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# BRAIN CHIPS AND WHOLE BRAIN EMULATION COULD ENSURE FOOTBALL'S SURVIVAL: IS IT WORTHWHILE?

JAMES T. GRAY\*

INTRODUCTION: FOOTBALL IS CAUSING PEOPLE TO LOSE THEIR BRAINS

*Talent hits a target no one else can hit; Genius hits a target nobody else can see.*

*Arthur Schopenhauer, German Philosopher, 1788-1860.*<sup>1</sup>

Football is treasured in the United States amongst many of its citizens. This challenging competition can result in notoriety, fortune, ridicule, as well as glory for administrators, coaches, and players. It is considered one of the rites of passage where a boy can learn how to become, and be recognized as, a man.

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1. OXFORD REFERENCE, OXFORD ESSENTIAL QUOTATIONS (Susan Ratcliffe ed., 6th ed. 2018) (ebook), <https://www.oxfordreference.com/view/10.1093/acref/9780191866692.001.0001/q-oro-ed6-00009189?rsk=33ftUp&result=1>.

Oftentimes, football is presented to the sporting public as the “Hero’s Journey.”<sup>2</sup> In this regard, there is the “death” of the boy which results in the “resurrection” of the man.<sup>3</sup> Football’s prominence was firmly established during President Theodore Roosevelt’s presidency with the reinforcement of “Muscular Christianity.”<sup>4</sup> To be physically effective and overcome adversity during football games was considered by many the essence of manhood.<sup>5</sup>

Further, football is an acceptable societal outlet for violent player conduct and aggressive spectator behavior.<sup>6</sup> Across the United States, during the season, violence and aggression are vented each Friday, Saturday, and Sunday in thousands of stadia, (i.e., Cathedrals) which cost billions of dollars to construct and maintain.<sup>7</sup> Football is one of the few opportunities within American society where ferocious player competition can be freely expressed before passionate fans who can witness an intense, collective, and competitive experience.

Football is distinctive because it is a rare communal practice for the American people to share. For example, when a national tragedy occurs, the American people mutually rally around one another. Similarly, football is an additional opportunity where a loyal, diverse, and penetrating nationwide audience is captivated by the annual Super Bowl, along with the yearly college national championship game. On the local level, the weekly “Friday Night Lights” is a cherished, and ubiquitous, national high school sport phenomenon.

Yet, football is now stymied due to the dangers related to repetitive brain trauma. Habitually, people think starkly of concussions in the context of the vivid, often sudden, demise of competitive playing careers.<sup>8</sup> At other times, brain injuries are a dramatic genesis of death while competing at the youth level to the professional one.<sup>9</sup> During the last twenty years, football culture has been condemned due to the substantial harm connected with player concussions, Chronic Traumatic Encephalopathy (“CTE”), various forms of dementia, and

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2. See generally JOSEPH CAMPBELL WITH BILL MOYERS, *THE POWER OF MYTH*, Ch. 4 (Betty Sue Flowers ed., 1st ed. 1988).

3. *Id.*

4. See generally Clifford Putney, *Muscular Christianity*, *THE ENCYCLOPEDIA OF PEDAGOGY AND INFORMAL EDUCATION* (2003), [www.infed.org/christianeducation/muscular\\_christianity.htm](http://www.infed.org/christianeducation/muscular_christianity.htm).

5. *Id.*

6. See generally RENÉ GIRARD, *VIOLENCE AND THE SACRED* (Patrick Gregory trans., 1977), for a historical overview of the role of violence within human society.

7. See, e.g., Peter Geisendorfer-Lindgren, *Stadiums, Cathedrals: Marks of Their Eras*, *STARTRIBUNE* (Sept. 2, 2016, 6:21 PM), <https://www.startribune.com/stadiums-cathedrals-marks-of-their-eras/392207411/>.

8. See Ingfei Chen, *Exactly How Dangerous Is Football?*, *NEW YORKER* (Feb. 1, 2020), <https://www.newyorker.com/culture/annals-of-inquiry/exactly-how-dangerous-is-football>.

9. *Id.*

brain related football player suicide.<sup>10</sup>

As a result, football is experiencing an existential crisis to preserve the current culture of its physical, often epic, competitions.<sup>11</sup> Further, it remains desperate to preserve revenue maximization, along with protecting the health and safety of all competitors.<sup>12</sup> For many Americans they are suddenly confronted with this profound question: Would you feel comfortable watching someone whom you love play football?

As football attempts to become less violent in order to protect the health and safety of player brains, has the game, now publicly perceived, devolved from the “Hero’s Journey” to something where football’s vigor has been forfeited, and is now flat, or worse, “dead?”

Currently, the collective American national responses to brain-based health and safety issues range from banning football, amending football hitting rules, to prohibiting youth from full contact participation until they become adolescents.<sup>13</sup> Additional recommendations have included improved coaching of competitors, limited physical player contact during practices, and cumulative head hit count maximum limits.<sup>14</sup> However, the shortcomings of these piecemeal responses will constrain football’s violent civic appeal and start to erode its historical privilege amongst the American public.

Nonetheless, there is one response to football’s traumatic brain injury dilemma that should be explored. To thrive, as compared to merely survive, football will be compelled, within the next 50 years, to replace biological athletes with synthetic ones. More specifically, in order to maintain football, in its present form, the use of either brain chips or Whole Brain Emulation (WBE) will ultimately be embraced by America’s football culture.

## I. ATHLETE BRAIN BASED TECHNOLOGY – AN OVERVIEW

Approaching technology will transform football with the initial use of athlete “brain chips” and concluding with player WBE. Conceptually, think of it as beyond the traditional anti-doping legal analysis. Performance enhancing drugs centers fully on the body. In contrast, brain technology will force people

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10. *Id.*

11. See Christopher R. Deubert et al., *Protecting and Promoting the Health of NFL Players: Legal and Ethical Analysis and Recommendations*, THE FOOTBALL PLAYERS HEALTH STUDY AT HARVARD UNIVERSITY, [https://footballplayershealth.harvard.edu/wp-content/uploads/2016/11/01\\_Full\\_Report.pdf](https://footballplayershealth.harvard.edu/wp-content/uploads/2016/11/01_Full_Report.pdf).

12. *Id.*

13. *Get a Heads Up on Concussion in Sports Policies*, CENTERS FOR DISEASE CONTROL AND PREVENTION, <https://www.cdc.gov/headsup/pdfs/policy/HeadsUpOnConcussionInSportsPolicies-a.pdf> (last visited Dec. 1, 2021).

14. *Id.*

to reevaluate the ancient issues of “Who am I?” and “What am I doing here?” In sum, brain technology directly impacts one’s understanding of identity and that of consciousness. Ultimately, it is the brain that absolutely dictates the sense of being. Stakeholders will be compelled to apply the law in order to evaluate the status of these “new” athletes during their task of integrating brain-based technology innovation within the existing football culture.

As WBE and brain chip technology continues to improve, a sound skepticism abounds. For example, is any of this reasonably feasible? If so, how much time is required to safely achieve WBE and brain chips usefulness in connection with football’s brain injury challenge? In evaluating these issues, several technology-based “laws” should be considered. The leading scientific principle concerning the development and implementation of computer based brain technology is known as “Moore’s Law.”<sup>15</sup> This law, “applies only to one aspect of digitization: computer processing.”<sup>16</sup> Since 1959, the number of transistors on an integrated circuit has doubled annually and this pattern is predicted to persist until at least 2025.<sup>17</sup> In addition, there are several scientific laws which provide insight connected to computer based brain technology advancements including:

(1) Metcalfe’s Law. This is: based on the insight that as a network grows in size, the number of potential connections increases faster than the number of nodes. Stated more generally, if the number of nodes equals  $n$ , the number of potential connections equals  $(n^2 - n)/2$ , which means that the number of potential connections increases quadratically with the number of nodes. In short, doubling the number of nodes will more than quadruple the number of potential connections.<sup>18</sup>

(2) Kryder’s Law. This “claims that magnetic disk storage

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15. Christopher S. Yoo, *Essay and Article: Moore’s Law, Metcalfe’s Law and The Theory of Interoperability*, 14 COLO. TECH L.J. 87, 90-91 (2015).

16. *Id.* at 94.

17. *Id.* at 90.

18. *Id.* at 92. A “node” is:

[a]ny system or device connected to a network. For example, if a network connects a file server, five computers, and two printers, there are eight nodes on the network. Each device on the network has a network address, such as a MAC address [Media Access Control Address], which uniquely identifies each device. This helps keep track of where data is being transferred to and from on the network.

*Node Definition*, TECHTERMS.COM (2006), <https://techterms.com/definition/node>.

density doubles every eighteen months.”<sup>19</sup>

(3) Nielsen's Law. This “predicts that network bandwidth doubles every twenty-one months.”<sup>20</sup> During 2021, an example of network bandwidth improvements included an external wireless transmitter that was now, “capable of transmitting brain signals at single-neuron resolution and in full broadband fidelity without physically tethering the user to a decoding system.”<sup>21</sup> With respect to this embryonic technology, “the traditional cables are replaced by a small transmitter about 2 inches in its largest dimension and weighing a little over 1.5 ounces. The unit sits on top of a user's head and connects to an electrode array within the brain's motor cortex using the same port used by wired systems.”<sup>22</sup>

(4) Butter's Law. This “posits that the cost of transmitting data over optical fiber drops in half every nine months.”<sup>23</sup> However, these technical laws all have limits. For example:

[t]he achievement of the cost reductions associated with Moore's Law have traditionally relied on a specific technological strategy: chip designers have been able to fit more transistors on a chip by making them smaller. . . . But the laws of physics impose a natural limit on how long innovators can rely on this strategy. Smaller chips tend to generate more heat, which in turn causes the interconnects to degrade.<sup>24</sup>

#### *A. WBE – From Biological Athletes to Synthetic Ones*

From a biological perspective:

there is an inextricable link between substrate and (human)

19. Yoo, *supra* note 15, at 94.

20. *Id.* at 94-95.

21. *Researchers Demonstrate First Human Use of High-Bandwidth Wireless Brain-Computer Interface*, BROWN UNIVERSITY (Mar. 31, 2021), <https://www.brown.edu/news/2021-03-31/braingate-wireless>.

22. *Id.*; see John D. Simeral et al., *Home Use of a Percutaneous Wireless Intracortical Brain-Computer Interface by Individuals with Tetraplegia*, 68 IEEE TRANSACTIONS ON BIOMEDICAL ENGINEERING 2313, 2313-2323 (2021).

23. Yoo, *supra* note 15, at 95.

24. *Id.* at 96.

body: the body is host to the brain, offering metabolic support and structural protection. When the brain is uploaded, the functions of the body become superfluous to brain function: an emulation no longer requires oxygen and nutrients for sustenance. Thus, the literal “incarnation” has changed from a biological substrate to the substrate of a computer and can now be considered a synthetic entity.<sup>25</sup>

At its infancy, WBE is a supercomputer based upon the reverse engineering of the mind.<sup>26</sup> For example, in 2015, Intel and Advanced Micro Devices, Inc. worked with target processors that by approximately 2020 would enjoy twenty-five times the energy efficiency of current ones.<sup>27</sup> In fact, during 2020 it was announced that this energy efficiency goal was surpassed with “31.7 times improvement leading to gaming and ultrathin laptops with unmatched performance, graphics and long battery life.”<sup>28</sup> In this regard, they foresaw that an “exaflop” machine available in 2020 would use no more than twenty megawatts of energy.<sup>29</sup> However, by 2021 the twenty megawatts power goal was not ultimately achieved.<sup>30</sup> However, researchers had approached “more than 1.5 peak exaflops of performance inside a 29 MW power envelope.”<sup>31</sup> In

25. Charl Linssen & Pieter Lemmens, *Embodiment in Whole-Brain Emulation and its Implications for Death Anxiety*, 26 J. OF EVOLUTION AND TECH. 1, 4 (2016); see Peter Jones, *ERCIM News No. 125 Special Theme: “Brain-inspired Computing,”* HODGES' MODEL: WELCOME TO THE QUAD BLOG (Apr. 2, 2021), <https://hodges-model.blogspot.com/2021/04/brain-inspired-computing.html>, for a broad general overview regarding brain technology advancements.

26. Randal A. Koene, Sci. Dir. of the 2045 Initiative, Founder and CEO of Carboncopies.org and NeuraLink Co., *Whole Brain Emulation: Reverse Engineering a Mind*, Address at the Global Future 2045 International Congress (Oct. 15, 2013), <http://gf2045.com/read/268/>.

27. Gary Feierbach & Randal A. Koene, *Whole Brain Emulation – State of the Art*, RSCH. GATE (2016), [https://www.researchgate.net/publication/290820977\\_Whole\\_Brain\\_Emulation\\_-\\_State\\_of\\_the\\_Art](https://www.researchgate.net/publication/290820977_Whole_Brain_Emulation_-_State_of_the_Art).

28. *AMD Exceeds Six-Year Goal to Deliver Unprecedented 25 Times Improvement in Mobile Processor Energy Efficiency*, AMD (June 25, 2020), <https://www.amd.com/en/press-releases/2020-06-25-amd-exceeds-six-year-goal-to-deliver-unprecedented-25-times-improvement>.

29. *Id.* Exaflops are an order of magnitude of ten:

The performance capabilities of supercomputers . . . are expressed using a standard rate for indicating the number of floating-point arithmetic calculations systems can perform on a per-second basis. The rate, floating-point operations per second, is abbreviated as FLOPS. The “S” in the acronym “FLOPS” stands for “second” and is used in combination with “P” (for “per”) to indicate a rate, such as “miles per hour” (MPH) or gigabits per second (Gbps).

See *Understanding Measures of Supercomputing Performance and Storage System Capacity*, INDIANA UNIVERSITY, <https://kb.iu.edu/d/apeq> (last visited June 25, 2018).

30. See generally AMD, *supra* note 28.

31. Tiffany Trader, *Frontier to Meet 20MW Exascale Power Target Set by DARPA in 2008*,

comparison, the human brain uses from twenty-five to forty megawatts of power.<sup>32</sup> An associated challenge for WBE research is the initial creation of exascale systems to effectively address data locality.<sup>33</sup> “Shuffling data at high speed and low latency between processors on chips, between chips and between circuit boards will become more important than just the raw processing power.”<sup>34</sup>

During 2017, the National Institutes of Health via its Brain Research through Advancing Innovative Neurotechnologies (BRAIN) initiative provided \$260 million in funding to include, “maps of whole brains in action, the ability to identify thousands of brain cells at a time, and innovative brain scanners.”<sup>35</sup> Amazingly, International Business Machines, supported by Defense Advanced Research Projects Agency (DARPA) funding, boldly predicted to produce a “brain in the box” by 2020 which included 10 billion neurons within a size of two liters powered by one kilowatt.<sup>36</sup> While the brain in the box has not yet come to fruition, “researchers at the University of Chicago and the U.S. Department of Energy’s (DOE) Argonne National Laboratory have imaged a whole mouse brain across five orders of magnitude of resolution,” which should “better connect existing imaging approaches and uncover new details about the

HPCWIRE (July 14, 2021), <https://www.hpcwire.com/2021/07/14/frontier-to-meet-20mw-exascale-power-target-set-by-darpa-in-2008/> (statement of Al Geist, Chief Technology Officer at the Oakridge Leadership Computing Facility, with respect to the 20 megawatt objective) (“‘You might wonder, where did that [20 MW number] come from?’ Geist posed. ‘Actually, it came from a totally non-technical evaluation of what was possible. What was possible said: it’s gonna take 150 MW. What we said is: we need it to be 20 [MW]. And why we said that is that [we asked] the DOE, ‘How much are they willing to pay for power over the life of a system?’” and the number that came back from the head of Office of Science at the time was that they weren’t willing to pay over \$100 million over the five years, so it’s simple math [based on an average cost of \$1 million per megawatt per year]. The 20 megawatts had nothing to do with what might be possible, it was just that stake that we drove in the ground.”).

32. *Id.*

33. *Id.*; see *Life at Exascale*, EXASCALE COMPUTING PROJECT, <https://www.exascaleproject.org/what-is-exascale/> (last visited June 26, 2018) (“The fastest supercomputers in the world today solve problems at the petascale- that is a quadrillion (10<sup>15</sup>) calculations each second. While these petascale systems are quite powerful, the next milestone in computing achievement is the exascale . . . at a quintillion (10<sup>18</sup>) calculations each second . . .”).

34. Trader, *supra* note 31.

35. *NIH BRAIN Initiative Builds on Early Advances*, NAT’L INST. OF HEALTH (Oct. 23, 2017), <https://www.nih.gov/news-events/news-releases/nih-brain-initiative-builds-early-advances>.

36. University of California, Berkeley, Helen Wills Neuroscience Institute, *IBM Says They Will Be Able to Produce a Brain in a Box By 2020*, YOUTUBE (Sept. 12, 2017), <https://www.youtube.com/watch?v=yjuE1rFZOHo>; see *Megawatt*, MERRIAM-WEBSTER DICTIONARY, <https://www.merriam-webster.com/dictionary/megawatt> (last visited June 26, 2018) (A megawatt is one million watts); *Kilowatt*, MERRIAM-WEBSTER DICTIONARY, <https://www.merriam-webster.com/dictionary/kilowatt> (last visited June 26, 2018) (A kilowatt is one thousand watts).

structure of the brain.”<sup>37</sup>

As it pertains to human benefits associated with this technology:

parallel whole brain emulation could restore neural function following injury and disease by providing an auxiliary pathway linking areas that were disconnected by the disease process. This homologous brain (whether emulated as digital software, neuromorphic firmware, or bioengineered neural constructs) would function continuously in parallel with the patient's brain and would compensate for disconnections within the patient's brain through connections within itself.<sup>38</sup>

Once achieved, WBE “would transform from only being an ‘auxiliary brain’ medical device for a patient and would become a potentially autonomous agent when evaluated in isolation, independent of the patient.”<sup>39</sup>

Presently, according to the Brain Injury Research Institute:

brain injuries cause more deaths than any other sports injury. In football, brain injuries account for 65% to 95% of all fatalities. Football injuries associated with the brain occur at the rate of one in every 5.5 games. In any given season, 10% of all college players and 20% of all high school players sustain brain injuries.<sup>40</sup>

Given these dire football brain injury circumstances, WBE could help restore health by mapping a player’s brain before injury was suffered. Further, WBE could function in parallel with the player’s biological brain and become a synthetic back-up when traumatic injury is sustained, and permanent harm is endured.

In this regard a synthetic brain could either help repair the damaged area of the biological brain, or replace it in whole, or, in part. However, when a player undergoes WBE the synthetic brain, because it is technology based, does not

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37. Alison Caldwell, *Researchers Image an Entire Mouse Brain for the First Time*, ARGONNE NAT’L LAB’Y (July 8, 2021), <https://www.anl.gov/article/researchers-image-an-entire-mouse-brain-for-the-first-time>.

38. Mijail D. Serruya, *Connecting the Brain to Itself Through an Emulation*, FRONTIERS IN NEUROSCIENCE (June 30, 2017), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5492113/>.

39. *Id.*

40. *What is a Concussion?*, BRAIN INJ. RSCH. INST., <http://www.protectthebrain.org/Brain-Injury-Research/What-is-a-Concussion-.aspx> (last visited Aug. 1, 2018).

require either oxygen or nutrients for survival. A change in brains from biological to synthetic means there is a new being with a synthetic brain within a biological body. When this occurs, how will American society, and its football culture, respond to this innovation? One thing is certain, WBE will create a significant social consternation along with a vigorous emotional public response. Moreover, it will demand additional study, reflection, and analysis from all involved.

### *B. Brain Chips and Mind Stimulation – The Future Is Now*

Less dramatic than WBE with its brain injury benefits is the use of computer chip implants in the near future. In this regard, chips can help football players engage in effective risk management by either preventing or minimizing brain injuries from occurring in the first instance. For example, brain chips can reduce the significant time and money currently invested regarding player learning and skill development. While WBE can be used to react to football brain damage, brain chips can be applied to help prevent these injuries from initially occurring.

Currently, football players, now using their biological brains, are required to learn their challenging, and voluminous, playbooks within a reasonable amount of time. They must understand competition strategies and in-game adjustments in connection with their opponent's strengths and shortcomings. Further, football is overwhelmingly rule bound relative to league governance issues, athlete eligibility standards, along with regulation promulgation, interpretation, compliance, and enforcement. Using the National Collegiate Athletic Association, as an example, the Division I rulebook is 451 pages in length and creates policy ranging from player-agent relationships, anti-gambling guidelines, drug testing procedures, and athlete recruiting procedures.<sup>41</sup>

Given the foregoing, is it reasonable to expect any player to learn everything demanded of him within a season which lasts anywhere from four to six months? The complexity and colossal volume of football-based rules, regulations, procedures, playbooks, and legal interpretations of these materials overwhelms the biological mind's capacity for effective learning. In order to contend with this perpetual player learning and understanding challenge brain chip technology could be adopted when it becomes safely available. In sum, the more that football players learn, the less likely it is for them to suffer life-long brain injury. As Benjamin Franklin, one of America's Founding Fathers,

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41. NCAA, 2021-22 NCAA DIV. I MANUAL (Aug. 1, 2021), <https://web3.ncaa.org/lstdbi/reports/getReport/90008>.

opined, “an ounce of prevention is worth a pound of cure.”<sup>42</sup> However, the issue is when, and under which circumstances, will brain chip technology become available for human use?

In 2017, it was reported that for approximately the last twenty years, neuroscientists have been designing revolutionary technology designated as “BrainGate.”<sup>43</sup> The intention is to wirelessly connect the human mind to computers.<sup>44</sup> BrainGate’s efforts include scientists who are presently studying “brain computer interfaces” using electronic microchips embedded in the brain to accurately connect minds to computers.<sup>45</sup> Not surprisingly, “the ability to communicate with others via thought, for example, is exciting, but giving others the ability to read your mind is frightening. Controlling a light switch or driving a car with one’s mind is exciting; the potential of others controlling your mind is frightening.”<sup>46</sup> During 2021, for instance, “[a] mind-reading machine has allowed a paralysed man to construct sentences on a computer screen by imagining that he is writing them with a pen.”<sup>47</sup>

From 2016 to 2018, DARPA has actively researched brain-based technology in humans.<sup>48</sup> During 2017, for instance, DARPA invested \$65 million to ultimately install brain based computer implants to restore impaired senses “including sight, hearing, and speech.”<sup>49</sup> As part of DARPA’s Neural Engineering System Design Program, “embedded computers, which will be ‘no larger than one cubic centimeter in size, roughly the volume of two nickels stacked back to back’, to translate the electrochemical language used by neurons in the brain into ‘the ones and zeros that constitute the language of information technology.’”<sup>50</sup> Thus, brains could “communicate directly with machines and vice versa.”<sup>51</sup> For instance, during 2019:

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42. *Ounce of Prevention, Pound of Cure*, UNIVERSITY OF CAMBRIDGE (Oct. 9, 2012), <https://www.cam.ac.uk/research/news/ounce-of-prevention-pound-of-cure>.

43. Jeff Stibel, *Hacking the Brain: The Future Computer Chips in Your Head*, FORBES (July 10, 2017, 8:46 AM), <https://www.forbes.com/sites/jeffstibel/2017/07/10/hacking-the-brain/#211f6aa2009>.

44. *Id.*

45. *Id.*

46. *Id.*

47. Rhys Blakely, *Brain Interface Lets Paralysed Man Write as if by Hand*, TIMES (London) (May 12, 2021, 5:00 PM), <https://www.thetimes.co.uk/article/brain-interface-lets-paralysed-man-write-as-if-by-hand-cslrt9dmk>.

48. Aatif Sulleyman, *DARPA To Plug Computers Into Brains To Let Machines Talk Directly To People*, INDEPENDENT (July 11, 2017, 11:47 AM), <https://www.independent.co.uk/life-style/gadgets-and-tech/news/darpa-co,mputer-plug-in-brains-lost-vision-hearing-speech-restore-us-military-r-n-d-research-neural-a7835131.html>.

49. *Id.*

50. *Id.*

51. *Id.*

the Magnetic, Optical and Acoustic Neural Access (MOANA) project is exploring a minimally invasive, nonsurgical approach to connect human brains with a machine via a special helmet. Users will undergo gene therapy that will make certain neurons absorb light when firing. This allows the helmet to detect active brain regions using red and infrared light that can pass into the skull. A second type of gene therapy will prime other neurons so that they can be fired remotely using magnets. In this way, the MOANA set up should be able to both read brain activity in one user and then write brain activity to another. Researchers hope to use the technology to transfer one person's vision into the mind of someone who is visually impaired.<sup>52</sup>

Similarly, in 2018, researchers from the University of Pennsylvania and Thomas Jefferson University in Philadelphia developed a brain implant that increased memory, by fifteen percent, which is approximately the amount Alzheimer's disease seizes from people over a two and half year period.<sup>53</sup> It is anticipated that this brain implant can benefit those suffering from either dementia or traumatic brain injuries.<sup>54</sup> "The device works like a pacemaker, sending electrical pulses to aid the brain when it is struggling to store new information, but remaining quiet when it senses that the brain is functioning well."<sup>55</sup>

In addition to the restoration of lost human functions, DARPA has embarked on maximizing individual learning in the shortest amount of time, at the least possible costs.<sup>56</sup> To achieve this goal, the "Targeted Neuroplasticity Training" (TNT) program wishes to advance the pace and effectiveness of cognitive skills training "through the precise activation of peripheral nerves that can in turn promote and strengthen neuronal connections in the brain."<sup>57</sup> According to TNT personnel, "you can think of peripheral nerve

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52. Ian Randall, *US Military Funds Mind-Reading Helmet That May Let Soldiers Telepathically Control Robots or Drones and Could Even Give the Gift of Sight to the Blind*, DAILY MAIL, <https://www.dailymail.co.uk/sciencetech/article-7111199/US-Military-funds-mind-reading-helmet-let-soldiers-TELEPATHICALLY-control-robots-drones.html> (June 6, 2019, 8:22 AM).

53. Benedict Carey, *A Brain Implant Improved Memory*, *Scientists Report*, N.Y TIMES (Feb. 6, 2018), <https://www.nytimes.com/2018/02/06/health/brain-implant-memory.html>.

54. *Id.*

55. *Id.*

56. *Boosting Synaptic Plasticity to Accelerate Learning*, DEF. ADVANCED RSCH. PROJECTS AGENCY (Mar. 16, 2016), <https://www.darpa.mil/news-events/2016-03-16>.

57. *Id.*

stimulation as a way to reopen the so-called ‘Critical Period’ when the brain is more facile and adaptive. TNT technology will be designed to safely and precisely modulate peripheral nerves to control plasticity at optimal points in the learning process.”<sup>58</sup> The goal is to reduce the duration and costs of Defense Department training and, simultaneously, improve employee learning outcomes.<sup>59</sup> If this technology proves to be successful, “TNT could accelerate learning and reduce the time needed to train foreign language specialists, intelligence analysts, cryptographers, and others.”<sup>60</sup>

In 2018, DARPA introduced its Next-Generation Nonsurgical Neurotechnology (N<sup>3</sup>) program to allow able bodied people to directly communicate with a device such as a computer or the Internet.<sup>61</sup> The most significant challenge facing the N<sup>3</sup> four year effort is “overcoming the complex physics of scattering and weakening of signals as they pass through skin, skull, and brain tissue.”<sup>62</sup> In addition, during 2019 research commenced regarding “a minimally invasive neural interface system, called BrainSTORMS (Brain System to Transmit Or Receive Magnetolectric Signals), involves the development of a novel nanotransducer that could be temporarily introduced into the body via injection and then directed to a specific area of the brain to help complete a task through communication with a helmet-based transceiver.<sup>63</sup> Upon completion, the nanotransducer will be magnetically guided out of the brain and into the bloodstream to be processed out of the body.”<sup>64</sup>

As it pertains to competitive athletes, current brain related technology includes a “protein shake for the brain,” known as “brain zapping” while using headphones, at a cost of \$699, Halo Sport operates in what it calls “neuropriming.”<sup>65</sup> “The product when worn provides a series of mild electric pulses that creates a warm, tingling sensation on top of the head. Those

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58. *Id.*

59. *Id.*

60. *Id.*

61. *Nonsurgical Neural Interfaces Could Significantly Expand Use of Neurotechnology*, DEF. ADVANCED RSCH. PROJECTS AGENCY (Mar. 16, 2018), <https://www.darpa.mil/news-events/2018-03-16>.

62. *Id.* Additional issues associated with this technology include “cross talk and low signal-to-noise ratio.”

63. *Battelle-Led Team Wins DARPA Award to Develop Injectable, Bi-Directional Brain Computer Interface*, BATTELLE (May 20, 2019), <https://www.battelle.org/newsroom/press-releases/press-releases-detail/battelle-led-team-wins-darpa-award-to-develop-injectable-bi-directional-brain-computer-interface>.

64. *Id.*

65. Eric Fisher, *Halo’s Headphones Produce ‘A Protein Shake for the Brain’*, SPORTS BUS. J. (Jan. 9, 2017), <https://www.sportsbusinessdaily.com/Journal/Issues/2017/01/09/Leagues-and-Governing-Bodies/Company-Watch.aspx>.

pulses seek to develop deeper signals and stronger ties between the user's brain and muscles, allowing for greater training and ultimately greater athletic performance."<sup>66</sup> As of 2017, athletes who had used this technology included members of the Golden State Warriors, the United States Ski and Snowboarding Association, National Football League players, and Major League Baseball teams.<sup>67</sup> However, this technology has not been scientifically proven because it lacks a large scale, peer reviewed medical journal study.<sup>68</sup> With the apparent willingness of athletes to embrace brain zapping it is reasonable to expect that football players, given their competitive impulses, will welcome brain chips in order to prolong their careers.

Given the foregoing, this article will evaluate brain chip technology and WBE computer aided advancements from a public policy perspective. Specifically, social construction of prospective government legal regulation connected with football player brain chip and WBE developments will be explored. In addition, this article will examine animal rights case law as a portent for legal regulation regarding future use of football player brain chips and WBE. Moreover, this review will address WBE and brain chip technology in the context of football's current non-discrimination rules as applied to its players. Lastly, patent, and copyright, laws will be applied to football players who may eventually elect to use brain-based technology. However, tort liability concepts such as medical malpractice, informed consent, product liability, negligence, recklessness, and strict liability have been intentionally omitted from this article. Presently, there is voluminous amounts of sport-based law review articles examining these legal theories. It is anticipated that when brain chip technology and WBE emerges traditional tort concepts will be applied as previously evaluated within the law review literature.

## II. PUBLIC POLICY AND SOCIAL CONSTRUCTION OF THE LAW

When evaluating the advancement of football players from a biological being to a synthetic competitor the law is imperative. Specifically, where to legally "draw the lines" will be influenced by public policy concerns and social construction assertions. As an indicator, during 2017, for example, the European Parliament stated that there should be a balance between legal regulation of artificial intelligence without inhibiting biological and computer-based innovation.<sup>69</sup> In this respect, Parliament pointed out that:

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66. *Id.*

67. *Id.*

68. *Id.*

69. *European Parliament resolution of 16 February 2017 with recommendations to the Commission on Civil Law Rules on Robotics*, EUR. PARL. DOC. (T8-0051/2017).

humankind stands on the threshold of an era when ever more sophisticated robots, bots, androids and other manifestations of artificial intelligence (“AI”) seem to be poised to unleash a new industrial revolution, which is likely to leave no stratum of society untouched, it is vitally important for the legislature to consider its legal and ethical implications and effects, without stifling innovation.<sup>70</sup>

Further, during 2021, the European Commission proposed a new, transformative legal framework to govern the use of artificial intelligence (AI) in the European Union. The proposal adopts a risk-based approach whereby the uses of artificial intelligence are categorized and restricted according to whether they pose an unacceptable, high, or low risk to human safety and fundamental rights. The policy is widely considered to be one of the first of its kind in the world which would, if passed, have profound and far-reaching consequences for organizations that develop or use technologies incorporating artificial intelligence.<sup>71</sup>

When applying the Parliament’s artificial intelligence declarations to football players who opt to use either brain chips or WBE, how should the law balance individual rights with these technological advances? For instance, should individual player’s legal rights dwindle when there is either an “altered biological life” while using brain chips or an “absence of life in the biological sense” when one has decided to adopt WBE?<sup>72</sup> Further, the United States Congress, and its state counterparts, will be compelled to evaluate if synthetic football players should be legally authorized to compete. Legislatures will be influenced by their constituents on how they use social construction regarding the use of football player brain chips and WBE. Societal evaluations could include the following:

(1) Public fears of tampering with biological humans in order to “play God;”

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70. *Id.*; see Laman Yusifova, *Ethical and Legal Aspects of Using Brain Computer Interface in Medicine: Protection of Patient’s Neuro Privacy* (2020) (Ph.D. dissertation, Alma Mater Studiorum, University of Bologna), for additional insight regarding brain chips and European privacy law.

71. Oliver Yaros et al., *The European Union Proposes New Legal Framework for Artificial Intelligence*, MAYER BROWN (May 5, 2021), <https://www.mayerbrown.com/en/perspectives-events/publications/2021/05/the-european-union-proposes-new-legal-framework-for-artificial-intelligence>.

72. *Id.*

- (2) A national presumption that biological humans are the only creation which should be endorsed by society; and
- (3) Technology's intrusion that alters biological human life as it is currently understood by people is artificial, unnatural, and ergo, wrongfully interferes with what is regarded as the natural course of human development.<sup>73</sup>

As it pertains to present human use of artificial implants, there are at least three million people who have availed themselves of this type of technology.<sup>74</sup> For example, "research on the cochlear implant and retinal vision have furthered the development of interfaces between neural tissues and silicon substrate micro probes."<sup>75</sup> In 2018, eight Florida siblings, who were born deaf were successfully fitted with "bilateral cochlear implants, allowing them to hear for the first time and develop communication skills."<sup>76</sup>

Cochlear implants are used in patients who suffer from severe hearing loss due to a genetic defect . . . or whose inner ear has been damaged and hearing aids are ineffective. The implants come in two parts, a surgically implanted internal device and an external speech processor worn near the ear.<sup>77</sup>

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73. Cary Funk, Brian Kennedy, & Elizabeth Podrebarac Sciupac, *U.S. Public Opinion on the Future Use of Gene Editing*, PEW RSCH. CTR. (July 26, 2016), <https://www.pewresearch.org/science/2016/07/26/u-s-public-opinion-on-the-future-use-of-gene-editing/>. A 2016 Pew Public Opinion Poll regarding the use of brain implants had, in general, indicated that those who had possessed strong religious convictions were either wary or opposed. Further, Americans were more comfortable with brain implants usage to address a disability as compared to able bodied use.

74. Ellen M. McGee & G.Q. Maguire, Jr., *Ethical Assessment of Implantable Brain Chips*, TWENTIETH WORLD CONGRESS OF PHILOSOPHY (Aug. 1998), <https://www.bu.edu/wcp/Papers/Bioe/BioeMcGe.htm>.

75. *Id.*

76. Nancy Dahlberg, *They Were Born Deaf. Now, These Six Siblings Can Hear, Talk, and Sing Joyously*, MIAMI HERALD <https://www.miamiherald.com/living/health-fitness/article214293894.html> (July 27, 2018, 10:45 AM).

77. *Id.*; see *Cochlear Implants Market is Expected to Reach US\$ 4,124.1 Mn with a CAGR of 11.9% from 2019-2027 by Cochlear Ltd., MED-EL, Sonova, Nurotron Biotechnology Co. Ltd., Medtronic, Demant A/S*, ICROWDNEWswire (June 22, 2021, 4:00 AM), <https://icrowdnewswire.com/2021/06/22/cochlear-implants-market-is-expected-to-reach-us-4-124-1-mn-with-a-cagr-of-11-9-from-2019-2027-by-cochlear-ltd-med-el-sonova-nurotron-biotechnology-co-ltd-medtronic-demant-a-s/>. Moreover, the global cochlear implants market is anticipated to increase to approximately US\$ 4.1 million in 2027. In 2018 it was US\$ 1.5 million. Given this economic opportunity, India, Malaysia and Thailand all had financially invested in world class cochlear implants and surgery facilities regarding the emerging industry of "medical tourism." Could brain chip and WBE medical tourism emerge as part of the medical tourism industry as well?

The Florida hearing implant recovery example illustrates that at least on an incremental basis people welcome technology assistance to improve one's quality of life. However, this technological assistance did not transform these children from biological beings to synthetic ones. Instead, a hearing disability was cured, and an individual's quality of life was enhanced. How should public policy respond when youth athletes, with their parents' consent and support, use brain chips in connection within an intensely competitive sport such as football?<sup>78</sup> Football is a complex game and mastery of the playbook results in a distinct competitive advantage. Simultaneously, some youth athlete parents are notoriously driven to provide the very best opportunities for their child competitors, no matter the consequences. With this in mind, should the law, as a matter of public policy, permit the installation of brain chips for football playing children?<sup>79</sup>

Moreover, the law when it creates public policy constructs social reality.<sup>80</sup> "Actions have meaning, even if their meaning differs across individuals. Even if there is no single meaning, there is a range or distribution of meanings, and the question we ask here is how that range gets made, and, more importantly, changed."<sup>81</sup> Further, "[c]onstruction is about change. Social meaning construction is about social meaning change."<sup>82</sup>

"Law was the word in the American founding, concerned as it was with 'a government of laws and not of men.'"<sup>83</sup> United States Supreme Court Justice Oliver Wendell Holmes observed that: "the felt necessities of the time, the prevalent moral and political theories, intuitions of public policy, avowed or unconscious, even the prejudices which judges share with their fellow-men, have had a good deal more to do than the syllogism in determining the rules by which men should be governed."<sup>84</sup>

When weighing the costs and benefits of either brain chips or WBE in the context of public policy formation and social construction application where to "draw the legal line" is daunting. For instance, who should be legally permitted to engage in WBE? Should all football competitors be entitled to retain WBE career centered immortality, if available? Who should pay for either brain chip

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78. See Ellen M. McGee & G.Q. Maguire, Jr., *Ethical Assessment of Implantable Brain Chips*, TWENTIETH WORLD CONGRESS OF PHILOSOPHY (Aug. 1998), <https://www.bu.edu/wcp/Papers/Bioe/BioeMcGe.htm>.

79. *Id.*

80. Lawrence Lessig, *The Regulation of Social Meaning*, 62 U. CHI. L. REV. 943, 948 (1995).

81. *Id.* at 955.

82. *Id.* at 961.

83. Theodore J. Lowi, *Law vs. Public Policy: A Critical Exploration*, 12 CORNELL J.L. & PUB. POL'Y, 493, 494 (2003) (emphasis omitted).

84. *Id.* at 495 (quoting OLIVER WENDELL HOLMES, JR., *THE COMMON LAW* (1881)).

or WBE medical procedures? Should it be confined to only those “immortals” who own superior playing talent? How should a legislature gauge the probability of harm sustained to the brain during football practices and competitions, and, therefore, require either brain chip or WBE assistance?

As it pertains to brain harm caused by football, presently, “the short-term and long-term effects of sub concussive impacts are currently poorly understood and difficult to study.”<sup>85</sup> Scientists cannot, within a typical clinical setting, study concussion caused harm because there is not any satisfactory procedure to introduce a suitable control group comprising people with similar bodies and activities, but without any head trauma.<sup>86</sup> Moreover, “diagnoses themselves are somewhat subjective, and based in part on a patient’s description of his or her injury.”<sup>87</sup> Lastly, not all concussions are identical. Instead, “a broad range of injuries, from concussions to bleeding of the brain, are lumped into the category of traumatic brain injuries . . . .”<sup>88</sup>

As a result of the medical knowledge shortcomings surrounding football induced concussions, should WBE be used to provide an unharmed, healthy, albeit synthetic, brain to replace the concussion damaged ones as required? Obviously, as of 2021 WBE brain storage requirements and the timing of football player “brain replacement” remains to be medically proven and technologically determined. More notably, scholars have pointed out that “if emulation of particular brains is possible and affordable, and if concerns about individual identity can be met, such emulation would enable back-up copies and ‘digital immortality.’”<sup>89</sup> Moreover, “brain emulation would itself be a test of many ideas in the philosophy of mind and philosophy of identity, or provide a novel context for thinking about such ideas.”<sup>90</sup> As it pertains to football, are Americans willing to consent, via their legislatures, to decide who is human or not? Who should ultimately decide whether one can be a diminished biological human possessing a brain chip implant? Additionally, who can become a synthetic human who has willingly undergone brain replacement via WBE?

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85. Rebecca Boyle, *Concussions and Traumatic Brain Injuries in Football: What We Know We Don't Know*, INSIDE SCI. (Sept. 8, 2017), <https://www.insidescience.org/news/concussions-and-traumatic-brain-injuries-football-what-we-know-we-dont-know>.

86. *Id.*

87. *Id.*

88. *Id.*

89. Anders Sandberg & Nick Bostrom, *Whole Brain Emulation: A Roadmap, Technical Report #2008-3*, FUTURE OF HUMANITY INST., OXFORD UNIV. (2008), <http://www.fhi.ox.ac.uk/reports/2008-3.pdf>.

90. *Id.*

### III. ANIMAL RIGHTS – HARBINGER FOR FOOTBALL BASED LEGAL REGULATION REGARDING BRAIN CHIPS OR WBE

Currently, neither the use of brain chips nor the utilization of WBE has been directly addressed either legislatively or judicially in the United States. However, when evaluating who is considered human, and who is not, there are a few federal case decisions pertaining to whether animals should enjoy human status, and, therefore, be afforded equal protection under the law. For instance, the Ninth Circuit Court of Appeals in *Cetacean Community. v. Bush*, reflected on whether the world's Cetaceans, (i.e., whales, dolphins, and porpoises), possessed standing to file a lawsuit.<sup>91</sup> In this case, the plaintiffs argued that the United States Navy use of underwater sonar system “pings” caused Cetacean’s tissue damage and interfered with their mating rituals and feeding activities.<sup>92</sup>

Surprisingly, in the case, the Court held that plaintiffs did allege sufficient facts to establish standing under the United States Constitution pursuant to Article III.<sup>93</sup> The Ninth Circuit held that the “sole plaintiff in this case” were the Cetaceans.<sup>94</sup> The Court pointed out that “Article III does not compel the conclusion that a statutorily authorized suit in the name of an animal is not a ‘case or controversy.’”<sup>95</sup>

Nevertheless, the Court did ultimately affirm the district court's dismissal of plaintiff's case because the Cetaceans lacked statutory standing under the environmental statutes at issue during this dispute. While rendering its opinion the Court recognized that:

[i]t is obvious that an animal cannot function as a plaintiff in the same manner as a juridically competent human being. But we see no reason why Article III prevents Congress from authorizing a suit in the name of an animal, any more than it prevents suits brought in the name of artificial persons such as corporations, partnerships or trusts, and even ships, or of juridically incompetent persons such as infants, juveniles, and mental incompetents.<sup>96</sup>

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91. *Cetacean Cmty. v. Bush*, 386 F.3d 1169, 1171 (9th Cir. 2004).

92. *Id.* at 1171-72.

93. *Id.* at 1175.

94. *Id.* at 1171.

95. *Id.* at 1175.

96. *Id.* at 1176.

In concluding its opinion, the Court observed that “[i]f Congress and the President intended to take the extraordinary step of authorizing animals as well as people and legal entities to sue, they could, and should, have said so plainly.”<sup>97</sup>

Similarly, in *Naruto v. Slater*, the Ninth Circuit Court of Appeals considered the case of Naruto, who at the time was a seven-year-old crested macaque that lived on the island of Sulawesi, Indonesia.<sup>98</sup> In 2011, David Slater, a wildlife photographer, left his camera unattended and Naruto took photographs of himself.<sup>99</sup> The plaintiff asserted ownership, and sued for copyright infringement when these photographs were published by the defendant.<sup>100</sup>

In holding against the plaintiff, the Court did recognize that as was previously decided by the Cetacean court, Naruto’s complaint included facts sufficient to establish United States Constitution Article III standing.<sup>101</sup> Therefore, the Court reasoned that it was compelled to determine whether Naruto possessed statutory standing to sue for copyright infringement.<sup>102</sup>

In its holding, the Court judged that their previous Cetacean decision did not rely on the fact that the statutes at issue in that case referred to “persons” or “individuals.”<sup>103</sup> The Court states:

Instead, the court crafted a simple rule of statutory interpretation: if an Act of Congress plainly states that animals have statutory standing, then animals have statutory standing. If the statute does not so plainly state, then animals do not have statutory standing. The Copyright Act does not expressly authorize animals to file copyright infringement suits under the statute. Therefore, based on the court’s precedent in *Cetacean*, Naruto lacked statutory standing to sue under the Copyright Act.<sup>104</sup>

As a result of the *Cetacean* and *Naruto* holdings, the United States Congress, along with its state-based counterparts, possess lawmaking authority in order to

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97. *Id.* at 1179.

98. *Naruto v. Slater*, 888 F.3d 418, 420 (9th Cir. 2018).

99. *Id.*

100. *Id.*

101. *Id.* at 425-26.

102. *Id.*

103. *Id.* at 426.

104. *Id.*

establish who should benefit from human status.<sup>105</sup> However, where to draw the lines in order to establish reasonable public policy via the use of statutory authority is a challenge for the American people and their elected officials. To be more precise, should public policy be socially constructed to afford either animals, robots, humans using brain chips, or those fully synthetic humans who successfully completed WBE legal rights and responsibilities as their biological human counterparts? This analysis should be mindful that social meaning statutory construction will result in social meaning change connected to the use of brain chips or WBE. Positive excitement for the future as well as fear of it will impact any legal analysis. For example, should this technology be regarded as an innovation to benefit society, or lead to the demise of it? Should it be studied as an existential crisis to humanity, or as part of its evolution?

#### IV. FOOTBALL BRAIN CHIPS/WBE USE – IS DISCRIMINATION WAITING TO HAPPEN?

*Reinvention is not changing what is, but creating what isn't. A butterfly is not more caterpillar or a better or improved caterpillar; a butterfly is a different creature.*<sup>106</sup>

It is reasonable to legally anticipate that with the advent of brain chips and WBE connected with football players, all sport governing bodies will be bound to decide on how it may amend its existing eligibility rules. On this point, non-discriminatory clauses have been promulgated in order to protect all football players from unlawful harm.<sup>107</sup> In this context, “discrimination” is understood as either individuals or groups unfairly treating brain chip using or WBE consuming football players because of their status.<sup>108</sup> Further, “[d]iscrimination takes the form of continuing segregation and exclusion” in this case, those football players who may be declared ineligible from competition, or team membership, because of their use of either brain chips or WBE.<sup>109</sup>

As a result, “[t]he most promising strategic approaches to reducing discrimination appear to be to introduce anti-discrimination law, which sets a

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105. See *Cetacean Cmty. v. Bush*, 386 F.3d 1169 (9th Cir. 2004); *Naruto v. Slater*, 888 F.3d 418 (9th Cir. 2018).

106. Tracy Goss, Richard T. Pascale & Anthony Athos, *The Reinvention Roller Coaster: Risking the Present for a Powerful Future*, HARV. BUS. REV. ON CHANGE, Nov.-Dec. 1993, <https://hbr.org/1993/11/the-reinvention-roller-coaster-risking-the-present-for-a-powerful-future>.

107. Liz Sayce, *Stigma, Discrimination, and Social Exclusion: What's in a Word?*, 7 J. MENTAL HEALTH 331, (1998).

108. *Id.*

109. *Id.*

benchmark for what our societies consider acceptable in treatment” of football players using brain chips or WBE.<sup>110</sup>

Historically, one strategy available to subordinated groups seeking to dispel the moral authority of dominant groups involves emphasizing the negative or oppressive activities of such groups. Since dominant groups are often granted authority regardless of their actual behaviors, subordinate groups may simply point out or make known the backstage realities and discriminatory actions that dominant groups rely upon for their social elevation.<sup>111</sup>

However, what was not reasonably contemplated at the time of football player eligibility rules were created was the use of either brain chips or WBE. Therefore, is it wise public policy to extend sport-based non-discrimination clauses to include football players who either possess non-biological brain chips or those who may be considered “synthetic” given their use of WBE technology? Once this technology becomes available, football eligibility rules will regulate the anticipated discrimination claims when players reinvent themselves from biological beings to synthetic ones, similar to “caterpillars” transforming into “butterflies.”

The major sports governing bodies which regulate football include the National Collegiate Athletic Association (NCAA), the National Football League/National Football League Players Association (NFL/NFLPA) via its Collective Bargaining Agreement (CBA), and each state’s interscholastic athletic association rules and regulations.<sup>112</sup> For example, the NCAA Division I Manual nondiscrimination clause states, in pertinent part, as follows:

2.6 The Principle of Nondiscrimination. . . . The Association shall promote an atmosphere of respect for and sensitivity to the dignity of every person. It is the policy of the Association to refrain from discrimination with respect to its governance

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110. *Id.*

111. J.E. Sumerau & Ryan T. Cragun, *I Think Some People Need Religion: The Social Construction of Nonreligious Moral Identities*, 77 *SOCIOLOGY OF RELIGION* 386, 389 (2016) (citations omitted).

112. 2021-22 *NCAA Div. I Manual*, NCAA (Aug. 1, 2021), <https://web3.ncaa.org/lstdbi/reports/getReport/90008>; *Collective Bargaining Agreement*, NFL/NFLPA (2020), [https://nflpaweb.blob.core.windows.net/media/Default/NFLPA/CBA2020/NFL-NFLPA\\_CBA\\_March\\_5\\_2020.pdf](https://nflpaweb.blob.core.windows.net/media/Default/NFLPA/CBA2020/NFL-NFLPA_CBA_March_5_2020.pdf); *The Pupil Nondiscrimination Guidelines for Athletics*, WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION & WISCONSIN INTERSCHOLASTIC ATHLETIC ASSOCIATION (Aug. 2013), <https://www.wiaawi.org/Portals/0/PDF/nondiscrimination.pdf>.

policies, educational programs, activities and employment policies, including on the basis of age, color, disability, gender, national origin, race, religion, creed or sexual orientation. It is the responsibility of each member institution to determine independently its own policy regarding nondiscrimination.<sup>113</sup>

Similarly, the NFL/NFLPA CBA non-discrimination clause provides, in pertinent part, as follows:

Article 49 Player Security Section 1. No Discrimination: There will be no discrimination in any form against any player by the NFL, the Management Council, any Club or by the NFLPA because of race, religion, national origin, sexual orientation, or activity or lack of activity on behalf of the NFLPA.<sup>114</sup>

On the interscholastic athletics level, and using the Wisconsin Interscholastic Athletic Association's Handbook, as an example, their non-discrimination clause provides, in pertinent part, as follows:

The intent of most civil rights laws is to ensure equitable treatment for minority groups and individuals who have been subject to discrimination. There is a comprehensive and relatively complex framework of federal and state case law, statutes, regulations, and guidance addressing the civil rights of students in our public schools. The Pupil Nondiscrimination Guidelines for Athletics provides direction regarding equity in athletics based on a thorough review of federal and state law and guidance.<sup>115</sup>

When applying sport governing bodies' anti-discrimination rules to football players using either brain chips or WBE, there is a tension between embracing this technology and preserving current, traditional public policy notions connected with "natural" biological football players. Initially, football

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113. 2021-22 NCAA Div. I Manual, NCAA, art. II § 6 (Aug. 1, 2021), <https://web3.ncaa.org/lstdbi/reports/getReport/90008>.

114. *Collective Bargaining Agreement*, NFL/NFLPA, art. 49 § 1 (2020), [https://nflpaweb.blob.core.windows.net/media/Default/NFLPA/CBA2020/NFL-NFLPA\\_CBA\\_March\\_5\\_2020.pdf](https://nflpaweb.blob.core.windows.net/media/Default/NFLPA/CBA2020/NFL-NFLPA_CBA_March_5_2020.pdf).

115. *The Pupil Nondiscrimination Guidelines for Athletics*, WISCONSIN DEPARTMENT OF PUBLIC INSTRUCTION & WISCONSIN INTERSCHOLASTIC ATHLETIC ASSOCIATION (Aug. 2013), <https://www.wiaawi.org/Portals/0/PDF/nondiscrimination.pdf>.

governing bodies will probably consider intrusion of technology as a form of “brain doping.” In sum, it may be that traditional sport doping reasoning, to prevent cheating and protect an athlete’s health, will be put forward to prevent this technological innovation from being used by football players.

However, brain chips and WBE are beyond the traditional anti-doping legal analysis. Performance enhancing drug use within football centers fully on the body. In contrast, brain technology will compel football regulators to deeply examine one’s understanding of personal identity and that of human consciousness. It is the brain that establishes one’s sense of being. As a result, football’s stakeholders should apply their anti-discrimination clauses, not their anti-doping rules, to evaluate the status of these “new” athletes during their analysis of integrating brain-based technology innovation within the existing football culture. In sum, a paradigm shift will be required from the current football based “doping is cheating” philosophy to an innovative attitude which can accept, or least appreciate, a football player emerging from a biological state of being to the synthetic one.

Moreover, anti-discrimination clause drafting has evolved over time in response to shifting societal attitudes.<sup>116</sup> For example, when anti-discrimination rules were first drafted during the 1960s, they were initially confined to gender, race, creed, religion, national origin and color.<sup>117</sup> Afterwards, during the ensuing fifty years, anti-discrimination regulations included age, disability and most recently, sexual orientation.<sup>118</sup> Given this trend, it should be anticipated that brain chip and WBE players will be recognized as a protected class within the next fifty years.

#### V. PATENT LAW - WBE OWNERSHIP BELONGS TO THE CREATOR

With respect to WBE technology ownership matters, patent as well as copyright law is relevant in connection with revenue distribution issues also known as “Show Me the Money?”<sup>119</sup> As it pertains to patents, current American case law indicates that ownership of WBE technology will be bestowed to the creator.<sup>120</sup> For instance, in *Association for Molecular Pathology v. Myriad*

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116. Risa Lieberwitz, *Employment Discrimination Law in United States: On the Road to Equality?*, THE JAPAN INSTITUTE FOR LABOUR POLICY AND TRAINING (Feb. 19, 2008), <https://www.jil.go.jp/english/reports/documents/jilpt-reports/no6.pdf>.

117. *Id.*

118. *The New Equal Protection*, JUSTIA, <https://law.justia.com/constitution/us/amendment-14/09-the-new-equal-protection.html> (last visited Oct. 10, 2021).

119. See Bailey Gallagher, Comment, *The Singularity is Near: Implications for Patent and Copyright Law in the Age of Whole Brain Emulation*, 26 FED. CIR. B.J. 1, 17 (2016), for a detailed analysis of patent and copyright laws regarding WBE ownership issues.

120. See *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576, 589 (2013).

*Genetics, Inc.* (“Myriad”), the United States Supreme Court confronted two patent law biology based technology issues.<sup>121</sup> The first question was whether a naturally occurring deoxyribonucleic acid (“DNA”) segment, a product of nature, should enjoy patent eligibility merely because it had been isolated by researchers.<sup>122</sup> The second dispute concerned whether complementary DNA (“cDNA”) was patent eligible because it was not naturally occurring.<sup>123</sup> In this case, the defendants discovered that the BRCA1 and BRCA2 genes were associated with breast and ovarian cancer.<sup>124</sup>

According to the Court, “Section 101 of the Patent Act provides: ‘Whoever invents or discovers any new and useful . . . composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.’”<sup>125</sup> Further, the Court noted that:

We have ‘long held that this provision contains an important implicit exception[:] Laws of nature, natural phenomena, and abstract ideas are not patentable.’ Rather, ‘they are the basic tools of scientific and technological work’ that lie beyond the domain of patent protection . . . without this exception, there would be considerable danger that the grant of patents would ‘tie up’ the use of such tools and thereby ‘inhibit future innovation premised upon them.’ This would be at odds with the very point of patents, which exist to promote creation.<sup>126</sup>

Given the facts of this case, the Court held that Myriad’s principal contribution was uncovering the precise location and genetic sequence of the BRCA1 and BRCA2 genes within chromosomes 17 and 13.<sup>127</sup> The concern was

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121. *Id.* at 580.

122. *Id.*

123. *Id.*; GERALD LITWACK, HUMAN BIOCHEMISTRY 257-317 (Acad. Press ed., 2017). cDNA is known to be synthesized or manufactured from a mRNA or messenger RNA template. It is synthesized in a reaction that is catalyzed by the reverse transcriptase and DNA polymerase enzymes.

124. *Ass’n for Molecular Pathology*, 569 U.S. at 582-83; See generally *BRCA Gene Mutations: Cancer Risk and Genetic Testing*, NAT’L CANCER INST., <https://www.cancer.gov/about-cancer/causes-prevention/genetics/brca-fact-sheet#q1> (last visited Dec. 1, 2021). BRCA1 and BRCA2 are human genes that produce tumor suppressor proteins. These proteins help repair damaged DNA and, therefore, play a role in ensuring the stability of each cell’s genetic material. When either of these genes is mutated, or altered, such that its protein product is not made or does not function correctly, DNA damage may not be repaired properly. As a result, cells are more likely to develop additional genetic alterations that can lead to cancer.

125. *Ass’n for Molecular Pathology*, 569 U.S. at 589 (quoting Patent Act of 1952, 35 U.S.C. § 101).

126. *Id.* (citations omitted).

127. *Id.* at 590.

whether this discovery rendered the genes patentable.<sup>128</sup> While the Court acknowledged that while *Myriad* found the location of the BRCA1 and BRCA2 genes, that discovery, did not, by itself, render the BRCA genes “new . . . composition[s] of matter” that were patent eligible.<sup>129</sup> On the other hand, cDNA did not present the same obstacles to patentability as naturally occurring, isolated DNA segments.<sup>130</sup> The Court declared that the creation of a cDNA sequence from mRNA resulted in an exons-only molecule that was not naturally occurring.<sup>131</sup> Therefore, cDNA is not a “product of nature” and was patent eligible under 35 U.S.C. § 101.<sup>132</sup>

The United States Supreme Court decision in *Myriad* provides guidance regarding prospective patent ownership of WBE technology. First, biological human brains are naturally occurring and are not patent eligible.<sup>133</sup> Second, WBE is not naturally occurring.<sup>134</sup> Instead, WBE, as currently understood, is a technology based synthetic brain which will be housed within a biological created human body.<sup>135</sup> More specifically, WBE will be a result of “reverse engineering” where computer scans are planned to completely map a human brain once exascale technology becomes available.<sup>136</sup> The *Myriad* Court recognized that the cDNA was a manufactured creation, and, therefore, should enjoy patent law protection.<sup>137</sup> Similarly, it is anticipated that WBE, because it is a synthetic, manufactured creation, should be patent worthy.<sup>138</sup> The challenge for future patent law case decisions will be to specifically identify what is naturally occurring, and what is not, as the WBE process is developed and becomes standard operating procedure.

## VI. COPYRIGHT LAW - WBE IS A WORK OF ATHLETE AUTHORSHIP

According to the United States Supreme Court as found in *Feist Publications, Inc. v. Rural Telephone Service Co.*, to qualify for copyright

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128. *Id.*

129. *Id.* at 591.

130. *Id.* at 594.

131. *Id.*

132. *Id.* at 595.

133. *See generally id.* at 589-590.

134. Linssen & Lemmens, *supra* note 25.

135. Randal A. Koene, Sci. Dir. of the 2045 Initiative, Founder and CEO of Carboncopies.org and NeuraLink Co., *Whole Brain Emulation: Reverse Engineering a Mind*, Address at the Global Future 2045 International Congress (Oct. 15, 2013), <http://gf2045.com/read/268/>.

136. *Id.*

137. *Ass'n for Molecular Pathology*, 569 U.S. at 580.

138. Linssen & Lemmens, *supra* note 25.

protection, a work must be original to the author.<sup>139</sup> The Court believed that the word “original” as applied to copyright law “means only that the work was independently created by the author (as opposed to copied from other works), and that it possesses at least some minimal degree of creativity.”<sup>140</sup> In addition, the Court pointed out that “the requisite level of creativity is extremely low; even a slight amount will suffice. The vast majority of works make the grade quite easily, as they possess some creative spark, ‘no matter how crude, humble or obvious’ it might be.”<sup>141</sup>

Interestingly, the Court pronounced that original works “are founded in the creative powers of the mind.”<sup>142</sup> Specifically, “the Court defined ‘author,’ in a constitutional sense, to mean ‘he to whom anything owes its origin; originator; maker.’”<sup>143</sup> In sum, according to the Court, “[t]he primary objective of copyright is not to reward the labor of authors, but ‘[t]o promote the Progress of Science and useful Arts.’”<sup>144</sup>

When applying the *Feist* holding to WBE based copyright law issues, a human brain is a “one of kind” original.<sup>145</sup> No two brains are identical in connection with one’s consciousness, self-identity, beliefs, and reasoning abilities.<sup>146</sup> Both the biological brain and its synthetic counterpart are owned by a human being.<sup>147</sup> A brain is as distinctive as one’s fingerprint.<sup>148</sup> The owner of a brain meets the low threshold of creativity when thinking occurs, even if it is considered “crude, humble, or obvious.”<sup>149</sup> Both the biological brain, along with the synthetic one, both possess the “creative powers of the mind.”<sup>150</sup> As it pertains to football players, creativity occurs when they learn their playbooks, prepare for competition during practices, engage in brain injury risk management practices, execute their assignments, adjust their mode of play

139. *Feist Publ'ns, Inc. v. Rural Tel. Serv. Co.*, 499 U.S. 340, 345 (1991).

140. *Id.* (quoting 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT §§ 2.01 [A]-[B] (1990)).

141. *Id.* (quoting 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 1.08 [C][1] (1990)).

142. *Id.* at 346 (quoting *The Trade-Mark Cases*, 100 U.S. 82, 94 (1879)).

143. *Id.* (quoting *Burrow-Giles Lith. Co. v. Sarony*, 111 U.S. 53, 58 (1884)).

144. *Id.* at 349 (quoting U.S. CONST. art. I, § 8, cl. 8).

145. *See id.* at 340-341.

146. *See* Bill Hathaway, *Imaging Study Shows Brain Activity May Be as Unique as Fingerprints*, YALE NEWS (October 12, 2015), <https://news.yale.edu/2015/10/12/imaging-study-shows-brain-activity-may-be-unique-fingerprints>.

147. Gallagher, *supra* note 119.

148. Hathaway, *supra* note 146.

149. *See Feist*, 499 U.S. at 345 (quoting 1 MELVILLE B. NIMMER & DAVID NIMMER, NIMMER ON COPYRIGHT § 1.08 [C][1] (1990)).

150. *See id.* at 346. (quoting *The Trade-Mark Cases*, 100 U.S. 82, 94 (1879)).

during games, and review film to improve on-field performance. The transition from a biological to synthetic brain promotes “the Progress of Science and useful Arts.”<sup>151</sup> “It is not the engineer's ideas and expressions that are encapsulated in the simulation. Instead, the emulation is composed exclusively of the Subject's human content. The Subject therefore authors the simulation's substance and introduces creativity, entitling her to exclusive copyright ownership.”<sup>152</sup>

## CONCLUSION

Why this article? Why now? The thesis of this paper concerns change, and how football governing bodies should apply the law when responding to these technological innovations. Both the use of brain chips and WBE, as applied to football, compels new legal thinking when exploring a new, technology-based football culture. Initially, this thinking requires the application of existing legal principles and current football-based regulations to create value for all stakeholders. For example, should either brain chips or WBE be legally authorized to maintain the appealing, albeit violent, aspects of football? When should either brain chips or WBE be used in connection with brain injuries? This article is urging an “open mind” approach with respect to this anticipated and significant societal change. In this regard, Peter Whybrow stated that it is easier to criticize than to construct and it is easier to rely upon the past because it is comfortable.<sup>153</sup> To consider a football player using either brain chips or WBE will unsettle the existing football order and culture.

Historically, both law and sport are generally conservative and are slow to effectively address change. However, when it is ready to compete in the “change arena” it possesses significant impact. For example, it was football which led integration in 1946 when four African American players, Woody Strode and Kenny Washington (Los Angeles Rams) as well as, Bill Willis and Marion Motley (Cleveland Browns) reintegrated professional football a year before Jackie Robinson did the same in 1947 for professional baseball while he was employed with the Brooklyn Dodgers.<sup>154</sup> Could professional football be a leader

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151. *Id.* at 349 (quoting U.S. CONST. art. I, § 8, cl. 8).

152. Gallagher, *supra* note 119, at 27.

153. PETER C. WHYBROW, *THE WELL-TUNED BRAIN: NEUROSCIENCE AND THE LIFE WELL LIVED* (2015).

154. Matthew Fleischer, *Op-Ed: Two L.A. Rams Desegregated Football. They've Never Been Given the Credit They Deserve*, L.A. TIMES (Feb. 3, 2019, 3:15 AM), <https://www.latimes.com/opinion/op-ed/la-oe-fleischer-nfl-football-desegregation-rams-20190203-story.html>; Branson Wright, *Cleveland Browns Pioneers Bill Willis and Marion Motley Are Focus of Attention in Documentary – Talking Shop (Video)*, CLEVELAND.COM, [https://www.cleveland.com/browns/2014/09/cleveland\\_browns\\_pioneers\\_bill.html](https://www.cleveland.com/browns/2014/09/cleveland_browns_pioneers_bill.html) (Jan. 12, 2019, 2:06 AM).

again and “integrate” its competition by admitting brain chip and WBE players in 2047?

As it pertains to technology’s role within American society, it was Neil Postman who pointed out that “it is inescapable that every culture must negotiate with technology, whether it does so intelligently or not. A bargain is struck in which technology giveth and technology taketh away. The wise know this well, and are rarely impressed by dramatic technological changes, and never overjoyed.”<sup>155</sup> In this regard, football, as currently understood, should not surrender to technology or be seduced by the beauty of either brain chips or WBE. Instead, the law and football governing authorities should lead the technology, instead of the technology leading football players.

For example, Michio Kaku has opined that with the use of brain chips, and in particular, WBE, consciousness will occur outside of the biological body, and that WBE can create human immortality.<sup>156</sup> As it pertains to football, does football’s stakeholders desire to have their heroes of one generation compete with others from different eras in order to determine the “Greatest Player of All Time?” Is it desirable to have players engage in never ending careers? As Postman has cautioned, “our task is to understand what that design is—that is to say, when we admit a new technology to the culture, we must do so with our eyes wide open.”<sup>157</sup>

Perhaps, one way to apply laws, rules, and regulations which impact football-based brain chip technology and WBE is to use of “Appreciative Inquiry.”<sup>158</sup> This process highlights the following skills and attributes:

- (1) Discover the “best of what is”— which current football processes can work effectively with either brain chips or WBE in order to preserve the tough, physical contact which is an enduring ethos of football?
- (2) Dream “what might be” — how can brain chips and WBE, on an ongoing basis, either reduce, or eliminate, football player concussions, dementia, CTE or suicide?
- (3) Design “what should be”— plan how brain chips can be used to improve football player competition techniques in order to prevent brain injuries from initially occurring.

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155. NEIL POSTMAN, *TECHNOPOLY: THE SURRENDER OF CULTURE TO TECHNOLOGY* 9 (1993).

156. MICHIO KAKU, *THE FUTURE OF THE MIND: THE SCIENTIFIC QUEST TO UNDERSTAND, ENHANCE AND EMPOWER THE MIND* (2014).

157. POSTMAN, *supra* note 155, at 11.

158. See Theodore Kinni, *The Art of Appreciative Inquiry*, HARV. BUS. SCH. (Sept. 22, 2003), <http://hbswk.hbs.edu/archive/3684.html>.

Simultaneously, strategize as to how WBE should be applied when either dementia or CTE is found within a football player's brain.

(4) Create a destiny based on “what will be”— how should lawmakers, and football's stakeholders, participate in the creation of a brain chip/WBE standard operating procedure with respect to the legal rights of all involved?<sup>159</sup>

In sum, if either brain chips or WBE were available would you feel comfortable watching someone whom you love play football?

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159. *See id.*