

**IN THE UNITED STATES DISTRICT COURT
FOR THE SOUTHERN DISTRICT OF NEW YORK**

PYGMALION, INC.

Plaintiff,

v.

WONDERLAND CO.

Defendant,

Civ. No. 24-cv-GSR

**ORDER GRANTING IN PART AND DENYING IN PART WONDERLAND’S
MOTION TO DISMISS UNDER FED. R. CIV. P. 12(b)(6)**

This case comes to this Court from a business deal gone wrong. After negotiations between the parties broke down, Pygmalion accused Wonderland of stealing Pygmalion’s intellectual property, asserting patent infringement and trade secret misappropriation claims.¹ Today, I resolve the parties’ dueling summary judgment motions: (1) cross-motions for (in)eligibility of U.S. Patent No. GSR,835,913 (“’913 patent”), and (2) cross-motions for (no) trade secret misappropriation. As explained in more detail below, I grant Wonderland’s motions for summary judgment of ineligibility, I grant Pygmalion’s motion for summary judgment of trade secret misappropriation, and deny the remaining two motions.

I. BACKGROUND

The plaintiff Pygmalion, a technology startup, developed a virtual reality system called the “Dance.” VR systems generally headset to project images into the user’s field of view via two near-eye displays, allowing the user to peer into the virtual world around them. These systems let

¹ Accordingly, this Court has jurisdiction over the patent infringement claim under 28 U.S.C. § 1331 and 1338(a). The Court has jurisdiction over the trade secret misappropriation claim under 28 U.S.C. § 1331.

users watch movies, play games, browse the internet, and more, all the while immersing users in what is shown on the displays. That said, these systems come with a downside: VR users often experience motion sickness, headaches, eye fatigue, nausea, and other symptoms. These symptoms are widespread enough that they have been dubbed “cybersickness” or “virtual reality sickness.”

Unlike the VR systems that had come before, the Dance had one major difference: it allowed the user to adjust the distance between the near-eye displays to match the interpupillary distance of the user (“IPD”), and automatically adjusted how images and videos were displayed to help cut down on virtual reality sickness symptoms.

During the development of the Dance, Pygmalion’s founder and CEO, Harriet Higgins, sought to patent the anti-virtual-reality-sickness systems she had developed during her Ph.D. studies and integrated into the Dance. She applied for a patent, and on July 14, 2019, the Patent and Trademark Office issued the ’913 patent, which was assigned to Pygmalion. Dkt. 1-1 (’913 patent).

This improvement was a success—users reported less virtual reality sickness symptoms, and by mid-2018, the Dance was the best-selling VR system in the U.S. Yet Pygmalion ran into a difficulty: while the Dance led the market for VR *equipment*, Pygmalion lagged well behind the rest of the market for VR *content*. Put differently, Pygmalion’s game and movie library paled in comparison to the existing libraries of the larger players in the entertainment industry.

At the same time that Pygmalion began taking over the market for VR hardware, Wonderland, a multinational technology company, wanted to break into the market. While Wonderland’s gaming division had been making the successful line of “White Rabbit” consoles since 1988, Wonderland had much less success with the VR market. In 2009, Wonderland launched the Alice, an early VR headset, although one with a fixed IPD. The Alice was only a

minor commercial success, largely due to user complaints regarding virtual reality sickness symptoms.

In March 2019, Wonderland approached Pygmalion, hoping to discuss a potential partnership, acquisition, or license agreement between the two companies. Pygmalion agreed, and the parties executed a nondisclosure agreement. Dkt. 1-2 (Wonderland-Pygmalion Agreement). The agreement required both parties to “maintain as secret and not to disclose, and not to use in any capacity whatsoever any Confidential Information for any purpose, other than the purposes for which such information was disclosed”—here, a potential business deal. As part of these negotiations, Pygmalion disclosed what it asserts are trade secrets relating to The Dance and Pygmalion’s VR technology, as well as details relating to the ’913 patent.

Despite the extensive negotiations, the talks fell through, and by October 2019, Wonderland broke off the negotiations, saying that it was no longer interested in pursuing a business relationship with Pygmalion. Wonderland did not license any IP from Pygmalion, nor did the parties cancel the NDA still in force.

Two years later, Wonderland released a new VR system, the “White Rabbit Vision,” which directly competes with the Dance. Like the Dance, and *unlike* the Alice, the White Rabbit Vision has an adjustable IPD, as well as software that automatically adjusts how images and videos are displayed to help cut down on virtual reality sickness symptoms. The White Rabbit Vision was a smash success, rocketing to the top of the market, while the market share for the Dance has steadily decreased.

Pygmalion, after seeing the White Rabbit Vision, filed the complaint in this case, alleging infringement of the ’913 patent and trade secret misappropriation claims under the Defend Trade Secrets Act. 18 U.S.C § 1831 *et seq.* Wonderland moved to dismiss in part, arguing that Pygmalion

had not identified the alleged trade secrets with enough specificity. Dkt. 12. I denied the motion to give the parties the chance to develop a better record. In the meantime, Wonderland answered the complaint, raising (among others) a statute of limitations defense,² as well as counterclaiming for noninfringement and invalidity of the '913 patent. Dkt. 27.

Now, the parties have filed four motions: (1) Wonderland's motion for summary judgment of ineligibility of the '913 patent under 35 U.S.C. § 101, (2) Pygmalion's motion for summary judgment of eligibility of the '913 patent under Section 101, (3) Wonderland's motion for summary judgment of no trade secret misappropriation, and (4) Pygmalion's motion for summary judgment of trade secret misappropriation.

II. LEGAL STANDARD

Summary judgment is appropriate when there are no genuine issues of material fact and the moving party can demonstrate that it is entitled to judgment as a matter of law. Fed. R. Civ. P. 56(a). A fact is material if it might affect the outcome of the lawsuit, and a dispute is genuine if the evidence could lead a reasonable jury to return a verdict for either party. *Anderson v. Liberty Lobby, Inc.*, 477 U.S. 242, 248 (1986). A court considering a motion for summary judgment must view the facts in the light most favorable to the nonmoving party and give that party the benefit of all reasonable inferences to be drawn from those facts. *Matsushita Elec. Indus. Co. v. Zenith Radio Corp.*, 475 U.S. 574, 587 (1986). Summary judgment is appropriate if the nonmoving party "fails to make a showing sufficient to establish the existence of an element essential to that party's case, and on which that party will bear the burden of proof at trial." *Celotex Corp. v. Catrett*, 477 U.S. 317, 322 (1986).

² I resolved Wonderland's statute of limitations defense when I granted Pygmalion's motion to strike. Dkt. 74.

III. DISCUSSION

A. Subject Matter Eligibility of the '913 Patent

I begin with addressing the parties' motions regarding the eligibility of the '913 patent under Section 101.

1. The Legal Standard

Section 101 addresses the preemption concerns underlying patent law. It provides that whoever “invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.” 35 U.S.C. § 101. The implicit corollary is that laws of nature, natural phenomena, and abstract ideas are not patent eligible. *Mayo Collab. Servs. v. Prometheus Labs., Inc.*, 566 U.S. 66, 70–71 (2012). After all, “monopolization of those tools through the grant of a patent might tend to impede innovation more than it would tend to promote it.” *Ibid.*

“Short and unadorned, [Section] 101 appears deceptively simple on its face, yet its proper application to computer-implemented inventions and in various other fields of technology has long vexed [the Federal Circuit] and other courts.” *CLS Bank Int’l v. Alice Corp. Pty.*, 717 F.3d 1269, 1276 (Fed. Cir. 2013) (*en banc*) (Judge Alan D. Lourie, concurring), *aff’d*, 573 U.S. 208 (2014). In *Alice Corp. Pty. v. CLS Bank Int’l*, 573 U.S. 208 (2014), the Supreme Court set out our two-step inquiry for evaluating patent claims under Section 101. Patent eligibility is assessed by reference to *Alice* and cases engaging in the *Alice* two-step analysis. See *In re Killian*, 45 F.4th 1373, 1383 (Fed. Cir. 2022).

At step one, the district court evaluates whether patent claims are directed to an abstract idea. *Alice*, 573 U.S. at 218. The Federal Circuit has explained that the district court should consider whether the claims “focus on a specific means or method that improves the relevant

technology” or are instead “directed to a result or effect that itself is the abstract idea and merely invoke generic processes and machinery.” *Apple, Inc. v. Ameranth, Inc.*, 842 F.3d 1229, 1241 (Fed. Cir. 2016). The district court should also consider whether the claims purport to improve the functioning of a computer or merely require generic computer implementation. *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1338–39 (Fed. Cir. 2016); *Alice*, 573 U.S. at 221–25. Claims that merely carry out a longstanding commercial practice with the benefit of a computer are directed to abstract ideas, as are those that merely gather, analyze, and display information. *See Alice*, 573 U.S. at 219; *Intell. Ventures I LLC v. Cap. One Fin. Corp.*, 850 F.3d 1332, 1340–41 (Fed. Cir. 2017) (*Capital One*); *Intell. Ventures I LLC v. Symantec Corp.*, 838 F.3d 1307, 1313–14 (Fed. Cir. 2016) (*Symantec*); *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1354 (Fed. Cir. 2016). When there are “close calls about how to characterize what the claims are directed to,” “an analysis of whether there are arguably concrete improvements in the recited computer technology could take place under step two.” *Enfish*, 822 F.3d at 1339.

At step two, if the patent claims are directed to an abstract idea, the district court evaluates whether the claimed elements recite an inventive concept that transforms an otherwise abstract idea into a patent-eligible invention. *Alice*, 573 U.S. at 221. A patent claim must do more than state an abstract idea and say “apply it” or “apply it with a computer.” *Id.* at 223–24. “[S]imply appending conventional steps, specified at a high level of generality, to laws of nature, natural phenomena, and abstract ideas cannot make those laws, phenomena, and ideas patentable.” *Mayo*, 566 U.S. at 82. Thus, the district court should consider whether the claims merely recite generic computer processes and machinery or whether the non-generic arrangement of such processes and machinery gives rise to an inventive concept. *Bascom Glob. Internet Servs., Inc. v. AT&T Mobility LLC*, 827 F.3d 1341, 1349–50 (Fed. Cir. 2016). The step two “[i]nquiry therefore must turn to any

requirements for *how* the desired result is achieved.” *Two-Way Media Ltd. v. Comcast Cable Commc’ns, LLC*, 874 F.3d 1329, 1339 (Fed. Cir. 2017) (quoting *Elec. Power Grp.*, 830 F.3d at 1355) (emphasis in original). Crucially, the district court may not rely on conclusory statements from the complaint or “technological details set forth in the patent’s specification and not set forth in the claims to find an inventive concept.” *Symantec*, 838 F.3d at 1322 (citation omitted); *see Iqbal*, 556 U.S. at 678 (citing *Twombly*, 550 U.S. at 555). Although the pleadings and the specification can illuminate the inventive concept, they cannot supply it. *See Am. Axle & Mfg., Inc. v. Neapco Holdings LLC*, 967 F.3d 1285, 1293 (Fed. Cir. 2020); *ChargePoint, Inc. v. SemaConnect, Inc.*, 920 F.3d 759, 769 (Fed. Cir. 2019).

2. The ’913 Patent

Wonderland asserts that Pygmalion’s claims are directed to patent-ineligible concepts because they are directed to conventional motion sickness reduction techniques, such as focusing the viewer’s eyes to a horizon line or to a visual anchor. Wonderland characterizes Pygmalion’s patent claims as an attempt to patent the abstract process of using a horizon line or visual anchor to reduce motion sickness, as travelers have done for many decades. At *Alice* step one, Wonderland argues that the claims use only result-based functional language and are agnostic to how any of the motion sickness reduction techniques are accomplished, as the patent discloses only generic computer components. At *Alice* step two, Wonderland argues that the claims only require the use of generic computer components (“system[s]” and “modules”) and functions to be performed by those components, which are functional and generic, and do not provide the requisite inventive concept. In short, Wonderland claims that the patent “focuses entirely on achieving ‘an abstract end-result’ with ‘already available computers, with their already available basic functions, to use as tools in executing the claimed process.’” Dkt. 109 at 17 (quoting *SAP Am., Inc. v. InvestPic*,

LLC, 898 F.3d 1161, 1169-70 (Fed. Cir. 2018); citing *RecogniCorp, LLC v. Nintendo Co., Ltd.*, 855 F.3d 1322, 1326-27 (Fed. Cir. 2017)).

Pygmalion responds that its claims provide a novel solution to modifying visual content to reduce cybersickness. It claims that this approach offers substantial advantages over the conventional prior art and is cabined by the claim limitations. Pygmalion argues that the claims provide for a substantial *improvement* in the electronic systems for generating and displaying virtual reality content. At *Alice* step one, Pygmalion explains that the claimed system is a special type of computer system with a linked data structure constructed from various “modules”—modules whose definitions and relationships are described at length in the claims and specification. Pygmalion faults Wonderland for ignoring the data structures disclosed in the patent, arguing that the claims in this case parallel the ones found eligible in *Enfish, LLC v. Microsoft Corp.*, 822 F.3d 1327, 1330 (Fed. Cir. 2016). According to Pygmalion, that the invention’s ability to run on a general-purpose computer does not “doom[] the claims,” as the claimed modules and linked data structure provides more than just a computerization of the process of modifying virtual reality content to mitigate motion sickness symptoms. Dkt. 124 at 11 (quoting *Enfish*, 822 F.3d at 1338). At *Alice* step two, Pygmalion argues that the patent claims and describes novel, interrelated data structures that go well beyond just automating an abstract idea, but rather that the specific limitations recited in the patent are a “non-conventional and non-generic arrangement of known conventional pieces.” Dkt. 124 at 14 (quoting *Bascom Global Internet Servs. v. AT&T Mobility LLC*, 827 F.3d 1341, 1350 (Fed. Cir. 2016)).

Here, I find that these claims do not clear the Section 101 bar. At step one, the claims do not provide the requisite link between the recited modules and the data structures described in the specification. While Pygmalion relies on the data structure in support of eligibility, unclaimed

features are irrelevant to the *Alice* analysis. *Am. Axle*, 967 F.3d at 1293. True, the specification describes a data structure that could create a genuine dispute of material fact, given the dispute between the parties' experts. But the claim language itself does not describe this technologically rooted improvement.

Here, Pygmalion analogizes to *SRI Int'l, Inc. v. Cisco Sys., Inc.*, which rejected likening a computer method to one which could be performed in the human mind, because the "human mind is not equipped to detect suspicious activity by using network monitors and analyzing network packets as recited by the claims." 930 F.3d 1295, 1304 (Fed. Cir. 2019). According to Pygmalion, a human mind is likewise not equipped to analyze virtual reality video and audio and modify the presentation of that video and audio as recited to the claims. Dkt. 124 at 17. True, a human mind is not equipped to apply modifications to video and audio files, but these are the generic processes and machinery used in generic computer implementation.

At bottom, unlike the representative claim in *SRI*, the representative claim here does not improve the functioning of a computer by reciting a specific technique. I find that the claims are directed to the abstract idea of monitoring user symptoms of motion sickness and modifying the presentation of virtual reality content based on those symptoms.

Turning to step two, I find that the claims fail to recite a saving inventive concept. Here, as explained above, "the purported improvements have not been captured in the claim language." *Voip-Pal.com, Inc. v. Apple Inc.*, 375 F. Supp. 3d 1110, 1145 (N.D. Cal. 2019), *aff'd sub nom. Voip-Pal.com, Inc. v. Twitter, Inc.*, 798 F. App'x 644 (Fed. Cir. 2020). "Nothing in the claims, understood in light of the specification, requires anything other than off-the-shelf, conventional computer, network, and display technology for gathering, sending, and presenting the desired information." *Elec. Power Grp., LLC v. Alstom S.A.*, 830 F.3d 1350, 1355 (Fed. Cir. 2016). "At

bottom, then, the validity of the Patent[-in-Suit does not turn on the factual issue of whether the alleged improvements are ‘well-understood, routine, and conventional.’” *Voip-Pal.com, Inc. v. Apple Inc.*, 411 F. Supp. 3d 926, 974 (N.D. Cal. 2019), *aff’d*, 828 F. App’x 717 (Fed. Cir. 2020).

Accordingly, I find that the ’913 patent is not directed to eligible subject matter.

B. Trade Secret Misappropriation

Next, I address the parties’ motions regarding trade secret misappropriation. The parties’ dispute centers on one question: has Pygmalion sufficiently defined its alleged trade secrets? I find that Pygmalion has failed to do so, and thus I grant Wonderland’s motion for summary judgment of no trade secret misappropriation.

1. The Legal Standard

Under the DTSA, a claimant bears the burden of identifying a purported trade secret with sufficient specificity. *See InteliClear, LLC v. ETC Glob. Holdings, Inc.*, 978 F.3d 653, 657-58 (9th Cir. 2020). The specificity requirement “place[s] a defendant on notice of the bases for the claim being made against it,” *Oakwood Labs. LLC v. Thanoo*, 999 F.3d 892, 906 (3d Cir. 2021), and allows a factfinder to determine whether certain information is, in fact, a trade secret. *See* Restatement (Third) of Unfair Competition § 39 cmt. d (characterizing purpose of specificity requirement as permitting determination of “fact of an appropriation”); *IDX Sys. Corp. v. Epic Sys. Corp.*, 285 F.3d 581, 583–84 (7th Cir. 2002) (observing that, if plaintiff fails to separate “trade secrets from the other information that goes into any software package,” the court “cannot do its job” at summary judgment).

2. The Software Trade Secrets

Pygmalion claims that it holds trade secrets in the architecture of the software in its Dance products.³ To support its claims, Pygmalion relies on the testimony of Pygmalion’s CEO and lead inventor, Harriet Higgins, as well as its technical expert, Dr. Megan Delaney. Dr. Higgins explained that during the development process for the Dance, she incorporated multiple features that improved on the system for adjusting the presentation of virtual reality content, including techniques for analyzing IPD and its effect on motion sickness symptoms, a data structure for processing symptom readings and settings of the Dance headset, and a method for dynamically modifying the video and audio of the virtual reality content on the fly during streaming of the video and audio to the headset. Dkt. 129-3 (Higgins Tr.) at XX. Dr. Delaney agreed, explaining that it was the combination of these individual features that provided value separate and apart from the ’913 patent, and that each feature was established by specific source code packages. Dkt. 129-4 (Delaney Tr.) at XX. Dr. Delaney also testified that the interplay between these features—which was managed by a separate control agent—was not readily ascertainable by an engineer or other person of skill in the industry. *Id.* at XX. Wonderland, along with its technical expert, Dr. Nick Bernard, disagreed. Dr. Bernard faulted Dr. Delaney’s testimony for failing to identify specifics of how the managed interplay between the features identified by Dr. Higgins and Dr. Delaney operated, and further arguing that the combination failed to identify a trade secret with specificity because the features could not be separated from the rest of the Dance software—the whole of which Pygmalion does not assert is a trade secret. Dkt. 109 at 22 (citing Dkt. 109-7 (Bernard Tr.) at XX).

³ The parties do not dispute that Pygmalion put in place reasonable measures to keep its information secret.

Pointing to Dr. Bernard’s testimony, Wonderland argues that Pygmalion merely “cherry-picked . . . concepts” from the software design of the Dance, and that because Pygmalion “failed to describe . . . the components of its claimed trade secret with particularity, [Pygmalion] has similarly failed to assert a unified process, design, and operation” with sufficient specificity. Dkt. 109 at 20 (quoting *Big Vision Priv. Ltd. v. E.I. DuPont De Nemours & Co.*, 1 F. Supp. 3d 224, 271-72 (S.D.N.Y. 2014), *aff’d* 610 F. App’x 69 (2d Cir. 2015)). Pygmalion counters, arguing that its identification of the *combination* of these features amounts to a specific and protectable trade secret, and that Dr. Higgins and Dr. Delaney provided sufficient explanation to identify the features underlying the combination. Dkt. 124 at 22 (citing *Neural Magic, Inc. v. Meta Platforms, Inc.*, 659 F. Supp. 3d 138, 169-70 (D. Mass. 2023); *Olaplex Inc. v. L’Oréal USA, Inc.*, 855 F. App’x 701, 711-12 (Fed. Cir. 2021)). Here, I find that Pygmalion has not identified its software trade secrets with sufficient specificity to separate them from the rest of the software underlying the Dance products, and thus I grant Wonderland’s motion for summary judgment of no trade secret misappropriation.

IV. CONCLUSION

For the above reasons, Wonderland’s motions for summary judgment are **GRANTED**, while Pygmalion’s motions for summary judgment are **DENIED**.

Dated: November 22, 2024

THE HONORABLE KATHARINE LANZA
UNITED STATES DISTRICT JUDGE

1

**VIRTUAL REALITY SYSTEM THAT
ALTERS VIRTUAL ENVIRONMENT IN
ORDER TO REDUCE RISK OF MOTION
SICKNESS**

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention is directed to virtual reality (VR) technology that implements one or more methods that address problems relating to motion sickness. The VR system modifies the visual outputs in order to accommodate a user upon determining that the user is prone to or is exhibiting signs of motion sickness.

Virtual reality is a computer-generated interface that allows users to see, move through and interact with information that is displayed as a three-dimensional world. Virtual reality thus allows interaction with an immersive artificial environment.

Likewise, augmented reality combines computer generated information (also referred to as virtual content) with real world imagery or a real world view in order to augment, or add content to, a user's view of the environment. The system and methods are directed to practicing techniques that reduce the risk of motion sickness.

2. Description of the Prior Art

Traditional still photography, movies and television have been influenced by the way that artists have represented physical reality in paintings, as if it were seen through a window. A detailed perspective image is provided, typically within a rectangular frame. Each provides images that induce the viewer to cooperate with the photographer's "vision" by assuming the artificial perspective of the representation. The viewer is able to suspend disbelief that the images themselves are not a real object space.

The degree to which the user is thus able is influenced not only by the image's resolution but also by the field of view. It is generally deemed desirable to increase both. For instance, high-definition TV standards have been developed in order to increase image quality. Likewise, larger format movie film such as 70 mm have been used to increase cinematic image detail. Along similar lines, panoramic movies, *e.g.*, "Cinerama" and IMAX increased the field of view to increase the realism of the user's experience.

In addition, various stereoscopic approaches have been developed for television and film.

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In stereoscopic imaging, two images (*e.g.*, a left and right image) are generally used in order to create the illusion of depth, or to create an illusion of a three-dimensional (3-D) image. With 3-D images'

5 illusion of depth, the user is led to perceive what appears to be a view of the world as it really is. Yet the choice of images and the corresponding perspective are determined by the creator of the image, and the user assumes a passive role.

10 A sensorama simulator was disclosed by M.L. Heilig in U.S. Pat. No. 3,050,870. The senses of an individual were stimulated, in order to simulate an actual experience realistically, with color images, peripheral vision, 3-D images, sound, breezes, odor, and tactile sensations. Likewise, M.L. Heilig disclosed a stereoscopic television for individual use in U.S. Pat. No. 2,955,156. This also was passive.

15 "Virtual reality," in an electronic image context, goes further in the direction of increased sense of realism. Moreover, virtual reality enables the viewer to take a more active role, *e.g.*, in selecting the image and the perspective. VR systems generally allow a user's natural gestures, *i.e.* head and body movements, by means of computer equipment, to control the images surroundings, as if the viewer were seeing and moving about in a real environment. Due to the large number of possible actions of the user, a corresponding multiplicity of virtual activities should be available for the user's choice. This represents a significant advance in artificial experience.

20 A user of a "virtual reality" system will typically wear a head-mounted display, which provides images of a virtual space that are matched to the sensed position and orientation of the head of the user as the user moves his head in space and time (*e.g.*, the x, y, z position of the head and/or the roll, pitch, yaw attitude of the head). Virtual reality systems can include additional controllers, such as handheld controllers with buttons.

25 The images for such VR systems are created by a computer program with the assistance of pre-stored image information that is retrieved according to the user's movements and presented to the user's eyes.

30 The goal of the VR system is to present panoramic images that immerse the user in an artificial reality with which she can interact. The degree of artificiality does not need not be total. Rather, the VR system can provide an "augmented reality," which comprises some artificial objects that are superimposed or interposed within images of the real world, as viewed with a display. These advances take advantage of converging technological developments in both computing and

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telecommunications. As a general matter, continuing advances in broadband, cellular, image processing, and other computer processing lead to increasing opportunities for more interactive, immersive experiences.

In addition, advances in VR system technology, including projection optics for displays, specialized sensors such as gloves designed to sense hand and finger movements, create additional possibilities for VR and augmented reality. Taken together, such advances can be expected to lead to exciting interactive games and other new types of interactive experiences within virtual worlds. This VR paradigm represents a great improvement over traditional photography, television, and film experiences, allowing for advancements beyond existing 2D representations.

Virtual reality is regarded as having three features, *i.e.*, immersion, navigation and interaction. Immersion is the use of advanced output devices to create the illusion of being inside the computer-generated virtual reality world. For example, a head mounted display with a high resolution two-dimensional color monitor in front of each eye can be used along with advanced 3-D stereoscopic display techniques to create the illusion to the user that the user is inside the computer-generated environment.

The second key feature of VR is the ability of the user to navigate through the VR environment. The user can navigate through the virtual reality world using control devices, such as an electronic glove, hand controllers, or head position sensors. The navigation features create a high feeling of immersion and grants the user a great sense of power of navigation (for example, using gestures) in the virtual reality environment.

The third feature of VR – interaction – is the ability of the user to interact with and control the virtual reality world. For example, a user can specify the parameters that define the virtual reality world. Navigation and interaction are related concepts. Virtual reality environments can be created using object-oriented libraries of functions.

For users of virtual reality or augmented reality systems, one problem that can arise is motion sickness or headaches. The terms “cybersickness” and “virtual reality sickness” have also been employed. In conventional stereoscopic 3-D movie or televisions, motion sickness and headaches are well known.

In general, motion sickness can arise because the visual cues show substantial movement, while the inner ear cues show stillness (or vice versa – the inner ear cues show movement, and the visual cues show stillness). This disconnect leads to symptoms.

Thus, motion sickness may arise due to the conflict between visual and vestibular (inner ear)

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cues – *i.e.*, cues that are related to the user’s perception of movement and position. In a VR environment, the user’s visual cues may show that that the user is in motion, yet the user’s vestibular cues show that the user is still.

Along similar lines, when people ride on a vehicle (*e.g.*, a car, airplane, boat, or airplane), they can feel their body moving through the vestibular organs but sometimes they cannot receive corresponding visual information.

When the visual information does not match the vestibular input, the sensory conflicts occur. If a person repeatedly receives sensory information that is different from their expectations, the person can experience motion sickness.

In a conventional physical setting, one way to reduce motion sickness symptoms is to look out at the horizon when moving. Likewise, in a virtual reality setting, one can focus on a “visual anchor” projected into the user’s field of view.

Virtual reality systems, which here includes augmented reality, may be improved by adapting the VR environment and experience in order to account for the user’s tendencies regarding motion sickness. For instance, visual cues that indicate movement may be slowed down (or possibly sped up), in order to mitigate motion sickness. In some embodiments, the VR system’s sensors may detect signs of user discomfort, such as fidgeting, sweatiness, and other signs of distress.

Also, the VR system may project a virtual horizon line, which would be directed towards reducing the disconnect between visual and vestibular information. Along similar lines, the VR system may project anchored virtual content, so that the virtual content appears as a distant, stable object that is fixed in the user’s field of view. For instance, the VR system may display visual content directly ahead of the user, so that she looks directly ahead at an eye level, thus providing anchor point for the body to match the visual and vestibular cues.

As shown in Fig. 1, anchored visual content **101** and/or a virtual horizon **102** may be provided to help the user orient herself in a virtual reality environment.

Fig. 2 illustrates an environment for a system for adapting virtual reality content in response to motion sickness symptoms. The environment **200** includes a system **208** for adapting virtual reality content and a virtual reality display system **230**. The system **208** includes a processor **210**, memory **212**, a display **216**, an input **214**, a sensor module **218**, an adaptation module **220**, and a transmission module **222**. The virtual reality display system **230** may include a processor **232**, a memory **234**, a display **236**, and an input **238**. The system **208** and the virtual reality display system **230** are preferably connected over a network **260**.

In an embodiment, the system **208** includes at least one processor **210**, configured to execute the instructions of the other modules. In some cases, each module may include a processor. In other cases, the system **208** may be a component within a server or network device, and the processor **210** may be a central processing unit for the server or network device. The memory **212** can be any electronic storage medium known in the art. The display **216** may be provided on any device suitable for displaying data outputted by the processor; for example, a monitor, a touchscreen, or similar.

The sensor module **218** is used for receiving information from the virtual reality display system **230**. The sensor module **218** may receive information about the user, including heart rate, eye movements, and head movements. The sensor module **218** may also receive information about the position of the display system **230**, including IPD, 3D rotation and position, display brightness, and frame rate.

The adaptation module **220** operates to adapt the outgoing virtual reality content in response to signals received about the user from sensor module **218**. The adaptation module **220** modulates the display system **230** or the virtual reality content to reduce motion sickness symptoms, including by modifying the frame rate, IPD, or display brightness.

The transmission module **222** processes the virtual reality content into a format usable by the virtual reality display device **230**, including by processing the video into monoscopic or stereoscopic format, 3 degrees of freedom or 6 degrees of freedom, or 180-degree view or 360-degree view.

Turning to Fig. 3, a flowchart for a method for adapting virtual reality content in response to motion sickness symptoms is shown.

310 marks the start of the method. At **320**, a VR environment is initialized. Methods of initializing VR environments are well known in the art.

At **330**, this environment is processed by system **208**, virtual reality content, including audio and video, is generated and processed, and displayed on virtual reality display system **230**.

At **340**, the virtual reality content is sent to virtual reality display system **230** by transmission module **222**.

At **350**, sensor module **218** monitors metrics and signs of motion sickness in the user, and generates a direction for adaptation if motion sickness is detected.

At **360**, sensor module **218** transmits a direction if motion sickness is detected.

At **370**, adaptation module **220** adapts the outgoing virtual reality content in response to directions received from sensor module **218**.

In operation, multiple modules and tables are required for operation of the method for adapting virtual reality content.

DeviceStatus Table

5 The DeviceStatus table provides information and status of all components of the virtual reality system. Each device has an assigned row in the Table which keeps track of the state of each device, including the CPU usage percentage, free and allocated memory, CPU die temperature, and disk availability.

Events Table

10 Stores all events which are user triggered, system triggered, or externally triggered.

Configuration Tables

15 All of the virtual reality systems read configuration information from the database in order to dynamically update the VR environment for the user.

20 A flexible database is used to interact with the system **208** and virtual reality display device **230**. Communication is preferably handled using standard protocols known in the art.

25 The above-described embodiments are intended to be examples only. Alterations, modifications, and variations can be effected to the particular embodiments by those of skill in the art without departing from the scope, which is defined solely by the claims appended hereto.

30 What is claimed is:

1. A system for adapting virtual reality content in response to motion sickness symptoms, the system comprising:

35 a sensor module adapted to monitor symptoms of motion sickness;

an adaptation module adapted to modify virtual reality content to mitigate motion sickness according to data received regarding the user;

40 wherein the adaptation module modifies at least the interpupillary distance of the virtual reality content; and

45 a transmission module adapted to transmit the virtual reality content in a manner that can be used by the virtual reality device.

2. A method for adapting virtual reality content in response to motion sickness symptoms, the method comprising:

50 monitoring symptoms of motion sickness; modifying virtual reality content to mitigate motion sickness;

wherein modification includes at least a modification to the interpupillary distance of the virtual reality content; and

55 transmitting the virtual reality content in a manner than can be used by the virtual reality device.

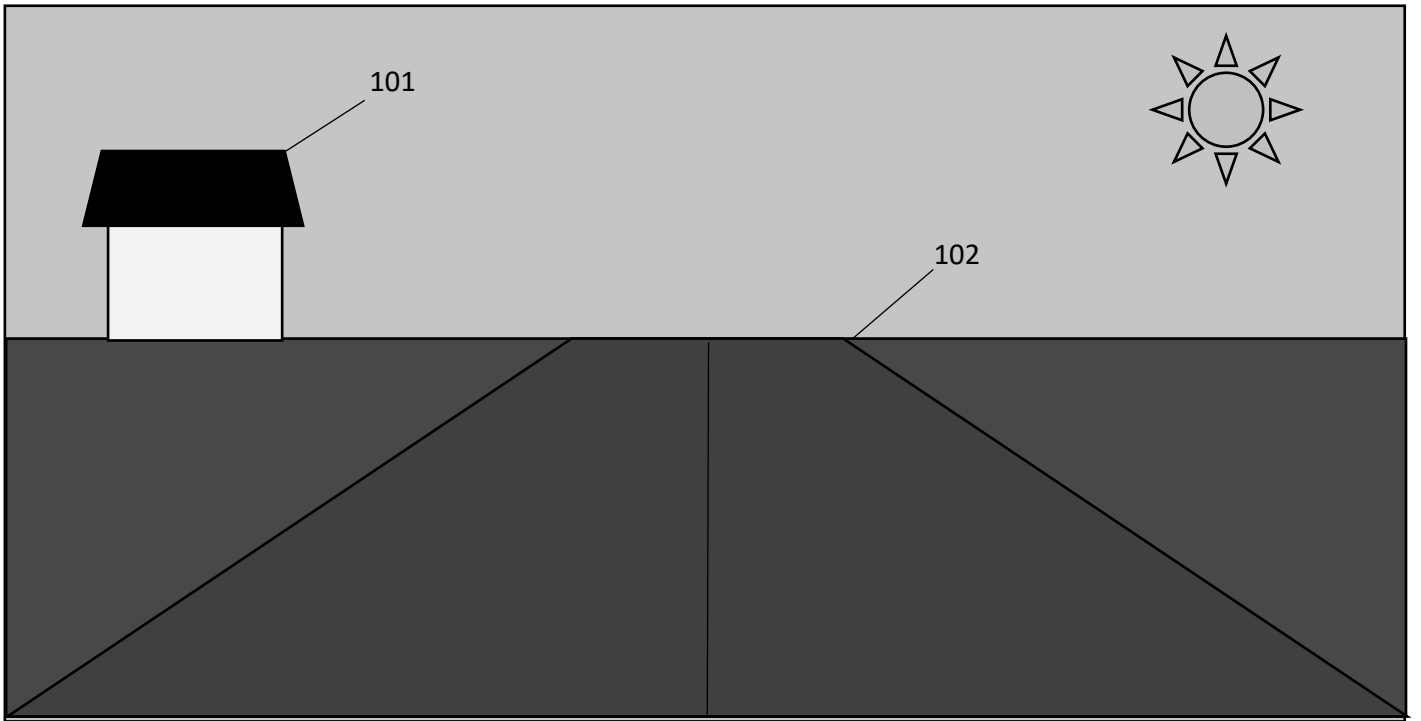


Fig. 1

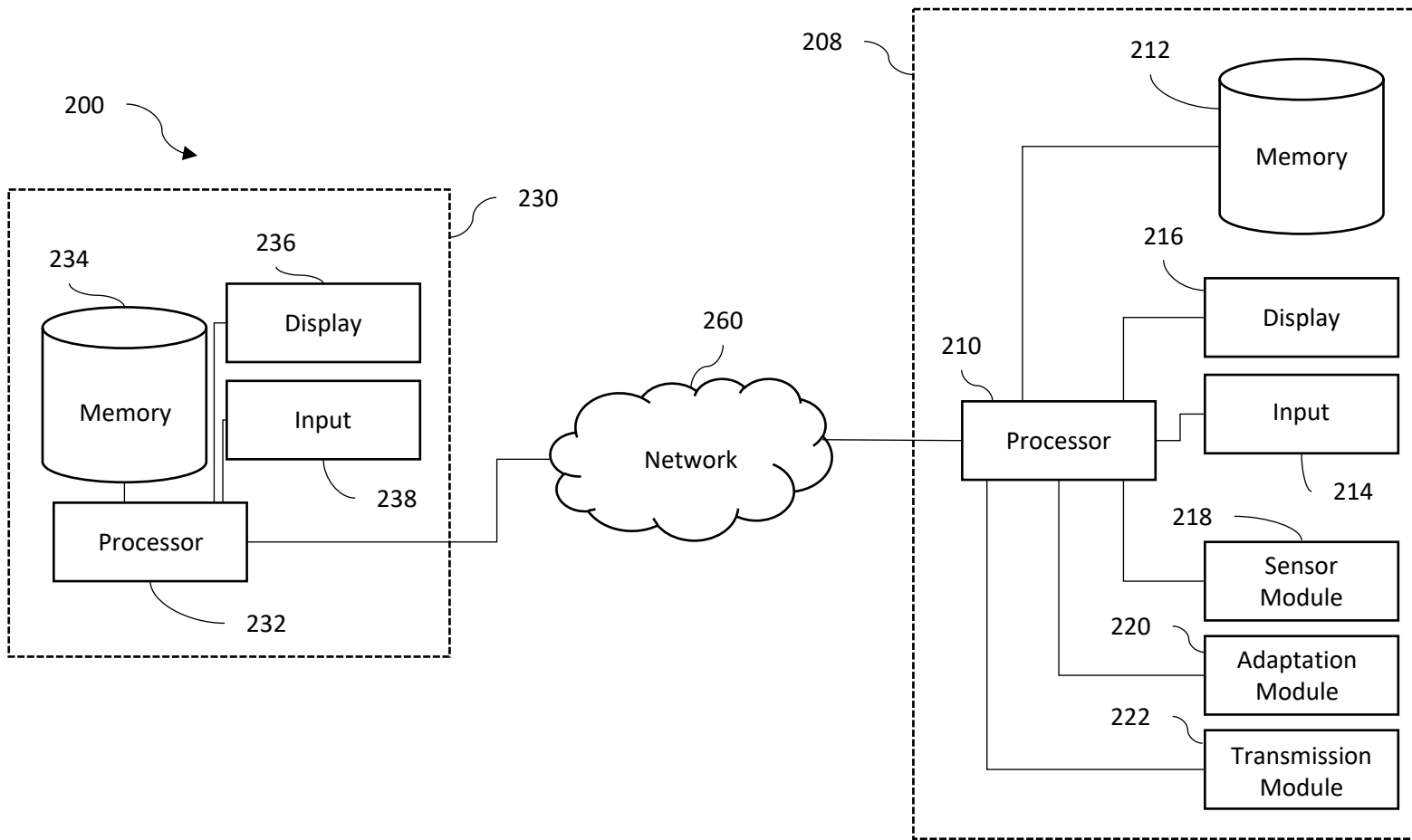


Fig. 2

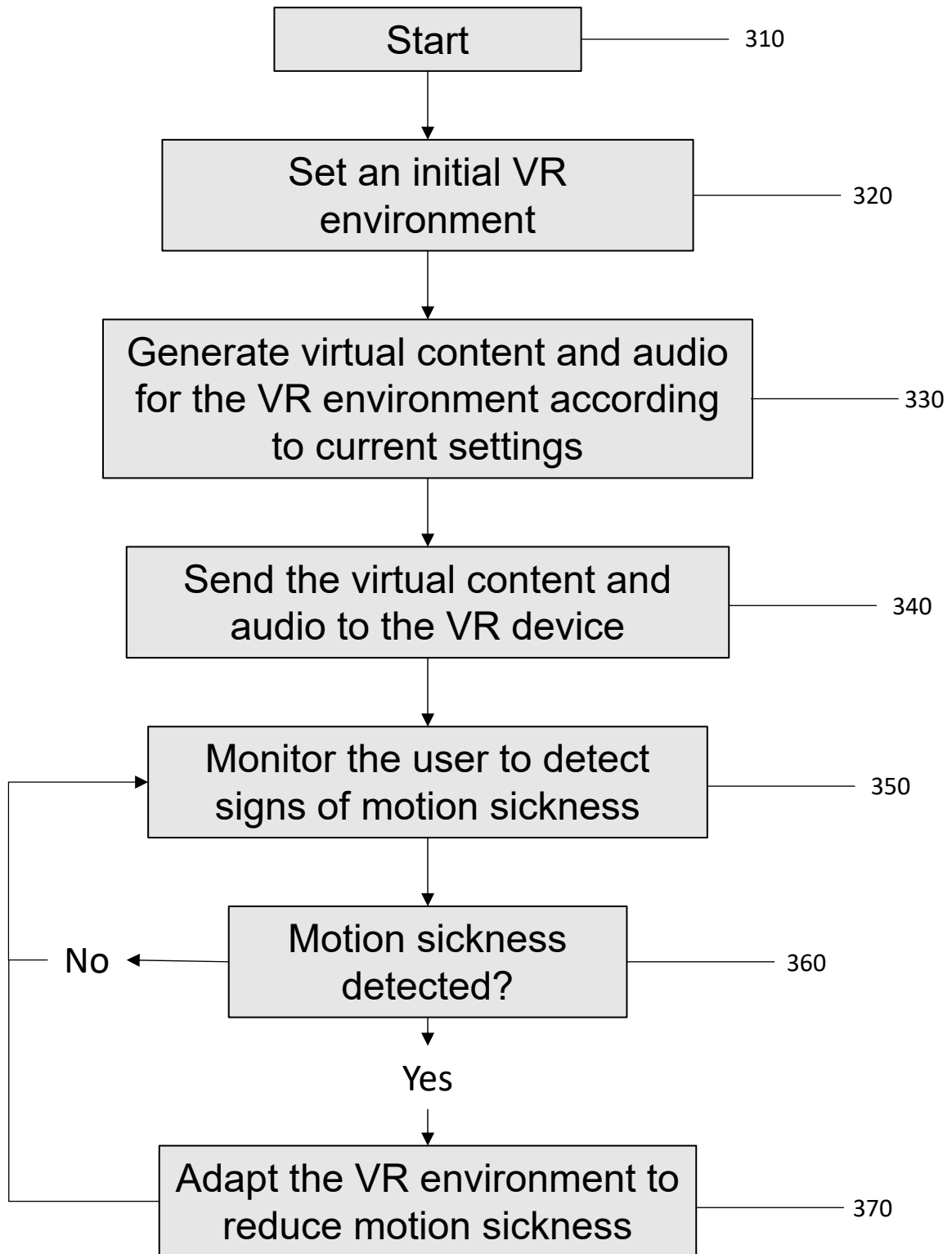


Fig. 3

1 Dr. Harriet Higgins, having been duly sworn, testified as follows:

2
3 EXAMINATION

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6
7 BY Mr. Duke Wolfson of Jones & Jones LLP

8 Q: Good morning, Dr. Higgins.

9 A: Good morning.

10 Q: I have some questions that I'd like to ask you today, if that's
11 all right with you.

12 A: Sure.

13 Q: You are the co-founder and CEO of Pygmalion, Inc., right?

14 A: That's correct.

15 Q: You founded Pygmalion while you were a Ph.D. student, right?

16 A: Right.

17 Q: When was Pygmalion founded?

18 A: In 2013.

19 Q: Had you finished your Ph.D. by that point?

20 A: No, I had finished everything but my dissertation by that point. I
21 received my Ph.D. in 2014.

22 Q: Your thesis was focused on techniques for reducing virtual reality
23 sickness stemming from the use of VR devices, right?

24 A: That's right. My thesis focused on the impact of dynamically adjus-
25 -ting interpupillary distance based on user anatomy, resolution and
26 angle of VR displays, the existence and placement of stationary an-
27 -chors in displayed content, and signs and symptoms of VR sickness.

28 *** LINES OMITTED ***

29 Q: I'd like to talk next about the development of the software for the
30 Dance system. Was there a specific end goal you were focused on

31 Q: when developing the software for the Dance?

1 A: Overall, I wanted to add to the system described in the '913 patent
2 and improve the outcomes for users of VR systems.

3 Q: How did you do that?

4 A: During my Ph.D. program, I discovered that one of the major flaws
5 of existing VR systems was that they did not address the anatomy
6 and feeling of their users. Existing VR systems were fixed, meaning
7 that there was no way to adjust how the hardware presented video
8 and audio or how the software processed and delivered that video
9 and audio. So, after I had developed hardware that could adjust the
10 interpupillary distance of the headset's displays and sense where a
11 user's eyes were in space, I wrote software that could control and
12 adjust the headset, as well as process and adjust VR content to
13 reduce VR sickness symptoms.

14 Q: Were there any features in particular that you added to achieve the
15 goal of reducing VR sickness?

16 A: Yes, I developed an interlocking set of features that are the back-
17 bone of the Dance. I created a subsystem that analyzed the sensors
18 that tracked eye placement and movement, which would recalculate
19 the proper IPD on the fly. I implemented a special data structure
20 that allowed the software to quickly and efficiently store all of
21 the sensor data streaming in, allowing the system to compress the
22 data during runtime to reduce the space used in the headset's hard
23 drive while still allowing for fast data processing. I also implem-
24 -ented an algorithm that was able to leverage the hardware and its
25 ability to change the IPD on the fly and dynamically modify the
26 presentation of the video and audio in response to collected data.
27 After testing, though, I realized that the software needed one more
28 feature: because the data structure involved compressing and
29 decompressing data during runtime, I needed to create an agent
30 that would coordinate these processes, because it was the
31 combination of those features that supercharged the improvements

1 in VR sickness symptoms.
2 Was the source code for this software ever shared with anyone?
3 Nobody outside of Pygmalion.

4
5 *** LINES OMITTED ***

6
7 Dr. Megan Delaney, having been duly sworn, testified as follows:

8
9 EXAMINATION

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12
13 BY Ms. Sarah McCormick of Jones & Jones LLP

14 Good morning, Dr. Delaney.

15 Good morning.

16 You've been hired as an expert in this case on behalf of Pygmalion,
17 right?

18 That's right.

19 Where do you work?

20 I am a professor of electrical engineering at Boston Institute of
21 Technology, with a co-appointment to the department of computer
22 science. My research focuses on VR applications, with a special
23 focus on the use of VR in medical and consumer applications.

24 *** LINES OMITTED ***

25 You've reviewed Dr. Higgins's testimony from last week, correct?

26 Correct.

27 You understand that she has identified a set of features as the
28 main advance in the software underlying the Dance product, right?
29 Right. I know that she identified the combination of three things:
30 first, techniques for dynamically measuring and recalculating the
31 proper IPD, a special compressible data structure that struck a

1 balance between saving space on the Dance's hard drive while still
2 allowing for high performance and data throughput, and an algorithm
3 that leveraged the Dance hardware's flexibility in presenting
4 video and audio to the user.

5 Do you agree with Dr. Higgins's statement that the combination
6 of these features provide the major benefit to the Dance?

7 I do.

8 Why do you say that?

9 The combination of the features, especially when managed using
10 the control agent that is implemented in the Dance, provides
11 an improvement to user experience of VR sickness symptoms well
12 above and beyond just adding the benefits of each of these
13 features in isolation. The dynamic management of the three
14 features Dr. Higgins identified allows for VR headset display
15 performance that meets or exceeds other high-performance VR
16 systems on the market while "supercharging" the improvements
17 in VR sickness symptoms, as Dr. Higgins put it.

18 Could someone tell that there was an agent managing these things
19 during runtime of the Dance?

20 No.

21 Why not?

22 The agent runs only in the background. The user is never given any
23 visual indicator or other indicator that the agent even exists, let
24 alone that the agent is working to coordinate these systems.

25 How do you know that?

26 I reviewed the source code for the Dance software, analyzed the
27 Dance hardware, and tested the use of the Dance product over the
28 course of three months. The code for the agent, seen primarily in
29 the [REDACTED].cpp, [REDACTED].cpp, and [REDACTED].cpp code files,
30 cannot be extracted from the binary software that is shipped with
31 the consumer Dance product. In short, based on my experience with

1 the Dance product and my experience with software, the existence
2 and operation of the agent would not be readily ascertainable
3 without access to the underlying source code.

4 Would the three features Dr. Higgins identified be visible to the
5 user?

6 No.

7 Why not?

8 For the same reasons as the agent. The features are only visible
9 in the source code, which I understand has been kept confidential.

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