TECHNOLOGY-ENHANCED EMPLOYEES AND THE AMERICANS WITH DISABILITIES ACT

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Abstract

Coming technological advances in the human/machine interface will soon render traditional concepts of physical disability obsolete. The federal American's with Disabilities Act – designed to protect and accommodate disabled persons in the workplace – will shortly be outdated and Congress needs to develop a task force to formulate new polices for the coming technology-enhance worker who may not only be no longer disabled, but will be enhanced.

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I. Introduction

Futurists[1] focus primarily on the implications of robotics and A.I.[2] from an "employee displacement" framework when considering the future of work.[3] However, future technology's more compelling

[1] *See Futurist*, MERRIAM-WEBSTER DICTIONARY (Sept. 14, 2017 *archived at* https://perma.cc/SBV6-4DR4 (defining futurist as "one who studies and predicts the future especially on the basis of current trends"); Graham Brown-Martin, *3 Mega-Trends Shaping the Future of Work*, BUSINESS INSIDER (Mar. 17, 2017), *archived at* https://perma.cc/CB9X-5TK5 (suggesting that futurology is based on "determinism, a reductionist theory that presumes a society's technology drives the development of its social structure and cultural values").

[2] *See* PATRICK LIN, KEITH ABNEY & GEORGE A. BEKEY, ROBOT ETHICS: THE ETHICAL AND SOCIAL IMPLICATIONS OF ROBOTICS 4 (2011) (explaining that robotics deals with utilizing new and old roles in society based on human limitations); *Robotics*, MERRIAM-WEBSTER DICTIONARY (Sept. 14, 2017), *archived at* https://perma.cc/89GL-TAXZ (defining robotics as "technology dealing with the design, construction, and operation of robots in automation."); *see also* ALAN S. GUTTERMAN, § 217:146. GLOSSARY OF COMPUTER TERMS (Business Transactions Solutions 2018) (defining Artificial Intelligence as "the ability of a machine to analyze information in ways similar to human beings"). The Glossary states:

> The machine does not 'know' that it is involved with Artificial Intelligence; the machine merely follows a carefully constructed program that defines procedures that simulate human analysis in specified areas. A successful Artificial Intelligence program allows a machine to produce results that are analogous to those that would be offered by human beings given the same information.

Id.

[3] *See* Tyson Tahl, *Technology and the Workplace: Artificial Intelligence and Robots in the 21st Century Workplace*, 26 NO. 1 EMP. & INDUS. REL. L. 27, 27 (2016) (discussing human displacement in the workplace as a possible consequence of A.I. on income-producing work); Matthew Hector, *Robots Invade Seyfarth*, 105 ILL. B.J. 22 (2017) (explaining the role robotics are playing in the legal field). *See* Jeffrey Hemker, *Will Robo-Advisers Invade Your Defined Contribution Plan*, HR DAILY ADVISORS (Aug. 11, 2017), *archived at* https://perma.cc/FR5M-9AEL (discussing the implications of using robots in the workplace and its effect on employment); PETER GORLE & ANDREW CLIVE, POSITIVE IMPACT OF INDUSTRIAL ROBOTS ON EMPLOYMENT 9-10 (Int'l Fed'n Of Robotics, Feb. 2013) (enumerating "five main areas where new jobs may be created in the next five years by the use of robotics"); Andrew Soergel, *Robots Could Cut Labor Costs 16 Percent by 2025*, U.S. NEWS (Feb. 10, 2015), *archived at* https://perma.cc/5SZ2-WG36 (predicting that "[i}ncreased automation in the workplace could cut labor costs by an average of 16 percent across the world's 25 largest goods-exporting nations--22 percent in the U.S. alone.").

workplace ramification is human enhancement[4] or transhumanism.[5] Specifically, the clash between transhumanism's inevitable vanquishment of human weakness and the current outdated nontechnology-based disability law employment protections.[6] Transhumanism is the future,[7] and, at its broadest sense, is an intellectual movement which

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[4] *See* Henry T. Greely, *Remarks on Human Biological Enhancement*, 56 KAN. L. REV. 1139, 1140 (2008) (defining "human biological enhancement" and some of the legal and biological concerns that accompany it). Greely explains:

> Human biological enhancement is a change to the human body that we do intentionally for the purpose not of making the disabled or the sick normal, healthy, or well, but of making healthy people better than well or of making disabled people not just normal, but beyond normal. In other words, it is using things not only to repair or bring up the human norm, but also to surpass either the preexisting position or to go to the extreme - to move outside the normal human range.

Id.

See also James Boyle, *Endowed by Their Creator? The Future of Constitutional Personhood*, GOVERNANCE STUDIES AT BROOKINGS 1, 6 (Mar. 9, 2011) (discussing human enhancement's impact on legal definitions, specifically the definition of "personhood" for "artificially created entities"). "In the coming century, it is overwhelmingly likely that . . . law will have to classify artificially created entities that have some but not all of the attributes we associate with human beings." *Id.*

[5] *See* Nick Bostrom, *A History of Transhumanist Thought*, 1 J. EVOL. TECH. L. 1, 10 (2005) (outlining how the human condition could be "radically transformed" through revolutionary technology); *see also* Daniel S. Rizzuto & Joshua W. Fost, *Transhumanism and Cognitive Enhancement*, THE ROUTLEDGE COMPANION FOR RELIGION AND SCIENCE 569, 569 (J. W. Haag et al. ed., 2012) (commenting on the continuing evolution of all species, including humans).

[6] *See* Zoltan Istvan, *In the Transhumanist Age, We Should Be Repairing Disabilities, Not Sidewalks*, MOTHERBOARD (Apr. 3, 2015), *archived at* https://perma.cc/R2LN-LFW2?type=image (describing the necessity to reconsider the Americans with Disability Act to help eliminate disability "via technology and modern medicine").

[7] *See* Glenn Cohen, *Legal Issues in the Evolving Healthcare Market: Honoring the Work of Einer Elhauge: What (If Anything) is Wrong with Human Enhancement? What (If Anything) is Right With It?*, 49 TULSA L. REV. 645, 650 (2014) (highlighting the importance of promoting wellness and curing disease through enhancement); *see also* Robert Sparrow, *A Not-so-New Eugenics: Harris and Savulescu on Human Enhancement*, 41 HASTINGS CTR. REP. 32, 39-40 (2011) (discussing similarities between old eugenic practices and advocates of a "new eugenics" or "liberal eugenics" through autonomous use of genetic technologies to enhance human biology); *see also* Tom Koch, *Enhancing Who? Enhancing What? Ethics, Bioethics,*

aims to transform the human condition by developing and creating widely available sophisticated technologies to interface with and enhance human intellectual, physical, and psychological capacities.[8] This work takes the position that current disability law employment protections – based on traditional concepts of human weakness and

and Transhumanism, 35 J. MED. & PHIL 685, 685 (2010) (arguing that using genetic selection technology to improve the lives of individuals or society is "a new riff on the old eugenics tune"); *see also* Sonia M. Suter, *A Brave New World of Designer Babies?,* 22 BERKELEY TECH. L.J. 897, 935 (2007) (citing public opinion polls from 1986 and 1992 which demonstrate that "forty to forty-five percent of the American public agreed with the use of gene therapy to help boost both physical and intellectual traits). Suter also notes that "[a]lthough genetic enhancement 'may indeed be very far down the road,' for technological reasons, 'the potential demand may be so great that private companies may soon begin making a substantial commitment toward enhancement research and development.'" *Id.* at 934 n.195. Wendell Wallach, a bio-ethicist at Yale University's Interdisciplinary Center for Bioethics, says that:

> It's just not clear to me why I would want to put these sensors into my body and whether it would undermine some of my other capabilities . . . I think one of the difficulties with all of these new trajectories in terms of how science can alter us is that it tends to aggrandize what these technologies bring into our life.

Ari Daniel, *Engineering Extra Senses,* PBS NOVA (Nov. 8, 2012), *archived at* https://perma.cc/88KB-2R2K.
"At the same time . . .it demeans a little bit how remarkable we are as human beings." *Id.* This paper takes no position on the ethics of Transhumanism. *See infra* Part V.

[8] *See* MAX MORE, THE PHILOSOPHY OF TRANSHUMANISM, THE TRANSHUMANIST READER: CLASSICAL AND CONTEMPORARY ESSAYS ON THE SCIENCE, TECHNOLOGY, AND PHILOSOPHY OF THE HUMAN FUTURE 3-4 (J. Wiley & Sons, Inc. eds., 2013) (explaining how the definition of transhumanism continues to evolve, but its central themes values and interests remain the same). "[T]ranshumanism is: [t]he intellectual and cultural movement that affirms the possibility and desirability of fundamentally improving the human condition through applied reason, especially by developing and making widely available technologies to eliminate aging and to greatly enhance human intellectual, physical, and psychological capacities." *Id.* at 3. "Transhumanism is a life philosophy, and an intellectual and cultural movement." *Id.* at 4.

associated antiquated views regarding ameliorative limits – are inadequate to address concepts of human disability in the coming transhumanist employee workplace.[9]

Going forward, Part II of this manuscript addresses the current status of disability employment law.[10] Part III establishes that technology will shortly upend our current thinking of a myriad of issues.[11] Part IV discusses how technology is already providing a link between technology and our biological selves and will continue to do so into the future.[12] Part V is a recommendation to Congress to act quickly to bridge the gap between our current definitions of disability for employment protections purposes and coming transhumanism.[13] Part VI is the conclusion which advocates prompt Congressional action on this issue.[14]

II. The Americans with Disabilities Act of 1990 and 2008 Amendments

Building on language and intent found in the Rehabilitation Act,[15] Congress passed the Americans with Disabilities Act (ADA) in 1990.[16] Under the ADA, it became illegal for a covered employer to

[9] *See* Ruth Colker, *The Americans with Disabilities Act is Outdated*, 63 DRAKE L. REV. 787, 788 (2015) (discussing how current disability law's failure to account for today's technological changes is negatively affecting people in areas such as employment); *see also* Istvan, *supra* note 6 (stating that America is a "bandage culture" that wastes money on treating rather than curing disabilities and arguing for investments in transhumanist technology).
[10] *See infra* Part II.
[11] *See infra* Part III.
[12] *See infra* Part IV.
[13] *See infra* Part IV(B).
[14] *See infra* Part VI.
[15] 29 U.S.C. § 794(a) (1973) (amended 2002) (stating that "[n]o otherwise qualified individual with a disability . . . shall, solely by reason of her or his disability, be excluded from the participation in, be denied benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance . . . .").
[16] *See* 42 U.S.C. § 12101 (1990) (amended 2008) (expanding on Congress' findings that society needs to integrate individuals with disabilities into "critical areas" such as employment, housing, and education); *see also* Barbara Merrill, Esq., *CEO Perspective: Celebrating the Past & Present Positioning for the Future*, AM. NETWORK OF COMMUNITY OPTIONS AND RESOURCES (July/Aug. 2015), *archived at* https://perma.cc/WH2S-KC7D (denoting that the bill was sponsored and written by

discriminate in employment against a disabled person.[17] Under the ADA a disability is defined as "a physical or mental impairment that substantially limits one or more of the major life activities of [an] individual[l]; a record of such impairment; or being regarded as having such an impairment."[18] The effect of the ADA was to standardize and nationalize employment protections for the qualified disabled employee in both the public and private sector and to back up those protections with the enforcement power of the EEOC.[19]

Congress left open the question whether an employer could take mitigating measures into account when determining whether an

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Senator Tom Harkin, who introduced his speech to the Senate in sign language so his deaf brother could understand).

[17] *See* 42 U.S.C. § 12101(b)(2) (providing that one purpose of the ADA is to provide enforceable standards to eliminate discrimination for individuals with disabilities in the workplace).

[18] *See* 42 U.S.C. § 12102(a)(1) (1990) (amended 2008) (explaining that historically, individuals with disabilities have been isolated and discriminated against in society, and therefore, the ADA was enacted to address this social problem).

[19] *See* Fry v. Napoleon Cmty. Sch., 137 S. Ct. 743, 748-49 (2017) (highlighting that discrimination against children with disabilities in public schools is prevented by the Individuals with Disabilities Education Act ("IDEA")). The ADA "forbids any public entity", such as public schools, from discriminating against an individual "based on a disability." *Id.* at 749; City and Cnty. of San Francisco v. Sheehan, 135 S. Ct. 1765, 1773-775 (2015) (discussing how only public entities can be liable for damages under the ADA, and an individual police officer did not violate any constitutional right when he arrested a woman with a disability); Young v. UPS, 135 S. Ct. 1338, 1343-344 (2015) (expanding on the protection for employed pregnant women through the Pregnancy Discrimination Act). The Act provides that "employers must treat women affected by pregnancy . . . as other persons not so affected but similar in their ability or inability to work." *Id.* at 1343. *See also* U.S. v. Georgia, 546 U.S. 151, 153 (2006) (considering "whether a disabled inmate in a state prison may sue the State for money damages" under the ADA and circumvent state sovereign immunity). The Court held that "Title II of the Americans with Disabilities Act of 1990 validly abrogates state sovereign immunity at least insofar as it creates a private cause of action for damages against States for conduct that violates the Constitution." *Id.* at 159-60; Brief *Amicus Curiae* Of The National Council On Disability In Support Of Respondents at 24, Olmstead v. L.C. ex rel. Zimring, *et. al.*, 527 U.S. 581 (1998) (No. 98-536) (emphasizing Representative Dellum's statement that the ADA is a civil rights statute designed to stop treating disabled individuals as "inferior"); *see also Employer-Provided Leave and the Americans with Disabilities Act,* U.S. EQUAL EMP. OPPORTUNITY COMMISSION (May 9, 2016), *archived at* https://perma.cc/M4QM-EF3V (affirming that "[t]he Equal Employment Opportunity Commission (EEOC) enforces Title I of the Americans with Disabilities Act"" to prohibit workplace discrimination).

individual is disabled.[20] The Supreme Court resolved this question in *Sutton v. United Air Lines, Inc*. (*Sutton*).[21] In that case, a defendant airline refused to hire twins due to their extreme nearsightedness.[22] The Court concluded that the plaintiffs were not disabled – and, therefore, not subject to the protections of the ADA – because *with the aid of corrective lenses*, they were not substantially limited in a major life activity.[23] The Supreme Court reasoned that, under the ADA, "[a] 'disability' exists only where an impairment 'substantially limits' a major life activity, not where it 'might,' 'could,' or 'would' be substantially limiting *if mitigating measures were not taken*."[24]

While lower courts quickly followed *Sutton's* rule, scholars and disability advocates criticized it as unduly limiting ADA's application and pedantically circumscribing the definition of disability.[25] The antidote came in the passage of Americans with Disabilities Act Amendments Act ("ADAAA") in 2008.[26] The Amendments emphasized that Congress meant for the original ADA disability definition to

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[20] *See* Sutton v. United Air Lines, Inc., 527 U.S. 471, 499-500 (1999) (noting the Senate Report states that "whether a person has a disability should be assessed without regard to the availability of mitigating measures"); *but see* Garcia-Hicks v. Voc. Rehab. Admin., 148 F. Supp. 3d 157, 165 (D. P. R. 2014) (asserting that Congress expressly rejected the holding of *Sutton*). Congress expresses several directives on how mitigating circumstances should be taken into account when determining whether a disability limits a "major life activity." *Id.* at 165-66.

[21] *See Sutton*, 527 U.S. at 482 (determining that mitigating measures and the effects of those measures are considered when determining whether a person is "'substantially limited' in a major life activity" under the ADA).

[22] *See id.* at 475-76 (articulating the intricacies of why the airline refused to hire the twins).

[23] *See id.* at 488 (concluding that courts must consider corrective measures when determining whether an individual is disabled under the ADA).

[24] *See id.* at 480 (explaining that disability requires a present "substantial limitation," not a potential future limitation).

[25] *See* Timothy S. Bland & Thomas J. Walsh, Jr., *U.S. Supreme Court Resolves Mitigating Measures Issue Under the ADA*, 30 U. MEM. L. REV. 1, 23-4 (1999) (proclaiming that in addition to acknowledging the positive effect that mitigating factors may have on an impairment, courts must also consider the negative connotations that certain mitigating measures may have on the individual).

[26] *See* Americans with Disabilities Act Amendments Act of 2008, Pub. L. No. 110-325, § 2, 122 Stat. 3553 (2009) (providing the full statute which expands the definition of disability in United States law). The intended purpose of the Act is to provide clear standards to eliminate discrimination against individuals who formerly were not classified as disabled. *Id.*

be broadly applied without undue analysis.[27] The Amendments rejected the Supreme Court's *Sutton* holding and provided that requiring mitigating factors could not place an employee – who was otherwise disabled – outside the purview of disability law employment protections.[28] The applicable language of the ADAAA reads as follows:

> (E)(I) The determination of whether an impairment substantially limits a major life activity shall be made without regard to the ameliorative effects of mitigating measures such as --
> (I) medication, medical supplies, equipment, or appliances, low-vision devices (which do not include ordinary eyeglasses or contact lenses), prosthetics including limbs and devices, hearing aids and cochlear implants or other implantable hearing devices, mobility devices, or oxygen therapy equipment and supplies;
> (II) use of assistive technology;
> (III) reasonable accommodations or auxiliary aids or services; or
> (IV) learned behavioral or adaptive neurological modifications.[29]

In its current form the ADA and its Amendments, reflect a Congressional intent for disability employment laws to apply persons in a

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[27] *See* Americans with Disabilities Act Amendments Act § 2 (demonstrating Congress' intent to have a broad definition of disability).

[28] *See* Americans with Disabilities Act Amendments Act § 2 (expounding on the definition of disability to avoid an individual being classified as not disabled due to mitigating factors); *but see* Sutton v. United Air Lines, Inc., 527 U.S. 471, 475 (1999) (holding that the determination of whether an individual is disabled should be made with reference to measures that mitigate the individual's impairment, including, in this instance, eyeglasses and contact lenses).

[29] *See* Americans with Disabilities Act Amendments Act § 4 (defining what is classified as an impairment that substantially limits a life activity, without regard for assistive technology); *see also* Alex H. Glaser, *The Americans With Disabilities Act Amendments Act: Legal Implications and The Effect on Employer-Employee Relationships*, 59 LA. B. J. 94, 95 (Aug./Sept. 2011) (highlighting how the ADAAA updated the ADA's definition of disability). The ADAAA retained the following definition of disability as "[a]n impairment that substantially limits one or more major life activities . . . [a] record of such impairment . . . regarded as having such an impairment." *Id.*

wholly natural state.[30] In other words, disability of an individual is to be calculated with his/her body functioning naturally – with no technological enhancements, additions or modifications.[31] Such a view, while certainty historically consistent with Congressional intent to protect disabled persons, fails to recognize the tsunami of imminent new technological "mitigations" to human performance – transhumanism – which will shortly remove most so-called disabilities.[32] To avoid law lagging technology – as it did with internet related copyright and privacy statutes – Congress must readdress the ADA in light of coming transhumanism.[33] The 21st century employee — no matter what his/her "natural state" – will be super enabled by technological enhancement/augmentation of limbs, organs and brain.[34] In light of these considerations, the Supreme Court in *Sutton* was not incorrect – it was prescient.[35]

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[30] *See* 42 U.S.C. § 12101(b)(3) (rejecting the Supreme Court's reasoning in *Sutton v. United Air Lines, Inc.* expressing intent to in the reasoning of the Court as announced in *School Board of Nassau County v. Arline*).

[31] *See* Kristine Cordier Karnezis, *What Constitutes Substantial Limitation on Major Life Activity of Lifting for Purposes of Americans with Disabilities Act, 42 U.S.C.A. §§ 12101 to 12213*, 23 A.L.R. Fed. 2d 197, 201 (2007) (explaining that in the calculation of whether a disability "substantially limits a major life activity" technological devices that may improve the disability are not to be considered).

[32] *See* 42 U.S.C. § 12101(a)(1) (describing Congress' intent in passing the Americans with Disabilities Act); *see also* Lisa C. Ikemoto, *Race to Health: Racialized Discourses in a Transhuman World*,9 DEPAUL J. HEALTH CARE L. 1101, 1102 (2005) (arguing that transhumanism could help to eradicate disabilities among humans).

[33] *See* Collin Bockman, Note, *Cybernetic-Enhancement Technology and the Future of Disability Law*, 95 IOWA L. REV. 1315, 1330-31 (2010) (asserting that disability law needs to adapt to emerging technological advances). Much has been noted regarding the inability of law makers to anticipate future trends and legislate accordingly. *Id. See* HENRY H. PERRITT, JR., LAW AND THE INFORMATION SUPERHIGHWAY 3-4 (Aspen Law & Business eds., 2d ed. 2001) (noting technological change has always been a major issue for humans "that the law must address"). The law should address disputes surrounding technology and its changes. *Id.* at 4

[34] *See* Bockman, *supra* note 33, at 1337-38 (describing the legal implications transhumanism might bring in the future because of super humans working as employees).

[35] *See* Sutton v. United Air Lines, Inc., 527 U.S. 471, 475 (1999) (addressing whether devices that can help to cure or mitigate a disability ought to be counted in the determination of the degree of a person's disability).

III. Future Shock is Now

Alvin Toffler writes,

> It has been observed, for example, that if the last 50,000 years of man's existence were divided into lifetimes of approximately sixty-two years each, there have been about 800 such lifetimes. Of these 800, fully 650 were spent in caves. Only during the last seventy lifetimes has it been possible to communicate effectively from one lifetime to another—as writing made it possible to do. Only during the last six lifetimes did masses of men ever see a printed word. Only during the last four has it been possible to measure time with any precision. Only in the last two has anyone anywhere used an electric motor. And the overwhelming majority of all the material goods we use in daily life today have been developed within the present, the 800th, lifetime.
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> In the three short decades between now [1970] and the twenty-first century, millions of ordinary, psychologically normal people will face an abrupt collision with the future. Citizens of the world's richest and most technologically advanced nations, many of them, will find it increasingly painful to keep up with the incessant demand for change that characterizes our time. For them, the future will have arrived too soon.[36]

While Alvin Toffler was correct in predicting massive change, even he would be stupefied by the rapid pace of technology's claim on

[36] *See* ALVIN TOFFLER, FUTURE SHOCK 13-14, 9 (1970) (summarizing key events of human history in a timeline of 800 lifetime segments).

the future.[37] Indeed, futurist, Ray Kurzweil,[38] has postulated that every twelve to eighteen months computers double their capabilities in concert with information technologies which use them.[39] According to Kurzweil, in 2020 technologies will advanced from the present by thirty two times.[40] The current eleven months doubling rate of technology known as Kurzweil's "The Law of Accelerating Returns" is getting faster.[41]

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[37] *See* RAYMOND KURZWEIL, THE SINGULARITY IS NEAR 3 (Penguin Group) (2005) [hereinafter THE SINGULARITY IS NEAR] (introducing the law of accelerating returns "which explains why technology and evolutionary processes in general progress in an exponential fashion").

[38] *See* Raymond Kurzweil, *Biography*, CLOSER TO TRUTH, *archived at* https://perma.cc/S873-YA2J. The biography states:

> Raymond 'Ray' Kurzweil is an American author, inventor, futurist, and Director of Engineering at Google. Aside from futurology, he is involved in fields such as optical character recognition (OCR), text-to-speech synthesis, speech recognition technology, and electronic keyboard instruments. He is the author of several books on health, artificial intelligence (AI), transhumanism, the technological singularity, and futurism.

Id.

[39] *See* Stephen S. Wu, *Message from the Chair*, 7 NO. 4 ABA SCITECH L. 4 (2011) (explaining how advances in technology are changing the legal industry for legal professionals); *see also* THE SINGULARITY IS NEAR, *supra* note 37, at 3 (restating Kurzweil's law of accelerating returns).

[40] *See* Ray Kurzweil, *The Law of Accelerating Returns*, KURZWEIL: ACCELERATING INTELLIGENCE (2001), *archived at* https://perma.cc/QG88-NW3J [hereinafter *The Law of Accelerating Returns*] ("[W]ith regard to the doublings of computation, that's about where we stand now—there have been slightly more than 32 doublings of performance since the first programmable computers were invented during World War II.").

[41] *See The Law of Accelerating Returns*, *supra* note 40 ("[u]ltimately we will get away from the tangle of wires in our cities and in our lives through wireless communication, the power of which is doubling every 10 to 11 months"); Stephanie Noble, *Researching Emerging Technology*, 42-AUG COLO. L. 103, 103 (2013) (stating Kurzweil's law of accelerating returns, declaring "we won't experience 100 years of progress in the 21st century—it will be more like 20,000 years of progress (at today's rate)"); Robert D. Kalinoski, *The Role of Law in Our Technological World*, 33 MD. B.J. 2, 3 (Aug. 2000) (explaining that the development of computer technology is rapidly outpacing other machines, such as jet engine technology); *see also* Noam Ebner, *Negotiation is Changing*, 2017 J. DISP. RESOL. 99, 108-09

Currently, computer power and sensor capabilities are quantifying cellular and molecular structures easily and cheaply and tools are able to manipulate molecules.[42] Indeed, in just twenty years, technological advancement will be far more advanced than they are today.[43] Three dimensional processors and memory drives along with biological, photon and quantum computing will keep the rate of information improvement on an exponential pace.[44]

Estimated in thirty years is a period of time referred to by futurists as "The Singularity."[45] Bio, nano, robotic and computer technology will become so rapid, so advanced, so profoundly impactful to humanity that we will not be able to ascertain or describe it or the kind of life which will exist.[46] Improved changes will be millions of times more advanced than today.[47] The only way we will be able to keep up

(2017) (discussing how "technological change is exponential, contrary to the common-sense 'intuitive linear' view").

[42] *See The Law of Accelerating Returns*, *supra* note 40 (explaining how technology created by humans is distinguished from the tool making of other species, which undergoes a process that builds off of the previous stage of technology to further innovate). Technology allows the possibility to change the molecular composition rather than through simple evolution. *Id.*

[43] *See The Law of Accelerating Returns*, *supra* note 40 (illustrating the paradigm shift rate, which is doubling every decade and depicts the technological progress evolving at rapid rates in the twenty-first century).

[44] *See The Law of Accelerating Returns*, *supra* note 40 (discussing new technologies being researched, such as three-dimensional silicon chips, crystalline computing, and optical computing, that will allow the law of accelerating returns to be applied until it approaches its natural limit).

[45] *See* Wendell Wallach, *The Singularity: Will We Survive Our Technology*, 56 JURIMETRICS J. 297, 297 (2016) (defining "[T]he 'Singularity'…. [as] a future moment in human history when science and science fiction, religion and philosophy, and hope and fear converge"); *but see* Richard E. Flathman, *The Good or Goodness of Polity and Polities A La Liberalism: Plurality Rather than Unicity, Singularity beyond Plurality*, 4 CARDOZO J. INT'L & COMP. L. 295, 298 (1996) (opining that "individualism promotes plurality over unicity").

[46] *See* Maciamo Hay, *The New Technologies That Will Change Human Civilization as We Know it*, HUMANITY PLUS MAGAZINE (May 13, 2014), *archived at* https://perma.cc/7HFT-MLR4 (predicting that by 2045, a computer "a billion times more powerful than all of the human brains on Earth" will cause an "intelligence explosion" that will render civilization unrecognizable to today's society.).

[47] *See id.* (noting that computer power can increase over 1 million times within only 30 years).

is with robots and computers to assist us.[48] Evolution will bring about artificial general intelligence (AGI)[49] and AGI will come in the form of self-evolving machines.[50] Without fear of death, poverty, boredom, disease, pain, or even maintenance, preoccupation with self-interests may diminish or even dissolve.[51] To be "alive" will be redefined to a series of "spontaneous events."[52]

Forty years out, paradigm after paradigm, the development of an interactive environment, quantum tech, and radical life extension,

[48] *See id.* (speculating that computers and robots will exceed the intelligence of the human brain and will be able to do most human jobs). Robots will soon displace humans for everyday jobs such as doctors, cashiers, construction workers, food service professionals, and elderly care givers. *Id.*

[49] *See* Sean Captain, *Robots Are Developing Feelings. Will they Ever Become "People"?*, FAST COMPANY (Oct. 4, 2017), *archived at* https://perma.cc/4QN6-MW36 (suggesting that artificial general intelligence ("AGI") can add personality, emotions, human-like common sense, and problem-solving to a robot). To date, several real projects exist in which engineers are designing robots with emotions and artificial general intelligence. *Id.*; *see also* Tim Urban, *The AI Revolution: The Road to Superintelligence*, WAIT BUT WHY? (Jan. 22, 2015), *archived at* https://perma.cc/K3NH-82UF (describing "intelligence " as "'a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience,'" and suggesting that AGI would be able to "do all of those things as easily as [humans] can"); David T. Laton, *Manhattan_Project.exe: A Nuclear Option for the Digital Age*, 25 CATH. U. J. L. & TECH. 94, 94-95 (2016) (distinguishing "AGI" as one of the three categories of AI). This type of AI includes programs that are designed to emulate "human-like cognitive abilities." *Id.*

[50] *See Estimating the Speed of Exponential Technological Advancement*, THE EMERGING FUTURE, LLC (2012), *archived at* https://perma.cc/L4D8-B97U [hereinafter *Estimating the Speed*] (explaining that by 2040, due to the rapid changes in technological developments, these intelligent machines will have the ability to self-evolve "hundreds of millions of times faster").

[51] *See id.* (predicting their evolution will be unabated by poverty, disease, or self-interests, and that "[l]iving might become a spontaneous series of events").

[52] *See id.* (hypothesizing that idea of living will change because of a lack of preoccupations with self-interest).

will advance minute by minute.[53] Accelerating intelligence, genetic engineering, nanobots, and computer brain technology will bring about human, animal, and machine communication.[54]

Finally, fifty years out, the technology that is a quadrillion times more advanced than today will give us the ability to perceive a quadrillion.[55] There will be an explosion of highly intelligent biological, non-biological, micro, nano, virtual, mixed, and morphing life forms colonizing the solar system and beyond.[56] Life spans will develop into life continuums.[57]

Against the onslaught of this technology surge, the biology of mankind cannot remain the same.[58] Transhumanism, is inevitable.[59] Merely twenty years ago, the technologies not present in the average mobile telephone were unthinkable.[60] The same will be true for human

[53] *See id.* (proposing AI will redefine life as we know it because will be so far more advanced than what it is today).
[54] *See id.* (making a premonition that AGI will allow humans, animals and machines to communicate).
[55] *See id.* (suggesting with the help of technology, in fifty years mankind will have the ability to conceptualize a quadrillion times more advanced technology than it could today).
[56] *See Estimating the Speed*, *supra* note 50 (insinuating technology development will result in an expansion of highly intelligent life forms "colonizing the solar systems and beyond").
[57] *See Estimating the Speed*, *supra* note 50 (indicating the concept of "life span" as we know it will cease to exist, transforming itself into a "continuu[m]").
[58] *See* Rich Haridy, *Welcome to the Era of Transhumanism*, NEW ATLAS (Feb. 15, 2017), *archived at* https://perma.cc/V2ZS-2GVD (discussing the pervasiveness of the Transhumanist movement within our society today, due to the influx of technology in the 21st century).
[59] *See id.* (illustrating that the dramatic acceleration of technological advancement has led philosophers and scientists, such as Julian Huxley, to believe that Transhumanism is a part of our near future).
[60] *See* Washington Post Staff, *The History of the Mobile Phone*, THE WASHINGTON POST (Sept. 9, 2014), *archived at* https://perma.cc/L5P4-FLKX (highlighting the fast-paced movement from simple phones, only capable of dialing out and receiving calls, to modern day pocket sized computers).

enhancement technologies.[61] In today's society, such machine/man interface will become common place and natural.[62] As Eve Herold,[63] Director of the Genetics Policy Institutes has written in her book, Beyond Human, there is "nothing more natural than human beings wishing to release themselves from biological constraints."[64]

IV. Human Enhancement

In light of the foregoing, in the near future technological devices will be incorporated in most every human.[65] Human enhancement will become normal, and move from the rehabilitative,[66] to the

[61] *See* Lev Grossman, *2045: The Year Man Becomes Immortal*, TIME (Feb. 10, 2011), *archived at* https://perma.cc/TZA9-6BB2 (comparing advancement in device technology to the technology used to advance humans). Kurzweil believes that by the end of the decade computers will be capable of human level intelligence. *Id.*

[62] *See id.* (highlighting the increasing normalcy of human computer interaction and artificial intelligence).

[63] *See Eve Herold*, MACMILLAN PUBLISHERS (2018), *archived at* https://perma.cc/3DEJ-HUP2 (identifying Eve Herold).

[64] *See* EVE HEROLD, STEM CELL WARS: INSIDE STORIES FROM THE FRONTLINES 41 (2006) (explaining the theory behind stem cell research is human renewal); *see also Kirkus Review of Beyond Human, How Cutting-Edge Science Is Extending Our Lives*, KIRKUS REVIEWS (June 15, 2016), *archived at* https://perma.cc/77D2-C5YS (providing a brief overview of Herold's book which, in part, predicts future advances in medicine). "An eye-opening description of scientific transhumanism that may provoke older readers to curse themselves for being born a few decades too early." *Id.*

[65] *See* Monique Frize, *A Debate on the Ethics of Body Enhancement Technologies and Regeneration*, 39 IFMBE PROCEEDINGS: WORLD CONGRESS ON MEDICAL PHYSICS AND BIOMEDICAL ENGINEERING 2072, 2073 (Mian Long ed., Springer, 2013) (explaining that computers were once seen as far-reaching enhancements, however, now they are more commonplace to humans).

[66] *See Rehabilitative and Assistive Technology*, EUNICE KENNEDY SHRIVER NATIONAL INSTITUTE OF CHILD HEALTH AND HUMAN DEVELOPMENT (Dec. 1, 2016), *archived at* https://perma.cc/4HR9-TRWF (describing rehabilitative and assistive technology as "tools, equipment, or products that can help a person . . . function successfully").

cosmetic[67] to the common place.[68] The first step in this process occurred eons ago when humans first picked up a stick to enhance the power of an arm.[69]

Most are aware that technological devices are already used to ameliorate disease symptoms and enhance human experience.[70] For example, Type -1 diabetics currently use sensor-augmented pump therapy and automated insulin bolus calculators,[71] which are attached to the body and monitor blood sugar and administer insulin.[72] Further, cochlear implants – implants which send electrical signals directly to the body's auditory nerve, bypassing the non-functioning sensory cells which cause hearing loss cochlear implants – have been available since

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[67] *See Cosmetic Surgery vs. Plastic Surgery*, AMERICAN BOARD OF COSMETIC SURGERY (2018), *archived at* https://perma.cc/3R7A-WL7K (providing an overview of what cosmetic surgery constitutes).

[68] *See* Joe Myers, *5 Human Enhancements that Could be Commonplace by 2020*, WORLD ECONOMIC FORUM (June 24, 2016), *archived at* https://perma.cc/56VD-QJDS (forecasting human enhancements such as smart skin, which is "stretchable, wearable integrated circuits" that could allow intensive care unit nurses to monitor your vital signs remotely).

[69] *See* Simon Cohen, *Cyborgs Are Already Here, But the Next Steps Will Make You Nauseous*, DIGITAL TRENDS (Aug. 22, 2016), *archived at* https://perma.cc/EE5R-CRGU (quoting the UK researcher Ian Harrison, whose Ph.D. thesis focused on how humans can expand their sensory perceptions through implanted magnets). Harrison suggests that "[h]uman enhancement on an individual level is not anything new, which most people forget . . . it has been going on for centuries." *Id.*

[70] *See Technology and Medicine*, SCIENCE MUSEUM (Feb. 8, 2018), *archived at* https://perma.cc/8JRN-3Q6H (explaining that computers have been "central" to medical care since the 1950's, and have significantly increased medical imaging and diagnostics). Technologies have greatly enhanced how professionals study, diagnose, and treat diseases. *Id.*

[71] *See Technology Transforms Diabetes*, SCIENCE MUSEUM (Feb. 8, 2018), *archived at* https://perma.cc/JK2Q-YHPW (depicting how patients with Type-1 Diabetes lack the ability to produce insulin and require devices to assist their bodies in turning sugar into energy). The first insulin pump was developed in the 1960's, which was "worn like a backpack" and delivered frequent, small doses of insulin directly into the abdomen. *Id.*

[72] *See Bolus Calculator*, THE DIABETES MALL (Feb. 8, 2018), *archived at* https://perma.cc/48QA-875R (highlighting that the bolus calculator uses personal settings to make insulin doses more accurate and are tailored to an individual's body).

1984.[73] This is one of the few technologies which actually replaces the original human organ.[74] But the range of imminent human/machine interfaces currently under development or in some form of application is no less than astounding.[75] Surely, as Arthur C. Clarke noted: "Any sufficiently advanced technology is indistinguishable from magic."[76]

Some of these new technologies include inserting a thin plate under the skin of the forearm to create a cell phone powered by blood,[77] brain stimulation implants,[78] advanced limbs designs,[79] skin and hair

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[73] *See* CAROLYN J. BROWN ET AL., TECHNICAL REPORT: COCHLEAR IMPLANTS (Am. Speech-Language-Hearing Ass'n, Mar. 2003) (discussing the technological developments in cochlear implants since the introduction in the 1980's). Over the course of the last two decades, cochlear implants have improved upon spoken word recognition of the average user. *Id.*

[74] *See* John Sandham, *Implanted Devices*, EBME (June 2006), *archived at* https://perma.cc/YK67-CPJD (differentiating a cochlear implant from a typical hearing aid which only amplifies sound). The cochlear implant replaces the "Organ of Corti, the sensory organ of hearing," and directly stimulates auditory nerves inside the cochlea with electrical impulses. *Id.*

[75] *See* Luca Chittaro, *Information Visualization and its Application to Medicine*, 22 ARTIFICIAL INTELLIGENCE IN MED. 81, 82 (2000) (describing how computer applications play an important role in medical technology through information visualization). Information visualization is "the computer assisted use of visual processing to gain understanding" of medical techniques. *Id.* The focus on computer enhancement will allow the medical practitioners to view images more easily, deal with large amounts of data, and provide the most effective patient management. *Id.* at 84.

[76] *See Sir Arthur's Quotations*, THE ARTHUR C. CLARKE FOUNDATION (Feb. 8, 2018), *archived at* https://perma.cc/GLH5-FSBY (reflecting the insights of Arthur C. Clarke, a British science fiction writer, and his thoughts "concerning the human condition, our existence on Earth, and Earth's place in a greater cosmos").

[77] *See* Jim Giles, *Gadgets Work Under your Skin – But are you Ready?*, NEW SCIENTIST (May 9, 2012), *archived* ***at*** https://perma.cc/D32L-VV4F (predicating that cellular implants into the human body is the future). Scientists have implanted a button, an LED and touch sensor into the skin of a cadaver's arm, which was able to "communicate transcutaneously using a Bluetooth connection and charge the electronics wirelessly." *Id.*

[78] *See* Mayo Clinic Staff, *Deep Brain Stimulation*, MAYO CLINIC (Dec. 30, 2017), *archived at* https://perma.cc/QKS8-ARU4 (explaining deep brain stimulation as a process involving "implanting electrodes within certain areas of your brain").

[79] *See* James Burck, *Developing the World's Most Advanced Prosthetic Arm Using Model-Based Design*, MATHWORKS (2009), *archived at* https://perma.cc/2HAN-J33E (highlighting Johns Hopkins Universities development of a prosthetic arm which responds to neural inputs "far exceed[ing] any prosthetic available today").

color modifications,[80] psychotropic anti fatigue drugs,[81] DNA and RNA strand folding[82] and gene selection.[83] Below are several other man/machine interfaces which are relevant to the discussion of the future definition of disability.[84]

A. Bionic Eyes.

One day so-called "bionic eyes" will be available for human implant.[85] Argus II made by the Second Sight[86] development company currently offers a high tech retinal implant which is attached to a camera mounted on eyeglasses.[87] The camera processes what it sees and sends signals to a small computer which a person wears.[88] The data is processed and translated into instructions that are sent wirelessly to an antenna in an implant in the optic nerve.[89] The optic nerve sends the

[80] *See* Kate Snow, *Genetics Will Let Parents Build Their Baby* (Nov. 3, 2006), *archived at* https://perma.cc/2FSW-PGJ4 (noting parent's ability to implant the sex of their baby through in vitro fertilization as far back as 2006).
[81] *See* William Saletan, *The War on Sleep*, SLATE (May 29, 2013), *archived at* https://perma.cc/KZF7-B9T4 (highlighting recent experiments around the world involving "modafinil," a psychotropic and anti-fatigue drug used to keep soldiers awake for extended periods of time).
[82] *See Folded DNA becomes Trojan Horse to Attack Cancer*, NEW SCIENTIST (Aug. 15, 2012), *archived at* https://perma.cc/YR8B-ZDWP (explaining that DNA origami, as it is playfully referred to, involves folding DNA strands to construct an object at the nano-level). These structures can then be used to deliver drugs, and fight cancer, among many other uses. *Id.*
[83] *See New Genetic Technologies*, LUNENFELD-TANENBAUM RESEARCH INSTITUTE (Feb. 8, 2018), *archived at* https://perma.cc/Q5T8-RBR6 (asserting that new genetic technologies and methods of genetic studies are changing the way in which researchers understand how both genes and cells function).
[84] *See infra* Section IV.
[85] *See Argus® II Retinal Prosthesis System*, SECOND SIGHT (2016), *archived at* https://perma.cc/F7AK-7E55 (introducing the Argus® II Retinal Prosthesis System "Argus II" as the "bionic eye").
[86] *See id.* (stating that Second Sight designed and developed the Argus II).
[87] *See id.* (describing the way in which the bionic eye attaches to the patient's eyeglasses to capture an image).
[88] *See id.* (providing information regarding the process behind the bionic eye, including the video which captures the "scene" and subsequently being sent to the viewer's "worn computer").
[89] *See* Maureen Duffy, *New Research: The Argus II Retinal Prosthesis (Bionic Eye) is Safe, Effective, and Improves Visual Function*, VISION AWARE (June 25, 2015), *archived at* https://perma.cc/5RCY-D2U6 (describing the process by which electrical impulses are carried by the optic nerve to the brain to interpret visual images).

signals to the brains which "sees" the data as shapes, light and movement.[90] While the vision has not reached 20/20 quality or color, a formerly blind person can read a book and see their homes and loved ones for the first time.[91]

More advanced efforts by Second Sight's Orion I technology bypasses the optic nerve and plugs directly into the visual cortex of the brain.[92] In 2016, Orion I was implanted in a human subject at the University of California at Los Angeles and a 30-year old formerly blind patient was able to see with no major side effects.[93]

The military has had a strong interest in man/machine technologies for years.[94] One new exciting development funded by DARPA,[95] and made by École Polytechnique Fédérale de Lausanne, that gives the wearer of a scleral lens[96] – one which has thin aluminum mirrors built into it that work with special liquid crystal glasses lens – the ability to

[90] *See id.* (explaining that new research shows that the retinal prosthesis functions as the optic nerves in the human eye do).
[91] *See Second Sight Frequently Asked Questions*, SECOND SIGHT (Feb. 8, 2018), *archived at* https://perma.cc/7WPY-3YPM (addressing that the Argus II improves, but does not perfect its user's vision). Second Sight does not claim to restore normal vision. *Id.*; *see also* Duffy, *supra* note 89.
[92] *See Second Sight Receives FDA Expedited Access Pathway Designation for the Orion Cortical Visual Prosthesis System*, BUSINESS WIRE (Nov. 8, 2017), *archived at* https://perma.cc/Z6GD-WXES (announcing Second Sight's new device known as the Orion, designed to stimulate the "human visual cortex").
[93] *See* Fink Densford, *Second Sight Reveals 1st Implant of Orion I Visual Cortical Stimulator*, MASS DEVICE (Oct. 25, 2016), *archived at* https://perma.cc/WTG4-5P23 (highlighting the first successful implant of the Orion I, which helped give a blind patient sight for the first time).
[94] *See* Eric Talbot Jensen, *The Future of the Law of Armed Conflict: Ostriches, Butterflies and Nanobots*, 35 MICH. J. INT'L L. 253, 257 (2014) (providing a survey of technology's role in warfare).
[95] *See About DARPA*, DEFENSE ADVANCED RESEARCH PROJECTS AGENCY (Feb. 8, 2018), *archived at* https://perma.cc/WEY6-A95U (introducing Defense Advanced Research Projects Agency "DARPA," an American military agency that focuses on the development of technology to be used in warfare).
[96] *See Understanding Scleral Lenses*, SCLERAL LENS EDUCATION SOCIETY (Feb. 8, 2017), *archived at* https://perma.cc/W8CM-PS9P (offering basic information about scleral lenses, a lens worn by patients suffering from a variety of eye abnormalities).

zoom like a telescope.[97] Likewise, another lens had been developed for the wearer to see in the infrared spectrum.[98] In the near future, a person will be able to switch between seeing in night vision, infrared, thermal, zoom, telescopic and more, just by blinking an eye.[99] Enhanced sight will eclipse natural sight.[100]

Finally, other systems allow for implanted eyes to record all they see and transmit the data wirelessly to a designated computer for storage.[101] A complete history of everything a wearer sees for his/her entire life is soon possible.[102]

B. Robotic Exoskeletons.

Giving new meaning to the term "power suit" exoskeletons – a framework of fitted motorized "muscles" which fit over the body of paralyzed persons – are becoming a reality.[103] The new exoskeletons

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[97] *See* Sarah Zhang, *This Contact Lens is Actually a Tiny Telescope*, GIZMODO (Feb. 13, 2015), *archived at* https://perma.cc/9Y6H-9WZ8 (reviewing the telescoping contact lens, developed in Switzerland that allows wearers to zoom in and out with a blink of an eye).

[98] *See* Dexter Johnson, *Graphene Gives You Infrared Vision in Contact Lens*, IEEE SPECTRUM (Mar. 17, 2014), *archived at* https://perma.cc/JVJ2-8W2M (expounding on graphene, a form of metal, which, when combined with a contact lens developed at the University of Michigan, allows the human eye to see with infrared vision).

[99] *See* Allison Barrie, *'Bionic' Eye on the Future: From 'Star Trek' Visors to 'Mission Impossible' Contact Lenses*, FOX NEWS (Feb. 16, 2017), *archived at* https://perma.cc/6E8R-4FLS (noting how the enhanced capabilities of the technology will reduce carrying weight and time lost from switching worn optics).

[100] *See* Victorina Woollaston, *Bionic Lens Could Give You SUPER SIGHT: Implant Promises Vision Three Times Better Than 20/20 - and Won't Deteriorate Over Time*, THE DAILY MAIL (May 26, 2015), *archived at* https://perma.cc/3W2U-H35C (explaining a specific lens technology that could allow wearers to see letters when standing at twenty feet that normally would only be visible when directly in front of the reader).

[101] *See* Max Plenke, *Google Is Working on a Tool That Would Record Your Memories—Just Like in 'Black Mirror',* MIC (July 24, 2015), *archived at* https://perma.cc/V8UK-N66W (describing technological advances in eyewear that may allow users to transmit photos, videos, and audio to a server cloud to be searchable and reviewed later).

[102] *See id.* (depicting the possibility of being able to play back memories).

[103] *See* Steven Ashley, *Robotics Exoskeletons Are Changing Lives in Surprising Ways*, NBC NEWS (Feb. 21, 2017), *archived at* https://perma.cc/4WRA-586H (acknowledging new technology that can help to allow non-functioning limbs the ability of movement).

will allow any disabled worker with a mobility issue to get around safely and independently.[104] The device is hooked up by wireless implants in a user's brain where sensors provide data to the brain which executes the commands for movement.[105] The exoskeleton can protect persons from injury and enhance speed agility.[106] Currently, exoskeleton configurations are bulky and have power source issues, but one day they will become "soft" and comfortable exo suits which will create a super enabled or transhumanist human.[107] Beyond obvious military applications, the exoskeleton will enable worker in dangerous jobs like undersea diving, timber cutting and high risk construction to move with ease during the work task.[108] The exoskeleton one day will allow quadriplegic or paraplegic workers to function at a higher level than a non-enhanced human.[109] Further, eventually the technology will provide for the actual interface between man and machine and aspects of the exoskeletons core faculties which be implanted into a human being directly.[110]

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[104] *See id.* (describing how exoskeletons could allow the injured or disabled to move freely and independently).

[105] *See id.* (explaining how the user of the exoskeleton can interact with the exoskeleton to the disabled parts of his body).

[106] *See id.* (overviewing the potential applicability of exoskeletons medical professionals, manual laborers and first responders).

[107] *See* Steve Davis, *Are Skintight Suits the Future of Robotic Exoskeletons?*, ROBOHUB (July 13, 2016), *archived at* https://perma.cc/KT7P-BZ9T (applying the potential use of "lightweight actuators such as pneumatic muscles," which use "physically soft advanced materials to carry out similar tasks to traditional rigid robotic devices" that use heavy electric motors with only a fraction of the weight). The soft exoskeleton material can bend to the location of the user's joints, bringing with it the ability to fit a range of users comfortably without needing "mechanical adjustment or calibration." *Id.*

[108] *See* Ashely, *supra* note 103 (explaining the potential usability of the exoskeleton for dangerous jobs and how it could improve safety for the worker); *Soft Exosuits*, HARVARD BIODESIGN LAB (Feb. 12, 2018), *archived at* https://perma.cc/E4JC-T3FQ (suggesting that exosuits can "assist soldiers walking while carrying heavy loads" and have the capability to increase mobility for patients with "muscle weakness" or neurological diseases).

[109] *See* Istvan, *supra* note 6 (predicting the potential possibilities for uses of exoskeletons, such as providing disabled individuals with the technology to become mobile again).

[110] *See* Maartje Schermer, *The Mind and the Machine. On the Conceptual and Moral Implications of Brain-Machine Interaction*, NANOETHICS, 217, 220 (Dec. 1, 2009) (contrasting the moral capabilities of a human with the bionic capabilities of

C. New and Improved Joints.

New technologies in the area of joint replacement and enhancement are revolutionizing hip and knee replacement.[111] Currently, a new hip implant – the Furlong Evolution[112] – features a ceramic coating which mimics a natural mineral present in the human bone and allows for the implant to bond directly to the patient's own bone material, making a seamless connection between the technological and the biological.[113]

Doctor Farshi Guilak[114] of the Washington University School of Medicine in St. Louis, is developing a system to influence stem cells to form new cartilage and hopes soon to "grow" entirely new knee and hip joints.[115] He and his team have developed a woven scaffolding

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an exoskeleton machine); *see also* Will Oremus, *Mind Plus Machine: Brain-Computer Interfaces Let you Move Things with a Thought*, SLATE (Mar. 11, 2013), *archived at* https://perma.cc/4BLN-AV7P (explaining some of the complications that can arise with exoskeleton's mobility and the ability to perform human functions gracefully).

[111] *See Robots Make Long-Lasting Hip, Knee Replacement a Better Option for Young Patients*, CBS NEW YORK, (Oct. 11, 2016), *archived at* https://perma.cc/PZ4W-9H3P (noting how a robot called "Mako" has allowed orthopedic surgeons to precisely align joint implants, revolutionizing hip and knee replacements in surgery).

[112] *See Furlong Evolution Total Conventional Hip Investigation*, AUSTRALIAN ORTHOPEDIC ASSOCIATION NATIONAL JOINT REPLACEMENT REGISTRY (Sept. 2016), *archived at* https://perma.cc/DD9F-VYY2 (comparing the "Furlong Evolution Total Conventional Hip Replacement Prosthesis" with "all Other Total Conventional Hip prostheses").

[113] *See* Amanda Onion, *Cutting-Edge Artificial Joints Are Better than Bionic*, SEEKER (Nov. 4, 2016), *archived at* https://perma.cc/7AA3-LPHJ (offering an example of the technology's impact on Michael Rix, a marathon runner's life). "The complete lack of pain is a promising sign that Rix's hip replacement could last a lifetime." *Id.*

[114] *See Overview*, WASHINGTON UNIVERSITY DEPARTMENT OF ORTHOPAEDICS (Feb. 13, 2018), *archived at* https://perma.cc/6NDW-K9UH (providing an overview of Dr. Farshid Guilak, a professor in the Department of Orthopedics Surgery at Washington University). Dr. Guilak is currently studying a "multidisciplinary approach to investigate the etiology and pathogenesis osteoarthritis." *Id.*

[115] *See* Jim Dryden, *Stem Cells Engineered to Grow Cartilage, Fight Inflammation*, THE SOURCE (July 18, 2016), *archived at* https://perma.cc/K6QP-WX42 (introducing Dr. Guilak's research that uses a patient's stem cells to regenerate new cartilage, combined with gene therapy to help keep arthritis to a minimum); *see also*

which is seeded with the patient's own stem cells and then wrapped around the joint needing attention.[116] Over time the patient would be left with a biologically grown new knee or hip.[117] Another approach is using a 3-D printer to achieve the same results.[118]

D. Cognitive Enhancement.

The concept of the bionic brain has fascinated futurists for decades because of the possibility of preserving personality beyond the expiration of the body and the benefits of increased mental acuity.[119] The most important aspect of brain research is the effort to record brain activity on microchips with the object of learning how the brain works so as to duplicate it electronically.[120] Researchers hope the technology be used as a tool to bring personalized therapeutic options to patients facing neurological disease.[121] Moreover, if the brain activity can be

Onion, *supra* note 113 (discussing Dr. Guilak's research, which aims to form entirely new knees and hip joints from stem cells).

[116] *See* Dryden, *supra* note 115 (noting how the "synthetic scaffold" can be implanted "onto the surface of an arthritic hip," which can "ease arthritis pain and delay or even eliminate the need for joint-replacement surgery").

[117] *See* Dryden, *supra* note 115 (explaining how the implants create a "high-performance fabric" that mimics cartilage).

[118] *See* BEC Crew, *This New 3D Printer Makes Life-Sized Ear, Muscle, And Bone Tissues from Living Cells*, SCIENCE ALERT (Feb. 16, 2016), *archived at* https://perma.cc/Z5Q6-SP9S (discussing how 3D printers can be used to create organs, such as an ear).

[119] *See* Glen Hiemstra, *Bionic Brain*, FUTURIST (2003), *archived at* https://perma.cc/DD6V-ZQS5 (characterizing the research of Theodore Berger, who is creating the first "brain prosthesis" by implanting computer chips in the brains of rats to test the ability to "encode memories for storage" in the hippocampus and other areas in the brain).

[120] *See* University of Calgary, *Neuro Chip Records Brain Cell Activity*, SCIENCEDAILY (Oct. 26, 2016), *archived at* https://perma.cc/7VME-HS3R (describing how microchips "tric[k] the brain cells into believing that they are connecting with other brain cells:" This process allows researchers to "view and record the two-way communication that would go on between normal functioning brain cells").

[121] *See id.* (asserting that new micro-chip technology will allow researchers to better understand neurological diseases such as epilepsy).

recorded and stored, perhaps one day it can be uploaded to a computer or transhuman subject.[122]

On raising mental acuity, researchers at Oxford have developed a process called Transcranial Direct Current Stimulation – which involves sending tiny painless currents across the brain.[123] This process is showing signs of improving language, math ability and even memory in the subjects.[124]

While only touching the surface, it has been shown above that, as a species, mankind is just beginning to ride the new technology wave which will impact what we consider a disability and what we do not.[125] The law must not just catch up, it must lead the charge in this technology revolution.[126] A future enhanced worker – a transhumanist – whose abilities and skills surpass the natural biological disabled version of himself – may yet be considered a disabled worker under a

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[122] *See id.* (noting that while brain micro-chips are currently used to analyze animal brain cells, they can potentially be used in the future to "make long-term recordings," and to store human brain cell activity).

[123] *See Electrical Brain Stimulation Could Support Stroke Recovery*, UNIVERSITY OF OXFORD (Mar. 17, 2016), *archived at* https://perma.cc/EM9E-DF3J (discussing the research of a team of clinical neuroscientists, who "studied the use of transcranial direct current stimulation,'tDCS' to support rehabilitation training" in stroke patients to re-learn how to use their bodies).

[124] *See id.* (tracing the use of tDCS to improvements in physical arm and hand movements in stroke patients).

[125] *See* Paul H. Wise, *Emerging Technologies and Their Impact on Disability*, 22 THE FUTURE OF CHILDREN 169, 170 (2012) (characterizing the definition of child's disability as "an environmentally contextualized health-related limitation in a child's existing or emergent capacity to perform developmentally appropriate activities and participate . . . in society"); *see also* Nira Datta, *Disability in the Digital Age,* ABOUT KIDS HEALTH (Feb. 1, 2011), *archived at* https://perma.cc/VBR7-BGQM (indicating that "advances in computer-based technology have allowed" greater freedoms to children with disabilities); DEEPTI SAMANT RAJA, BRIDGING THE DISABILITY DIVIDE THOUGH DIGITAL TECHNOLOGIES 3 (World Development Report 2016) (explaining how "digital technologies break traditional barriers . . . for persons with disabilities").

[126] *See* 42 U.S.C. § 12101(a)(1)(7) (stating that Congress' goals in enacting the ADA are "to assure equality of opportunity, full participation . . .and independent living); *see also* Vivek Wadhwa, *Laws and Ethics Can't Keep up with Technology*, MIT TECH. REV. (Apr. 15, 2014), *archived at* https://perma.cc/EJM7-92EW (pointing out the "regulatory gaps" that exist in the employment context due to the law's inability to keep up with advances in technology).

current reading of the ADA if there is some flaw in the natural body.[127] This makes little sense going forward and the ADA must be reexamined.[128]

V. Congress Must Reconsider Amendments to the Americans with Disabilities Act in Light of Transhumanism.

Returning to the legal implications of transhumanism to the definition of disability legislation we look to see if the passage of the ADAAA – with its rejection of *Sutton v. United Airlines, Inc.'s* mitigating factors ruling, and its expanded definition of "disability," still remain relevant in light of the coming transhumanist worker.[129] It does not.[130]

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[127] *See* 42 U.S.C. § 12102(3)(E)(i) – (iii) (providing that ameliorative effects, such as medication, are not considered when determining whether an individual has a disability); *see also* Erica Worth Harris, *Controlled Impairments Under the Americans with Disabilities Act: A Search for the Meaning of "Disability*," 73 WASH. L. REV. 575, 600-01 (1998) (predicting that under the" no mitigating measures guideline" individuals can control their impairments and still qualify for protection under the ADA). *But see* Ian D. Thompson, *Medicating the ADA—Sutton v. United Airlines, Inc.: Considering Mitigating Measures to Define Disability*, 28 PEPP. L. REV. 257, 288 (2000) (arguing that if two coworkers both suffer from depression, and if one is treated with medication and the other is not, the latter has no legal recourse against the employer for the same ADA claim in the event of termination of their employment based on their disability).

[128] *See* WOODROW BARFIELD, CYBER-HUMANS: OUR FUTURE WITH MACHINES 29-30 (Springer Int'l Pub. Switz. ed., 2015) (discussing how transhumans may not receive the benefits of being covered under the ADA if enhancements are done for reasons other than medical necessity).

[129] *See* Americans with Disabilities Act Amendments Act § 2 (rejecting *Sutton v. United Air Lines, Inc.*, the ADAAA expanded the definition of disability to provide broad protection to individuals). Congress' intent under the ADAA was to provide protection to individuals with disabilities without an individual having to demonstrate that mitigating steps were taken. *Id. But see* Sutton v. United Air Lines, Inc., 527 U.S. 471. 482 (holding the use or non-use of corrective devices does not determine whether an individual is disabled, but rather it depends on the limitations an individual with an impairment actually faces and the mitigating steps taken as an attempt to correct their impairment). The Court defined a disability as an "impairment that 'substantially limits' a major life activity, not where it 'might,' 'could,' or 'would' be substantially limiting." *Id.*

[130] *See* Americans with Disabilities Act Amendments Act § 4 (E)(i)(I)-(IV)(setting forth that whether an impairment "substantially limits a major life activity" shall

A. Congress Should Amend the ADAAA to Undo Its Rejection of the Mitigating Factors Analysis of Sutton v. United Airlines, Inc.

At the time of its passage, most disability advocates praised the ADAAA as elevating disability from merely impairment to a protected class akin to Title VII protections for individuals whose particular impairments produced significant functional limitations, widespread stigma, and pervasive social exclusion.[131] The idea being, that the term disability was a social construct of the majority to label, define and subordinate a minority population.[132] That may be true and if the notion of disability were static then the ADAAA remains a laudable attempt to free disabled workers from the unnatural prison of prejudice.[133] However, the debate on the various social models of disability and the application of the ADA by the Court rests on a false notion that

not be made about corrective devices such as prosthetics, hearing aids, or oxygen therapy equipment).

[131] *See* Michelle A. Travis, *Impairment as Protected Status: A New Universality for Disability Rights*, 46 GA. L. REV. 937, 939 (2012) (proffering that there are advocates both for and against disability as a minority status). Advocates in favor of disability as a minority status believe that civil rights law should be broad enough to include any individual with a disability as a protected class. *Id.*

[132] *See id.* at 939-40 (construing that some sects of society have "socially constructed" the idea that disabled individuals are a minority group segmented from society).

[133] *See id.* at 940 (asserting that the ADAAA has recognized the social stigma against people with disabilities and aims to correct the "socio-legal backlash" created by many advocates against recognizing disability as a protected class). The ADAAA does not intend to "erase the stigmatizing line" between disabled and non-disabled individuals as a matter of formal law or perception, but rather, it is intended to embrace disabled individuals and provide them with legal support. *Id.* at 939-40.

disability is a fixed condition.[134] As has been shown above, it is not.[135] The coming transhumanist worker is going to transform modern notions of disability and humanity itself.[136] The law needs to adapt accordingly.[137] That adaption calls for a return to the "mitigating factors" rule enunciated by the Supreme Court in *Sutton v. United Airlines, Inc.*[138] This is so, because the Supreme Court's reasoning in *Sutton* allows for an individualized determination of whether mitigating factors – such as those cited above, may enter into the calculus of determining whether an employee is disabled for ADA purposes.[139] Given the fluid and rapidly evolving nature of the man/machine interface, there is no other approach which will recognize that a person with a human enhancement – who may normally be considered disabled – is actually super abled.[140]

The *Sutton* court reasoned the ADA could not be read to reach the conclusion that when determining whether a plaintiff is disabled,

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[134] *See* Harris, *supra* note 127, at 575-76 (examining the justifications for the ADA and noting how courts have interpreted disabilities as fixed conditions, but are constantly debating if certain non-fixed conditions such as alcoholism or back pain constitute a disability).

[135] *See* Harris, *supra* note 127, at 600 (dissecting the Court's interpretation of the ADA's protection as applied to non-fixed conditions and recognizing that individuals who control their impairments with mitigating measures do not have disabilities under the ADA).

[136] *See* Istvan, *supra* note 6 (hypothesizing that in the future transhumanists will be able to overcome disabilities using technology and will transform the way society views the disabled).

[137] *See* EMILY A. BENFER, THE ADA AMENDMENT ACT: AN OVERVIEW OF RECENT CHANGES TO THE AMERICANS WITH DISABILITIES ACT 2-3 (Am. Const. Soc'y for L. and Pol'y , Sept. 2009) (suggesting that the legal definition of the term "disability" should move away from the three-prong structure currently used by the ADAAA).

[138] *See* Sutton v. United Air Lines, Inc., 130 F.3d 893, 899 (10th Cir. 1997), *aff'd*, 527 U.S. 476 (1999) (opining on the Equal Employment Opportunity Commission's Interpretive Guidance of the ADA, which states that that the "existence of impairment should be determined without regard to 'mitigating' measures, such as medicines, or assistive or prosthetic devices.").

[139] *See id.* (explaining that the court should evaluate the individual's condition in their "uncorrected" state, because the fact that the disorder or condition may be mitigated should be irrelevant).

[140] *See* Nick Bostrom & Rebecca Roache, ETHICAL ISSUES IN HUM. ENHANCEMENT 120 (Jesper Ryberg et al. eds., 2008) (indicating that human enhancement has developed to a point where disabilities can be corrected, and even enhanced).

one must evaluate the plaintiff's condition in the unmitigated state.[141] The court noted that a person who has a disease or condition may be impaired, but when that impairment is mitigated it must nevertheless substantially limit a major life activity in order to qualify as a disability under the ADA.[142] The court was on good ground to make this conclusion because whether a person is considered disabled for the purposes of the statute is an "individualized inquiry."[143] So, in the coming world, where exoskeletons, enhanced joints, bionic eyes, and brain enhancements will render the natural biological disabilities of a man/woman meaningless, the law should not offer equally meaningless disability protections to those persons.[144] The purpose and goal of the ADA is remedial, but where no remedy is necessary when super mitigating factors are present, the law should not be crafted to protect those who need no protection.[145] Further, new technologies will actually render the new transhumanist worker a super worker.[146] As noted above, with the case of exoskeletons and bionic eyes, the mitigating factors correcting a disability actually make the disabled worker more powerful and better equipped than the natural man/woman.[147] It makes no sense to apply an antiquated definition of disability to drive modern

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[141] *See Sutton*, 130 F.3d at 899 (stipulating that the determination of whether an individual is disabled should occur without reviewing mitigating factors, such as assistive technology and device).

[142] *See Sutton*, 130 F.3d at 898 (presuming that impairment must substantially limit a major life activity to be considered a disability under the ADA).

[143] *See* Homeyer v. Stanley Tulchin Assoc., 91 F.3d 959, 963 (1996) (recognizing that because there are "person-specific considerations" to address in regards to disabilities, each individual inquiry must be considered on its own).

[144] *See* Adam Conti, Note, *Drawing the Line: Disability, Genetic Intervention and Bioethics*, 6 MULTIDISCIPLINARY DIGITAL PUB. INST. 1, 2 (July 10, 2017) (predicting that biological advancement will render the term "disability" meaningless as human enhancement technologies evolve).

[145] *See* 42 U.S.C. §12101(b) (describing that the purpose behind the American Disabilities Act is to prevent discrimination against individuals with disabilities that truly need protection).

[146] *See* Bostrom, *supra* note 140, at 11 (analyzing that the most effective way of achieving super human strength, currently, is through technology, rather than physical enhancements).

[147] *See* Ashley, *supra* note 103 (inferring that exoskeleton will enable a disabled worker to have the same, if not better capabilities of a natural human).

legal protections.[148] In the new world the legal protections offered employees will focus, not on disabilities, but on control.[149] That is, will an employer have power to force an employee to employ a mitigating factor as a condition of employment.[150] Another consideration is the notion that in a world where the majority of workers are enhanced or transhuman, an unenhanced or "natural" worker will be viewed as disabled.[151] In an upside down world it may shortly be the case that a healthy nondisabled worker may seek protection under the current ADA because of discrimination against him/her by an transhumanist enhanced worker or boss.[152] This scenario is only a few decades away and will the driving issue not disability.[153]

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[148] *See* Robert F. Rich, et al., *Critical Legal and Policy Issues for People with Disabilities*, DISABILITY RESEARCH INSTITUTE 6-9 (identifying the various definitions of disability and how the slightest variation can make a difference in eligibility of benefits and policy).

[149] *See* Melinda Hall, Transhumanist Utopias: Rethinking Enhancement and Disability 104 (Aug. 2013) (unpublished Ph.D. dissertation, Vanderbilt University) (on file with Vanderbilt University Library) (discussing that transhumanists seek "absolute freedom, chosen and controlled individually").

[150] *See id.* at xviii n.12 (requiring individual responsibility to mitigate employment conditions as opposed to employer insuring safe working conditions); s*ee also* Bockman, *supra* note 33, at 1339 (stating that Congress should modify the ADA in order to redefine impairment and conditionally allow for the consideration of mitigating factors).

[151] *See* Zoltan Istvan, *Future Transhumanist Tech May Soon Change the Definition of Disability*, TECHCRUNCH (Sept. 14, 2015), *archived at* https://perma.cc/EA6R-FKGJ [hereinafter *Future Transhumanist Tech*] (questioning the future of humans in the workplace compared to transhuman employees).

[152] *See id.* (theorizing that in the future, 'transhuman' people would be considered normal and able-bodied individuals without robotic extremities would be considered disadvantaged).

[153] *See id.* (hypothesizing that with radical medical and technological enhancements, we should focus on changing the definition of "disability" in the Americans with Disabilities Act, as opposed to attempting to categorize individuals through an antiquated definition).

B. *Congress Must Set About Reviewing the ADA in Light of the Coming Boom in Transhumanism.*

The issue of technology, the coming Singularity, and transhumanism are complex issues with a myriad of bio-ethical and social implications.[154] The impact of these factors on all facets of society are too great to quantify and even contemplate.[155] Human enhancement's effect on the human condition will be enormous, as will its impact on law.[156] Work, of course, will change its nature and transhumanism will profoundly influence what we consider to be a "normal" biological status for disability purposes.[157] As shown above, what is normal in a transhumanist world will also affect how we frame disability protections under employment law and the ADA.[158] Because the issue is of such magnitude Congress should act now to establish a review of technology's implications for the ADA.[159] That action should include first,

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[154] *See* Stephen Hawking et al., *Transcending Complacency on Superintelligent Machines*, THE HUFFINGTON POST (Apr. 19, 2014), *archived at* https://perma.cc/7E2L-3BD3 (examining the future of humanity with highly intelligent machines that could able to outperform humans in research and development).

[155] *See id.* (listing the possible benefits of the continuing development of AI, including: the elimination of disease, poverty, and war).

[156] *See* Kalinoski, *supra* note 41, at 7 (expounding on legislative solutions for controlling technological enhancements, primarily through "light" regulation).

[157] *See* U.S. Dep't of Health and Human Services, *supra* note 66 (theorizing that rehabilitative and assistive technologies will allow individuals with disabilities to live lives like those without disabilities). Transhumanism will lower barriers by providing optimal function and designs which will allow people with disabilities to "interact successfully in their environments." *Id.*

[158] *See* Istvan, *supra* note 6 (noting the importance of how transhumanism is evolving and the necessity to have laws that "insis[t] on eliminating disability via technology and modern medicine"). Due to the technological advances, it is important to reconsider the Americans with Disability Act to protect against discrimination. *Id.*

[159] *See* Bockman, *supra* note 33, at 1336 (reasoning that because Congress rejects the mitigating factors discussed in *Sutton*, it adopts a "conception of the human body as solely its flesh-and-bone biological makeup," thereby categorizing all people with prosthetic limbs as disabled). For example, for a woman who use devices, such as prosthetics for replacement of limbs, would fall under the traditional definition of "disabled" under the ADAAA. *Id.* This woman would be considered legally disabled, even though her prosthetic would be more efficient than her biological limb. *Id.*

as noted above, immediately reversing itself on the ADAAA's rejection of the mitigating factors analysis of *Sutton*.[160]

Second, Congress should establish a federal task force to study the issue of the coming intersection of man and machine for the purpose of amending disability law to account for it.[161] As part of that effort, the task force should include representatives from the disabled commu-

[160] *See* Bockman, *supra* note 33, at 1321-22 (examining the interplay between *Sutton* and the ADAAA). Originally, in *Sutton*, the Supreme Court held that mitigating measures, such as medication or medical devices, should be considered in determining if someone is disabled. *Id.* at 1321. For example, under *Sutton*, correcting a disability with corrective lenses makes the individual no longer disabled. *Id.* Shortly after, Congress passed the ADAAA and rejected the holding in *Sutton*. *Id.* Congress banned mitigating factors due to *Sutton's* narrowed interpretation of a "disability" under the ADA, when the purpose of the legislation was to have broad coverage. *Id.* However, because transhumanism and mitigating factors can result in major improvements compared to biological body parts, Congress should follow the holding in *Sutton* and consider mitigating factors when evaluating if an individual has a disability. *Id.* at 1336.

[161] *See* Glaser, *supra* note 29, at 96-97 (highlighting that a definition of "disability" under the ADAAA is extremely broad and expansive, allows for a multitude of complaints, such as employment discrimination complaints, and more requests for accommodation). Because of the extreme amount of issues that would qualify as a disability under the ADAAA, a line needs to be established by legislation for a new fair standard. *Id.*

nity, futurists, bio-medical ethicists, the National Science Foundation,[162] the Department of Labor,[163] the Equal Employment Opportunity Commission[164] and Health and Human Services Department.[165]

VI. Conclusion

The most common transhumanist thesis is that human beings may eventually be able to transform themselves into different beings with abilities so greatly expanded from the natural condition as to merit the label of posthuman beings. As a society, our laws are not ready for this massive shift – this Future Shock. Our laws do not even contemplate such a drastic change. However, Congress could begin the transformative process by reconsidering its definitions under the ADA. This call to action is not premature, as the Singularity will be upon us in less than fifty years.

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[162] *See About the National Science Foundation*, NATIONAL SCIENCE FOUNDATION (Feb. 22, 2018), *archived at* https://perma.cc/9UJH-THMB (describing the National Science Foundation as an independent federal agency established "to promote the progress of science; to advance the national health, prosperity, and welfare; to secure the national defense…"). The National Science Foundation is essential to transform the future; which aligns with the idea of being fair to all individuals with disabilities. *Id.*

[163] *See Our Mission*, UNITED STATES DEPARTMENT OF LABOR (Feb. 22, 2018), *archived at* https://perma.cc/27UY-HQV5 (stating its mission "[t]o foster, promote, and develop the welfare of the wage earners, job seekers, and retirees of the United States; improve working conditions; advance opportunities for profitable employment; and assure work-related benefits and rights").

[164] *See Overview*, UNITED STATES EQUAL EMPLOYMENT OPPORTUNITY COMMISSION (Feb. 22, 2018), *archived at* https://perma.cc/Y5WS-B77R (asserting the mission of the U.S. Equal Employment Opportunity Commission is to prevent discrimination against persons with disabilities).

[165] *See About HHS*, UNITED STATES DEPARTMENT OF HEALTH & HUMAN SERVICES (Feb. 22, 2018), *archived at* https://perma.cc/D3CM-MGU5 (declaring that the Department of Health & Human Services promotes "advances in medicine, public health, and social services").