as Spence's conclusion drives home the reality-fantasy

connection: “In the meantime, for those of us missing parts of our bodies, we’ll keep exploring, and upgrading. It’s possible we are the pioneers of a new cybernetic age, not unlike the world of *Deus Ex: Human Revolution*.”

Throughout the documentary, the juxtaposition of real and fictional technologies uses dramatic lighting, slow-motion filming, and an appropriately techno-electronic soundtrack to create a seamless presentation that highlights the mechanical beauty of the bionic technologies on display. Each presentation of a real prosthetic technology and each topic of salience—such as functionality, technological advancement, and bioethics—is met or “augmented” with supporting imagery from the game.[77] In addition to highlighting the reality-fantasy connection, it also exemplifies some of the contradictory ways that science fiction’s “double visions” can be refocused in support of technologies aimed to save and improve lives.

After the game’s release, Eidos-Montréal and Square Enix continued to engage audiences through social media, posting stories on the official “Deus Ex” *Twitter* account that were related in some way to the game’s themes of human augmentation. For example, an April 30, 2014 post on the official “Deus Ex” *Twitter* account asks: “Is human augmentation a double edged sword?” Included is a link to an article on technology news site *New Atlas* titled “Will superhuman powers give us superhuman problems?”[78] In taking up this question, the article notes that while “mention of cyborgs or superpowers evokes fantastical images from the realms of science fiction and comic books,” less attention is paid to “the individual, social and ethical consequences of

[77] EidosMontreal. "Deus Ex: The Eyeborg Documentary." YouTube. August 26, 2011. Accessed June 16, 2014. http://youtu.be/XpR5Z1RzFlI.
[78] Deus Ex (@DeusEx). "Is Human Augmentation a Double Edged Sword? Http://t.co/WLII0piC2I." Twitter. April 30, 2014. Accessed May 10, 2015. https://twitter.com/DeusEx/status/461505314831863811.

enhanced humans."[79] A May 1, 2015 post asking fans to "Check out this heartwarming video of a dog walking again thanks to prosthetics" links to an *Associated Press* story on *YouTube* about a dog who lost his paws to frostbite and was able to walk again after receiving four lower leg prostheses. In the spirit of *Deus Ex*, it is declared to be "Dogmentation!" in reference to the game's augmented characters.[80]

Many posts feature new developments in bionic technologies. A June 13, 2014 post features an image of 29-year-old paraplegic man Juliano Pinto using a new "mind-controlled" robotic exoskeleton to famously—and literally—"kick off" the 2014 World Cup. The post, which includes a link to a *CBC News* story covering the event, describes it as "raising awareness for the future technologies."[81] Likewise, a May 28, 2015 post sharing a news story about a promising new bionic eye implant suggests that "Soon, thanks to this Bionic Lens, you'll be able to say that your vision is augmented."[82] And on February 13, 2016, the account shared a news story on *The Guardian* titled "'Bionic spine' could enable paralysed patients to walk using subconscious thought." The new device, described as the "holy grail" of bionics research, will be implanted onto the motor cortex of paralyzed patients, allowing them to control bionic limbs with subconscious thought.[83] As if to illustrate the tension between the game's themes and the way its marketed, a reply to the post from user "Pulak Kumar" (@doofenshmertz) jibes:

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[79] Robarts, Stu. "Will Superhuman Powers Give Us Superhuman Problems?" New Atlas. April 22, 2014. Accessed August 26, 2016. http://newatlas.com/human-enhancement-issues/31743/.
[80] Deus Ex (@DeusEx). "Dogmentation! Check out This Heartwarming Video of a Dog Walking Again Thanks to Prosthetics. Https://t.co/UsPRVm9a2g Pic.twitter.com/njz1HDfZ1e." Twitter. May 1, 2015. Accessed May 10, 2015. https://twitter.com/DeusEx/status/594226259359637506.
[81] Deus Ex (@DeusEx). "Raising Awareness for the Future Technologies: Mind-controlled Exoskeleton Kicks off #WorldCup Http://t.co/VqtaetYzCo Pic.twitter.com/TqlwoWR6Mm." Twitter. June 13, 2014. Accessed August 26, 2016. https://twitter.com/DeusEx/status/477521244674605056.
[82] Deus Ex (@DeusEx). "Soon, Thanks to This Bionic Lens, You'll Be Able to Say That Your Vision Is Augmented. Http://t.co/iSKZbH5YeF Pic.twitter.com/TvMjjaiPgr." Twitter. May 28, 2015. Accessed August 26, 2016. https://twitter.com/deusex/status/604001721145253888.
[83] Davey, Melissa. "'Bionic Spine' Could Enable Paralysed Patients to Walk Using Subconscious Thought." The Guardian. February 08, 2016. Accessed August 26, 2016. https://www.theguardian.com/science/2016/feb/08/bionic-spine-could-enable-paralysed-patients-to-walk-using-subconscious-thought.

"@DeusEx Curious how your games portray augmentation being so disruptive, yet you promote biotech IRL. Deus Ex, you ARE the conspiracy!"[84] In this way, Eidos-Montréal and Square Enix are able to use their social media accounts as a forum for the kinds of conversations they claim are encouraged by the games themselves.

Other posts feature celebrity users of bionic technologies. A post on June 24, 2014 shares a link to a short video documentary featuring the "bionic chef" Eduardo Garcia, who cooks with a Touch Bionics i-limb ultra on his left arm.[85] And on September 30, 2015, the account shared a picture of "athlete, actress, activist" Aimee Mullins, with a link and suggestion to "check out" her 2009 TED talk titled "My 12 Pairs of Legs."[86] This is just a small sample of many examples that demonstrate how the Deus Ex Universe continues to be marketed in relation to real-world technological developments, a rhetorical strategy that closely associates the fictional world with actual events in order to highlight the series' proleptic transhumanism. Here, it is as if Eidos-Montréal and Square Enix are saying: "Look, aren't these things similar to what you are seeing unfold in the *Deus Ex* series?"

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[84] Deus Ex (@DeusEx). "'Bionic Spine' Could Enable Paralysed Patients to Walk Using Subconscious Thought - Https://t.co/0lgLYG4i27 Pic.twitter.com/rh0SVDb9jb." Twitter. February 13, 2016. Accessed August 26, 2016. https://twitter.com/deusex/status/698615479657750528.

[85] Deus Ex (@DeusEx). "Meet the Bionic Chef: Eduardo Garcia And The Future Of Bionic Limbs - Http://t.co/1RUsMCqWXL Pic.twitter.com/dsLL6QlWsD." Twitter. June 24, 2014. Accessed August 26, 2016. https://twitter.com/DeusEx/status/481512625898291200.

[86] Deus Ex (@DeusEx). "Aimee Mullins: Athlete, Actress, Activist. Check out Her TED Talk on Her "12 Pairs of Legs". Http://t.co/SJAnlzyaKw Pic.twitter.com/02wc5FVWNW." Twitter. September 30, 2015. Accessed August 26, 2016. https://twitter.com/deusex/status/649309286510800896.

5.6 AUGMENTED FUTURE: A DEUS EX UNIVERSE AND OPEN BIONICS COLLABORATION

The popularity of Adam Jensen's augmented arms has inspired recent efforts to bring their sophisticated design to life through collaborations with developers of alternative bionic limbs. In the summer of 2016, Eidos-Montréal, PC gaming product manufacturer Razer, technology company Intel, and open-source bionics developer Open Bionics announced their partnership on a project to design and produce 3D printed mass-market bionic limbs inspired by the augmentations featured in the Deus Ex Universe, timed to promote the August 23, 2016 release of *Deus Ex: Mankind Divided*, the sequel to *Human Revolution*. In an article on *PC Gamer*, Shaun Prescott notes that "If you've ever gazed longingly at Adam Jensen's augmentations and wished they were yours, here's some unexpected good news: soon you'll be able to make one for yourself." According to Prescott, "It's a pretty unusual way to market a game, but it's also pretty cool if you happen to lack an arm and fancy Deus Ex's dystopian, cyberpunk aesthetic."[87] With this latest marketing endeavor, Eidos-Montréal and Square Enix had officially entered the "augmentation" business, firmly establishing Adam Jensen's role as an iconic science fiction benchmark and virtual prosthetics ambassador.

On June 8, 2016, an announcement on the official Open Bionics *Twitter* account announced that "This is happening! We're bringing @DeusEx bionic limbs to life." Included was a brief twenty-three second video featuring a 3D rendering of a bionic arm materializing layer-by-layer, overlaid with the iconic black and gold graphic design aesthetic that is a trademark of

[87] Prescott, Shaun. "You'll Soon Be Able to Get Prosthetics Based on Deus Ex's Augmentations." PC Gamer. June 08, 2016. Accessed August 27, 2016. http://www.pcgamer.com/youll-soon-be-able-to-get-prosthetics-based-on-deus-exs-augmentations/.

the Deus Ex Universe. The arm is a modified design based on Adam Jensen's characteristic augmentations. A voiceover explains the goals of the project, stating that: "With *Deus Ex*, we want it to be the window to the future. What we're trying to do is change the prosthetics industry so we can offer affordable, functional, and beautiful prosthetic devices for amputees." At the end of the video, the collaboration's name is revealed as "Open Bionics x Deus Ex."[88]

According to the official website for the project, titled *Augmented Future*, by bringing the arms to life the game developers are "Bridging the Gap" between fiction and reality, as "The Deus Ex team brings their unparalleled expertise in near-futuristic art direction and augmentation to create high quality, fashionable arm designs." The website advertises two bionic arm designs: the "Adam Jensen" arm is modeled after the ones worn by the character in the game, while the "Deus Ex Universe Arm" features a geometric, polygonal look inspired by the futuristic graphic design elements featured in the game world. Another section of the page also declares: "Trying is Believing: We want everyone to be able to experience this leap forward in prosthetic technology. Thanks to Razer and Intel, this is now possible." The arms are advertised as using Razer's "Stargazer" webcam, and Intel's "RealSense" technology in order to track hand motion and "deliver naturalistic bionic hand control."[89] This means that able-bodied fans will be able to purchase their own bionic arm and control it remotely using motion-capture technology. Just as Open Bionics previously marketed open-source, do-it-yourself hand kits for educational purposes, the Deus Ex Universe arms are marketed to a broad audience of amputees, fans, and curious aficionados, which ultimately helps to promote the technology. Furthermore, companies known for their gaming and computing technology are also cross-promoting themselves by

[88] Open Bionics (@openbionics). "This Is Happening! We're Bringing @DeusEx Bionic Limbs to Life. Pic.twitter.com/5qJQtOMz3x." Twitter. June 08, 2016. Accessed August 27, 2016. https://twitter.com/openbionics/status/740577260680404993.
[89] *Augmented Future. 2016. Accessed August 27, 2016. http://www.augmentedfuture.com/.*

association with similarly "high-tech" products featured in a popular science fiction franchise.

In an extended promotional video posted to the *Augmented Future* site as well as the official "Open Bionics" and "Deus Ex" *YouTube* pages, André Vu, "Deus Ex Universe Executive Brand Director," explains how the designs of augmentations in the *Deus Ex* world were always intended to be fashionable:

> The way we wanted to depict a future world was that human augmentations couldn't be just medical device [sic], we wanted it to be super rewarding. People are wearing this kind of prosthetics in a fashionable way. For *Deus Ex*, we never wanted to do some gimmicky big robot's hand and so on, we wanted something to touch upon the high fashion, very refined design, something that looks very sleek and very, you know, you could be very proud to wear it.

Here, the creative approach of the developers mirrors some of the goal of alternative prosthetics manufacturers that aim to create limbs that are both useful and exciting to look at while instilling confidence and pride in their wearers.

Vu also notes that they did not want to limit the technology's "accessibility" to people who are missing one or both hands—a linguistic role reversal in the traditional relationship between disability and society. Through their partnership with Razer and Intel, able-bodied people can use the motion-capture webcam technology to control the prosthesis remotely, allowing their hand gestures to be mirrored one-to-one by the bionic hand. In discussing the collaboration, Open Bionics CEO Joel Gibbard notes that they "want to show limb different people that the products and devices that they're seeing in science fiction, and gaming, and in movies, can become reality, and can become reality very soon." This is one way in which the promises of science fiction can be used to position technologies as a means to fulfill desires for

something better. Likewise, Open Bionics team member Dan Melville, who was born without a right hand, explains the innate connection between bionic hands and science fiction: "I've always wanted to have a robotic hand. I never said I wanted two hands, just a robotic one, just to feel more cyborg, 'cause it's just so much cooler. Especially being into sci-fi and comics and stuff."[90]

These types of depictions capitalize on that "existential dilemma" that is central to the rhetoric of science fiction cool. Accordingly, the promotional video intercuts interview-style commentary and actual demonstrations of the Open Bionics hand technology and their 3D printing process with shots of Jensen using his augmentations in the game, footage from previous live action game trailers, and fake Sarif Industries advertisements featuring actors using CGI augmentations. In summarizing this nexus of video games, alternative prosthetics, and futuristic existentialism, gaming news site *IGN* correspondent James Duggan concluded that the "Adam Jensen" arm "looks pretty badass," labeling it "the potential beginning of transhumanism."[91]

One of the "Adam Jensen" arms also appeared at the 2016 San Diego Comic-Con at the "Open Bionic x Deus Ex" panel, hosted by Greg Miller from gaming news site *IGN*. A video of the nearly one-hour-long event was posted to the official "Deus Ex" *YouTube* channel on July 31, 2016. In attendance was Samantha Payne (COO, Open Bionics), Laura Gallagher (Lead Character Artist, Deus Ex), and ten-year-old Tilly Lockey, a volunteer working with Open Bionics who had recently received a custom-fit "Adam Jensen" arm. Lockey, who in 2007 had both of her hands amputated at the wrist after contracting a deadly form of meningitis, was the star of the panel. Although she had only been wearing the prosthesis for three hours, she explained that she has had a lot of practice with bionic hands, and was even able to throw a ball.

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[90] Deus Ex. "Augmented Future - Open Bionics × Deus Ex × Razer." YouTube. June 8, 2016. Accessed August 27, 2016. https://youtu.be/Ia3P-_RHVWQ.
[91] IGN. "Check Out This Amazing Deus-Ex Mankind Divided Bionic Arm - IGN Access." YouTube. June 16, 2016. Accessed August 27, 2016. https://youtu.be/3BY4iCv73ZQ.

Although still a child, she had an unflappable attitude towards being part of Open Bionics' so-called "experiments."

When Miller asked about the types of prostheses she has used in the past, Lockey replied, "When I first got my hand it was like a little hook thing, and I looked like a puppet cause I had to pull the strings, it wasn't very good." "That's not fashionable, no. You wouldn't want a closet full of those," replies Miller, as Lockey shakes her head in agreement. "And then there was the Touch Bionics one which looked really realistic, but…nah," explains Lockey, scrunching her face and shaking her head, "I like to be unique." "And now you have this awesome Adam Jensen black and gold arm," offers Miller, suggesting that "It's definitely a step up, right?" "Yeah," concludes Lockey, reinforcing the presumed superiority of a fully-functional prosthesis that is also "fashionable" and "unique."

Likewise, when asked by Miller about what changes have happened in the world of prosthetics in the past nine years, Payne explained that while 3D printing has helped to make limbs affordable and available, there has also been an "attitude change in society." According to Payne:

> So now, we really respect being individual, we all really respect being unique, and we all want to look different from one another, and we celebrate those differences. Whereas in the past, everyone had to conform. Everyone had to look the same, and you were made fun of if you were different. Now it's like really cool if you've got a robot arm. We had to wait for that attitude change. So now everyone's really accepting and people are jealous of people who get to wear robot arms that are super cool."

"You have a room full of people staring at you Tilly and they're jealous of your robot arm," adds Miller,[92] reiterating the theme of envy that so often accompanies media assessments of alternative bionic limbs.

Whether this envy is the result of a true "attitude change in society" or just marketing rhetoric remains to be seen. As we have seen in previous chapters, the "coolness" of prosthetic technologies is often noted in news reports and on social media, and many able-bodied individuals seem to express a desire to dress up and pretend to have bionic limbs. Furthermore, the fact that many amputees themselves want to show off the mechanical or robotic nature of their bionic limbs or embellish them with science fiction-inspired aesthetics is another kind of evidence of a change in attitudes towards technology. Today, amputees generally do not choose to amputate an otherwise healthy limb, and they presumably bring all of the cultural attitudes they previously had about technology to their new relationship with prosthetics. In other words, while I cannot imagine what it is like to be an amputee, I can imagine the kind of limb that I would want if I ever needed a prosthesis. However, the repeated assumption in alternative prosthetics depictions that able-bodied persons are envious of those who get to wear bionic limbs, as if it was a special kind of privilege, ignores the fact that even the most advanced bionic limbs are functionally inferior to a biological one. Instead, this envy may actually be describing a desire not for prosthetic technology as it *is*, but as it *will be* in the future.

Meanwhile, Lockey has become something of a sensation among the gaming community. A July 20, 2016 post on the official Open Bionics *Twitter* shows an image of Lockey wearing a sleek black and gold "Adam Jensen" prosthesis on her right arm, holding two fingers across her mouth in a classic "thinking" pose. The caption reads: "Welcome to the #bionic future. 10-year-

[92] Deus Ex. "Open Bionics × Deus Ex - SDCC 2016 Panel." YouTube. July 31, 2016. Accessed August 27, 2016. https://youtu.be/nncOByejXDg.

old Tilly testing out the @DeusEx Adam Jensen arm. #Amputees." In response, user "durrdevil" (@Namenamenamw) photo-shopped Jensen's trademark sunglasses and cigarette onto the image. However, user "Photonic" (@PhotonicFab) noted that "@openbionics @DeusEx This and she is super badass but is no one else weirded out by the face on the robot behind her? Nightmare fuel," in reference to the humanoid research robot with blocky open-mouthed face standing in the background.[93] As a result, a subsequent post on July 21 features a photo of Lockey with her bionic hand around the neck of large humanoid research robot, declaring that: "A #bionic hero is born. [Smirking face][Flexed Biceps]."[94] Here, the juxtaposition of a young girl with a bionic hand squaring off with a large robot is humorous and charming, yet it also reveals the way in which bodily prosthetics that are presumably under human control are privileged over more "inhuman" robotic technologies that suggest a certain level of autonomy—the "killer robots" popularized by so many science fiction films.

At the Comic-Con panel, Payne notes that while bionic hands with similar functionality can cost up to $65,000-$125,000, they are aiming to produce the "Adam Jensen" and other similar Open Bionics arms for under $5000. Additionally, the production time is much faster, and while Lockey would normally have to wait three months to receive a prosthetic socket, they were able to 3D print it in two days. Lockey also demonstrates how the flexibility of 3D modeling and printing allows prostheses to be custom-fit to individual body sizes. In order to translate the original game files of Jensen's arms into a version suitable for 3D printing, Gallagher needed to remodel the limbs before sending them to Open Bionics. Here, she used this

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[93] Open Bionics (@openbionics). "Welcome to the #bionic Future. 10-year-old Tilly Testing out the @DeusEx Adam Jensen Arm. #Amputees Pic.twitter.com/qYTcG6Owld." Twitter. July 20, 2016. Accessed August 27, 2016. https://twitter.com/openbionics/status/755690552889344000.

[94] Open Bionics (@openbionics). "A #bionic Hero Is Born. 😊💪 Pic.twitter.com/3wrRkf7qkO." Twitter. July 21, 2016. Accessed August 27, 2016. https://twitter.com/openbionics/status/756143708903309312.

as an opportunity to remove the "screws," noting that designers often try to hide the screws on the most sophisticated and sleek consumer technologies. In joking about how she had to remove the weapons from the arm renderings, Gallagher also notes that the military application of bionic technology is "perhaps one of the scary parts of having prosthetics that are beginning to be this advanced." However, even at the civilian level, she explains that at some point in the future "these bionic limbs will probably outperform human limbs themselves, and that's both extremely exciting and also extremely scary at the same time."[95]

Gallagher's comments in particular reveal some of the interesting ways in which ambivalent or even violent depictions of technology can be used to promote benevolent endeavors. Her dual roles of modeling Adam Jensen's weaponized augmentations and then collaborating with Open Bionics to bring those designs to life mirrors to some degree the dual military/civilian nature of the prosthetics industry in general. In other words, even in the world of science fiction, technology with military origins ultimately finds its way to civilian applications—Gallagher's 3D designs first appear on an augmented sci-fi agent and ultimately become a ten-year-old's arm. The dual military/civilian nature of augmentations in the Deus Ex Universe is overlaid onto the dual nature of military/civilian prostheses in the real world.

On November 11, 2016, *BBC News* featured a video segment on Lockey, then eleven-year-old. "It looks awesome and it makes you feel confident," declares Lockey, flexing her sleek black and gold "Deus Ex" branded robotic hand. She explains that "Instead of people thinking that they feel sorry for you, because you don't have the hand, they're like 'oh my gosh that's a cool hand.' And I like it that way."[96] While there is something odd and perhaps even humorous

[95] Deus Ex. "Open Bionics × Deus Ex - SDCC 2016 Panel."
[96] "Meningitis Survivor Tilly Lockey Helps to Pioneer Bionic Limbs." BBC News. November 10, 2016. Accessed December 07, 2016. http://www.bbc.com/news/uk-england-tyne-37938466.

about an eleven–year-old girl wearing an "awesome" bionic arm modeled after a heavily weaponized video game character, the celebration of technology in this way reveals a contradiction inherent to even the most critical works of visual science fiction. For example, in discussing the depiction of robotic technology in the 1956 film Forbidden Planet, Telotte suggests that the film "admits the lure of the mechanisms and constructs it parades before us, only to pull back, like so many other science fiction films, from that lure, as if it had reassessed the very images or signs with which it so powerfully speaks." However, he notes that "since the genre's central focus, its raison d'être" is the realm of science and technology, "no science fiction film ever really repudiates that fundamental fascination, regardless of its era's attitudes or the unsettling implications of the genre's motifs."[97] In other words, in spite of the dangers associated with human augmentation in the Deus Ex Universe, great care is taken to depict them as sophisticated works of art and design. Additionally, for people with disabilities, these kinds of transhumanist depictions can be seen as having a liberating bodily potential. As Springer notes, "Although it is easy to be horrified by scientific texts that coolly and dispassionately discuss replacing human beings with technology, the prospect might not seem as repugnant to someone suffering from a debilitating illness that destroys bodies but leaves minds untouched."[98] In other words, Springer reminds us that critiques of biomedical technologies must be mindful of their very real benefits for those who choose to use them—such as the confidence Lockey attributes to her new arm. Ultimately, despite the moral uncertainty surrounding technology in the Deus Ex Universe and its oftentimes tumultuous depictions of human augmentation, the style and functional capability of the technology depicted—not its combat potential—is portrayed as a powerful source of inspiration and a symbolic technological benchmark.

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[97] Telotte, J. P. *Replications*. (p.115)
[98] Springer, Claudia. *Electronic Eros.* (p. 15)

On August 3, 2016, representatives from the Open Bionics x Deus Ex/Augmented Future collaboration presented their work at the "Human by Design" conference, an interdisciplinary symposium on bionic technology co-produced by CNN's brand studio Courageous and Square Enix. Held at The Paley Center for Media in New York City and streamed live on *Twitch* and across CNN's digital platforms, the one-day conference was timed to promote the August 23, 2016 release of *Deus Ex: Mankind Divided*, the sequel to *Human Revolution*. The existence of such an event is itself a significant milestone in science fiction-themed prosthetics marketing, and I will discuss the full scope of the Human by Design conference in detail later in this chapter. However, I will focus here on the Open Bionics x Deus Ex presentation, titled "Human Intermission: Meet Jonathan Jacques-Belletête, Joel Gibbard and Catherine Disney." Here, Jacques-Belletête and Gibbard were joined by Catherine Disney, one of the first recipients of a prototype arm Deus Ex-themed arm, in order to discuss the nature of the collaboration in regards to the experiences of actual prosthetics users.

In the first part of the presentation, Jacques-Belletête explains that when he began designing the augmentations for *Human Revolution* in 2007, he wanted to look beyond a straight "one-one relationship" with biology, giving them "some weird kinks" and a "very sculptural" quality. However, in the following years, he began to notice that "all these amazing prosthetics started appearing with crazy mathematical shapes, and weird geometry, or just beautiful engravings" due to the proliferation of 3D printing and custom prosthetics manufacturers. This would lead to the realization that the ideas featured in the games were "catching up" to him in real life. In describing a photo of a 21st-century war veteran with prosthetic legs, Jacques-Belletête describes feeling a sense of transhumanist envy upon witnessing what for him was a science fiction vision brought to life:

> And the picture is just his waist down. And he's wearing these super cool basketball shorts, and all you see is those two robot legs sticking out in the most awesome trendy Nike shoes. And then for the first time it hit me, I was like "holy crap," it's like we're this close, at least for me, of wanting to be him now. Like "take my legs, it's okay."

As an artist responsible for overseeing the design of the augmentations in the Deus Ex Universe, Jacques-Belletête's statement that "we're this close" reinforces the notion that science fiction technologies have certain cultural desires built into them. These sci-fi presentations then become standards or benchmarks by which actual technologies are judged. While Jacques-Belletête presumably has no desire to experience the trauma of a veteran amputee, prosthetic technology is now reaching a level where able-bodied individuals are able to express a half-joking yet increasingly serious transhumanist desire to amputate their own limbs.

According to Jacques-Belletête, these types of images indicated a shift in the way prosthetics were viewed by soldiers in recent years. For veterans returning from World War II and Vietnam, "It was all about hiding them." However, in describing the new culture of prosthetics, he explains that:

> And now we have this whole generation of young people coming back from these wars … having this pride of showing them because it's not about just reproducing the limbs, the biological counterparts anymore. It's almost an entire culture in itself. They're starting to look like art pieces, more like decoration. They look highly mechanical and technological, and there's a pride that came out of it.

A slide shown during his presentation features a brief video clip of a man in picture-perfect Adam Jensen cosplay demonstrating Razer's motion capture software by moving one of the

bionic arms remotely with his left hand. This system was set up in the convention lobby for attendees to try out, and Jacques-Belletête joked that the technology is "for us puny people that have both our arms," who are "not lucky enough to wear one of these amazing augmentations." In the aims of promoting the work done by Open Bionics, the goal was to allow as many people as possible to experience what the technology "really means," and "how crazy it is." However, while one can experiment with and appreciate the technology itself, one cannot yet pretend to be an amputee.

Jacques-Belletête's blasé sense of able-bodied envy, as well as his notion of "pride" among amputees, recalls previous questions concerning just what qualities, if any, would make an artificial limb more desirable than a biological one—or no limb at all. Joining Jacques-Belletête on the stage, Open Bionics CEO Joel Gibbard and test subject Catherine Disney would take up this question in describing their firsthand experiences in the prosthetics industry. In the previous chapter, I discussed the work of Open Bionics in developing affordable, customizable, open-source bionic hand kits as well as alternative limbs inspired by characters such as Iron Man and Venom Snake, as well as properties such as *Star Wars* and *Frozen*. According to Gibbard, in their attempt to "reinvent" the prosthetics industry, the Open Bionics team "spoke to hundreds and hundreds of people with limb differences" in order to "take a step back and find out what people actually want" from prosthetic technologies. They found that

> the vast majority of prosthetics that people get are very medical, they're trying to replicate the look of human limbs. People find them ugly, people find them creepy, often non-functional, and they're not what people want. What we discovered was that what people with limb differences want is something much more consumer-focused. The experience they want from prosthetics is something

> more like buying a pair of shoes. They want to be able to go to the shop, or even look online, gets something that fits really nicely, is comfortable, functional, but also really fashionable. And they want to be the ones to choose how it looks, and so that it makes them feel good when they wear it, rather than have a doctor prescribe it.

As we have seen, this classic dichotomy between "medical" prosthetics and "fashionable" prosthetics is one that contemporary prosthetics providers—both within the medical industry and those producing alternative limbs—have continually tried to reconcile through "consumer-focused" approaches such as customization, personalization, and upgradeability.

This approach also lends itself to science fiction comparisons. According to Gibbard, on social media "people started to draw comparisons between the work that we were doing, and science-fictional media, which often glorifies prosthetics in a way that we were very much trying to do. And one of these science fictional universes that kept cropping up, and people would suggest time and time again was the Deus Ex Universe, and Adam Jensen's arm." After he was officially approached by Eidos-Montréal about the possibility of a collaboration, Gibbard realized that there was "a really natural fit between Deus Ex and Open Bionics, because what they had been doing very much in the digital realm, we were trying to do in the physical realm." Each group aimed to create "a world where prosthetics were incredibly desirable."

Disney, a self-described "artist and designer exploring the blurry boundaries between the human body and emerging technology," demonstrated one of the project's "Deus Ex Universe Arm" prototypes. Born without a lower left arm, she described her early experiences with prosthetics as a young child as "traumatic," recalling the "clinical setting" of the orthopedic center and its cabinets filled with "weird gadgets and attachments hanging from hooks" that

looked “like something from a horror movie.” The socket fitting process involved the making of a plaster cast that was “really warm, and gooey, and it smelt funny, and for a child, I’m sure you can imagine how horrible that was.” Disney’s comments echo the sentiments of prosthetics testimonies featured on the websites of bionic limb manufacturers and clinics, which decry the out-of-date and so-called clinical qualities of low-budget—and low-tech—prosthetics:

> Standard prosthetics and attachments offered by health organizations such as the NHS are like Joel said pretty horrendous. They’re not only very kind of offensively ugly in their poor attempts to mimic human hands, but they’re very heavy and they’re clunky and they’re ultimately useless, which is why up until very recently I’ve decided to live my life without prosthetics.

According to Disney, Open Bionics’ more high-tech fitting process uses a “completely non-invasive” 3D scanning technology that allows wearers to “choose the new color, shape, texture of your new body part.” In describing the social qualities of these alternative prosthetics, Disney notes that “It’s not just about the look, feel, and function of the prosthetics. Limbs like these can offer wearers a huge amount of emotional value.” According to Disney:

> Young children can now go to school wearing their really super-cool prosthetics, and they can show them off to their friends, and they don’t have to feel like they need to bury their ugly NHS arms on the bottom of their bags anymore. I feel, instead of being the elephant in the room, all eyes are on us for the right reasons now, and people don’t awkwardly ask like, “Ooh where’s your arm?” Now, they look at me and they say “Oh my god, I really want one of those.”[99]

[99] DeusEx. "Deus Ex: Mankind Divided Presents Human by Design." Twitch.

Ultimately, the Open Bionics x Deus Ex collaboration brings together the three worlds of alternative prosthetics design: science fiction artistry, prosthetics development and manufacturing, and feedback from actual patients and users. However, the question remains as to how far the average person with a healthy biological arm would go if they were actually given the opportunity to have "one of those," including the amputation that goes with it. In other words, bionic limbs may be science fiction cool, but at what point do they *really* become desirable? Or, is this simply a narrative that the prosthetics industry must maintain in order to market these technologies to amputees in spite of the fact that they are extraordinarily niche products that are not actually any better than a biological limb? In the end, what is most important is that they are better—more functional, more beautiful, more affordable—than other types of bionic prostheses.

5.7 THE ETHICS OF AUGMENTATION: HUMAN BY DESIGN

Today, the Deus Ex Universe continues to be marketed as a relevant nexus for discussion and debate on questions concerning transhumanism, human enhancement, and the use of new bionic technologies, reframed under the umbrella of the "augmentation community." As mentioned previously, on August 3, 2016, CNN's studio Courageous and Square Enix partnered to host a one-day conference on human augmentation at The Paley Center for Media in New York City called "Human by Design." The conference was filmed by Courageous and streamed live on *Twitch* and across CNN's digital platforms, and was timed to support the August 23, 2016 release of *Deus Ex: Mankind Divided*, which "features a world that has become so divided by hatred, prejudice, and fear that many countries are enacting harsh laws aimed at segregating

mechanically augmented humans and 'Naturals' from each other." According to the conference's official press release, "The many parallels of the near-futuristic Deus Ex Universe® will be explored at the conference, particularly around how technology is rapidly shaping the human condition and the ethics of self-regulation." Here, leading scientists, technologists, ethicists and cyborg activists would come together to "debate, question, and challenge what it means to be human"[100] in the spirit of the game series.

The conference was organized into three main panels, each dealing with a particular aspect of human augmentation: "Is Augmentation a Human Right?: How can augmentation be accessible to everyone on the planet?," "Selective vs. Therapeutic Augmentation: Who should have the final say on augmentation procedures — doctors or individuals?," and "The Future of the Far Far Next: What will medical advances enable 10 years from now?" Additionally, the conference concluded with the presentation of "The Code of Ethics on Human Augmentation," a document co-authored by an interdisciplinary board of experts—made up of conference panelists—intended to serve as the first set of ethical guidelines for the future of human augmentation. In addition to discussing "the cutting-edge technologies and innovations that are shaping human augmentation," it was also the hopes of the conference organizers that the "gaming world" would tune in. According to Jon Grant, senior product marketing manager at Square Enix, the conference "goes beyond bringing to life the key themes of Deus Ex: Mankind Divided" and is a "special opportunity for a video game to take pause from the limitless world we play in, and to drive the conversation around what is really happening in the space of human augmentation."[101] Ultimately, this ambitious attempt to bring a science fiction video game series

[100] Square Enix Members. "Human by Design: Conference." Square Enix. June 30, 2016. Accessed August 29, 2016. http://na.square-enix.com/us/blog/human-design-conference.
[101] Ibid.

to bear on issues concerning technology and humanity in the real world reveals some of the limitations to the rhetoric of science fiction cool. In demonstrating the similarities between science fiction and reality, the particular material differences between the two worlds are brought into sharp contrast.

The official Human by Design website opens with a full-page video loop of a young redheaded woman superimposed onto a monochromatic lakeside background, looking shyly at the viewer. She is wearing an "EMOTIV Epoc" headset, a consumer-grade brain-computer interface that uses built-in electroencephalography (EEG) technologies. Developed by the American technology company Emotiv, the futuristic headset features a sleek black headband with various round sensors on flexible appendages that reach around to the front of the wearer's head—looking almost as if they are receiving a temple massage from a many-tendrilled robot.[102] The sequence is featured prominently across the conference's multimedia marketing assets, where the juxtaposition between the model's demure expression and the bizarreness of the technology serves as a way to heighten the audience's curiosity and introduce the kinds of science fiction-seeming bionic technologies on display.

Following this introduction, the website declares that the conference is "Presented By *Deus Ex: Mankind Divided*," and features a brief written introduction to Adam Jensen and the game's setting. The vertically-scrolling site also includes a section introducing each of the three main conference panels, including a description of their main themes and a list of participants. The first panel, "Is Augmentation A Human Right?," focuses on the following ethical questions:

> In the shadow of some recent high-profile medical cases being battled in U.S. courts comes the increasingly relevant question: Do we own our bodies? If the

[102] *Human by Design - Presented by Deus Ex: Mankind Divided*. Directed by Luanne Dietz. Amazon Video. August 1, 2016. Accessed August 29, 2016. https://www.amazon.com/dp/B01ISIPKB4.

> answer is yes, then is that right of ownership inalienable to the point that we can augment it without limits? These core questions will be debated in a panel discussion featuring the top thinkers on both sides of the issue. Transhumanist philosopher Dr. Natasha Vita-More and augmentation pioneer and former U.S. Navy engineer Adam Arabian, along with Christian ethicist and moral philosopher E. Christian Brugger and Dr. Steve Mann, victim of the first cyborg hate crime, will delve into the morality and ethics of human augmentation. Their discussion will be a launchpad for the day's conversations and the larger issues surrounding human rights and augmentation.

This summary is followed by a brief embedded video documentary titled "Meet Asem Hasna." In the video, we learn that Asem Hasna is a Syrian war refugee who in April of 2013 lost his lower left leg in a bomb blast while serving as a paramedic. Afterwards, Hasna used 3D printing technologies to develop components for his own prosthetic limb. The video features footage of Hasna's involvement in the refugee crisis intercut with his own reflections. Recognizing the prohibitively high cost of prosthetics, Hasna concludes that "There's a lot of talks about human rights, humanity, welcoming refugees. But if you want to make someone feel as a human being, please give him his basic needs."[103]

Hasna now works to provide this "basic needs" as a "3D Printing Technician" at Refugee Open Ware (ROW), developing open source prosthetic limbs and "teaching Arduino programming and DIY robotics to both refugees and Germans in Berlin." According to the official ROW website, the organization works to establish centers around the world dedicated to technology research, development, and education. ROW's goal is to "harness advanced

[103] HXD | Human by Design. 2016. Accessed August 30, 2016. http://www.humanxdesign.com/.

technology, co-creation and open innovation to reduce suffering, fulfill basic needs, and accelerate inclusive development in fragile and conflict-affected areas."[104] On the Human by Design website, the video featuring Hasna and his work with refugees is illustrative of the types of "larger issues surrounding human rights and augmentation" taken up by the panel and the conference in general. Yet as a means to promote the conference, its presence on the Human by Design website also has an important rhetorical function, granting the collaboration an air of immediacy and relevance as well as lending gravity to the proleptic transhumanism of the Deus Ex Universe's science fiction world. While the conference takes places under the auspices of a video game series, we are reminded of the real lives that are presumably at stake in these discussions.

This blending of real-world issues with video game thematics continues throughout the Human by Design webpage. The second panel, titled "Selective Vs. Therapeutic Augmentation," addresses the topic of elective human enhancement:

> Though permanent body augmentation is often thought of only in the context of corrective prosthetics, this is also the age of the voluntary cyborg. For thousands of years humans have sought to permanently modify their bodies with tattoos, piercings, and implants—pushing the boundaries of the human body. But now technologists seek to enhance the capability of human anatomy without a preexisting condition. On this panel, well-known contemporary artist and cyborg activist Neil Harbisson will join author and "cyborg memoirist" Michael Chorost, 3D-printed prosthetic CEO Samantha Payne, and roboticist and UC–Berkeley

[104] Refugee Open Ware. 2016. Accessed September 10, 2016. http://www.row3d.org/.

> professor Dr. Homayoon Kazerooni. They will discuss and debate the issue of medical vs. non-medical augmentation as well as the onset of cyborg culture.

This section includes a link to pre-order *Mankind Divided* on *Amazon.com* and "learn more" at the official Deus Ex Universe website, as well as brief video featuring Eidos Montréal's Jonathan Jacques-Belletête. Here, it is seemingly left up to the game itself to depict what this "cyborg culture" might look like in the future. In the video, footage from *Mankind Divided* plays as Jacques-Belletête explains that:

> There is a major difference in the state of the world between *Deus Ex: Human Revolution*, and *Deus Ex: Mankind Divided*. *Human Revolution* was really what we'd call the golden age, enlightenment era of transhumanism, where the world started really indulging and it was just like "oh my god, this is our future, this is where we're going." We go two years later, 2029, *Mankind Divided*, so now it's like "wait, this is crazy, having the masses augmented like this was probably a bad idea."

Here, Jacques-Belletête's observations about the game series' double visions seem to be at odds with statements featured on the Human by Design homepage—one of which reads: "Should augmentation be accessible to everyone on the planet? YES." Yet this segment also reminds us that despite the conference's academic appearance, it is born of an exigency involving the advertising of a blockbuster video game release. In turn, the game lends the conference a means to place the issues under discussion within a familiar and immediately understandable pop-culture frame of reference.

The third panel, "The Future of the Far, Far Next," is described as a look towards the future with a science fiction lens:

> Today's cutting-edge prosthetics and augmentation technology allows human bodies to run faster, jump higher, record interactions, and see colors previously unseen. But what's next? What is the vision for human augmentation in the future and how far are we from that reality? In this exciting look forward, medical technology entrepreneur Will Rosellini, science-fiction artist and TED Fellow Lucy McRae, writer and presidential candidate for the U.S. Transhuman Party Zoltan Istvan, and bioinformatics entrepreneur Tan Le will offer a glimpse of the road ahead. Their insights will show the deeper implication not only for developers and makers, but also for doctors, lawmakers, and society at large.

This section features another real-world example that illustrates the questions at stake. Titled "Meet Steve Sanchez," the video documents Steve Sanchez, described as having been paralyzed for twelve years. Sanchez, who is seen maneuvering around his kitchen in a wheelchair, preparing food, notes that "At the time, when I first got injured, the community hadn't given us fully the tools to use to be able to be independent and walking." The video depicts Sanchez and his girlfriend—who also uses a wheelchair—travelling the world together. He concludes that "Life after disability has been a roller coaster. We all want the standard of walking and we all should have the privilege of walking." Although it does not specifically deal with the future, there is a strong implication that as technology advances, new opportunities will present themselves that will make Sanchez's desires possible.[105] Ultimately, the Human by Design website juxtaposes advertising for *Mankind Divided* with sobering stories of actual people living with disability in an attempt to play up the perceived "seriousness" of the game world. This positions the game as an appropriate—in rhetorical terms—reference point for guiding

[105]HXD | Human by Design. 2016.

conversations about real-world prosthetic technologies and the potential future of transhumanism.

On August 3, 2016, the official "DeusEx" *Twitch* account hosted a live stream of the full seven-hour conference. Moderated by scientist and filmmaker Nadja Oertelt, the event combines live on-stage conversations and demonstrations with pre-recorded video segments. In addition to the above panels, there were also a series of "Human Intermissions," or full-length presentations featuring the persons featured in the Human by Design website promos. For example, during the presentation titled "Meet Steven Sanchez," Sanchez appeared in person to discuss his experiences with disability after injuring his spinal cord in a BMX accident, before focusing on the development of new robotic exoskeletons that will someday allow people to walk again. "In 2004 when I was injured, the technology wasn't really there," notes Sanchez, who explains that while he "really wanted to walk," after intensive rehab it required nearly 150% of his energy just to take one step under his own power.

According to Sanchez, "It's very difficult to re-learn how to actually walk again." However, he explains that "now, with robotics, we have so much more potential in being able to aid all those people who can't walk, and also who just need the extra aid, basically." For Sanchez, the benefits of assistive robotic technologies are universal:

> Really, truly, with robotics, I mean we really need to give it to everybody. At this point, everybody needs one. I mean, there's not one person in this room who wouldn't actually benefit from wearing an exoskeleton every day to do some monotonous thing they do every day, like picking up a box, or feeding your dog, or bending over, or running, or whatever.

Sanchez's point is crucial for thinking about prosthetic technologies beyond disability and bringing the question of human augmentation to mass audiences. Barring radical transhumanist developments in the near future, the one difficulty all people will face is the aging of their bodies. Discussing this process in regards to disability, Rosemarie Garland-Thomson has noted that "everyone is subject to the gradually disabling process of aging. The fact that we will all become disabled if we live long enough is a reality many people who consider themselves able-bodied are reluctant to admit."[106]

"I want to have a more healthier and more functional lifestyle," says Sanchez, who then demonstrates what this means to him using a new backpack harness device created at the University of California, Berkeley that allows people to "feel comfortable in an exoskeleton" by allowing them to independently transfer themselves from a wheelchair into a standing position. By putting on the harness and activating it in combination with crutches and specialized powered braces on his legs, Sanchez is granted the ability to "basically stand up for about five to ten minutes throughout the day" whenever he wants or needs to. "I feel much more comfortable, I feel much more alive in a sense," declares Sanchez, as he stands up with slight mechanical whirr and walks across the stage. According to Sanchez, "These devices are coming a long way. And it's happening a lot faster than we all think. But, Iron Man is not the reality, this is the true reality, is getting it at a low cost using very off-the-shelf parts where you can give this to somebody for the cost of what a wheelchair costs." [107]

In a tempering of the popular "Iron Man" metaphor for robotic technology, Sanchez's vision for human augmentation reinforces the idea that one day we can all benefit from

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[106] Garland-Thomson, Rosemarie. *Extraordinary Bodies: Figuring Physical Disability in American Culture and Literature*. New York: Columbia University Press, 1997. (p. 13-14)
[107] DeusEx. "Deus Ex: Mankind Divided Presents Human by Design." Twitch.

augmentations whether or not our ultimate aim is to pursue transhumanist ideals. However, this is complicated by his presence at a conference sponsored by *Mankind Divided*, which features its own iconic "Iron Man" in the character of Adam Jensen. While the presence of Sanchez and his exoskeleton makes the conference—and the game world—seem more important by associating with real-world biomedical technologies, the backdrop of the Deus Ex Universe—at least to some extent—frames the exoskeleton as another example of science fiction cool.

At the conclusion of the conference, a paper produced by the "Human by Design Board" titled "An Ethical Framework for Human Augmentation" was released as a twelve-page PDF document on the Human by Design webpage. The document outlines key guidelines for the future of human augmentation, and the foreword to the paper emphasizes that "The authors have collaborated to create the framework, unaffiliated with the conference organizers and sponsors, both of whom had no input into the final document." However, while this may be true, the very existence of a serious attempt to produce an ethical framework for human enhancement by leading thinkers and technologists at a conference inspired by a science fiction-themed video game series is a tremendous boon for the Deus Ex Universe's attempt to portray itself as the premier depiction of proleptic transhumanism.

According to the paper's introduction, "It is our responsibility to create a public, open discourse around the ethical implications of technology that will shape what it means to be human in the near and distant future." The paper defines human augmentation as: "Human augmentation is a deliberate act. It is a permanent or temporary bodily intervention that changes or augments otherwise normal ranges of human function." [108] The paper describes in detail four

[108] Oertelt, Nadja, Adam Arabian, E. Christian Brugger, Michael Chorost, Nita A. Farahany, Samantha Payne, and Will Rosellini. *Human by Design: An Ethical Framework for Human Augmentation*. Proceedings of Human by

"guiding principles of ethics," including the need to "Promote Freedom and Responsibility," "Promote Public Beneficence," "Promote Responsible Stewardship," and "Promote Justice." [109] The paper also provides a series of questions for various "stakeholder communities" such as the medical community, the DIY community, corporate interests, the public policy community, and the military. In regards to military augmentations, a category of augmentation featured heavily in the Deus Ex Universe, the paper asks:

- Can the military ask—or order—soldiers to augment their bodies in ways that are irreversible?
- Can the military ask, or order, soldiers to augment themselves in ways that make them more likely to act in certain ways?
- Is it immoral to augment the capacities of soldiers to make them more effective or efficient during times of war?
- How can the military accommodate or facilitate the reintegration of an augmented soldier into civilian population if they have been augmented with conspicuously different capacities?[110]

Although the paper was produced under the auspices of a blockbuster video game series, these types of questions indicate a serious attempt to grapple with the stakes of transhumanism. The paper's pop-culture associations may also bring greater attention to issues that will ultimately affect all of society in the near future. However, these questions also highlight the ethical concerns associated with the marketing of human augmentation technologies in conjunction with a videogame-inspired rhetoric of science fiction cool. Reworking these questions, we can ask if it

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Design, The Paley Center for Media, New York. August 3, 2016. Accessed August 29, 2016. http://humanxdesign.com/downloads/080116-HXD-EFHA-%C6%92.pdf. (p. 2)

[109] Ibid. (p. 6)

[110] Ibid. (p. 11)

is ethical for the military to market augmentation technologies using science fiction metaphors and fictional imagery that masks the everyday reality of their use.

This fraught relationship between augmentation ethics and mass entertainment came to a head in a short video to complement the ethical framework paper posted to the official Deus Ex *YouTube* channel on August 25, 2016. The description for the video reads: "See the first ever Ethical Framework for Human Augmentation, inspired by Deus Ex and presented earlier this month at the Human by Design conference. http://humanxdesign.com/." The video provides a summary of the paper's key themes, intercut with scenes from the trailers for *Mankind Divided*. Incidentally, in addition to being the "first ever Ethical Framework for Human Augmentation," the document may have the special privilege of being the only academic conference paper to be featured in the advertising for a blockbuster video game series.

A female voice narrates the video, declaring that "We stand on the edge of a new age for mankind" as a shot of Adam Jensen preparing to jump from the "edge" of a high-tech VTOL (vertical take-off and landing) aircraft is shown. "Human augmentation is here and the evolution of man merging with machine has begun," continues the narrator, as Jensen leaps from aircraft, electrified wings sprouting from his arms in order to soften his landing. "While the needs and hopes of the world have begun to be fulfilled through new technologies," begins the narrator, as an image from a *Mankind Divided* trailer depicting a fictional advertisement for an in-game debate on human augmentation—a mirror of the Human By Design discussion taking place in real life—is shown, she notes that "the threat of abuse is more possible than ever." This is accompanied by gameplay footage of Jensen taking out enemy combatants in first-person mode, his left arm augmentation transformed into an explosive energy cannon. In juxtaposing key themes from the framework with complementary imagery from the game, this pattern of careful

editing playfully translates these concepts into images that will resonate with popular audiences, while simultaneously legitimizing the game as part of a larger conversation about the future of humanity.

Using a play on the game's title, the video cautions that "To ensure that mankind is not divided, we must enter into an ethical framework to guide us as we develop these incredible new technologies," as footage from the conference itself is shown. The video then introduces seven "guidelines of ethical decision making for human augmentation." The first guideline, "Develop Fair Policies and Intelligent Regulation of Augmentation Technologies," explains that "The first step is to develop fair policies and intelligent regulation of augmentation technologies." The second guideline, "Minimize Social Disruption," suggests that "We must always aim to minimize social disruption, so that our society can adjust to these new technologies in a respectful manner." The third guideline, "Create Educational Resources for the Public," explains how "That will require us to create educational resources for the public."

These first three guidelines are crucial when formulating the fourth guideline, "Understand the Rights and Obligations of the Augmentation Community," which concludes that "That way, we can all understand the rights and obligations of the augmentation community." In combining the term "augmentation" from the Deus Ex Universe with the concept of a disability community, the contemporary conversation concerning disability and technology is effectively rebranded in the futuristic terms of the Deus Ex Universe. It also means that disability is removed as a primary characteristic of bodily and social difference. The language of the framework groups together users of a wide range of technological augmentations, from bodily prosthetics to recreational devices such as the EMOTIV headset. Here, the defining factor is a

commitment to the use of technology to rebuild, modify, and/or enhance the human body, and this "augmentation community" includes makers and researchers as well as users.

The remaining guidelines focus on the ethics of augmentation. The fifth guideline, "Adopt Ethical Principles for Behavior and Research," warns that "Those developing new technologies must also adopt ethical principles for behavior and research that align with the public trust." The sixth guideline, "Promote Fairness and Equity for All," means that "So that society doesn't find itself divided, we must promote fairness and equity for all, and ensure that access is not unnecessarily restrictive." The seventh guideline, "Safeguard Autonomy for Individuals," concludes that "And finally, so that no one has to make any augmentative adjustment against their will, we must safeguard autonomy for individuals."

The final conclusions of the video echo the fundamental principles of science fiction—in particular the idea that "We can't control the speed at which mankind changes, but we can control how we react to those changes," and that "We need public discourse around the technology that will shape what it means to be human in the near, far and distant future."

The video ends with the Human by Design project's trademark shot of the young woman wearing the Emotiv-brand EEG headset, looking shyly at the viewer, before revealing the video's status as a pseudo-ad: The *Deus Ex: Mankind Divided* is revealed, along with messages indicating that the game is "Available Now" and that there is "More Info on DeusEx.com."[111] These types of tonal shifts snap the viewer back to a different reality—that of commercial advertising. On one hand, the cultural artifacts "inspired by" the Deus Ex Universe, such as the Ethical Framework for Human Augmentation, seem to legitimize—in rhetorical terms—the series' proleptic vision of the future and its role in actively helping to create it. However, the

[111] Deus Ex. "Human by Design - Ethical Framework for Human Augmentation." YouTube. August 25, 2016. Accessed August 29, 2016. https://youtu.be/ck6XDwf6Dl4.

sudden reminder that this is all in service of advertising a blockbuster video game seems to take away from the ethos of an otherwise serious and thoughtful presentation of technological concerns by industry leaders.

In addition to the seven-hour conference itself, the subsequent publication of the proceedings in the form of a brief paper, and the above promotional video, Square Enix and Courageous also produced a thirty-minute documentary titled *Human by Design - Presented by Deus Ex: Mankind Divided*. Directed by Luanne Dietz, the film began streaming exclusively on *Amazon Video* on August 8, 2016. The *Amazon Video* description indicates that the documentary will take up issues of transhumanism in light of the futuristic world presented by *Mankind Divided*:

> What does it mean to be human? Human by Design examines this question through the lens of 12 extraordinary people who are at the intersection of technology and imagination. Inspired by the futuristic themes and ethical questions within the video game Deus Ex: Mankind Divided, this real world journey introduces the leading minds in bionics who are redefining what it means to be human.[112]

As an extension of the Human by Design conference, the documentary is one of the clearest examples of a type of product placement called "branded entertainment," defined by Simon Hudson and David Hudson as "the integration of advertising into entertainment content, whereby brands are embedded into storylines of a film, television program, or other entertainment medium. This involves co-creation and collaboration between entertainment, media and

[112] *Human by Design - Presented by Deus Ex: Mankind Divided.*

brands."[113] As branded entertainment, this final "real world" piece of the Human By Design project—which includes a list of people from "Square Enix Marketing" in the credits—exemplifies the total trans-media branding of the Deus Ex Universe as a nexus for issues surrounding technologies that fall under the "human augmentation" label. The "augmentations" featured include a wide ranges of technologies, from prosthetic limbs to extra-sensory brain implants. The documentary also features many of the panelists from the Human By Design conference, including extended versions of segments that were used previously in various trailers and promotional videos for the project. Along with the above *YouTube* video promoting the Ethical Framework paper, the *Amazon Video* documentary takes a multi-media approach to present the issues central to the Human by Design conference in a package readily accessible to more casual audiences. It also completes an advertising loop that began with a special link on the Human by Design website to pre-order *Mankind Divided* on *Amazon.com*.

The documentary begins with a male voiceover declaring that "The future of humanity, the future of our bodies will be determined by technology," as the camera pans over shots of one of Adam Jensen's augmented arms while mechanical gadgetry unfolds from his hand. A female voiceover then notes that "There's a lot of parallels in the kinds of things that we've explored in science fiction and the kinds of things that we're seeing in the technology world." Another male voiceover argues that "Now the question isn't should we or shouldn't we, because it's absolutely going to happen. The question is can we do it safely in a way that fits with our ethical or moral boundaries." In suggesting that science fiction "parallels" real-world technological developments, the opening montage positions the Deus Ex Universe's proleptic transhumanism

[113] Hudson, Simon, and David Hudson. "Branded Entertainment: A New Advertising Technique or Product Placement in Disguise?" *Journal of Marketing Management* 22, no. 5-6 (2006): 489-504. (p. 492)

as not only a possible future, but an inevitable one. As the rest of the documentary demonstrates through its slate of technological pioneers, this future is already starting to take shape.

One of the twelve "extraordinary people" featured is Neil Harbisson, a "Cyborg Artist" who has an Internet-connected antenna surgically implanted in his head, allows him to see color beyond the visual spectrum by translating those colors into vibrations and then sounds inside his skull. "I consider myself a cyborg," declares Harbisson, who explains that "The aim was not to wear technology or to use technology, I wanted to become technology." Another person featured is Tan Le, CEO of Emotiv. According to Le, "Today, the way that we define augmentation is a lot more elaborate. But if you think about it, fundamentally it's just about extending capability where it doesn't occur naturally." Michael Chorost, a "Technological Theorist," uses technological implants that allow him to hear. According to Chorost, "If you take a look at an x-ray of my skull, you would see this awesome array of wires and computer chips and magnets and antennas and plastic to allow me to hear." For Chorost, "I don't think that the question of humanity is changed in the slightest by the actual composition of your body." Taken together, these statements reinforce the notion of human augmentation as a "natural" part of human evolution, where technology ultimately allows us to direct this process on our own terms—a type of transhumanist vision of humanity by design.

Double-amputee prosthetics developer Hugh Herr, discussed in previous chapters, also makes an appearance, credited here as a "Biophysics Engineer, MIT Media Lab." Seen walking on treadmill, testing out a pair of bionic legs developed by his company BIOM, he explains that:

> Right now, we separate us from them, where them is the machines that we build. My body is unusual because my biological limbs are missing. As a person with an unusual body, I am acutely aware of the importance of technology. I'm reliant

> on technology. With technology, I'm freed from the shackles of disability. But if you take my bionics away from me, all I can do is crawl, I'm completely crippled. But with technology, it's life-fulfilling.

In this appearance, Herr again describes the freeing potential of prosthetic technology, the implication seeming to be that because prosthetics themselves are artifices of human design and purpose, a desire for "life-fulfilling" prosthetic technologies is no less human than choosing to go without them.

Old video and photographs of Herr as a free-climber wearing specially-designed prostheses are shown, as he recounts his disappointment with the prosthetics that were available at the time of his amputation:

> I became interested in human augmentation and bionics actually in 1982. I was in a mountain climbing accident and suffered severe frostbite. About two months post-amputation, I was fitted with artificial limbs, basically chunks of wood and some plastic. And I said to myself at that time, "Is this it? This really cannot be it. In the day and age of space travel and automobiles, this is really extraordinarily pathetic."

As demonstrated throughout this dissertation, Herr's expression of disappointment is a narrative common in prosthetics discourses, especially those concerning the latest technologies. Here, prosthetic technologies that don't seem to live up to the level of sophistication of a particular technological moment—or a perceived potential that hasn't yet been reached—are deemed crude and primitive. These expectations are often based on other "futuristic" technologies. (Of course, prosthetics are always immediately compared to that original technology of the human body itself.)

As the camera pans across a series of prototype mechanical feet and ankles on a desk, Herr explains his views on the future of augmentation:

> I view the historical trend of augmentation as continuous. Imagine a future where there's a blending or merging of cells and tissues that make up our bodies. In that future, what is biological and what is not, what is human and what is not, will be forever blurred.

Herr echoes Chorost's view that the essential component of humanity is unrelated to the material makeup of the body itself, indicating that it may be this ability to change the body that ultimately defines humanity—a decidedly transhumanist philosophy that materializes in the present in the way in which the prosthetics industry is rapidly allowing individuals to change the shape of their limbs. These themes of bodily agency and technological transformation are also central to the Deus Ex Universe.

The documentary then shifts focus to the Open Bionics x Deus Ex collaboration, featuring "Material Innovator" Catherine Disney, who demonstrated her arm at the Human by Design conference, as well as Samantha Payne from Open Bionics and Jonathan Jacques-Belletête from Eidos Montréal. We see Payne creating a 3D scan of Disney's left arm in the Open Bionics studio using a "bioccipital" scanner attached to the back of her smartphone—the same process she described in her conference presentation. This scan is then used to 3D print the custom socket for Disney's Deus Ex-themed prosthesis out of a pliable material. Payne notes that traditionally the prosthetist and they would take a plaster cast and "it would take ages." Here the synergy between mobile technology, 3D printing, and prosthetics displays the contemporary "do-it-yourself" ethos that permeates consumer goods and represents a different type of individual "freedom" through technology.

According to Jacques-Belletête, “The limitations between video games and reality are very different. I think most of the prosthetics designed today still have this over-mechanical aesthetics to them. We’re cooperating with a real prosthetics company, they’re making Adam’s arms. That’s something that we never, ever would’ve thought.” In discussing the relationship between the game and prosthetics companies, Payne explains that:

> We got to work with the Deus Ex 3D artists and design crew. We had a meeting with them, and they were like, “Okay, we design these for video games. You design them in real life. So what do we need to think about?”

We then see Open Bionics member “Jonathan” working with a 3D model of one of the arms, as Payne explains that he is “altering their designs to make them wearable. And this one specifically is for Catherine. So it was a character’s arm in a fictional video game, it’s now going to be a very cool design for a real person.”

As indicated by Payne, the transition from a video game to a “very cool design for a real person” involves certain limitations. Practically speaking, a 3D model designed for the virtual space of a video game lacks the structural integrity and precise tolerances needed to print an actual model. These limitations are also conceptual as well: Although the intention is likely to demonstrate the similarities between science fiction and reality, the documentary’s use of footage from *Mankind Divided* seems to magnify the differences between the two. As we see game footage of Adam Jensen’ left hand unfolding and intricately rearranging itself into a high-powered energy weapon, shooting a bright beam that creates a concussive bubble that blows his enemies away, Jacques-Belletête explains that:

> There’s like a wanted uncanniness in Adam’s arms. There’s like some weird little kinks in his arms, and there’s like negative spaces where there shouldn’t be. So

> these are things that, if you'd see them on a human being with a regular arm, would be really, really freaky.

Still, while Disney's prosthetic arm lacks the explosive transformations of Jensen's augmentations, there is a measure of "uncanniness" to the prosthesis' stylized geometric design. As Disney explains, this has its own benefits:

> I meet new people all the time. And it's not that it's a negative thing to meet people like, the way I am, but having a prosthetic that's so different and so interesting is just going to be a much better conversation starter.[114]

In describing the "discomforting dissonance between experienced and expressed reaction" that often occurs when able-bodied individuals encounter a person with a visible disability, Garland-Thomson explains that "The interaction is usually strained because the nondisabled person may feel fear, pity, fascination, repulsion, or merely surprise, none of which is expressible according to social protocol."[115] Therefore, in addition to its grasping and manipulating abilities, Disney's alternative limb may serve as a means to channel uncomfortable attention away from the subject of disability itself to the more "interesting" or perhaps familiar topic of the science fiction-ness of her Deus Ex Universe-themed bionic arm. In moments where "disability threatens to snap the slender thread of sociability,"[116] a bit of science fiction cool is an effective icebreaker.

As it reaches its climax, the documentary begins to abandon its role as a pseudo-advertisement—or pseudo-documentary—and resembles a full-blown trailer for *Mankind Divided*. Towards the end of the documentary, "Ethicist" E. Christian Brugger emphasizes the continually blurring line between reality and fantasy, declaring that:

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[114] *Human by Design - Presented by Deus Ex: Mankind Divided*.
[115] Garland-Thomson, Rosemarie. *Extraordinary Bodies*. (p. 12)
[116] Ibid. (p. 13)

> The realm of possibility and impossibility overlaps in the field of human augmentation. So it's a good time to be asking what is fantasy and what is reality? And how do we even define those? Because are we at such a point where we can take what is fantasy now and make it reality in the future?

Brugger's comments are juxtaposed with a shot of a black nano-blade extending from Jensen's arm, followed by cinematic footage from *Mankind Divided* of Jensen fighting a hulking augmented man, as Jacques-Belletête discusses the key themes of the game world. While the documentary wants viewers to consider Brugger's question about the relationship between technological reality and futuristic fantasy, it also readily provides the answer. The implied connections between the game and actual reality are pointedly reinforced by a cut back to Asem Hasna, who describes thinking of his experiences as a refugee like a "game" in order to try and cope with it and think positively—each step of his migration was like a level or task in a video game.

However, at the end of the documentary, the central tension between science fiction-inspired alternative prosthetics and their fictional analogs is made clear. According to Jacques-Belletête:

> I mean, we're going to see stuff in our lifetimes that are going to be insane. Like, the first person who's literally going to say, "Hey, my arm is perfectly fine, but take it off. And I want to have this cool thing instead."

Yet Payne reminds us that: "Truthfully, like right now, there isn't a robotic technology that can replicate how good the human hand is."[117] And for all its efforts at proleptic transhumanism, there still isn't a robotic technology that can replicate the sophisticated augmentations featured in

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[117] *Human by Design - Presented by Deus Ex: Mankind Divided*.>.

the Deus Ex Universe. However, until technology catches up, one can have their arm at least look like it's from the future, which, for many users and able-bodied bystanders, is "cool" enough for now.

6.0 CONCLUSION: THE FUTURE OF HUMAN BY DESIGN

The technological double visions and ambivalent futures depicted in popular science fiction are belied by a bionic reality that—at least for now—looks quite promising. Most recently, bionic technologies gained the national spotlight at the one-day White House Frontiers Conference held in Pittsburgh, Pennsylvania on October 13, 2016. Hosted by President Barack Obama and co-hosted by the University of Pittsburgh and Carnegie Mellon University, the purpose of the conference was to "focus on building U.S. capacity in science, technology, and innovation, and the new technologies, challenges, and goals that will continue to shape the 21st century and beyond."[1] At the conference, the University of Pittsburgh Rehab Neural Engineering Labs exhibit, titled "Restoring Movement and Touch with Brain Interfaces," demonstrated how neural signals from brain implants allowed individuals with spinal cord injury to control and receive sensory feedback from a "lifelike robotic arm"—the dexterous MPL developed by the Johns Hopkins University's Applied Physics Lab.[2] In a complementary University of Pittsburgh Medical Center (UPMC) news release about the DARPA-funded technology, called the "Brain

[1] "The Conference." The White House Frontiers Conference. 2016. Accessed December 10, 2016. http://frontiersconference.org/.
[2] "Exhibits." The White House Frontiers Conference. 2016. Accessed December 10, 2016. http://www.frontiersconference.org/exhibits.

Computer Interface" (BCI), project leader Dr. Robert Gaunt explained that "The ultimate goal is to create a system which moves and feels just like a natural arm would."[3]

In attendance was 30-year-old research participant Nathan Copeland, who became paralyzed from the chest down after a car accident in 2004. In March of 2015, UPMC surgeons implanted an array of microelectrodes into a section of Copeland's brain, giving him the ability to remotely control the MPL as well as experience a "tingling" sensation that tells him "with definite precision" which of the robotic hand's fingers are being touched or moved.[4] In an *NBC News* video featuring a meeting between Copeland and Obama, Copeland, seated in an electric wheelchair and hooked up to the BCI via a series of cables extending from the top of his head, demonstrated his ability to skillfully manipulate the robotic arm, mounted beside him on a stand. "Let's see what you got," announces Obama, before "fist-bumping" the disembodied arm's black and silver hand. As a machinegun flurry of camera shutters is heard in the background, Obama asks Copeland if he wants to "blow it up," and the two make a second attempt, slowly expanding their hands as they pull away. "That is unbelievable," declares Obama, before explaining to the media that "Nathan is moving this hand with his brain" and that it is "also very cool … that he is feeling me touching and pulling on this robotic arm."[5]

The image of Obama sharing one of his trademark fist-bumps with Copeland and his "very cool" robotic arm trended widely, bringing incomparable media attention to the research being conducted with the BCI and MPL at the University of Pittsburgh and UPMC. It also

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[3] UPMC/University of Pittsburgh Schools of the Health Sciences. UPMC Media Relations Department. "In a First, Pitt-UPMC Team Help Paralyzed Man Feel Again Through a Mind-Controlled Robotic Arm." News release, October 13, 2016. UPMC/Pitt Health Sciences Newsroom. Accessed December 7, 2016. http://www.upmc.com/media/NewsReleases/2016/Pages/bci_scitransl-lms.aspx.

[4] Ibid.

[5] Fox, Maggie. "Brain Chip Helps Paralyzed Man Feel His Fingers." NBC News. October 13, 2016. Accessed December 07, 2016. http://www.nbcnews.com/health/health-news/brain-chip-helps-paralyzed-man-feel-his-fingers-n665881.

reinforced that as means of interacting with the world, bionic limbs are intimately *human* technologies, and media depictions invariably showcase the indomitable resolve of those involved in their development and use. In 2011, quadriplegic patient Tim Hemmes used an earlier version of the BCI system to "reach out with a mechanical arm to touch his girlfriend." According to Hemmes, "I got to reach out and touch somebody for the first time in seven years."[6] One year later, Jan Scheuermann, another research participant with quadriplegia, famously used the device to feed herself chocolate, declaring "One small nibble for a woman, one giant bite for BCI." According to Scheuermann, "This is the rollercoaster. This is skydiving. It's just fabulous."[7]

In a DARPA news release promoting the Frontiers Conference event, Justin Sanchez, Director of DARPA's Biological Technologies Office and Revolutionizing Prosthetics program manager, declared that "DARPA has previously demonstrated direct neural control of a robotic arm, and now we've completed the circuit, sending information from a robotic arm back to the brain."[8] In addition to completing the circuit between human and machine, the DARPA-sponsored research on prosthetics is rapidly completing the circuit between reality and fiction. As a result, the "unbelievable" image of a dexterous, mind-controlled limb is likely familiar to even the most casual admirer of popular science fiction, a notion that continues to be exploited in public presentations of these technologies. In a video released by UPMC to coincide with the

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[6] UPMC/University of Pittsburgh Schools of the Health Sciences. UPMC Media Relations Department. "Man with Spinal Cord Injury Uses Brain Computer Interface to Move Prosthetic Arm with His Thoughts." News release, October 10, 2011. UPMC/Pitt Health Sciences Newsroom. Accessed December 24, 2016. http://www.upmc.com/media/NewsReleases/2011/Pages/bci-press-release.aspx.

[7] UPMC/University of Pittsburgh Schools of the Health Sciences. UPMC Media Relations Department. "Woman with Quadriplegia Feeds Herself Chocolate Using Mind-Controlled Robot Arm in Pitt/UPMC Study." News release, December 16, 2012. UPMC/Pitt Health Sciences Newsroom. Accessed December 24, 2016. http://www.upmc.com/media/NewsReleases/2012/Pages/bci-press-release-chocolate.aspx.

[8] Outreach@darpa.mil. "DARPA Helps Paralyzed Man Feel Again Using a Brain-Controlled Robotic Arm." DARPA. October 13, 2016. Accessed January 17, 2017. http://www.darpa.mil/news-events/2016-10-13.

White House Frontiers Conference, Copeland—a self-professed fan of Japanese anime—emphasized the science fictional qualities of the BCI and MPL by drawing a parallel to similar technologies featured in the *Star Wars* film series: "Luke Skywalker got his hand chopped off, and the next day he has a robot one. … That could be someone else, not even that far in the future."[9] Due to technologies such as the BCI and the MPL, the gap between Copeland and Luke Skywalker is quickly diminishing.

On the morning of the Frontiers Conference, I was given the opportunity to visit the Rehab Neural Engineering Labs exhibit and interact with the MPL on display. Upon learning that the exhibition space in the University of Pittsburgh Alumni Hall Ballroom would be open to the public for approximately two hours, I rushed across the street from my office, eager to get a firsthand glimpse of the robotic arm that would make headlines with a famous "fist-bump" later that day. At the exhibit, Bioengineering Ph.D. candidate Sharlene Flesher asked if I "wanted a handshake," and, using a Sony PlayStation controller, she confidently positioned the black and silver hand until it gently gripped my own. I could hear the gentle whirr of the arm's electric motors as it moved up and down in response to my own. However, as if to preempt any visions of bionic superheroes, the research team described their scientific achievements with characteristically measured optimism. When I told one of the lead scientists that I was studying the "marketing" of bionic limbs, they gave a bemused laugh and told me that it would be a long time before these would reach the market. When the subject of the MPL's price tag of tens of thousands of dollars came up, I was told that the actual cost was "more like millions," in reference to the years of government-funded work necessary to develop both the bionic arm and

[9] "October 2016 Interview Clips: Nathan Copeland." Media Video Library - UPMC/University of Pittsburgh Schools of the Health Sciences. October 2016. Accessed December 7, 2016. http://www.upmc.com/media/Pages/video.aspx?vcat=606%3b%23e2f9d53a-9732-4bb6-a192-07bd74771b65%7cBrain+Computer+Interface+Research.

the BCI. Still, this long-overdue encounter reinforced what I—and Spider-Man, and Tilly Lockey, and many others cited in this dissertation—already knew: bionic limbs are *awesome*.

In light of the "awesome" bionic technologies and transhumanist futures discussed in this dissertation, if you were given the opportunity to replace one of your natural limbs—or your current prosthesis—with an artificial version of your choosing, what features would be most important you? Would it need to function at least as well as—or better than—your original limb? Would it need to be removable, replaceable, and upgradeable to the latest models as technology improves? Would it need to be fully customizable, allowing you to express your unique sense of style and/or install specialized components to aid in everyday personal and professional tasks? Or, would it need to be nearly "invisible," blending in seamlessly as a natural limb while still affording the above benefits? After considering all of your options, you might even choose to reject the idea altogether for moral, sentimental, and/or practical reasons, opting to avoid yet another technological responsibility—and heavy rechargeable battery—in your everyday life. These questions are central to contemporary discourses concerning the development and use of bionic limbs, and with the increasing availability of bionic technologies for all people, these questions will remain central to the future of science, technology, and society.

Today, there is good reason to think twice about amputating an otherwise healthy appendage. In addition to every day pain and discomfort, individuals with limb loss and limb differences currently experience many rehabilitative challenges. Learning to use a new myoelectric prosthesis effectively takes time and effort, and medical-grade devices can be prohibitively expensive, even with insurance. Even the most advanced robotic prostheses are generally functionally inferior to their biological counterparts, lacking the dexterity and fine motor control of natural limbs. Many users even prefer older, body-powered or non-functioning

prostheses due to habit, familiarity, or a general lack of desire to upgrade. Depictions of prosthetics-wearing individuals in the media—including those featured in the marketing for major prosthetics manufacturers and clinics—also tend to waver between an appreciation for the mundane, everyday experiences of amputees, and the need to downplay them in order to glamorize the transformative role that prosthetic technologies have played in their lives. This has led to a somewhat inflated rhetoric of science fiction cool that prosthetic technologies are currently—on the whole—unable to live up to.

Still, while not everyone wants an artificial arm or leg, bionic prostheses continue to epitomize technological cool in public discourses, and in recent years the notion of having an artificial limb has come to be viewed as a positive—and even enviable—characteristic. In a 2015 article on Vice Media's *Motherboard* titled "I Would Replace My Right Arm With a Robotic One," columnist Bay Morten notes that while he wishes he had a "smarter" arm, "considering the horrifying trauma of losing a limb in an accident, to disease, or sacrificing it on the battlefield, one could argue that wishing one's arm away is equally ungrateful and disrespectful." However, he argues that "if things turn out the way some researchers are predicting, giving up an arm voluntarily may not be quite as socially unacceptable in the future. In fact, it may well be worth the initial investment of dollars and human flesh and bone."[10] In other words, in the future it may be viewed as a social liability not to have (at least) one.

In a 2012 *New York Times* "Student Opinion" column titled "When Is It O.K. to Replace Human Limbs With Technology?," author Daniel E. Slotnik posed a similar series of questions concerning artificial limbs to teenaged students:

[10] Bay, Morten. "I Would Replace My Right Arm With a Robotic One." Motherboard. April 14, 2015. Accessed December 07, 2016. http://motherboard.vice.com/read/i-would-replace-my-right-arm-with-a-robotic-one.

> Do you think prosthetic limbs that appear almost robotic can be "beautiful"? Could having an artificial limb ever be preferable to your natural one? … Do you think that doctors who offer to amputate patients' limbs so that they can use a better prosthetic should also amputate those of people who, for other reasons, want them removed? What other questions does this kind of issue raise for you about the degree to which it is ethical to use science and technology to improve people's bodies and lives?

The responses, which were collected through 2016, varied between those who embraced the possibilities of artificial limbs and those who were concerned about the ethical implications of their use. For example, in regards to the aesthetic qualities of artificial limbs, user "Kieran" argued that:

> We often find machines beautiful, and this is no different. With the right design, you can make a wonderfully graceful and even artistic artificial limb. … All in all, robotics can be just as beautiful, if not even more so, than natural limbs, simply because they are unnatural, and not limited by flaws we may possess.

Likewise, "Eileen S" agreed that "having a robotic limbs can be beautiful. Having an artificial limb can be preferable to a natural one if your normal one doesnt work write."

However, "Seth M." simply noted that while "it is obviously O.K. to have prosthetics only if you need them … it wouldn't be good to do it out of vanity." "Sebastian" agreed that "the only people who deserve artificial limbs are those who already lost them to some accident or from war or attack." Alternatively, "jeff" bluntly declared: "i don't think human body parts should be changed out for robot ones.I think they would rooin the uniqueness of us humans we

would probably be ugly machines." Likewise, "OldGreg" warned that "it will create an uprising of cyborgs that will take over the world."

Other responses recognized the benefits of prosthetics but privileged the sanctity or intuitiveness of the natural body. "Navya S" declared that "Sometimes it becomes necessary to replace one's limbs with technology, especially when someone undergoes an accident. But I think that replacing natural limbs with artificial is not very profitable because human can never create anything which is above God's gift." "VanessaBEL" agreed that "This technology is amazing but it can never compare to a part of your own body … your own legs and arms are very valuable and no prosthetic can replace them."

A few comments even referenced Adam Jensen and the *Deus Ex* series, securing his place as a transhumanist benchmark in contemporary visual culture. In embracing the series' transhumanist ethos of "human by design," user "Dmitri" writes:

> Personally I'm all for body modification for just about any purpose. I personally plan on getting my first tattoo in the next few months once I have the money and have sketched it out thoroughly enough to be satisfied, however assuming that in the next several decades prosthetic's advance enough (my base line being similar to the technology displayed in the "Deus Ex" series or the new Robocop movie) then if I can afford it I would legitimately consider getting artificial limbs, most likely an arm or even both.

Likewise, "Marquuis" concludes that:

> I personally have been asking myself this question for a long time, I came to realise that the human body is very restricted by its own biological design – we have likely reached the peak of our own evolution. … When looking at projects

> around the world, more great minds are building not only prosthetics but also looking at implants, exoskeletons, and advanced cybernetics. I think people have this romantic idea that the human race will become something of the like of Adam Jenson, a character from the successful video game Deus Ex.[11]

Ultimately, whether they are "beautiful," "ugly," "natural," "artificial," or resemble characters from science fiction, discussions of bodily prosthetics generate a multiplicity of cultural responses ranging from bio-centric skepticism to transhumanist dogma. Despite the bloody, techno-militaristic future depicted in the Deus Ex Universe, the "romantic idea" of Adam Jensen's powerful, beautiful augmentations persists. In navigating these cultural attitudes towards bodily prosthetics, the question remains: In contemporary society, what does it mean to say that a technology is like science fiction?

In this dissertation, I have worked to theorize how science fiction themes and imagery in television programs, films, video games, comics, web pages, product advertisements and news reports shape public attitudes towards human bodily prosthetics, focusing in particular on bionic limbs. I explore the cultural and ethical implications of this increasingly close relationship between science fiction and technology, paying special attention to what happens to technologies such as prosthetics when they are presented through a sci-fi lens. A central question throughout my research concerns the role of contradiction and ambivalence in how society views new technologies, and how the presentation of these technologies as "cool" and "futuristic" can be used to mediate their seemingly negative characteristics by associating them with similarly "dangerous"—but technologically inspiring—depictions in science fiction. Bionic prostheses

[11] Slotnik, Daniel E. "When Is It O.K. to Replace Human Limbs With Technology?" The New York Times. May 16, 2012. Accessed December 07, 2016. http://learning.blogs.nytimes.com/2012/05/16/when-is-it-okay-to-replace-human-limbs-with-technology/.

have become exemplars of technological achievement in popular culture, and my approach emphasizes how the form and function of these technologies helps frame public arguments about their value, morality, and social appeal.

Increasingly, popular culture is the means by which new technologies are explained and understood. Therefore, as a rhetoric and media studies project, this research was conducted using primary mass media sources. In particular, the marketing of bodily prosthetics and their representations in the media is illuminating for the study of how technological rhetoric circulates through popular culture. However, in focusing on media texts, this dissertation lacks firsthand encounters such as the brief one that occurred at the White House Frontiers Conference. The challenge has been to reconcile the presumably truthful nature of personal testimonials from developers and users of prosthetics with their commission and use as advertising rhetoric for prosthetics companies and government research institutions. In order to form a more complete and intimate view of the complex ways in which popular culture affects our relationship to technology, future research would benefit from the incorporation of original, "less-mediated" ethnographic interviews with developers of bionic prosthetic technologies and the amputees and people with limb differences that use them.

Furthermore, this dissertation lacks the space for a fuller discussion of topics such as prosthetics and sport. Combining human bodily achievements with human technological achievements, bionic athletes have become prominent figures in the worlds of prosthetics and athletics. Of particular importance is the controversy surrounding the efforts of amputee athletes to compete against able-bodied competitors, and the question as to whether or not their artificial limbs make them into super-abled cyborgs with an unfair advantage. Due to their increasing visibility as sports sex symbols through publications such as *ESPN Magazine*'s annual "The

Body Issue," the bodies of these athletes have a complex visual rhetorical quality as bodies of both human and technological desire. Most recently, the first "Cyborg Olympics" were held in the fall of 2016, where individuals using bionic technologies competed in a series of mental and physical tasks that pushed experimental augmentation technologies and human willpower to the limits.

In many ways, to "be like science fiction" is to embody the ideal that the technology of the future will in some way be *better* than the technology of today. As a result, studying how this rhetoric of science fiction cool is used to market and interpret new bionic technologies is crucial in order to be able to discern mechanical reality from fantasy depictions and advertising hyperbole. It is also a means for society to ensure that our technological future lives up to the most enlightening of those visions.

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