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"VR": Virtual Reality, or Very Risky? Injuries and Liability from Virtual Reality Headsets

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I. INTRODUCTION

Virtual reality (VR) headsets are an excellent example of the innovations of modern computer gaming technology, and an equally excellent example of the risks that such improvements may bring. VR headsets utilize "a three-dimensional, stereoscopic head-tracker display, hand/body tracking and binaural sound" to provide "an immersive, multi-sensory experience."[1] As of 2020, there were over 50 million VR users in the United States, with slightly less than half of these consumers using VR headsets.[2] Gaming revenue from VR is expected to hit $6.9 billion by 2025.[3] Many major companies manufacture VR headsets, including Meta, [4] Sony,[5] Nintendo,[6] Google,[7] and Samsung[8] (notably, Apple has also announced it will release a VR headset in 2024). While these headsets provide a unique form of entertainment, they may carry more risks than consumers may realize—and when these injuries occur, the injured consumer may have nowhere left to turn for compensation.

The injuries caused by VR headsets, as well as the resulting liability, have become a growing problem for both users and the headset manufacturers. As the video game experience has enhanced over the years, so have the injuries that accompany the experience. Relatively minor hand injuries were observed when the PlayStation 2 and similar consoles were popular,[9] and these injuries became more pronounced when the Wii introduced motion capture.[10] Now that VR combines this motion capture with a significantly more immersive experience, these injuries have become appreciably more severe, including shoulder

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[1] Tomasz Mazuryk & Michael Gervautz, *Virtual Reality - History, Applications, Technology and Future*, 4, RESEARCHGATE (Dec. 1999), https://www.researchgate.net/publication/2617390_Virtual_Reality_-_History_Applications_Technology_and_Future [https://perma.cc/36NK-YALH].

[2] Victoria Petrock, *US Virtual and Augmented Reality Users 2021*, INSIDER INTELLIGENCE (April 15, 2021), https://www.insiderintelligence.com/content/us-virtual-augmented-reality-users-2021 [https://perma.cc/A88N-6LJJ].

[3] J. Clement, *Virtual Reality (VR) Gaming Content Revenue Worldwide in 2019, 2020 and 2025*, STATISTA (Aug. 25, 2023), https://www.statista.com/statistics/499714/global-virtual-reality-gaming-sales-revenue/ [https://perma.cc/6548-FMZK].

[4] Team Counterpoint, *Global XR (AR & VR Headsets) Shipments Market Share: By Quarter*, COUNTERPOINT (Sept. 19, 2022), https://www.counterpointresearch.com/global-xr-ar-vr-headsets-market-share/ [https://perma.cc/KLS7-VAMN].

[5] *Health Warnings,* SONY, https://www.playstation.com/en-us/legal/health-warning/ [https://perma.cc/EQR8-E4CP] (last visited Nov. 4, 2022).

[6] *Information About the VR Mode of Nintendo Labo Toy-Con 04: VR Kit*, NINTENDO, https://en-americas-support.nintendo.com/app/answers/detail/a_id/43723/~/information-about-the-vr-mode-of-nintendo-labo-toy-con-04%3A-vr-kit [https://perma.cc/QT6B-2ATQ] (last visited Oct. 6, 2022).

[7] *Google Cardboard Product Safety Information*, GOOGLE (Oct. 6, 2022), https://arvr.google.com/cardboard/product-safety/ [https://perma.cc/U9K5-3J83].

[8] *Mobile Device User Manual*, SAMSUNG (Nov. 20, 2022), https://content.syndigo.com/asset/681b6f70-c448-442f-8a46-eeeb8579fe74/original.pdf [https://perma.cc/Y9Q7-GGBD].

[9] Thomas Fysh & J.F. Thompson, *A Wii Problem*, 102 J. R. SOC. MED., 501 (2009) [https://perma.cc/F9X3-SV6F].

[10] Sparks, et al., *Did Too Much Wii Cause Your Patient's Injury?*, 60 J. FAMILY PRACTICE, 404 (2011) [https://perma.cc/ATB5-8B6E].

dislocation,[11] broken neck,[12] and traumatic brain injury.[13] As the realism of these virtual activities increases, the accompanying risks may begin to more closely resemble the activity being simulated, rather than simply playing a video game—somewhat like how using an indoor golfing simulator would be more similar to playing golf than playing a golf video game on a Nintendo 64 or PlayStation 2-like console.[14] Furthermore, there may be fundamental issues with a product that limits the user's perception during use, and therefore limits the user's ability to comply with the accompanying instructions that are designed to prevent injury.

But where are consumers expected to turn when they are injured by their VR headsets? Traditional products liability is generally equipped to handle injuries caused by hardware alone, but under current interpretations of products liability doctrine, persons injured by the combination of software and hardware may not have an adequate means of compensation for their injuries. While manufacturers of VR headsets may adequately warn for an activity for which the hardware is "normally" used, software developers may design programs that simulate riskier activity, or encourage the user to use the headset in a way that was not contemplated by the headset manufacturer. Moreover, even without the additional complications caused by the intersection of hardware and software, it may not be possible to comply with the given instructions while the headset is in use. Without certain safety features, users can do little to follow these instructions. Absent doctrinal or regulatory changes, users of this rapidly growing market will continue to receive serious injuries and have no means of redress.

In the absence of other doctrinal changes, there should be minimum standards for warnings for these types of products, particularly in relation to the extent of injuries that may occur while using VR headsets. However, a change in the doctrine relating to the reasonableness of the expectation by manufacturers that warnings for VR headsets will be read and heeded may also serve to open the door for relief for injured consumers. In the context of VR, instructions that must be complied with during use of the headset may be physically impossible to follow, thus defeating the reasonableness of such a presumption. Next, this doctrine should broaden the definition of the term "product" to include software or video games for the purpose of warning liability. Because the products liability doctrine does not create liability for software developers,[15] developers may create games or other software

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[11] Noor Al-Sibai, *Virtual Reality Users Keep Suffering Horrible Injuries*, FUTURISM (Feb. 1, 2022), https://futurism.com/neoscope/vr-injuries [https://perma.cc/GLC6-8DQN].
[12] Baur, et al., *Cervical Spine Injury After Virtual Reality Gaming; a Case* Report, 15 J. OF MED. CASE REPORTS (2021) [https://perma.cc/57R2-MPKM].
[13] Warner & Teo, *Neurological Injury from Virtual Reality Mishap*, 2021 BRITISH MED. J. (2021), https://casereports.bmj.com/content/bmjcr/14/10/e243424.full.pdf [https://perma.cc/F4VG-W3X4].
[14] Sparks et al., *supra* note 10.
[15] *See* Wilson v. Midway Games, 198 F. Supp. 2d 167, 174 (D. Conn. 2002); *see also* James v. Meow Media, Inc., 90 F. Supp. 2d 798, 800 (W.D. Ky. 2000).

that simulate activity which falls outside the expectation of the manufacturer, and thus, outside the manufacturer's ability to warn about the risks of such simulated activity. Simulated activity may often pose similar risks to the activity being simulated, and the software developer is in the best position to give such warnings. The last proposed change is already being implemented among some higher-end products[16]—the implementation of certain safety features, both in hardware and software. Regulations could require such safety features, although to some extent, consumers weigh how much they are willing to spend on hardware against their desired level of safety. Nonetheless, such consumer choice has little substantive value if the consumer is not made adequately aware of the risks involved.

This article will begin by introducing virtual reality technology and highlighting both the size and continued growth of the industry. Second, it will describe the history of injuries received from playing video games and underscore how subsequent technological enhancements have increased the risks that users face. Third, it will describe and compare several warnings given by popular manufacturers of VR headsets. Fourth, it will generally examine the law that surrounds VR headsets and video games product liability. Finally, this article will posit several prescriptive elements—for both hardware manufacturers and software developers—that may help to mitigate the amount and extent of injuries received from using VR headsets, as well as increase the likelihood that such injured users will have some avenue of recovery.

II. BACKGROUND TO THE PROBLEM OF VR INJURIES AND LIABILITY

A. What is Virtual Reality?

Virtual reality headsets provide "an interactive and immersive (with the feeling of presence) experience in a simulated (autonomous) world."[17] What distinguishes VR from many other forms of entertainment is the level of immersion which they provide: "[t]he illusion of participation in a synthetic environment rather than external observation of such an environment. VR relies on a three-dimensional, stereoscopic head-tracker display, hand/body tracking and binaural sound. VR is an immersive, multi-sensory experience."[18] By holding or strapping the device to their face, VR allows the user to preempt many of their senses including sight, sound, and at least to some extent, touch, given that the user is actively moving their body around with respect to what they are experiencing in the game or other activity.[19]

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[16] *Health and Safety Warnings*, META (Nov. 21, 2022) [https://perma.cc/U9SP-W5UG].
[17] Mazuryk & Gervautz, *supra* note 1, at 4.
[18] *Id*.
[19] VR is similar to, but distinct from, augmented reality (AR). AR utilizes similar technology but allows the user to perceive their surroundings. The user's reality is "augmented," rather than replaced entirely. This distinction is important in this context because augmented reality allows for a greater perception of the user's surroundings, thus mitigating or eliminating many of the risks discussed herein. *See* Alexander Gillis,

B. Growth of the VR Industry

The VR headset market has increased significantly in recent years and appears to be maintaining this trajectory. As of 2020, there are 50.2 million VR users in the U.S.[20] By 2025, the number of VR headsets shipped annually is expected to hit 28.6 million units.[21] In terms of the number of shipments of VR headsets, Oculus dominates the competition with 66% of the market share, as of the second quarter in 2022.[22] By comparison, the company with the second-largest market share for that quarter, Pico, only comprised 11% of the market share.[23] This market extends beyond the hardware involved. In 2019, the virtual reality software market was expected to reach a value of 1.9 billion U.S. dollars.[24] VR gaming revenue is expected to reach 2.4 billion U.S. dollars by 2024.[25]

Furthermore, VR should not be dismissed as only used for entertainment purposes. This technology is increasingly utilized non-recreationally, such as in the medical industry. One study found that 182 games on the Steam[26] platform were related to mental health and therapeutic uses.[27] The authors concluded that, "[a]s these games are easily acquired, they could hold great potential for expanding virtual reality as a tool in therapy in clinical settings or at home using commercial headsets."[28] A review in the Journal of Clinical Neuroscience "supports the idea that rehabilitation through new VR tools could positively affect MS [multiple sclerosis] patients' outcomes by boosting motivation and participation with a better response to treatment."[29]

Although medical use currently occupies a relatively niche portion of the VR market, other non-recreational uses may become more

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Augmented Reality (AR), TECHTARGET (July 2022), https://www.techtarget.com/whatis/definition/augmented-reality-AR [https://perma.cc/2P6S-H35J].

[20] Petrock, *supra* note 2.

[21] David Nagel, *Virtual Reality Headsets See Explosive Growth*, THE JOURNAL (July 1, 2021), https://thejournal.com/articles/2021/07/01/virtual-reality-headsets-see-explosive-growth.aspx [https://perma.cc/T4KS-3QJ9].

[22] Team Counterpoint, *supra* note 4.

[23] *Id*.

[24] Lionel Vailshery, *Global Consumer Virtual Reality Software Market Size 2016-2022*, STATISTA (Mar. 17, 2022), https://www.statista.com/statistics/550474/virtual-reality-software-market-size-worldwide/ [https://perma.cc/8RPD-LJJT].

[25] Clement, *supra* note 3.

[26] Steam is "the most widely used video game distribution platform in the world." Barry Elad, *25+ Steam Statistics 2022 Users, Most Played Games, Market Share and Demographics*, ENTERPRISEAPPSTODAY (Aug. 15, 2022), https://www.enterpriseappstoday.com/stats/steam-statistics.html [https://perma.cc/L4ET-G8ZA].

[27] Thunström, et al., *Prevalence of Virtual Reality (VR) Games Found Through Mental Health Categories on STEAM: A First Look at VR on Commercial Platforms as Tools for Therapy*, 76 NORDIC J. OF PSYCHIATRY 474, 476 (Dec. 01, 2021), https://www.tandfonline.com/doi/pdf/10.1080/08039488.2021.2003859?needAccess=true [https://perma.cc/Z3LC-ZYDR].

[28] *Id*. at 484.

[29] Maggio et al., *Virtual Reality in Multiple Sclerosis Rehabilitation: A Review on Cognitive and Motor Outcomes*, 65 J. OF CLINICAL NEUROSCIENCE 106 (2019), https://www.sciencedirect.com/science/article/pii/S0967586819301857 [https://perma.cc/83DF-9YTK].

common in the near future. For instance, Oculus's parent company, Meta, has big plans for VR. Since 2019, Meta, which is owned by Mark Zuckerberg, poured $36 billion into Reality Labs, its division that oversees both VR products and the "immersive version of the internet" it calls the "metaverse."[30] Even though its Oculus headsets continue to dominate the market,[31] Meta's Reality Labs division has only returned $5.3 billion over that period.[32] This lack of revenue is mainly due to the cost of the "more than 10,000 people working on metaverse projects."[33] Meta's vision for VR is one where video conferencing calls at work, for example, are replaced with a VR environment.[34] Zuckerberg has said that the "defining quality of the metaverse will be a feeling of presence[—]like you are right there with another person in another place."[35] Meta does not stand alone in its pursuit of this style of virtual environment, as Microsoft has developed a similar VR environment that it calls "Microsoft Mesh."[36] Such VR meeting spaces "allow colleagues to meet as avatars in VR or participate in real-world meetings as photorealistic holograms."[37] There certainly could be benefits for a company that adopts such technology. For instance, meetings could be no longer constrained to limitations of physical space or physical presence. Although teleconferencing software has become more popular since the rise of the COVID-19 pandemic, VR may more accurately mimic physical presence in a way that teleconferencing software, such as Zoom or Skype, cannot replicate. This would be particularly helpful for an increasingly remote work force.[38]

C. History and Extent of Injuries from Video Games

With greater control comes greater risk. When playing video games was a less immersive experience, injuries incurred during gameplay tended to manifest as repetitive stress injuries in the extremities.[39] A classic example is that of "PS2 thumb:" overuse of the controller presented as blisters and/or flaking skin on the thumbs.[40] The authors also describe a series of injuries that were common in the 1990s, known separately as "Nintendonitis" or "Nintendinitis."[41] These injuries

[30] Grace Dean, *Meta Has Pumped $36 Billion Into its Metaverse and VR Businesses Since 2019. These 4 Charts Show the Scale of its Extreme Spending — and Huge Losses.*, BUSINESS INSIDER (Oct. 29, 2022), https://www.businessinsider.com/charts-meta-metaverse-spending-losses-reality-labs-vr-mark-zuckerberg-2022-10 [https://perma.cc/2SCW-PZBL].
[31] Team Counterpoint, *supra* note 4.
[32] Dean, *supra* note 30.
[33] *Id*.
[34] Suparna Dcunha, *Working in the Metaverse: What Virtual Office Life Could Look Like*, FAST COMPANY MIDDLE EAST (Sep. 20, 2022), https://fastcompanyme.com/technology/working-in-the-metaverse-what-virtual-office-life-could-look-like/ [https://perma.cc/VS8N-BKUM].
[35] *Id*.
[36] *Id*.
[37] *Id*.
[38] *Id*.
[39] Fysh & Thompson, *supra* note 9.
[40] *Id*.
[41] *Id*.

presented as an ulcer to the palm or a strain of the wrist and/or elbow, respectively.[42] Injuries from such classic consoles that utilized only a simple, button-operated controller appear to be almost exclusively repetitive injuries caused by overuse—the aforementioned palm ulcer, as an example, developed "[a]fter an enthusiastic and prolonged session with a new" Nintendo 64 system.[43]

The Wii ushered in a new era of video games. No longer were users limited to pressing buttons on the controllers but were instead able to move the controllers themselves to provide input. This shift led to more "physically demanding" games which resulted in a greater class of injuries.[44] The term "Wii knee" was coined to describe avulsion of the ligaments in the knee;[45] other injuries consisted of infraspinatus [rotator cuff] tendonitis, traumatic haemothorax, effort thrombosis, dislocated patella, and fractured limbs.[46] One 46-year-old man ruptured his Achilles tendon while using a Wii,[47] an injury usually caused by "high impact activities," and often without any "previous injury or problem reported in the affected leg."[48] The Journal of Family Practice describes several common categories of Wii injuries, including bursitis, enthesitis, and epicondylitis.[49] Furthermore, the authors suggest that "the types of injuries caused by playing simulated sports are generally the same as (or similar to) injuries sustained by those engaging in the sport itself."[50]

Like the Wii, VR headsets have ushered in yet another era of video games with respect to the level of immersion they provide. Also like the Wii, these advancements have come at the price of increased severity of injuries received while using the product. One notable injury, for example, includes an otherwise healthy thirty-one-year-old male who fractured his seventh cervical vertebra.[51] "Rapid movements" and "additional weight" of the headset, as well as the "decoupling of audiovisual stimuli from the perceived proprioceptive information," may have been responsible for this man's injury. Additionally, the British Medical Journal published a case study of an otherwise healthy fifty-seven-year-old man who was diagnosed with a "spinal cord injury, hypoglossal nerve injury, vertebral artery dissection and traumatic brain injury" as the result of a "low-impact VR-related fall."[52] The authors of the case study observed that "self-sustained injury risks exist with the use

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[42] *Id*.
[43] *Id*.
[44] *Id*.
[45] *Id*.
[46] *Id*. at 501-502.
[47] Singh, et al., *Nintendo Wii Related Achilles Tendon Rupture: First Reported Case and Literature Review of Motion Sensing Video Game Injuries*, 2014 BRITISH MED. J. (2014) [https://perma.cc/F348-W8EP].
[48] *Id*.
[49] Sparks et al., *supra* note 10, at 407-408.
[50] *Id*. at 404.
[51] Baur, et al., *supra* note 12.
[52] Warner & Teo, *supra* note 13.

of this technology in the uncontrolled home environment, however, the public awareness of these risks may not be recognised [*sic*]."[53]

Although these seem like extreme examples, they are likely not isolated incidents. As the number of headsets being sold increases, so too does the number of reported VR injuries. The British insurance company Aviva saw a 31% "jump in home contents claims involving VR headsets" in 2021 from the previous year.[54] It seems that many of these injuries arose because the user was reacting to the game, i.e., the "game demanded 'swipe'" (of the controller), or "a zombie jumped out [at me]."[55]

These injuries are not limited to the users of VR headsets. Although the type and extent of injury may be different, there are reported instances of bystanders receiving injuries at the hands of a roommate or spouse that was using a VR headset.[56] This sort of injury is not entirely unforeseeable—it could be as simple as a VR "user wearing a headset [that] might walk into a houseguest."[57] An English man accidentally hit his girlfriend in the head while playing a game "that involves striking moving neon blocks with laser swords, or sidestepping or ducking to avoid them, to the tempo of popular songs."[58] In recounting the event to the Washington Post, he recalled, "I heard this shriek and the crumble of someone hitting the floor."[59] While his girlfriend was able to laugh off this particular incident,[60] this incident is likely reflective of a larger pattern. Non-users that are injured may not have the chance to review the relevant health and safety warnings that accompany the product, and therefore, are less likely to appreciate the risks of entering an area occupied by someone currently using a VR headset.

D. Warnings Given by Popular VR Manufacturers

Nintendo was quickly pressured to release warnings to supplement those originally provided after the Wii was released in 2006. In response to property damage and injuries, Nintendo issued a recall within a month of the Wii's release that included both additional warnings and new physical safety features, such as an improved wrist

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[53] *Id*.
[54] Jem Bartholomew, *Rising Popularity of VR Headsets Sparks 31% Rise in Insurance Claims*, THE GUARDIAN (Feb. 12, 2022), https://www.theguardian.com/technology/2022/feb/12/rising-popularity-of-vr-headsets-sparks-31-rise-in-insurance-claims [https://perma.cc/FXF2-VY6R].
[55] *Id*.
[56] Sarah Needleman & Salvador Rodriguez, *VR to the ER: Metaverse Early Adopters Prove Accident-Prone*, WALL ST. J. (Feb. 1, 2022), https://www.wsj.com/articles/metaverse-virtual-reality-vr-accident-prone-meta-11643730489 [https://perma.cc/S2ZU-VAZC].
[57] Eugene Volokh, *Tort Lawsuits Against VR/AR Companies When Users Physically Injure Outsiders*, WASH. POST (Mar. 31, 2017), https://www.washingtonpost.com/news/volokh-conspiracy/wp/2017/03/31/tort-lawsuits-against-vrar-companies-when-users-physically-injure-outsiders/ [https://perma.cc/EZT8-XAWF].
[58] Needleman & Rodriguez, *supra* note 56.
[59] *Id*.
[60] *Id*.

strap for the remotes.[61] The additional warnings and instructions recommended were (1) using the wrist strap; (2) keeping a firm grip on the controller; (3) making sure people and objects are out of range of movement; (4) drying hands if they become sweaty; and (5) refraining from "excessively rapid, violent or wide swinging motions."[62]

Nintendo seems to have learned from its mistakes. Nintendo's VR headset, Labo, contains warnings similar to the updated warnings the company released for the Wii.[63] An on-screen warning will warn you to take a break at regularly scheduled intervals and use is restricted to children ages seven and older.[64] Although the Labo does not warn about certain key virtual reality hazards, such as running into furniture or failing to maintain a safe environment, this lack of warning may be due to the fact that the headset is designed to be held to the face, rather than strapped on to the head.[65] Similarly, Nintendo only peripherally touches on the issue of the lack of perception while using the product,[66] likely due to the user's ability to readily remove the headset and regain their perception. In any case, it is important to note how these design choices influenced which warnings Nintendo felt the need to provide. Nintendo's general warnings (presumably applicable to their entire line of products) are quite thorough, and in some respects, are more specific than the warnings for its headset. These general warnings caution users about the risk of seizures, repetitive motion injuries, motion sickness, and TV damage.[67]

Oculus's Quest 2 also has thorough warnings. The Quest 2 warns of pre-existing medical conditions (e.g., seizure risks), instructs how to use in a safe environment, recommends a maximum time of use before taking a break, and warns that the "headset produces an immersive experience that can distract you and can completely block your perception of your actual surroundings."[68] Note, however, these warnings seem to center mainly around falling or colliding with objects. While these are major sources of injury, the warnings and instructions mention little to nothing about the potential for repetitive injury or cervical injury due to the weight of the device. Furthermore, the Quest 2 only warns that

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[61] *Nintendo of America Initiates Replacement Program for Wrist Straps Used with Controllers for the Wii Video Game System*, CONSUMER PRODUCT SAFETY COMM'N (Dec. 15, 2006), https://www.cpsc.gov/Recalls/2006/nintendo-of-america-initiates-replacement-program-for-wrist-straps-used-with [https://perma.cc/MYA9-DH2T].

[62] *Wii Wrist Strap Statement*, GAMESINDUSTRY (Dec. 15, 2006), https://www.gamesindustry.biz/wii-wrist-strap-statement [https://perma.cc/ZM9S-C77R].

[63] It should be noted that, for the purpose of this section, the included warnings from each manufacturer are not comprehensive. Rather, this section is intended to highlight that certain warnings are common across many manufacturers, while other manufacturers choose to not include certain warnings that are otherwise popular.

[64] Nintendo, *supra* note 6.

[65] *Id*.

[66] *Id*.

[67] *Important Health and Safety Precautions Information,* NINTENDO, https://www.nintendo.com/consumer/manuals/precautions_general.jsp [https://perma.cc/J9JH-3N4L] (last visited Nov. 4, 2022).

[68] Meta, *supra* note 16.

"serious injury" may occur from falls or collisions, yet provides no further information as to the nature of this potential injury. Meta is one of the only companies discussed herein to specifically direct the user to "[t]ake appropriate steps to prevent others from entering your play space, including people (particularly children) or pets who do not understand that your perceptions are limited," and "[i]f you sense that something or someone has entered your play space, stop, remove your headset, and pause your VR experience to make sure your play space is still safe."[69] Meta further directs users to only use the device indoors, because outdoor use "creates additional and uncontrolled hazards, like uneven and slippery surfaces and unexpected obstacles and vehicles (traffic)."[70]

Pico, the second-most popular VR headset in the second quarter of 2022,[71] also recommends that users take a break at certain intervals. Although the company instructs the user to maintain a certain amount of free space around themselves during use and warns of the potential for motion sickness, the instructions merely mentions this precaution is to "avoid injury" without respect to the extent of that injury.[72]

Although it is no longer available for sale, the Google Cardboard is another example of a shocking lack of warnings, especially considering the size of its parent company. The Cardboard only had four recommendations. These provided that the product should not be used (1) without taking frequent breaks; (2) by children without adult supervision; (3) while driving or operating heavy machinery; and (4) by persons who are at risk of seizures without consulting a doctor.[73] The simplicity of these warnings may have been due to the simplicity of the device. Like Nintendo's Labo, the Cardboard is held to the head, rather than strapped to the head. Even so, the absence of warnings related to extent of injury, potential for collision with household objects, and potential for falling are both notable and concerning, given the comparably low price point of the product and the extent of Google's reach as a company.

III. THE LAW SURROUNDING VIRTUAL REALITY AND PRODUCTS LIABILITY

A. Strict Products Liability, Generally

Much of the underlying products liability doctrine is reflected in the Restatement of Torts (Second) §402A. Subsection (1) provides:

> (1) One who sells any product in a defective condition unreasonably dangerous to the user or

[69] *Id*. at 4.
[70] *Id*. at 6.
[71] Team Counterpoint, *supra* note 4.
[72] *Important Health and Safety Notes,* PICO, https://www.picoxr.com/us/terms/user_safety.html [https://perma.cc/5QA2-J4QP] (last visited Nov. 4, 2022).
[73] Google, *supra* note 7.

> consumer or to his property is subject to liability for physical harm thereby caused to the ultimate user or consumer, or to his property, if:
>
> (a) the seller is engaged in the business of selling such a product, and
>
> (b) it is expected to and does reach the user or consumer without substantial change in the condition in which it is sold.[74]

The comments to §402A describe the contours of product liability. Comment *g* relates to defective condition generally and provides that if a product is "in a condition not contemplated by the ultimate consumer," it "will be unreasonably dangerous to him."[75] Comment *i* expands on this notion of an "unreasonably dangerous" product, defining such products as those that are "dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics."[76]

Comment *j* attaches a duty to warn or instruct to unreasonably dangerous products: "In order to prevent the product from being unreasonably dangerous, the seller may be required to give directions or warnings . . . as to its use."[77] Furthermore, Comment *j* observes that, "[w]here warning is given, the seller may reasonably assume that it will be read and heeded; and a product bearing such warning, *which is safe for use if it is followed*, is not in defective condition, nor is it unreasonably dangerous" [*emphasis added*].[78] Notably, Comment *j* also provides that sellers (and manufacturers) do not need to provide a warning when the product is "only dangerous, or potentially so, when consumed in excessive quantity, or over a long period of time, when the danger, or the potentiality of danger, is generally known and recognized."[79] The Restatement posits alcohol or foods with saturated fats as examples of products that may have such long-term risks.[80]

If a product's risks cannot be eliminated entirely by following particular instructions—in other words, if a product is "quite incapable of being made safe for their intended and ordinary use"—Comment *k* deems such products to be "unavoidably unsafe products."[81] The authors

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[74] RESTATEMENT (SECOND) OF TORTS § 402A (AM. L. INST. 1965).
[75] "The rule stated in this Section applies only where the product is, at the time it leaves the seller's hands, in a condition not contemplated by the ultimate consumer, which will be unreasonably dangerous to him... Safe condition at the time of delivery by the seller will, however, include proper packaging, necessary sterilization, and other precautions required to permit the product to remain safe for a normal length of time when handled in a normal manner." RESTATEMENT (SECOND) OF TORTS § 402A cmt. g (AM. L. INST. 1965).
[76] RESTATEMENT (SECOND) OF TORTS § 402A cmt. i (AM. L. INST. 1965).
[77] RESTATEMENT (SECOND) OF TORTS § 402A cmt. j (AM. L. INST. 1965).
[78] *Id*.
[79] *Id*.
[80] *Id*.
[81] RESTATEMENT (SECOND) OF TORTS § 402A cmt. k (AM. L. INST. 1965).

of the Restatement note that this "unavoidably unsafe" classification of products is "especially common in the field of drugs."[82]

Comment *n* provides that, while contributory negligence ("such negligence [that] consists merely in a failure to discover the defect in the product, or to guard against the possibility of its existence") is not defense to a strict products liability claim, assumption of risk ("voluntarily and unreasonably proceeding to encounter a known danger") is a defense to a strict products liability claim.[83] Therefore, "[i]f the user or consumer discovers the defect and is aware of the danger, and nevertheless proceeds unreasonably to make use of the product and is injured by it, he is barred from recovery."[84]

Case law provides further contours for the doctrine of products liability. For example, *Wilson Foods Corp. v. Turner* observed that one of the primary purposes of warnings is to inform consumer choice.[85] The court noted that, "[w]hether or not many persons would, when warned, nonetheless decide to use or consume the product, warnings are required to protect the interest of those reasonable foreseeable users who would, based on their own reasonable assessments of the risks and benefits, decline product use or consumption."[86] This principle was further affirmed by the court in *Watkins v. Ford Motor Co.*, which held that the purpose of a warning is not necessarily to prevent an accident. The court elaborated:

> Although a warning may have the net effect of preventing an accident, that is not what is required by the law. The law merely requires the warning to inform the customer of the nature and existence of the hazard, allowing him to make an informed decision whether to take on the risks warned of.[87]

While §402A served to abrogate the privity requirement,[88] the Restatement did not explicitly address the issue of bystander liability.[89] The issue of bystander liability was addressed in *Elmore v. American Motors Co.*., which held that strict liability claims are available to bystanders who are injured by defective products.[90] The court observed that bystander injury is often a "perfectly foreseeable risk," and that, if

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[82] *Id*.
[83] RESTATEMENT (SECOND) OF TORTS § 402A cmt. n (AM. L. INST. 1965).
[84] *Id*.
[85] Watkins v. Ford Motor Co., 190 F.3d 1213, 1219 (11th Cir. 1999) (*citing* Wilson Foods Corp. v. Turner, 218 Ga. App. 74 (Ga.Ct.App. 1995)) (reflecting shift toward Third Restatement).
[86] *Id*.
[87] *Id*.
[88] RESTATEMENT (SECOND) OF TORTS § 402A cmt. l (AM. L. INST. 1965).
[89] RESTATEMENT (SECOND) OF TORTS § 402A caveat 1 (AM. L. INST. 1965).
[90] Elmore v. Am. Motors Co., 70 Cal. 2d 578, 586 (1969).

anything, "the bystander is in greater need of protection from defective products which are dangerous."[91]

Finally, with respect to the extent of warnings required on products, *MacDonald v. Ortho Pharmaceutical Corp.* found the defendant pharmaceutical company liable because it did not properly convey "reasonable notice of the nature, gravity, and likelihood" of the risks related to that product.[92] There, although the manufacturer warned of death as a possible side effect of the birth control the plaintiff took, it did not specifically warn about the risk of stroke.[93] In determining the adequacy of a particular warning, the court noted that "[a] reasonable warning not only conveys a fair indication of the nature of the dangers involved, but also warns with the degree of intensity demanded by the nature of the risk."[94]

B. Is a Video Game a Product?

§402A does little to define a "product" as it applies in the products liability context. Thankfully, several cases provide the answer to this issue in the context of software, and more particularly, in the context of video games. A federal court in Washington State heard exactly this issue in *Quinteros v. InnoGames*, and held that the video game "as pled in this case is not a product under the" product liability statute in Washington State.[95] The court further elaborated:

> [O]nline games are not subject to Washington's products liability law. [The statute] in question defines "Product" as "any object possessing intrinsic value, capable of delivery either as an assembled whole or as a component part or parts, and produced for introduction into trade or commerce." [The game] is software as a service, not an "object," hence Plaintiff's product liability claim must fail as a matter of law.[96]

The court in *Quinteros* did not stretch to reach this conclusion. It relied on the decisions of both *Wilson v. Midway Games* and *James v. Meow Media*, *Inc*.[97] The former case, *Wilson v. Midway Games*, involved

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[91] *Id*.
[92] MacDonald v. Ortho Pharm. Corp, 394 Mass. 131, 139 (1985).
[93] *Id*. at 141.
[94] *Id*.
[95] Quinteros v. Innogames, 20, No. C19-1402RSM, 2022 U.S. Dist. LEXIS 55640 (W.D. Wash. Mar. 28, 2022).
[96] Bexis, *New Decision Directly Addresses the "Is Software a Product" Question*, DRUG & DEVICE LAW (May 2, 2022), https://www.druganddevicelawblog.com/2022/05/new-decision-directly-addresses-the-is-software-a-product-question.html [https://perma.cc/WV98-AK56].
[97] *Id*.

a 13-year-old boy who was stabbed in the chest by his friend.[98] This friend was addicted to the video game "Mortal Kombat," which he played on a virtual reality console.[99] The deceased child's mother filed a products liability claim against Midway Games, the developer of Mortal Kombat.[100] The court dismissed this claim, asserting that the video game did not fall under the definition of a product under the Connecticut Product Liability Act.[101] "Mortal Kombat is not sufficiently different in kind to fall outside the 'intangible' category that is demarcated in the case law, and thus the video game if proved as Wilson has described it in her pleadings cannot be a product within the ambit of the CPLA."[102]

The latter case, *James v. Meow Media, Inc.*, involved a similar fact pattern, where a fourteen-year-old boy shot and killed three other children.[103] Parents of the deceased children filed a products liability claim against the software developer of a video game that the perpetrator frequently played.[104] The court held that, "While computer source codes and programs are construed as 'tangible property' for tax purposes and 'goods' for UCC purposes, these classifications do not indicate that intangible thoughts, ideas, and messages contained in computer games ... should be treated as products for purposes of strict liability."[105]

When viewed in tandem, this series of cases clearly conveys that the general trend followed by courts is to not recognize video games as products, regardless of the platform on which they are played.

C. Litigation Surrounding Video Games and Virtual Reality

Given the scarcity of published litigation relating to more serious injuries caused by virtual reality headsets, an examination of litigation relating to injuries caused by the Nintendo Wii should serve as a useful tool in determining how courts may react to product and warning liability claims against VR manufacturers. Although Nintendo issued a recall shortly after the Wii's release, the number of injuries continued to grow. Nonetheless, the recall and additional warnings may have been instrumental for Nintendo in avoiding further liability as plaintiffs did not have much success in the ensuing litigation.

The most prominent case relating to the Wii and its accompanying warnings is *Elvig v. Nintendo of Am., Inc*. Prior to Nintendo's December 2006 recall for the Nintendo Wii, the plaintiff purchased one for her son, who lost control of his controller while

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[98] Wilson v. Midway Games, 198 F. Supp. 2d 167, 169 (D. Conn. 2002).
[99] *Id*. (Note that the court did not specify which VR headset model was involved in the injury, likely due to the fact that a claim was not brought against the headset's manufacturer.)
[100] *Id*.
[101] *Id*.
[102] *Id*. at 174.
[103] James v. Meow Media, Inc., 90 F. Supp. 2d 798, 800 (W.D. Ky. 2000), *aff'd by* 300 F.3d 683 (6th Cir. 2002).
[104] *Id*. at 801.
[105] *Id*. at 810.

playing a bowling game.[106] The strap broke, causing the controller to damage her television.[107] Plaintiff filed a claim that the wrist strap was an unreasonably dangerous product.[108] The court granted summary judgment for Nintendo, observing that the company had warned against letting go of the remote, and it "may reasonably assume that it will be read and heeded."[109]

Courts have noted the importance of these issues. In a pending class-action lawsuit, the court denied Nintendo's motion to keep 3,600 pages of customer complaints confidential. [110] These customer complaints related to injuries and property damage sustained while using the Wii.[111] The court observed that the case presented issues "important to the public...suggested by the popularity of the Wii console, in general, and the media attention paid to the plight of consumers who have cracked their expensive television screens, in particular."[112]

Although these issues may be important, individual plaintiffs may face enormous difficulty litigating those claims. Not only do companies such as Nintendo have massive resources to litigate extensively, but they may not entirely comply with the rules of the litigation process. In an earlier case, the Fifth Circuit determined that a trial court had improperly denied the plaintiff's motion notwithstanding the judgment, partly due to Nintendo's conduct during the litigation process. Plaintiff was playing a Super Nintendo Entertainment System when he suffered "a cluster of violent seizures."[113] He filed a failure to warn claim against Nintendo, but prior to the trial, Nintendo was held in contempt for altering discovery documents ordered by the court.[114] These documents included "all complaints of seizures from play of Mega Man X or the Super Nintendo system."[115] While these incidents do not speak directly to the potential underlying liability of these claims they do establish that, even if a plaintiff has an otherwise reasonable claim against a large corporation such as Nintendo, these companies are extremely adversarial and hesitant to comply with the legal process. Furthermore, this may explain the lack of published litigation in this area to some extent.[116]

Finally, courts on at least one occasion have dismissed a claim against a virtual reality headset manufacturer for failure to warn against

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[106] Elvig v. Nintendo of Am., Inc., 696 F. Supp. 2d 1207, 1208 (D. Colo. 2010).
[107] *Id.*
[108] *Id.*
[109] Elvig v. Nintendo of Am., Inc., Civil Action, 21, No. 08-cv-02616-MSK-MEH, 2010 U.S. Dist. LEXIS 100643 (D. Colo. Sep. 23, 2010).
[110] *Leonard v. Nintendo of Am., Inc.*, No. C06-1743JLR, 2007 U.S. Dist. LEXIS 108198 (W.D. Wash. Oct. 9, 2007).
[111] *Id.* at 3-4.
[112] *Id.* at 4.
[113] Roccaforte v. Nintendo of Am., Inc., 802 So. 2d 764, 765 (La. Ct. App. 2001).
[114] *Id.* at 767.
[115] *Id.*
[116] There appears to be very little, if any, available data pertaining to the number of cases in this area that have avoided litigation through settlement.

seizures. In *Khader v. Samsung Elecs. Am., Inc.*, the plaintiff had a seizure while using a Samsung VR headset.[117] He subsequently brought a failure to warn claim against Samsung and Valve, the latter being the company that provides the platform (Steam) for video games on such devices.[118] In 2022, plaintiff's claim against Valve was dismissed for failure to properly execute service (although this claim would have likely been dismissed anyway, as software does not fall under the definition of a "product," as discussed above). His claim against Samsung was also dismissed because Samsung had properly warned about the risk of seizures while using the device.[119] The warning in question provided that some specified percentage of the population may experience epileptic seizures while "experiencing virtual reality" or engaging in other similar activities, even if they have no prior history of epileptic seizures.[120]

There have been few, if any, published cases that relate to a non-seizure warning (or, for that matter, defective design) with respect to virtual reality headsets; however, some authors have posited this is certainly an option.[121]

IV. ANALYSIS: WHAT CAN BE DONE ABOUT THIS PROBLEM?

A. Importance of Warnings; Minimum Warning Standards

Absent other regulatory, legislative, or other doctrinal changes, at the very least, manufacturers should be required to warn as to the extent of injuries that may be received while using virtual reality headsets. Generally, §402A groups potentially dangerous products into two categories: "unreasonably dangerous" products[122] (e.g., the Ford Pinto that could have been made more safely[123]) and "unavoidably unsafe" products[124] (e.g., birth control that has inherent risks[125]). Virtual reality headsets probably belong in the "unreasonably dangerous" category of products, given their risk is greater than "that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge common to the community as to its characteristics."[126] In the context of unreasonably dangerous products, warnings serve dual purposes. To some extent, warnings (more specifically, instructions) serve to instruct the user as to how to properly

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[117] Khader v. Samsung Elecs. Am., Inc., 2-3, No. 21 C 4632, 2022 U.S. Dist. LEXIS 115456 (N.D. Ill. June 30, 2022).
[118] *Id*. at 4.
[119] *Id*. at 9.
[120] *Id*. at 7.
[121] *See* Eugene Volokh, *Tort Lawsuits Against VR/AR Companies When Users Physically Injure Outsiders*, WASH. POST (March 31, 2017), [https://perma.cc/EZT8-XAWF]; *Wearable Tech Touches Personal Injury Law,* SETTE LAW (Oct. 7, 2022), [https://perma.cc/NW7E-J7KG]; David Shiner, *Virtual Reality Injuries*, SHINER LAW GROUP (2022), [https://perma.cc/6ER2-ZAGJ].
[122] RESTATEMENT (SECOND) OF TORTS § 402A cmt. i.
[123] Hughes v. Ford Motor Co., 677 F. Supp. 76, 85 (D. Conn. 1986).
[124] RESTATEMENT (SECOND) OF TORTS § 402A cmt. k.
[125] MacDonald v. Ortho Pharm. Corp, 394 Mass. 131 (1985).
[126] RESTATEMENT (SECOND) OF TORTS § 402A cmt. i; *see also* Warner & Teo, *supra* note 13.

use the product in a safe manner.[127] More generally, warnings serve to enable consumer choice, both in deciding which product to purchase and in fully appreciating the risks of ultimately using that product.[128] Much of the language in the comments of §402A reflects the weight that the law places on consumers appreciating the extent of the risk (e.g., consumer expectations test for defective design[129] or assumption of risk serving as a defense to products liability).[130] But this raises an important question—how much warning is required? The answer to this question necessarily depends on the risks inherent to using the product.

As video game technology has evolved, so, too, have the injuries that accompany video games—an examination of this parallel evolution is particularly illustrative to evaluate the relationship between the nature of a video game (i.e., how it is controlled and typically played) and the extent of injury that arises from doing so. Back when video game consoles were controlled with simple, button-operated controllers, the extent of the risk involved was quite limited. This risk was largely limited to seizures (from the screen itself) and repetitive injuries (such as to the upper extremities).[131] These risks were largely not outside the contemplation of ordinary consumers, and courts were generally unwilling to hear failure to warn claims for these types of injuries. Furthermore, particularly with respect to the overuse injuries commonly seen on older consoles, the Restatement expressly denies failure to warn claims when that are predicated on the product's danger arising solely from overuse.[132]

Next, when the Wii introduced a new evolution of controller input in the form of motion capture, the class of injuries received from playing video games became demonstrably more severe. As observed above, these include avulsion of ligaments of the knee, infraspinatus tendonitis, traumatic haemothorax, effort thrombosis, dislocated patella, and fractured limbs.[133] Still, courts were reluctant to "make the jump" to extend failure to warn liability to the risks posed by playing on a Wii console.[134] The general rationale behind this reluctance seems to be that customers, even if previously unaware of the risks involved when playing video games on a Wii, were made sufficiently aware of these risks and how to operate the console in such a manner that mitigates or eliminates most of this risk.[135] The law has lagged behind technological

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[127] Note that, while warning and instruction are conceptually distinct, this paper will use "warning" to encompass both statements from manufacturer that relate to risk, as well as steps to be taken to mitigate such risk.
[128] Watkins v. Ford Motor Co., 190 F.3d 1213, 1219 (11th Cir. 1999) (*quoting* Wilson Foods Corp. v. Turner, 218 Ga. App. 74 (Ga.Ct.App. 1995)).
[129] RESTATEMENT (SECOND) OF TORTS § 402A cmt. g.
[130] RESTATEMENT (SECOND) OF TORTS § 402A cmt. n.
[131] Fysh & Thompson, *supra* note 9.
[132] RESTATEMENT (SECOND) OF TORTS § 402A cmt. j.
[133] Fysh & Thompson, *supra* note 9, at 501-502.
[134] *See* Elvig v. Nintendo of Am., Inc., 696 F. Supp. 2d 1207, 1215-1216 (D. Colo. 2010).
[135] *Id.*

innovation—seizures and overuse injuries were nothing new as far as video games were concerned, and consumers likely expected some obvious degree of risk involved in swinging a Wii controller around. In Restatement language, these dangers were "generally known and recognized."[136] Indeed, seizures and overuse injuries are not unlikely to occur with virtual reality headsets either. To some extent, courts have dealt with these issues the same way as they previously had with non-VR consoles.[137]

However, VR technology, by its very nature, carries a new category of risks that were not previously contemplated by consumers (and, arguably, are still not contemplated by consumers). These risks, as noted earlier, seem to be appreciably more dangerous than previous consoles that did not rely on this immersive technology. As a result, courts should be less hesitant to find a warning is insufficient compared to previous video game consoles. Even if courts believed the risks involved in swinging Wii controllers around were both obvious and manageable, the risk involved in similar motions is far greater when the user is completely unable to perceive their surroundings and obstacles. In other words, the risk of injury from features such as motion capture and total immersion are compounded when combined—and the combined risk is greater than the sum of the individual risks.

While the existence of this risk may be appreciable to some consumers, available research suggests that the average virtual reality user does not understand the extent of this risk. It may be obvious to users that they may hit other people or objects, or trip and fall over such obstacles, but the average user almost certainly does not expect the extent of injury that can arise, even without such a fall or collision. One may expect to break an arm or an ankle, or to be scraped and bruised to some extent, but users are likely not expecting to break their necks[138] or receive other severe nerve damage[139]— and at least in the former case, there was no fall, as the injury occurred simply due to the motion and weight of the device. Ultimately, using a VR headset goes beyond simply playing a video game and is instead much more similar to actually simulating an activity. Simulating activity appears to bear similar risks to actually undertaking the activity being simulated[140]—for instance, stepping into a golf simulator and physically swinging a golf club is much more similar to actually playing golf than playing a golf video game that uses a simple button controller. Therefore, simulating activity through virtual reality carries far more risk than simply playing video

[136] RESTATEMENT (SECOND) OF TORTS § 402A cmt. j.
[137] Khader v. Samsung Elecs. Am., Inc., 9, No. 21 C 4632, 2022 U.S. Dist. LEXIS 115456 (N.D. Ill. June 30, 2022) (denied liability for seizure after using VR headset, manufacturer warned appropriately [consistent with previous systems]).
[138] Baur, et al., *supra* note 12.
[139] Warner & Teo, *supra* note 13.
[140] Sparks et al., *supra* note 10.

games with a traditional controller, and to a large extent, the same is true compared to simple, Wii-style motion capture.

Take the case of a man who reinjured an old boxing injury.[141] He injured his shoulder years prior and was told by a doctor that he should no longer participate in boxing.[142] He subsequently thought it would be permissible to simulate similar activity with a virtual reality headset.[143] He said, "I wasn't supposed to do real boxing after the first injury, so I figured I can play games."[144] He dislocated his shoulder while doing so; the injury required months of physical therapy.[145] While he may have thought he was simply playing video games, the activity he simulated bore enough resemblance to actual boxing that he unknowingly stepped outside the bounds of his doctor's advice.[146] This instance further supports the inference posited by Sparks that simulated activities bear risks resembling the activity being simulated.[147] Furthermore, as the use of virtual reality technology becomes more prevalent in non-recreational contexts, it becomes increasingly more difficult to lump this technology into the same category of products as, and as carrying similar risks to, simple video games. This goes directly against the concept of awareness of risk that permeates warning liability.

Courts currently view the act of using a VR headset through the lens that they used when faced with someone playing a video game. This had a rather unappreciable effect on liability when the Wii introduced motion capture, but VR headsets provide a much more simulator-like experience than a traditional "video game" experience. The manufacturer of a simple handheld golf video game would obviously have a different warning standard than would a manufacturer of a full-size golf simulator, yet courts still view VR headsets as belonging more in the former category despite involving additional risks that are appreciably greater than traditional video game consoles.

An appropriate warning "warns with the degree of intensity demanded by the nature of the risk."[148] Notably, none of the health and safety instructions that have been discussed herein warned of the extent of injury beyond describing the potential injury as "serious." At the very least, manufacturers should be required to warn about certain specific injuries, for instance: cervical injury, nerve injury, broken bones, and dislocated joints. Manufacturers could even instruct users to stretch

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[141] Needleman & Rodriguez, *supra* note 56.
[142] *Id.*
[143] *Id.*
[144] *Id.*
[145] *Id.*
[146] *Id.*
[147] Sparks et al., *supra* note 10.
[148] MacDonald v. Ortho Pharm. Corp, 394 Mass. 131 (1985) (while this case refers to an unavoidably unsafe product [birth control], this should be analogous here because warning serves the same purpose of informing consumer choice. Furthermore, there may be an argument that virtual reality headsets are unavoidably unsafe—like prescription medications, VR headsets, to a certain extent, cannot be made safer by following instructions).

before simulating strenuous physical activity. Although warning fatigue is a concern, the benefit that more specific warnings confer to consumer choice likely outweighs the risk that an additional line or two of warnings would unnecessarily dilute all of the included warnings.

Thus, even if the manufacturers or software developers are not ultimately liable for these injuries, consumers should be able to make an informed choice as to the risks involved when simulating an activity. While people may expect minor injuries, broken necks and nerve injuries are likely outside the expectation of the average VR consumer. Whether manufacturers are required to implement these additional warnings through regulatory or legislative means, or whether manufacturers simply choose to do so voluntarily out of a general fear of liability, these additional warnings would certainly serve to better inform consumer choice with respect to the risks involved in simulating activity with almost total immersion.

B. Change in Interpretation of Doctrine: Expectation that Warnings Will Be Heeded

While additional warnings could help to inform consumer choice and possibly prevent injuries as some consumers will no longer buy these products, supplementation of additional warnings alone would do little to provide an avenue of relief for people that are injured by virtual reality products. However, some minor tweaks to the interpretation of Restatement §402A in the context of virtual reality products may provide this avenue of relief for injured users. Particularly, there are some questions as to the reasonable applicability of Comment *j* in the virtual reality context.

Comment *j* provides that the seller may reasonably presume that a given warning will be read and heeded.[149] In the context of VR headsets, it may not be a reasonable presumption that the user will follow directions when it is physically impossible for the user to follow the directions while using the product. Many of the existing warnings focus on what to do prior to using the product, and this would be something the user should have no difficulty following.

However, as the Quest 2 instructions observe, VR headsets reduce the user's perception of their surroundings to effectively zero; they are "an immersive experience that can distract you and can completely block your perception of your actual surroundings."[150] Picture, for instance, a car that contains a standard engine temperature gauge. The car's user manual expressly instructs the user to watch the temperature gauge while driving the car as excessive engine heat could be dangerous to both the user and the vehicle. However, if this temperature gauge is located in the trunk of the car—as opposed to on

[149] RESTATEMENT (SECOND) OF TORTS § 402A cmt. j.
[150] Meta, *supra* note 16.

the dashboard—it becomes entirely impossible for the user to comply with this instruction during use. This analogy is similar to the problem faced by VR users: while the user may be able to clear out their area before use, they have no ability to see when another individual, pet, or autonomous object, such as a Roomba, has entered their zone of activity. That is, the user has no ability to follow the instruction while in use. Sure, the user could use the VR headset when no one is at home, lock their pet away, and turn off their Roomba vacuum. But what if their spouse arrives home and walks into the area the user is occupying? It is simply not possible, absent some other safety features, to use this product as intended while maintaining awareness of their surroundings. This, in turn, makes it impossible for the user to follow this instruction while using the product.

Indeed, this is the entire purpose of virtual reality: "VR's selling point also presents major safety hazards: the immersive, interactive games that require you to stand up and move around, which is not dissimilar to actually undertaking strenuous physical activity."[151] The very features that make virtual reality headsets worth buying are what make them dangerous, with respect to both the user's lack of perception and the ability to simulate a level of activity greater than that which can be done on traditional video game consoles. Other authors have similarly reflected this notion:

> When a user immerses themselves in a virtual reality environment, it becomes easy to forget that the people and objects around them are not actually real — and that beyond the VR environment, real people and objects do exist. This can lead to a false sense of reality, and as a result, people may take risks they would never normally take in the real world.[152]

Not only does this lack of perception bring a host of risks—such as, running into objects or people, motion sickness, falling over—but the total risk of injury is greater than the sum of these parts. The physical activity compounds the risk from the lack of perception, and the lack of perception compounds the risk from the physical activity. In other words, simulating an activity such as boxing is already somewhat risky—but simulating blindfolded boxing is much riskier.

Ultimately, the issue here is these warnings about the lack of perception of the surrounding environment are ineffective because the user cannot comply with that warning while the product is in use. Therefore, there should not be a reasonable presumption that these

[151] Al-Sibai, *supra* note 11.
[152] *Metaverse Injury Lawyer*, 1-800 INJURED (Nov. 15, 2022), [https://perma.cc/H7SD-EMWY].

warnings will be heeded. Perhaps courts could introduce some sort of burden-shifting scheme here: there could be a presumption that the user was able to follow the warning, but the user should have the ability to rebut this presumption and show that it was not possible to comply with the warning during use. For instance, if a plaintiff was injured by their VR headset, the initial presumption would be, consistent with Comment *j*, that the (hypothetically) sufficient warnings could be—and, in fact, were—followed during use. Then, the plaintiff would have the opportunity to dispute the reasonableness of that presumption and may be able to demonstrate that the VR headset itself actually made it impossible to comply with the accompanying directions and warnings. Finally, the burden would shift back to the manufacturer to prove that it is possible for the user to comply with the warning during use, which is presumably not a high bar for the manufacturer to reach. This sort of burden shifting system would allow plaintiffs to rebut the presumption provided in Comment *j* while not entirely removing it to the detriment of these hardware manufacturers.

The question of misuse is raised here as well. Are users who are unable to comply with warnings misusing the product by not following these warnings? It may be true that many of the injuries caused by virtual reality headsets are due to misuse. Despite clear instructions to use the product in a designated area free from obstacles, people may decline to do so and are likely to be injured as a result. However, many of the injuries discussed herein are probably not caused by misuse; the man with the broken neck discussed in the Journal of Medical Case Reports is an excellent example.[153] The authors observe that this injury was likely caused by the weight of the device and the motion inherent in using it, rather than as the result of a fall or collision.[154]

With respect to misuse, Comment *n* focuses this doctrine on an assumption of risk model.[155] Again, this is yet another area where warning liability is dependent on the user understanding the extent of the risk involved. "Knowing and voluntary" is necessarily predicated on the user actually understanding the extent of this risk.[156] Available authority seems to indicate this is not the case; users do not fully appreciate the extent of these risks.[157] This is further compounded by the fact that none of these products really warn about the extent of the injury, as discussed above. Furthermore, the doctrine of misuse does not effectively preclude the core issue here, wherein users are unable to comply with provided warnings due to their complete lack of perception while the product is in use. In a sense, this inability to comply with directions creates a sort of necessitated misuse. While true misuse of virtual reality headsets may

[153] Baur, et al., *supra* note 12.
[154] *Id.*
[155] RESTATEMENT (SECOND) OF TORTS § 402A cmt. j.
[156] RESTATEMENT (SECOND) OF TORTS § 402A cmt. n.
[157] Warner & Teo, *supra* note 13.

very well eliminate a large portion of claims against manufacturers, this doctrine almost certainly should not extend to injuries caused by inherent risks of the product.[158]

Ultimately, a reinterpretation of the reasonableness of the expectation that a warning will be heeded under Comment *j* will serve to both (1) increase consumer awareness of the risks involved in using virtual reality headsets, as well as (2) further the intent of other aspects of warning liability that are predicated on the consumer's awareness of risk, such as misuse. In turn, manufacturers will have a better understanding of how to avoid liability from these risks, courts will have more guidance as to applying these doctrines to updated technologies, and injured users will have a clearer path towards recovery if manufacturers do not follow these standards.

C. *Change in Interpretation of Doctrine: Defining Software as a "Product"*

Although many of the issues discussed above can be alleviated by the VR headset's manufacturer, these issues cannot be fully addressed without also confronting the role software plays in causing them. Reinterpretation of a different area of the product liability doctrine could further serve to ameliorate the problem of virtual reality injuries and the resulting potential liability. A large part of this problem is sourced in the fact that hardware manufacturers and software developers have independent standards to follow, while the injuries discussed herein seem to arise through the combination of the hardware and the software. Even if all the above issues related to hardware were solved or otherwise adequately warned for, additional problems related to software remain. Virtual reality hardware manufacturers may reasonably expect the device to be used for certain activities, but software developers may create games or programs that fall outside of the manufacturer's intended or expected use. Therefore, the headset's manufacturer may have properly warned to the extent expected of them, and the software developer is largely unconcerned with potential product liability given that its software falls outside the definition of a product.[159] This leaves injured users without an avenue of compensation for their injuries.

As mentioned, the Journal of Family Medical Practice suggests "the types of injuries caused by playing simulated sports are generally the same as (or similar to) injuries sustained by those engaging in the sport itself."[160] Although the headset may warn for "typical" activities (i.e., those which are contemplated by the manufacturer), the headset

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[158] This is yet another reason that virtual reality headsets may be deemed "unavoidably unsafe products," a category otherwise largely reserved for prescription drugs. RESTATEMENT (SECOND) OF TORTS § 402A cmt. n. However, an in-depth discussion of the merits of this categorization is beyond the scope of this work.
[159] *See* Wilson v. Midway Games, 198 F. Supp. 2d 167, 174 (D. Conn. 2002); *see also* James v. Meow Media, Inc., 90 F. Supp. 2d 798, 800 (W.D. Ky. 2000).
[160] Sparks et al., *supra* note 10.

itself serves as a platform to use software that may allow the user to perform activities that should require more warning. For example, if the user is simulating exercise, something along the way (either hardware or software) should give warnings that are more appropriate to the activity being simulated (e.g., stretching before use). Indeed, some software is ostensibly designed to try to get the user to fall—many viral videos show a game called "Richie's Plank Experience" that simulates the user walking out on a plank off the side of a skyscraper, which encourages users to place a real board on the floor to see how far they can get before falling.[161] This manner of use is likely not contemplated by the manufacturer, which largely precludes their ability to warn against using the headset in this manner.

While a manufacturer may be able to warn that, generally, simulated activity may bear risks similar to the activity being simulated and that users should stretch before undertaking physically strenuous activity, it is the software developers who design this type of virtual reality software that seem to be in a much better position to give such a warning. The software developer that creates the potentially risky software will have a more intimate knowledge of the risks involved in using its software, with respect to both risks from the simulation of activity itself and what steps may be taken to eliminate or mitigate these risks. This is true even if the injuries caused by using the software are merely 'incidental' to using the software. For instance, solo boxing may not be the riskiest activity for the average, healthy individual.[162] Yet, some of these programs seem to be specifically designed to disorient the user with the end goal of making them fall over.[163] In such a case, the injury is no longer 'incidental' to using the software, but rather, the entire intention of the software developer. It is this intersection of risky hardware (that may contain otherwise adequate warnings) with potentially risky software that is responsible for injury. Yet, of the two creators, only the hardware manufacturer may face liability because software is not a "product" under products liability doctrine.

In order to require software developers to enact these warnings, legislatures or courts will need to reconceptualize what constitutes a "product" in this context. Simply changing the definition of "product" for purposes of warning liability would open the door for users to be adequately compensated for injuries they receive, as well as provide a strong incentive for manufacturers to adopt more modern safety features

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[161] *Richie's Plank Experience*, STEAM (Dec. 13, 2017), [https://perma.cc/7LKN-N52N] (VR game that is designed to simulate walking on a plank that is extended from the top of a skyscraper).

[162] This raises the somewhat tangential issue of hypersensitive plaintiffs, sometimes referred to as "eggshell plaintiffs." For instance, the boxer with the preexisting injury may be considered a hypersensitive plaintiff that is more predisposed to injury than an otherwise healthy user. However, the existence of these users and their injuries is not detrimental to resulting warning liability: "The rule is that the perpetrator of a tort is responsible for the direct and immediate consequences thereof, whether they may be regarded as natural or probable, or whether they might have been contemplated, foreseen, or expected, or not." Watson v. Rinderknecht, 82 Minn. 235, 84 N.W. 798, 799 (1901).

[163] Steam, *supra* note 161.

or warn to the extent necessary. Moreover, headset manufacturers would be incentivized to ensure that the software available on their platform complies with such warnings, which further serves to ameliorate the issue discussed in the prior section. This would also help software developers to internalize the costs that their software poses on society while targeting the entity that is most capable of providing these specific warnings. Thus, the interconnectedness of these principles also seems to serve a sort of "self-policing" function, as software and hardware manufacturers are maximally incentivized to ensure that the other is providing adequate warning. While the prescribed steps for hardware manufacturers that are described in previous sections would still be useful and important for consumers with respect to the *manufacturer's* role in these problems, the overall efficacy of these solutions would be severely undermined if the software developers otherwise remain immune to liability for those injuries that are caused primarily by software (and, necessarily, in conjunction with hardware).

D. Implementation of Additional Safety Features

Finally, there may be non-warning precautions that manufacturers could take in order to reduce the amount or extent of injuries caused by VR headsets. Certain safety features in both hardware and software should help to prevent many of these injuries, and thereby abrogate the need for additional or more stringent warnings.

For some higher-end products, the market is already implementing additional safety features. A notable example is Oculus's VR headset, the Quest 2. Quest 2 safety features include a "guardian system," which warns the user that they are leaving their designated zone of activity, and the "pass-through camera," which allows the user to see their surroundings overlaid on the screen.[164] Similar to how warnings inform consumer choice by describing the extent of risk from using a certain product, the availability of such features is, to some extent, another aspect of consumer choice: consumers are able to weigh the level of safety they desire against the additional cost of such features. Yet, as discussed previously, this aspect of consumer choice presumes that the user is adequately warned of the risks involved in order to weigh that risk. As the British Medical Journal observes, "the public awareness of these risks [of injury] may not be recognised [*sic*]."[165]

One potential safety feature would be to prohibit the simultaneous use of audio and video. However, there are substantial issues with this choice of design. For one, that disturbs the very purpose of the product, which is immersion. Two, not all obstacles are able to be perceived audibly. While people or animals may be able to be heard nearby, stationary objects in an area you've wandered into are not likely

[164] Meta, *supra* note 16.
[165] Warner & Teo, *supra* note 13.

to be perceived audibly. Ultimately, this precaution is a good example of one which interrupts the purpose of the product while not significantly improving its safety. Simply put, the trade-off is not worth it for most consumers.

Even so, there are additional safety features that could be implemented that should improve the product's safety without significantly interrupting the purpose of the product. For instance, it is likely economically and technologically feasible for manufacturers to include rubber bumpers for the motion controllers of virtual reality headsets, somewhat akin to those provided for Wii controllers. Or perhaps the manufacturer could include some sort of external motion sensor that would serve to notify the user if another person or animal enters the area of use. Although these safety measures are not warnings, they could help prevent the need for additional warnings by increasing overall safety.

Legislatures could create requirements—or delegate such authority to an appropriate regulatory body—for these types of products. A regulatory body could establish a baseline for manufacturers, and given the increasing availability of these safety features, this would theoretically help to prevent a lot of these injuries. A thorough examination as to a court's involvement in addressing this issue would require a defective design analysis, which is outside the scope of this article. However, it is important to recognize that there may be non-warning steps that can be taken to not only avoid injury from the perspective of consumers, but to help the manufacturer avoid potential liability as well. If the aforementioned doctrinal changes are not implemented, these additional physical safety features may be the "last line of defense" for virtual reality headset users, so to speak.

V. CONCLUSION

In conclusion, there appears to be a rapidly growing industry causing increasingly severe injuries, yet little, if any, relief remains available to a growing population of injured users. This problem arises due to a unique intersection of issues that tort law is currently unprepared to handle: video game technology has advanced, and these advancements carry previously unforeseen risks due to the level of immersion they provide. Even if hardware manufacturers were to otherwise adequately warn about these increased risks, and even if the manufacturer's instructions could otherwise be followed by the user during use, there remain additional considerations related to the intersection between the hardware and the software.

Many of the risky aspects of VR arise due to the software itself, which the hardware manufacturer cannot possibly be expected to foresee and therefore warn against—but because software is not a "product," the software developers are unconcerned with potential liability. Therefore, hardware manufacturers and software developers each assert adequate

warnings are not their responsibility. Consequently, failure to warn becomes the problem of the injured consumer. Whether it be minimum warning standards, a reinterpretation of doctrines relating to reasonableness of heeding warnings or inclusion of software as a product, or more fundamental hardware design choices, one thing is certain: action needs to be taken. Without such action, consumers will continue to fail to grasp the extent of the consequences they face from using VR headsets and similar products. This, in turn, will continue to leave many consumers injured and without a means of redress. It is time to fill the cracks of products liability through which this problem falls, afford consumers the ability to use these products safely, and provide them with a route through which to pursue compensation for their injuries.