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The legal ambiguity of advanced assistive bionic prosthetics: Where to define the limits of 'enhanced persons' in medical treatment

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Abstract

The rapid advancement of artificial (computer) intelligence systems (CIS) has generated a means whereby assistive bionic prosthetics can become both more effective and practical for the patients who rely upon the use of such machines in their daily lives. However, *de lege lata* remains relatively unspoken as to the legal status of patients whose devices contain self-learning CIS that can interface directly with the peripheral nervous system. As a means to reconcile for this lack of legal foresight, this article approaches the topic of CIS-nervous system interaction and the impacts it may have on the legal definition of "persons" under the law. While other literature of this nature centres upon notions of transhumanism or self-enhancement, the approach herein approached is designed to focus solely upon the legal nature of independent CIS actions when operating alongside human subjects. To this end, it is hoped that further discussion on the topic can be garnered outside of transhumanist discourse to expedite legal consideration for how these emerging relationships ought to be received by law-generating bodies internationally.

Keywords

Assistive bionic prosthetics, computer intelligence, human augmentation, medical device regulation, neural interfacing, speculative bioethics

Introduction

As we have seen with the integration of artificial (computer) intelligence (hereafter referred to as CI)[a] in previous medical technologies, those that are emerging on the horizon will undoubtedly generate a slew of ethical and legal complications with their implementation. Much like cochlear implants or technologies utilised to help the blind (re)gain their vision, certain technologies will also generate social movements within patient groups to establish their community as having cultural importance.[1–4] As is already the case, these communities will doubtlessly continue arguing that they should *not* be required to undergo procedures that would remove them from this environment. Among these, one such emerging technology—the CI-dependent assistive bionic prosthetic (CIDABP), a potential successor to traditional assistive bionic prosthetics (ABPs)—has currently not undergone much ethical scrutiny in academic or legal scholarship. For contextual reference, a *HeinOnline* search conducted on September 15, 2020, yielded 46 results with the search query of "assistive bionic prosthetics" without quotations bracketing the phrase—the majority of these developed by USA Congressional hearings spanning back to the 1970s. Conversely, general Internet interest in CIDABP-like devices is overwhelming in comparison when inputting phrases such as "assistive bionic prosthetics" or "bionic prosthetics," each generating over 230,000 and 430,000 results respectively in a general Google search on the same date. As an update for relevance, a similar search conducted during the final

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proofing of this article revealed only one addition to the *HeinOnline* search and ammendents to the respective Google searches without utilising quotation marks yielding 102,000 and 421,000 results for each query.

Returning to the matter at hand, this paper addresses those ABPs that act as surrogates for arms, legs, or limb parts rather than on a broader spectrum of prosthetics—particularly neuroprosthetics or organ-function-replicating prosthetics—given how their relative visibility to other humans will ultimately generate legal debates hereto unaddressed as a result of their relative technological lack of ability to date.[b] For legs, it is generally understood that the motor system within ABPs stylised after legs or leg parts aid the user to maintain balance and gait.[c] ABPs stylised after hands or arms generally have limited functions, as the motions required by a hand (as compared to an ankle or knee) are much more sophisticated—and "gripping" actions are difficult to achieve given the need to balance pressure and other tactile senses necessary to maintain an object's stability.[5] Though these systems may utilise dormant or static computer intelligence systems (D/SCIS), the implementation of self-learning CI systems (SLCIS) has only experimented with fairly recently.[6–8] In terms of academic focus for prosthetics to date, they have been primarily focused on issues of prisoner rights regarding ABP or general prosthetic use[9] and a patient's long-term ownership of experimental prosthetics after trials.[10] Though it may not be surprising that CIDABPs have not found themselves in the legal spotlight yet—possibly given a difference in terminology between this author and the body of research CIDABP's belong to—current debates centred on transhumanism or technological enhancements seem to be aiding in the general lack of attention scholars have to address issues related to CIDABP implementation.

This article touches upon three pillars of legal scrutiny regarding CIDABPs to generate attention to the legal issues surrounding them, specific to the unanticipatory nature of the USA legal system: that of liability when damages arise from the use of a CIDABP, of the extension of labour-market protections given to the patient with the prosthetic, and of the defining line between an organic human and a cyborg. For reference, the usage of "cyborg" here takes from the Ancient Greek combination of κυβερνήτις ὄργανόν (Romanized as *kybernitis organon* and displayed phonetically as [k=ubernɛːtis órganón]), roughly translating to "an instrument, implement, tool, or engine managed by a steersman or governor," rather than the more common Greek-Latin combination coined in 1960 of *kybernetes organon*.[d] To give a further distinction between the significance of this alternative usage and that of the 1960 coinage, the purely Greek translation of the term (though arguably not too different from the Latin *organum* said to be its equivocation)[e] challenges the notion that *the human aspect of the organism has full control over its various functionings*. The most significant rationale for this distinction, and emphasis in this specification of definitional usage, lies in the concern that discussions centred on the line to be drawn between technologically-augmented biological human intelligence (TABHI) and cyborg-specific intelligence draw too close to an assumption that cyborg-specific intelligence will be *unflawed*—as might be portrayed to varying degrees in science-fiction media.[11] Another lies in the complexity of arguments focused on human augmentation or enhancement, and how a lack of granular definitions for differing intelligences only further conflates these generally monotonous discourses.

This semantic digression aside, our lack of specific legal literature on the "hard-line" drawn between a TABHI and cyborg-specific intelligence raises concerns for how the law might treat any individual considered to be technologically augmented (although not classifiable as a cyborg) if a precise determination cannot be made as to the CIS' intelligence and the human's.[11] To this end, a though experiment will be presented in the next section that displays specifically how such a situation may come about within a broader conversation of ABP liability. Then, a broad-strokes approach to the implementation of CIDABPs in society and their potential influence on labour-market mentalities, along with issues that may arise in workplace damages to such systems under current frameworks established in the USA is focused. Although it will be relatively brief herein, an examination into current and suggested legal treatments of TABHI in contrast to D/SCIS or SLCIS shall be undertaken in 'The limits of *Homo sapiens*' section. Through discussing such topics with a viable method whereby to grant protections to SLCIS that displays human-like intelligence, and considerations as to the legal standing of individuals produced through *in vitro* methods or subjected to somatic cell therapies, it is hoped that a more focused discussion as to the perceived "need" for such delineations can carry forward outside of the realm of the sphere of "transhumanism."

Who is at fault? The notion of CIS responsibility in law

Previously, CIS-based devices have been treated akin to other such products that (at face value) do not seem prone to causing personal injury with regular use—such as cell phones, e-mail, and genetically-modified organisms.[12–14] However, the progression towards

advanced SLCIS generates an environment in which the "intent" of the programmer (*if* the software is not open-sourced)[f] may become blurred with the intent of the user, purchasing organisation, or even the CIS in question;[11,15(pp. 347–348)] given that the architecture of these systems intrinsically differs from those of D/SCIS or "software" programmes as we understand them today. Strictly speaking, the lack of security against a "run-away" system as proposed by Bostrom[16]—on the basis that SLCIS utilises logical frameworks normally considered to exist only in human-based logic processes—is an eventuality humanity *must* come to terms with given that CIS has been developed to replicate the ability of humans to perform seemingly menial tasks in a highly-condensed span of time.[17] To emphasise the "greyness" of the issue at hand, let us turn our attention towards a thought experiment that may soon reflect the facts of a trial case in a USA-based court:

> Sergeant Güntherson (retd.) has been accused of sexual assault against Missus Smith, a nurse at a local Veteran's Affairs Hospital. The assault is said to have occurred throughout several of Güntherson's physical rehabilitation sessions, as they suffer from the combat loss of their left arm while on patrol with their squadron. Rather than receive a traditional prosthetic, Güntherson was invited to test an ABP that utilises a third-party SLCIS to effectively replicate or improve upon the reactions of their lost arm barring any form of tactile sensory information. Though the argument could be made that the testing of such a device would naturally lead to a few awkward interactions with medical personnel, Missus Smith claims that she has experienced several attempts to be "felt up" by Güntherson during their rehabilitation at the clinic—to which Güntherson responded in confusion or indignation when chastised for their "behaviour."
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> The question set before the court, then, is to determine whether it was the intent of Güntherson to perform such actions or if those actions were performed against their will. Or, more to the point, whether Güntherson is simply not *aware* of their impulse to perform these actions and are thus being performed by the SLCIS. To our knowledge, for sake of clarity, this SLCIS has no sentience as would be defined in comparison to that of a human. However, it *does* possess the ability to translate and store conscious thought into action; as the intent of the ABP is to function in a manner that does not require conscious thought after an initial training period, as defined by the manufacturer, to allow for "natural" motion in daily life. The lack of sensory information present to the SLCIS—and in turn, to Güntherson—is another factor in the consideration of Güntherson's perceived intent or lack thereof to conduct themselves in a harassment-inducing manner and must therefore be kept in mind throughout the defences presented throughout this trial; given that like or more enhanced aspects of a regularly functioning limb's sensory information may have changed Güntherson's overall demeanour during treatment or provided an added layer of awareness to Güntherson regarding the actions being conducted by the prosthetic in question.
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> If the fault lies upon neither Güntherson nor the assistive bionic prosthetic's "malfunctioning," we must then question whether it is the fault of the manufacturer in developing such a sensitive device, the programmer for developing such an effective code, or the technicians on-site performing the maintenance upon the prosthetic that have adjusted its values beyond the manufactured norm specified. If the fault *still* cannot be determined after all of this analysis from a human or technological error that may be directed towards a human-based party, it is proposed that the court then questions the sentience of the SLCIS given that its programming then becomes a scientific "black box." To clarify what a "black box" is for the non-expert, it is a device, system or object which can be viewed in terms of its inputs and outputs (or transfer characteristics), without any knowledge of its internal workings.

It may be argued that such a case simply is implausible under our *current* understandings of the abilities of D/SCIS and SLCIS, and the intent for which they are utilized in CIDABPs.[5–10,18,19] While the author sympathises with those who would make such an argument with *today's* established norms in mind, the matter of fact remains that pushes towards the development of such a CIDABP *will* overcome ethical and scientific rationality—either of today's scholars or tomorrow's. The proof for this is evident in the nature of humanity, and in our never-ending quest to attain that which is virtually "unattainable." Insofar as something *can* plausibly be accomplished through enough trial and error, it evidently *will* be accomplished—whether by the will of an underground development team, publicly regulated scientific projects, or a codeword-classified government programme to develop bionics or robots for ground-based combat missions or other like projects. Hence our advances into aeronautics, atomic theory, miniaturisation, nano-scale production, quantum mechanics, and other such seemingly "impossible" to develop technological fields and their "useful" applications to modern life. To ignore this reality, while simultaneously brushing aside the potential for extreme D/SCIS or SLCIS capabilities, is to discredit the rationale behind the use of

speculative ethical thought in industrial or scientific discourses and the harms it evidently prevents.[20]

Unlike other advances in ABPs to-date, the allowance of SLCIS-nervous system interaction poses a great range of potential risks hereto only displayed in science-fiction novels and electronic media. While the author will concede that direct access to the central nervous system may not be entirely possible for CIDABPs as they exist today,[6–8] the potentiality of a direct neural interface with a (realistically) alien form of intelligence brings into question how concepts such as "self" can remain centred in traditionally understood—biologically bounded—notions of embodiment and how individual "authenticity" will effectively be swayed. And this says nothing of how to distinguish between the "intelligence" presented by the patient and the SLCIS. Fundamentally, the only relatable human experience that would likely equate to such a scenario would be found in depictions of schizophrenia, dissociative personality disorder, or other similar psychiatric states of mind—although the author will clarify that such relations cannot be accurately related to given a lack of physical evidence at this point in time to indicate relatedness between the indicated experiences (Jaynes,[15] pp. 345–346).

Returning to the justification for why the experiment's CIS exhibits such an abnormal level of capability, it may very well be that highly predictive D/SCIS or SLCIS of the nature implemented within the supposed CIDABP is demanded not by researchers in the field of bionics specifically; but for disease researchers or general practitioners who desire faster and more accurate means whereby to effectively cure or diagnose patients.[g] The problem therein becomes in the ability for a CIS to maintain a level of dormancy or incompatibility of application and function when desired for such a range of purposes, as the implementation of a singular CIS in this setting would lead to issues in computational processing capacity or in the effective ability to "trace" a string of commands throughout the programme. While it *can* be said that such concerns are not *presently* pressing in the field, they *will* become *unavoidable* given the benefits patients and practitioners alike will gain from their development and urges to avoid developing multiple CIS programmes from a cost-benefit perspective. If we have learned *anything* from the accelerated rate of technological advancement in the past hundred-or-so-years, it is that we can only entertain questions of "if" something will be developed for so long before it becomes a matter of "when" its development will become a reality.[20]

Currently, it could be argued that *no* court on Earth is prepared to address a claim of the sort developed in this thought experiment; and thusly should it explicate the concern that it draws from the perspective of speculative bioethical inquiry.[20] To begin with, what level of court would be sufficient to deliberate on a case as complex as this? Abiding by the normal process of law in the USA, it could feasibly be argued that only the Supreme Court would have the capacity to deliberate on some of the nuances presented within the case as drafted herein—and that would be after several other court systems flush out parts of the case that pertain to their specific range of influence. The issue, at least as it has been pressed in this case, is in determining whether a string of code could feasibly become complex enough to develop its own sense of intentionality or "will." The flexibility of USA courts aside, it should be mentioned that the efforts of the EU to provide protections to CI-based agents is (to date) at least some positive sign that international jurisprudence on the subject is being established[21],[h]—though questions remain as to how effective these efforts will ultimately be in the long-term.

Particularly, when discussing the liability of robotic prosthetics, Andrea Bertolini argues:

> . . . the environment in which prostheses are going to be used cannot be *ex ante* restricted. The same grip and posture of the hand may be used to hold a shopping bag, lift a weight on a chest press exercise on a bench or hold the steering wheel of a motor vehicle. The same malfunctioning in the two scenarios (e.g., the slipping or failure of a finger) may lead to very different consequences: the breaking of all the eggs in the shopping bag, a potentially severe personal injury or an accident involving innocent third parties. (Bertolini,[18] p. 119)

Given the sophistication of how a robotic prosthetic hand is classified by developers, as well as the range of motions that it feasibly *should* perform for the patient,[5,6,8] there are many more aspects that both judiciaries and legislatures internationally must consider once sophisticated SLCIS technology becomes a mainstay for these types of prosthetics.

Finally, some considerations need to be given for the limits of human competency both concerning *de lege lata* and medicine when the CIDABP in question gains access to the human nervous system. Until the technology can be proven to have no unintended effects on the central nervous system (*if* such a claim can be made), such as potentials for the human to be "hacked" internally and prevented from moving under their own will, can it be said that these patients are *genuinely* competent and functioning under their own will without duress? Note, this is not the "light-hearted" biohacking that has been written on by other scholars or news reporters in the field, but a more sinister application of the term.[i] Though such a question may inevitably put further restrictions on the development of

CIDABPs, we *cannot* allow its ambiguity to abide when considering the potential for abuse the technology poses to the patient.

It is in this vein of thought that we should turn our attention to a similar aspect of liability in legal frameworks—namely, those centred on the rights held by individuals requiring ABPs today and their translatability to CIDABPs.

Bionics: A labour-market equaliser?

This work is not the first to discuss, however briefly, the rights a disabled individual has to attain a prosthetic that would suit as a viable replacement for their lost limb. Nor is it the first to discuss the legal complications of a "robotic" prosthetic. Yet despite *all* of the research in the field, those that are of particular interest to this study rarely discuss the treatment of the patient requiring the prosthetic beyond citations of various disability laws.[9,18,19,22,23] While the discussion of the history of disability law *is* vital to a degree, it should be argued that a well-learned researcher in the field is already aware of such facts. As such, the lack of an individual rights treatment for patients with CIDABPs is baffling and highly concerning given the breadth of research already conducted on the legal ambiguity of prosthetic-requiring individuals both within the workplace and without.[9,18,19,22–25]

To be clear, defining those individuals who *ought* to be considered "disabled" brings into question the metaphysical nature of "normal" functioning in the human population. For instance, there may not be an accurate measure for the total number of USA citizens that would be classified as being "disabled" under local and federal statutes on account of how the nation's healthcare system neglects to treat psychiatric illness as severely as physical illness.[26] Although the USA federal code *does* explicate that certain psychiatric conditions apply to the Americans with Disabilities Act (ADA),[j] the relative prevalence of all classifiable "disabilities" brings into question how severe a condition *ought* to be to be categorized in such a way as to have medical significance.

For the purposes of this article, the focus of what "dis-"ability entails centres on those individuals who would be missing a limb—however the loss may have occurred—as explicated in the introduction. While the author understands that limb-focused prosthetics are not the end-all-be-all of CIDABP implementation, the questions posed by this article have already explicated the complexities with integrating patients with visible CIDABPs into the legal spectrum insofar as their "human-ness" is brought into question before a judicial panel. Necessarily, neuroprosthetics or other organ-function-replication prosthetics cover other aspects of "dis-"abilities in the human population regarding tissue or organ "mis-"functions; and therefore require a separate realm of considerations due to their life-sustaining *modus operandi* as prosthetic devices and their ability to influence human behaviour or rationalisation. Whether nootropic or other mood-regulating compounds (when released via a bionic device) constitutes as an organ-function-replication prosthetic or neuroprosthethic extends beyond this dialogue insofar as they are not integrated into limb-focused CIDABPs—though is mentioned herein due to its relation to psychiatric-related "dis-"ability categorisations and potential bionic methods to provide internal treatment to affected patients.

On the subject of CIDABPs and the "dis-"abilities they compensate for, one may not consider non-robotic prosthetics to be modern forms for human augmentation or enhancement—or even traditional ones for that matter. Nevertheless, the delineating line between "medical aid" and "augmentation" becomes blurred when we consider how to define TABHI from "unaugmented" human intelligence or cyborg-specific intelligence[k] as it becomes integrated into robotic components for modern ABPs.[l] The question at hand in this context is whether the use of a CIDABP by someone who relies upon it due to their disability constitutes a *viable* claim for a non-disabled individual to attain a similar implement. Much like the raising concerns regarding the use of psychopharmacologic substances (e.g., neuroenhancers, nootropics) in academic and work environments,[27,28] individuals who argue for "equality" under this model could claim that they cannot be denied bionic enhancements under the 1st or 14th Amendment privileges granted to them in the USA. From an international perspective, there are several combinations of rights one could cite from the Universal Declaration of Human Rights to back their claims for a similar denial. This argument becomes complicated in environments like prisons, where those serving sentences still have some fundamental rights regardless of the crime they have been convicted for. (Brown,[9] pp. 84–90)

Part of the complication that arises with a more universal distribution of CIDABPs arises from their impact on the labour market—specifically in regards to those positions that require manual labour and in professional sports—as the intentional removal of limbs by patients to augment their physical capacities necessarily serves as a double-edged sword for the field. On the one hand, it allows for CIDABPs to gain in sophistication while becoming more affordable to the populations that require them. On the other, it (feasibly) develops a labour-market mentality that views unaugmented labourers as being less beneficial to their business model than augmented workers—

notwithstanding the recuperation time that would be required by patients willingly seeking CIDABPs. Of course, these concerns also extend to the development of exoskeletal devices that may feasibly serve as alternatives to CIDABPs for members of the non-disabled population—although their overall influence on challenging notions of legal personality is significantly decreased as a result, and will therefore not be covered in detail herein.

On notions of current corporate liability for damages caused to labourers

Other concerns arise when considering current disability laws in the USA and abroad. As argued by Lee and Read, the current rules that apply to the ADA "...reflect a Congressional intent for disability employment laws to apply persons in a wholly natural state. In other words, disability of an individual is to be calculated with his/her body functioning naturally—with no technological enhancements, additions, or modifications. (Lee and Read,[22] pp. 245–246)"[m] Yet with the allure of bionics tempting various industries to utilise them to their fullest extent to attain maximum productivity (as suggested in the prior paragraph), the current model of the ADA or international equivalents would become obsolete. Let us consider another potential case:

> Throughout their daily work routine, Mister Glades and Missus McIntyre are among several workers caught in an earthquake that causes the structural integrity of the building they carry out their duties in to fail. Coincidentally, both Mister Glades and Missus McIntyre use CIDABPs to aid their respective disabilities, and both workers have sustained a moderate amount of damage in the resulting building collapse—including extensive damage to their respective CIDABPs. Also of note is the abdominal injury sustained by Missus McIntyre. She recently underwent an *in vitro* fertilisation treatment to ensure her child was not born with the same bone defect that led to her limb being amputated at a young age or suffer from her genetic history of ovarian cancer (for which she has already undergone chemotherapy). Since this disaster befell her workplace, the pain now originating in her abdomen has her fearful for complication with the child she is carrying—rather than assuming they arise from the usual pains felt by expecting mothers.

Various new elements were added to this experiment out of consideration for how the law would treat each instance of injury to a non-disabled worker—at least in the USA. At a glance, a regular worker who lost a limb to an accidental injury at work would be awarded damages for the injury to their physical, emotional, and economic losses as they pertain to the loss of a limb. However, injury claims for individuals with prosthetics may *only* apply for the repair or replacement of the damaged prosthetic and may not pertain to restitution for emotional damages caused by the prosthetic's damage. (Sullivan,[23] p. 672) Of course, this issue will become more challenging to address when we consider if the patient would be able to regain some semblance of "pain" detection in the CIDABP given its interactions with various muscle groups and nerves—which, of course, is a separate concern regarding D/SCIS or SLCIS interactions with the human nervous system to any extent.

Should the would-be mother's abdominal injury cause the miscarriage of her child, it is questionable whether she would be compensated for the death—even with Workers' Compensation—considering the tenuous legal status of embryos that undergo *in vitro* treatment in the USA.[29] And should she miscarry, there may not be another opportunity for her to attain motherhood through biologic means[n] if the damage caused to her uterus is too severe—which then brings into question what should be done to the remaining embryos that have yet to be implanted if surrogacy support is denied to her despite her injuries.[o] And once again, we are faced with the concern for how much emotional support she would be given as a result of the restitution she would receive from insurance providers—as it could be argued that the death of a child *in utero* is significantly different from experiencing the death of a co-worker.

Potential complications in liability compensation. So, what, then, of the legal status of CIDABPs and their users? The treatment of these entities by *de lege lata* may not be as favourable as they would be to a non-disabled individual who attained bionics at their own expense and found a way to get insurance coverage for specific instances of damage or disrepair. Ultimately, however, it would depend *heavily* upon the nature of the CIDABP in question. The treatment for a CIDABP that continuously stores the code it develops in the Cloud will be different from one that stores all of its data locally—especially if it was designed in such a manner as to prevent that information from being extracted. All of this, of course, does not even begin to involve a mention of an insurer's responsibility; nor the cost of maintaining such a system outside of experimental environments and the potential impacts it may have on TABHI-classified individuals. Patients in the former category may be treated equivocally to current models insofar as a "backup" version can be installed into a different device. In contrast, patients in the latter category may receive better treatment (depending on

the court) because the sophistication of the CIDABP cannot be replicated—which entails that a new system would have to start from "ground zero" to "learn" how the patient naturally would move their missing limb.

To this end, it may be prudent to re-evaluate the entirety of various country's medical systems as they pertain to members of the population who would require CIDABPs. After all, the expense of these devices cannot weigh well on either private or social health systems.[10],[p] And that is not even considering the future medical expenses that would be incurred by those individuals who argue that it is their "right" to embed their bodies with a CIDABP even if they realistically never required one in the first place. Given this potential conflict, a delineation *needs* to be made between those who are naturally (or forcefully made) disabled and those humans that would be considered TABHIs.[q] While this may become an argument against discriminatory treatment, the argument remains that previously uninhibited TABHIs (relative to "dis"-abled populations) *chose* to have bionics graphed onto their forms—whereas the disabled populations of society (or select other members of society)[r] may *not* have been presented that same choice.

Insofar as CIDABPs are the limitations of bionic "enhancement" in the human population, and legal regulation is enacted to monitor the development of technologies that would further blur the line between TABHI and cyborg-specific intelligence, the only real changes that would need to be addressed are those surrounding the topics that have already been briefly mentioned. More equitable treatment of TABHI would still be something that is argued for and voted upon—if not by lawmakers, then by taxpayers—but no further considerations for the *personhood* of the individual in question should arise. That is, until such a point that the CIDABP has developed to the point where its power extends to the central nervous system. Or rather, it begins to display a sort of "will" that is separable from that of its "host" or developers, at the very least.

The limits of *Homo sapiens*

Coupled with philosophic debates centred on notions of human augmentation and enhancement, *de lege lata* arguably has not treated the limitations of our species in great severity when coupled with technology—or, at least, treat it in such a way that it is considered "common sense." However, the advent of "wilful" CIDABP is *not* the only technology in existence that challenges our notions of biological limitation. One could even claim that such deliberations have been made since the development of the first commercial computer system in the 1900s. The nature of such a debate could be found in this simple question: do we limit *Homo sapiens* to our biology, or do we consider our technologic artefacts to be an extension of the individual[11] (Jaynes,[15] pp. 348–350)?

Although this question may not have had much significance before the public usage of the Internet of Things, the need to address it has gained in urgency in recent years.[11,15] Insofar as one has access to a desktop computer, one can gain access to a wide range of knowledge that would previously only be available to a subject-matter expert. Is the knowledge retrieved in this method *genuinely* natural, or has some line been crossed? Other machines (or rather, artefacts) that humanity has developed do not possess the potential to exceed our collective ability to perform a specific task, so it may only be natural that such a subject has not been fully broached to this point in time.[11,15] After all, one must distinguish which "technologies" constitute as being non-essential to our perceived notion of "natural" status given that tool creation serves as an anthropological characteristic of our species.

Another technology currently in use that blurs the line between *Homo sapiens* and some other advanced organism would be that of biotechnology-assisted eugenics—though it would be debatable whether gene therapy treatments that only target somatic cells could qualify one to be "beyond human (Galván and Luppicini,[30] p. 2)" given the conundrum presented in the prior paragraph. The manipulation of the human germline with biotechnology raises concerns as to whether the resulting embryo can *still* be classified as a member of the same species as its parents, should unrestricted genetic manipulation be permitted on legal and moral grounds for more than life-saving interventions.[s] In contrast, the manipulation of somatic cells is steadily being considered an ethically permissible medicinal therapy to circumvent potentially dangerous illnesses in one's post-partum life.[31–35] Yet in both cases, the patient in question is subjecting their genome to "unnatural" changes—which some would call a technology-aided artificial selection practice or directed evolution—and as such are no longer "natural" humans if we consider this status to be tied to our genetic makeup. The commonly held concern is whether our notion of "humanness" is enough to incorporate these patients as part of the species at large,[36,37] and whether individuals have a right to an unaltered genome.[38] Depending upon the definition of who constitutes as a member of human society, there is concern that patients with manipulated genetics would not fit under a "genetically-natural" definition if it is proposed.

For this purpose, it may be best to separate the human population into distinct categories, such as biologically-natural, genetically-manipulated, computer-aided, and cybernetically-enhanced (TABHI), among others. The line that would be most ambiguous would be the

cybernetically-enhanced human category, which would need to have specific definitions in place to separate the "humans" from the "CIS(s)" and cyborg-specific intelligences. However, it would be presumptuous to assume that a single voice should have an *absolute* claim to the definition of the members that fit into each category and the level of legal protections granted to them. As such, this work can do no more than advocate for an international discussion that would take each of these matters into consideration so as to add some semblance of definition to these proposed, intentionally ambiguous, classifications.

Yet, there is still one item that has not been properly addressed within this dialogue—although it has been touched upon in several areas—namely that of computational "will," and how it serves as a means to complicate our current notions of "humanity" and legal personality. There will certainly be objections to the proposed motion to adopt that "will," as opposed to an ambiguously defined "consciousness," be sufficient enough a display of unique intelligence to require the bestowal of legal protections to CIS. Nevertheless, such a motion *needs* to be made given how academics have failed to clarify and agree upon a set of characteristics CIS are required to display to "prove" their place in human society as a free-"thinking" agent.[11,15,t]

Computer-based "will" as a signifier for base-line legal protections

The notion of computer-based "will" has been a recurring theme flittering in the backdrop of science-fiction media for decades,[11,15] though it is a topic that is looked at by many with contempt given its fictional origins.[u] Still, the reality of what is to come—both for technologic advancement and jurisprudence on any level—is far too *real* to ignore for much longer. Once the threat of SARS-CoV-2 (or COVID-19) no longer prevents humanity from resuming some greater semblance of normalcy without concerns of infection, a concerted effort *needs* to be made to discuss the implications of thought experiments such as those presented herein. Without a *serious*[v] consideration for the real possibility that human intent may be indeterminable (as in the thought experiment in 'The limits of *Homo sapiens*' section), we will be doing our society and progeny a serious injustice. The complexity, however, lies in the distinction between what *ought* to be categorized as hereto understood computational "glitches" within the execution of code and computer-based "will" or "intentional" action in divergence to anticipated self-learning architectures—particularly in relation to interfaces that interact with neural signals the human nervous system.

Truly, this author cannot speak from an objective technical stance when it comes to the structure of self-learning architectures and the likelihood of computational artefacts developing logic structures that would bring them to human-level intelligence. As suggested by the author in a prior work[11] however, significant advances towards the development of heat-minimising computational systems utilising diamond-semiconductors may yield related gains in processing speeds and power—as the energy required to cool the system would then be diverted towards those functions. Positing that self-learning architectures would similarly make gains as a result of these innovations, and results from the joint Canadian-EU Human Brain Project[w] allow for new perspectives into the logical structure of human-level thought to spur these architectural developments, the likelihood of computational "glitches" being misinterpreted as such will inevitably diminish. Ultimately, this would result in some advanced SLCIS displaying not *consciousness*,[x] but *will* or *self-determination*.

This notion of computer-based *will* inevitably extends to other aspects of industrial and medical development, specifically in the realm of technologic implants or interfaces that interact directly with the human nervous system[y] or with other electronic artefacts in our environment. Where the most common chip implanted into humans (today) only holds around one kilobyte of memory,[z] humanity does not have to worry too extensively about individual privacy and the potential for one's nervous system to become "hacked" like one's laptop or smartphone could be *as of this moment in history*.[a1] However, innovations in micro- and nano-chipping technology, as well as in CIDABPs, will inevitably lead us to these sorts of concerns—as is already been discussed in the field.[39–43] A reliance upon CIS-generated encryption software may not even yield in the sort of cybersecurity one would desire for highly-invasive (and potentially deadly if exploited) implants.

While there are many more topics that could be covered in this realm, they are beyond the scope of this paper to address. Some questions have already been posed by the author in a prior work[11] as to the "necessary" gap between unaugmented humans and those that would border on being classified as cyborgs, but others still remain—such as, for example, the base constituent(s) for a cyborg as opposed to a technologically-augmented organism. The author is of a mind that exterior factors, such as those that apply to social mores and norms, will ultimately have a vital influence into how these discussions unfold from one nation to the next. As such, there is *no* clear or concrete explication that could be given herein to effectively

sway these discussions in a significant manner—as they would necessarily be ignorant to particular cultural realities or become (potentially) contradictory across various national interpretations of what it means to be a "person" under the letter of the law. In this vein of thought, however, some guidance can be given as to the protections that *ought* to be receive by patients requiring CIDABPs given how they play into international laws and treaties.

Conclusion

The incorporation of CIDABPs into society at-large poses distinct challenges to those disabled members of the community that would benefit most from its distribution, as well as to the legal community at-large. Specifically, when matters related to CIS "sentience" or "consciousness" arise, *exercitati legis* has consistently displayed a reluctance to treat the topic. Although it could be said that the complexity of the subject is serious enough to warrant a reluctance from the legal community to cement any precedence that may ultimately end up being inaccurate, such reluctance can *no longer* be allowed to stand. The urgency humanity *should* be feeling towards the subject of defining CIS "intent," "will," "sentience," or "consciousness" after this pandemic realistically *ought to* match our concerns for the Human Genome Project—if not exceed them—observing this phenomenon from the lens of speculative bioethics.[20]

This urgency is not only for the betterment of the patients who will inevitably have access to CIDABP or other CI-dependent bionic modifications, but for the developers of CI-dependent products and services as well. Continuing to lag due to an "unease" for the notion of legal protections or definitions of TABHI or cyborg-specific intelligence (beyond that of D/SCIS and SLCIS) is beyond ridiculous for a society whose technology is advancing at a rate previously thought impossible. While arguments can be made as to the viability of the emergence of specific technological advancements that would catapult CIS into a position that ultimately threatens a third-party observation as to the dividing line between "human" and "computer" intelligence, the unpredictability of these advances should be significant enough to incite anticipatory discourse into how society will adapt to a proliferation of bionics in the human population—as well as the protections owed to individuals who can viably regain their ability to productively contribute in society with the use of CIDABPs or organ-function-replicating prosthetics. Leaving the greater debate of a perceived *need* to delineate between computer-assisted humans, TABHIs, and cyborgs for a separate dialogue, it is difficult to refute the reality that augmented individuals will impact societal productivity in a significant number of ways.[11] Without distinct torts explicating the responsibilities expected of augmented versus unaugmented individuals, or the protections granted to and between each group as a result of these expectations, society will ultimately be unprepared for the coming sophistication of CIS and the legal complications that surround its improved capabilities.

Declaration of conflicting interests

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Notes

a. This effort is made to remove the innate stigma the term "artificial" elicits within the field regarding computer-based intelligence systems, as defining computer-based intelligence as "artificial" seems only to be cementing the idea that it cannot be treated with legal personality in a court of law. This notion is untenable considering that other "artificial" entities—namely, corporations—are granted legal personality regardless of the fact that they do not possess "intelligence" by themselves as a means to serve some greater legal "good." Ultimately, only advanced CIS will be able to handle itself in such a way that legal personality makes sense to be bestowed upon it—namely, when it behaves in a manner indistinguishable from a biological human being. *When* that time comes is only a manner of understanding when computer "glitches" becomes a sense of "being" or "will",[11,15] and will likely not

occur for several more years (depending upon how significantly the current pandemic will impact technological advancement logistically).

b. To be clear, neuroprosthetics or organ-function-replicating prosthetics will require specific treatment in a separate dialogue given their controversial nature. A joint treatment of limb-based prosthetics and these other types of prosthetics would generate a work more conducive to a doctoral thesis or book-length work and is therefore not approached herein given article length constraints.

c. *See, generally*: literature.[18,19]

d. This usage was determined after referencing several separate Greek-English Lexicons developed from the work of Liddell and Scott, along with that of Schneider, and scholars who did not reference these two works directly. While subtly different from *kybernetes organon*, the difference in pronunciations between the two phrases (focused on pre-modern Greek phonetics) *ought* to signify a difference in concept between the etymologic roots for "cyborg" and its usage since the 1960s—namely being that of a "man-machine hybrid, a human modified by integrated machinery to have extended powers," as defined by Etymonline.com (last accessed 9 November 2020).

e. *Oxford Latin Dictionary, Libero-Z*. Oxford, UK: The Clarendon Press of Oxford University Press, p. 1268.

f. That is not to say that the "intent" of programmers that utilise open-sourced algorithms is not important for this dialogue, but that the ambiguity of intent in these scenarios is severe enough to bring into question the reliability of the systems that depend upon these publicly-available codes in terms of meting out punishments for damages caused by the system's misuse or malfunction.

g. Beyond corporations interested in developing robotic surgical equipment or "companion" robots to be deployed in hospital and hospice settings whose strength (in comparison to humans) would serve to grant some form of automation to hospital wards or senior care facilities.

h. https://www.europarl.europa.eu/doceo/document/A-8-2017-0005_EN.html (2017, accessed 10 November 2020).

i. To this end, all such literature on "bio-hacking" should be reconsidered from an academic perspective so as not to confuse the general populace as to the *true* dangers that lie in being "biologically hacked," *if* such a reversal could feasibly occur with the proliferation of the term. Such mis-usage of terminology is highly irresponsible and inappropriate and should therefore be condoned in all such cases.

j. A guide to disability rights laws. *U.S. Department of Justice, Civil Rights Division*. https://www.ada.gov/cguide.htm#:~:text=Americans%20with%20Disabilities%20Act%20(ADA,to%20the%20United%20States%20Congress (2020, accessed 10 November 2020).

k. Above and beyond our definitions of D/SCIS or SLCIS and their relation to human-level intelligence(s).

l. Seen broadly throughout 1–17, 22–25, 30, and 39-42.

m. It should be noted here that Lee and Read make a broader reference to disability in their work, such that it conforms to the concept of disability as prescribed by the ADA.

n. It is debatable whether surrogacy would constitute as being a "biological mean" to attain parenthood. In one sense, surrogacy *could* be construed as a roundabout method of adoption given that the genetic mother of the surrogated child is not being developed within her own womb, but that would be a difficult claim to maintain (Furrow et al.,[44] pp. 154–163). The author imagines that the basis *for* biological parenthood is to be physically capable of developing a child within one's body—for those possessing such required organs—and therefore any arguments that lean in the direction of surrogacy being a replacement for this experience would ultimately become null and void.

o. Let us remember that chemotherapy for ovarian cancer necessarily sterilizes the patient, which is why women who still wish to have a chance for biological parenthood opt to have a certain number of their eggs cryofrozen before undergoing the procedure (*see, generally* (Furrow et al.,[44] pp. 113–163)). On a separate note, both surrogacy and midwifery are practices typically not covered by health insurance companies in the USA (Furrow et al.,[44] p. 155). As such, it would be highly unlikely that Worker's Compensation insurance would allow for a woman to pay for a surrogate birth in select (if not all) states given the limitations of medical coverage it affords.

p. Note, the price referenced here (being $75,000) only refers to more traditional ABPs. Depending upon the sophistication of a given CIDABP, it is easy to imagine a cost equivocal to the relative advanced nature of the system.

q. To be clear, the concerns as defined in this essay would pertain to those individuals whose disability covers their extremities as opposed to those who would require prosthetics on account of some neurological or psychiatric ailment. While the author does realise the importance of addressing the metaphysical constraints of "choice" from neurological and psychiatric perspectives, such a treatment within this work would serve more as a digression than a supplement; and therefore needs to be addressed in a separate discussion.

r. Such as those coerced into gaining CIDABPs to perform "essential" job functions (including for military service) or enslaved populations.

s. Beyond, of course, the legality of acquiring stem cells from developing zygotes for stem-cell research (Furrow et al.,[44] pp. 182–190) and broader questions as to the relative "cost" of germline manipulation in the human population.

t. The author's prior work is cited here to abbreviate the larger body of work that should also be cited in this area.

u. Prime examples of this can be found in the portrayal of Lt. Commander Data and the Borg in *Star Trek: The Next Generation*, the Synthetics found in the *Alien* franchise, and the androids in *Detroit: Become Human*, among other numerous works; and their treatment by the academic and scientific research communities.[20]

v. Referring to its usage as "significant or worrying because of possible danger or risk; not slight or negligible," or even "acting or speaking sincerely and in earnest, rather than in a joking or half-hearted manner," above all other definitions of the term.
w. https://www.humanbrainproject.eu/en/brain-simulation/ (n.d., accessed 10 November 2020), https://www.humanbrainproject.eu/en/silicon-brains/ (n.d., accessed 10 November 2020).
x. As the nature of conscious being is a metaphysically complex rabbit hole that has alluded concrete scientific definition as a phenomenon.
y. Which, it should be noted, is already becoming a reality.[22,23]
z. https://medicalfuturist.com/rfid-implant-chip/ (2019, accessed 19 June 2020).
a1. However, that is not to say that fears over remote access to other bionics that have no connection to the peripheral or central nervous systems are unfounded. Rather, the ever-constant threat of cyberattacks on electronic artefacts is a real concern that prevents significant advances towards advanced robotic or bionic systems—which should be a non-controversial claim in this sphere given the damages that would arise from autonomous systems being accessed by malicious actors.

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