Trials@uspto.gov
Tel: 571-272-7822

Paper 24
Entered: October 16, 2015

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

UBISOFT ENTERTAINMENT SA,
Petitioner,

v.

PRINCETON DIGITAL IMAGE CORPORATION,
Patent Owner.

Case IPR2014-00635
Patent 5,513,129

Before BENJAMIN D. M. WOOD, TRENTON A. WARD, and BETH Z. SHAW, *Administrative Patent Judges.*

WOOD, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. INTRODUCTION

A. Background

Ubisoft Entertainment SA ("Petitioner") filed a Petition (Paper 3, "Pet.") requesting an *inter partes* review of claims 1–23 of U.S. Patent No. 5,513,129 (Ex. 1001, "the '129 patent"). Princeton Digital Image Corporation ("Patent Owner") filed a Preliminary Response (Paper 8, "Prelim. Resp."). We instituted an *inter partes* review of claims 1–13, 15–18, and 21–23 based on the following grounds of unpatentability:

Reference[s]	Basis	Claims Challenged
Tsumura[1]	§ 102(b)	10 and 11
Lytle[2]	§ 102(b)	5–7, 9–12, 16–18, 22, and 23
Adachi[3]	§ 102(b)	1, 12, 13, 15, and 21
Lytle and Adachi	§ 103(a)	1, 8, 12, 13, 15, and 21
Thalmann[4] and Williams[5]	§ 103(a)	1–4, 12, 13, 15, and 21

Decision on Institution ("Dec. on Inst.") 24–25.

[1] Tsumura et al., US 5,208,413 (iss. May 4, 1993) ("Tsumura," Ex. 1002).

[2] Wayne T. Lytle, *Driving Computer Graphics Animation from a Musical Score*, Scientific Excellence in Supercomputing, The IBM 1990 Contest Prize Papers 643–686 (Keith R. Billingsley et al. ed., 1992) ("Lytle," Ex. 1003).

[3] Adachi et al., US 5,048,390 (iss. Sept. 17, 1991) ("Adachi," Ex. 1004).

[4] Daniel Thalmann, *Using Virtual Reality Techniques in the Animation Process*, Proc. Virtual Reality Systems, British Computer Society 1-20 (1992) ("Thalmann," Ex. 1006).

[5] Williams et al., US 5,430,835 (iss. July 4, 1995) ("Williams," Ex. 1005).

After the Board instituted trial, Patent Owner filed a Patent Owner Response (Paper 14, "PO Resp."), to which Petitioner replied (Paper 16, "Pet. Reply"). Oral Hearing was held on July 7, 2015, and the Hearing Transcript (Paper 23, "Tr.") had been entered in the record.

We have jurisdiction under 35 U.S.C. § 6(c). This Final Decision is entered pursuant to 35 U.S.C. § 318(a). We determine that Petitioner has shown by a preponderance of the evidence that claims 1–13, 15–18, and 21–23 are unpatentable.

B. Related Proceedings

The parties represent that the '129 patent is the subject of the following district court proceedings: (1) *Princeton Digital Image Corp. v. Ubisoft Entertainment SA*, Case No. 1:13-cv-00335-LPS-CJB (D. Del.); (2) *Princeton Digital Image Corp. v. Harmonix Music Systems, Inc.*, Case No. 1:12-cv-01461 (D. Del); and (3) *Princeton Digital Image Corp. v. Activision Publishing, Inc.*, Case No. 2:12-cv-01134 (C.D. Cal.) (dismissed). Pet. 59; Mandatory Notice by Patent Owner under 37 C.F.R. § 42.8 (Paper 7), 1–2.

In addition, the'129 patent was the subject of an *inter partes* review in *Harmonix Music Sys., Inc. v. Princeton Digital Image Corp.*, Case IPR2014-00155 ("'155 IPR") (PTAB May 9, 2014) (Paper 26). In that proceeding, the Board determined that claims 10, 11, 22, and 23 are unpatentable. '155 IPR, Paper 26, 29.

C. The '129 Patent

The '129 patent relates to systems and methods for controlling a computer system—in particular, a "virtual reality" computer system—using audio signals. Ex. 1001, 29:1–64, 29:65–30:65. The '129 patent uses the

terms "virtual reality," "virtual world," and "virtual environment" interchangeably "to describe a computer-simulated environment (intended to be immersive) which includes a graphic display (from a user's first person perspective, in a form intended to be immersive to the user)." *Id*. at 1:22–27.[6] A component of the disclosed invention, referred to as an "Acoustic Etch," receives music (in electronic, acoustic, or optical form) and processes it to generate signals to control the VR computer system. *Id*. at 4:54–67. For example, the Acoustic Etch can use a known algorithm to "extract a rhythm signal indicative of the beat of some frequency band of the music . . . or of some other parameter of a frequency band of the music," and use the extracted signal to control the movement of a virtual dancer. *Id*. at 5:4–10.

The Acoustic Etch also can supply prerecorded control tracks or generate control signals from prerecorded control tracks. *Id*. at 5:11–17. "The control tracks can be generated automatically (e.g., by electronic signal processing circuitry) in response to a music signal and then recorded, or can be generated in response to manually asserted commands from a person (while the person listens to such music signal) and then recorded." *Id*. at 5:21–26.

Figure 2 of the '129 patent is reproduced below:

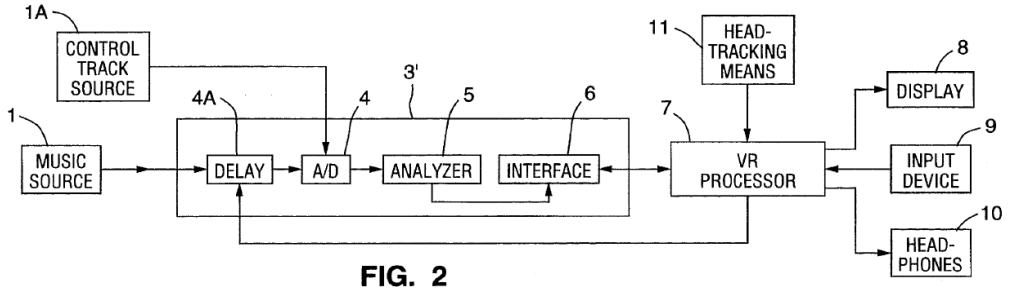

FIG. 2

[6] We adopt the '129 patent's use of the abbreviation "VR" to denote "virtual reality," "virtual environment," or "virtual world." Ex. 1001, 1:20–33.

Figure 2 above depicts a diagram of a computer system in which a control track is recorded on, and played back from, first medium 1A, e.g., a video game cartridge; and a corresponding music signal is recorded on, and played back from, second medium 1, e.g., a compact disk ("CD"). *Id*. at 8:58–65. Analog-to-digital ("A-to-D") conversion circuit 4 within Acoustic Etch 3' receives and digitizes the control track from first medium 1A and the music signal from second medium 1. *Id*. at 8:33–35. Analyzer 5 within Acoustic Etch 3' receives the digitized output and generates control signals by processing the control track and music signal, and outputs the control signals through interface 6 to VR processor 7. *Id*. at 8:38–42. VR processor 7 "is a computer programmed with software for implementing a virtual environment" and "can cause image data representing a virtual environment to be displayed on display device 8." *Id*. at 8:1–4. VR processor 7 uses the control signals to control generation of the virtual environment. *Id*. at 8:41–44.

Figure 5 of the '129 patent, which depicts a system for creating a control track, is reproduced below:

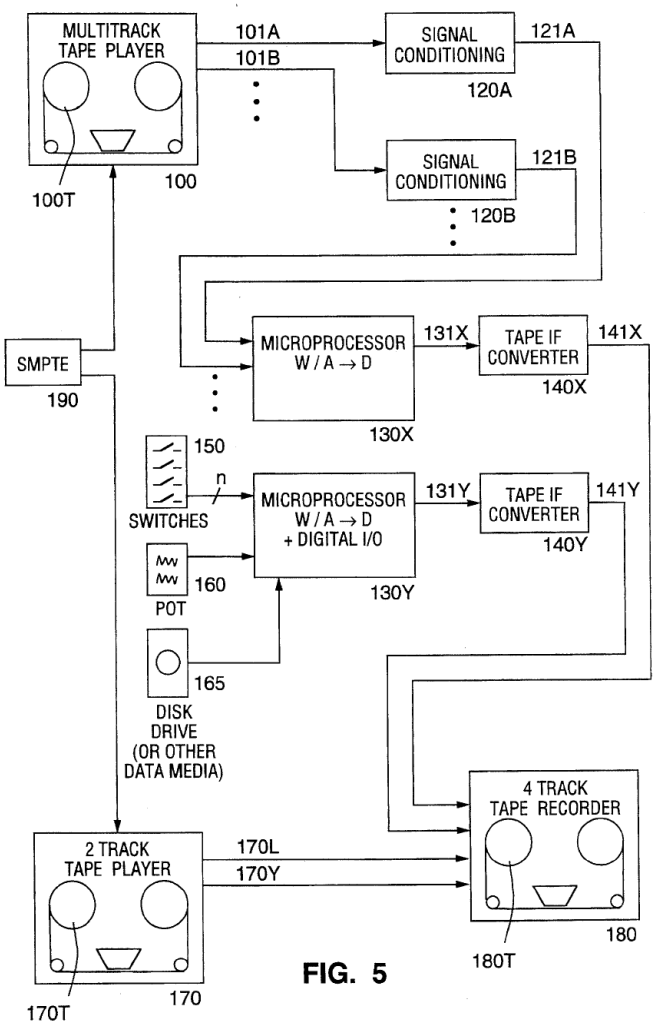

FIG. 5

Figure 5 depicts "a block diagram of a system for creating an audio tape with control tracks." *Id*. at 7:29–31. In Figure 5, multitrack tape player unit 100 is loaded with master tape 100T and outputs music signals 101A, 101B. *Id*. at 13:11–15. Signal conditioners 120A, 120B receive music signals 101A, 101B and output analog control signals 121A, 121B to A-to-D converter/microprocessor 130X for generating a digital control track. *Id*. at 13:16–26. Microprocessor 130X outputs a serial data stream to tape interface ("IF") converter 140X, which sends output data signal 141X to 4-track audio tape recording unit 180 for recording onto 4-track audio cassette tape 180T. *Id*. at 13:16–31.

Figure 5 also illustrates assembly of switches 150 (or other means by which a human operator can input digital signals) that "feeds parallel digital data to microprocessor 130Y." *Id*. at 13:33–36. Microprocessor 130Y generates another control track in response to this input data, and sends it, via tape IF converter 140Y, to 4-track audio tape recording unit 180. *Id*. at 13:42–48. Two-track tape playing unit 170, loaded with master tape 170T, is time-synchronized with multitrack tape player unit 100 through SMPTE synchronizer 190, and outputs left and right audio signals 170L, 170R to 4-track audio tape recording unit 180. *Id*. at 13:49–55. In this way, 4-track audio cassette tape 180T contains audio signals 170L, 170R (which are typically music signals) and "two other tracks containing control tracks corresponding to the audio signals." *Id*. at 13:56–59.

Virtual objects that can be generated by the VR processor are illustrated in "the display of a virtual environment shown in FIG. 11." *Id*. at 18:15–17. Figure 11 of the '129 patent is reproduced below.

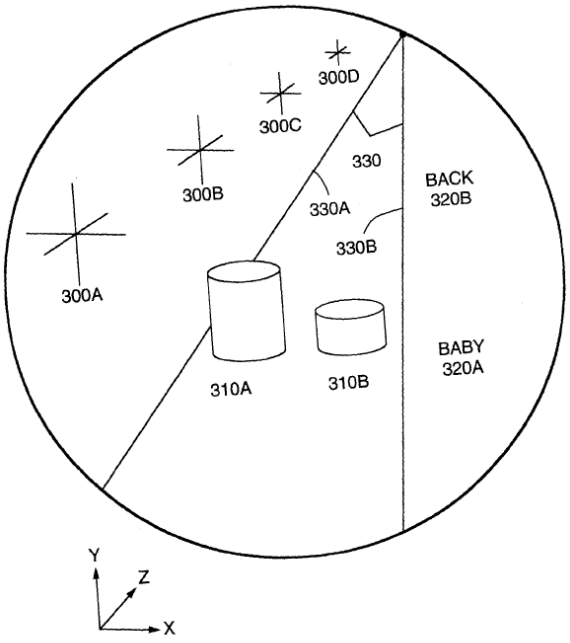

FIG. 11

Figure 11 depicts examples of virtual objects that can be created by the VR program of the invention. *Id*. at 7:47–48, 14:39–40. Cylindrical objects 310A, 310B "are fixed in space, but change height over time." *Id*. at 14:44–45. The height of objects 310A, 310B can be "controlled via the control track information and the two heights indirectly represent the first two audio channels." *Id*. at 18:23–26. For example, if the first two audio channels are recordings of a bass drum and snare drum, respectively, then one cylinder (e.g., 310A) would change height in response to the base drum and the other cylinder (e.g., 310B) would change height in response to the snare drum. *Id*. at 18:27–33.

D. Illustrative Claims

Claims 1, 5, 10, 12, 16, 21, and 22 are independent. The remaining claims upon which institution was granted are dependent from these independent claims. Dec. on Inst. 24–25. Claims 1 and 5 are each drawn to a method for controlling production of a virtual environment by a virtual reality computer system; claim 10 is drawn to a method of controlling a computer system; claims 12, 16, and 21 are each drawn to a virtual reality computer system; and claim 22 is drawn to a computer system. Independent claims 1 and 22 are illustrative of the claimed subject matter and are reproduced below:

> 1. A method for controlling production of a virtual environment by a virtual reality computer system, including the steps of
> (a) processing music signals to generate control signals having music and/or control information; and
> (b) operating the virtual reality computer system in response to the control signals to generate said virtual environment.

22. A computer system, including:
means for prerecording a control track having audio and/or control information corresponding to an audio signal; and
a processor which receives the control track and which is programmed with software for operating the computer system in response to said control track.

II. ANALYSIS

A. Claim Construction

The '129 patent expired on July 14, 2013. "[T]he Board's review of the claims of an expired patent is similar to that of a district court's review." *In re Rambus, Inc.*, 694 F.3d 42, 46 (Fed. Cir. 2012). Because the expired claims of the patent are not subject to amendment, we apply the principle set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312 (Fed. Cir. 2005) (en banc) (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)), that "words of a claim 'are generally given their ordinary and customary meaning'" as understood by a person of ordinary skill in the art in question at the time of the invention. "In determining the meaning of the disputed claim limitation, we look principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

We expressly construe below only those claim terms that require analysis to resolve arguments related to the patentability of the challenged claims. *See Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (holding that "only those [claim] terms need to be construed that are in controversy, and only to the extent necessary to resolve the

controversy"). All other terms will be accorded their ordinary and customary meaning as would be understood by one of ordinary skill at the time of the invention.

1. "virtual environment" (claims 1, 5–9, and 12–21)

Petitioner asserts that the term "virtual environment" should be construed to mean "a computer-simulated environment which includes a graphic display, and optionally also sounds which simulate environmental sounds." Pet. 4. Petitioner alleges that "parenthetical statements of 'intent'" appearing in the description of the term "virtual environment," such as "intended to be immersive" and "from a user's first person perspective" , should not be accounted for in the claim construction analysis. *Id*. To the extent the parentheticals are incorporated in the construction, Petitioner argues that the construction should encompass the exemplary virtual environments described in the Specification, such as virtual hands clapping, dancing characters, and lyrics. *Id*. at 4–5.

In the Decision on Institution, we included these so-called "parenthetical statements of intent" into our construction, because the '129 patent expressly defined "virtual environment" to include those statements. Dec. on Inst. 8. Petitioner fails to persuaded us to modify that construction; thus, as in the Decision on Institution, we adopt the Specification's express definition of "virtual environment," which is "a computer-simulated environment (intended to be immersive) which includes a graphic display (from a user's first person perspective, in a form intended to be immersive to the user), and optionally also sounds which simulate environmental sounds." *Id*. (quoting Ex. 1001, 1:22–33).

However, we agree with Petitioner that the term should be construed to encompass the specific embodiments that the '129 patent describes. As the Federal Circuit has noted, "the specification is always highly relevant to the claim construction analysis," and, in fact, "is the single best guide to the meaning of a disputed term." *Phillips*, 415 F.3d at 1315 (internal citation and quotation marks omitted). Here, given that the Specification does not elucidate what it means by "intended to be immersive to the user," and given that the phrase is subjective, we find the specific embodiments discussed in the Specification to be particularly informative.

As part of "the preferred VR program," Figure 11 depicts a group of simple cylindrical objects that appear to change height in response to the sound of drums. Ex. 1001, 18:16–33. Also in the "preferred VR program embodiment," words representing the lyrics of a song are displayed as the words are vocalized. *Id*. at 18:49–53. Further, as Petitioner notes, the Specification teaches that the graphic display generated by a VR system can be either two-dimensional or three-dimensional, and can be displayed on a single flat screen display that need not be stereoscopic. Pet. 4 (citing Ex. 1001, 1:34–35, 8:7–13).[7] Given that a claim construction that excludes a preferred embodiment is "rarely, if ever, correct," *Vitronics*, 90 F.3d at 1583, it is appropriate to construe "virtual environment" broadly enough to encompass these displays.

[7] The Specification also discloses embodiments of the "VR system" that perform operations such as: using a rhythm signal extracted from music "to control the rhythm of a virtual dancer," "displaying virtual hands clapping in time to the beat of the music," or a virtual "stick figure dancing in time" to the music. *Id*. at 5:1–10, 11:36–41, 58–62, 12:18–24.

2. Means-Plus-Function Claim Terms

Several terms relevant to this decision are means-plus-function claim terms. "An element in a claim for a combination may be expressed as a means . . . for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof." 35 U.S.C. § 112 ¶ 6.[8] We construe such a limitation by first determining the claimed function and, second, identifying the structure or materials disclosed in the Specification that correspond to the means for performing that function. *See Kemco Sales, Inc. v. Control Papers Co.*, 208 F.3d 1352, 1360 (Fed. Cir. 2000). With respect to the second step, "structure disclosed in the specification is 'corresponding' structure only if the specification or prosecution history clearly links or associates that structure to the function recited in the claim." *Golight, Inc. v. Wal-Mart Stores, Inc.*, 355 F.3d 1327, 1334 (Fed. Cir. 2004) (citations and quotation marks omitted). Structural features that do not actually perform the recited function do not constitute corresponding structure and thus do not serve as claim limitations. *Asyst Techs, Inc. v. Empak, Inc.*, 268 F.3d 1364, 1369–70 (Fed. Cir. 2001) (citations omitted).

[8] Section 4(c) of the Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011) ("AIA") re-designated 35 U.S.C. § 112 ¶ 6, as 35 U.S.C. § 112(f). Because the '129 patent has a filing date prior to September 16, 2012, the effective date of § 4(c) of the AIA, we refer to the pre-AIA version of 35 U.S.C. § 112.

a. "means for supplying a first signal selected from a group consisting of a control signal having music and/or control information generated in response to a music signal, a prerecorded control track having music and/or control information corresponding to the music signal, and a control signal having music and/or control information generated in response to the prerecorded control track" (claim 12)

The recited function is "supplying a first signal selected from a group consisting of [1] a control signal having music and/or control information generated in response to a music signal, [2] a prerecorded control track having music and/or control information corresponding to the music signal, and [3] a control signal having music and/or control information generated in response to the prerecorded control track." We agree with the Petitioner that the function is written as a Markush group, meaning that the three options are presented in alternative form. *See Fresenius USA, Inc. v. Baxter Int'l, Inc.*, 582 F.3d 1288, 1298 (Fed. Cir. 2009) (holding that an element written in Markush form is disclosed by the prior art if one alternative in the Markush group is in the prior art).[9] However, Petitioner does not contend that any of the asserted prior-art references or combinations of references discloses the third option. Therefore, our analysis focuses on the first two options.

[9] In the '155 IPR Final Written Decision, we construed terms using "and/or" to require alternatives as well, e.g., the term "a control signal having music and/or control information" reads on a control signal having music, ***or*** a control signal having control information, ***or*** a control signal having both music and control information. '155 IPR, Paper 26, 10. Neither party disputes this particular construction, and we apply it for purposes of this Final Written Decision.

Petitioner contends that the required structure may be only an audio source, such as a tape player or CD player, presumably based on the reasoning that the "first signal" may be "a control signal having . . . music." Pet. 6. Alternatively, according to Petitioner, if the first signal is "a control signal having control information generated in response to a music signal," the required structure is a processor "programmed with software for implementing algorithms such as 'those related to simple filtering and analysis [] of the same type used by well known graphic equalizers' to process a music signal to produce control information and pass it on to a VR computer." *Id*. (citing Ex. 1001, 5:1–7, 11:28–39, 4:29–33, Fig. 4). Petitioner further contends that if, instead, the first signal is "'a prerecorded control track having control information corresponding to the music signal,' the processor is programmed with software to 'implement the extraction of the control information from a control track.'" *Id*. at 7 (quoting Ex. 1001, 11:1–4; citing *Id*. at 8:55–57, Figs. 1, 2, 4).

Patent Owner, on the other hand, contends that the structure necessary to perform the claimed function includes:

> [A] media player having signal outputs, a sound processor connected to one or more of the media player outputs, an audio amplifier connected to the sound processor, one or more tape IF converters connected to one or more of the media player outputs, an audio source such as a microphone, a multichannel audio digital [*sic*, digitizer] with serial output connected to one or more outputs of the media player and to an audio source, a microprocessor having inputs connected to the tape IF converters and programmed to generate control signals.

PO Resp. at 11–12. In other words, according to Patent Owner, the required structure includes *all* of the components depicted in Figure 6 that are "connected to the inputs of the VR system 250 and the VR display 260."

PO Resp. 12. Patent Owner asserts that Petitioner's recitation of corresponding structure is incorrect because it omits components that are necessary to perform the recited function. PO Resp. 13–14.

In its Reply, Petitioner contends that Patent Owner's "proposed structure includes numerous elements that are not necessary to perform any of the recited functions," such as (using the numerical identifiers in Figure 6) multichannel audio digitizer 245, sound processor 205, microphone 248, and audio amplifier 210. Pet. Reply 2–3 (citing Ex. 1001, 10:51–65, 17:13–22, 19:15–22; Ex. 1013 ¶ 19). Petitioner also asserts that the '129 patent contemplates a digital "alternative embodiment" that would render other components, such as tape IF converters, unnecessary. *Id*. at 3. (citing Ex. 1001, 20:32–34; Ex. 1013 ¶ 20).[10]

Having reviewed the '129 patent, we determine that the Specification clearly associates the following structure with the first two recited functions: (1) a *source* of music and/or a control track, such as a four-track audio tape, video-game cartridge or compact disk (CD); and (2) a *processor* programmed to generate control signals from the input music and/or control track and send the control signals to the VR processor. For example, in discussing Figure 1, the Specification states:

[10] The parties make essentially the same arguments with respect to two other means-plus-function limitations: "means for receiving said music signal in digital or analog form, and processing said music signal to produce control information for modification of objects in the virtual environment" (claim 13); and "means for supplying the music signal to the means for producing the virtual environment" (claim 18). *See* PO Resp. 15–16, 21–22; Pet. Reply 5–8. The analysis that follows applies equally to these limitations, and we determine that the structure that corresponds to the "supplying" function of claim 12 also corresponds to the functions recited in these limitations.

> An analog-to-digital conversion circuit within Acoustic Etch unit 3 receives and digitizes a *music signal from source 1*. The music signal is optionally accompanied by one or more prerecorded control tracks corresponding to the music signal. . . . *Analyzer 5*[11] *within Acoustic Etch unit 3* receives the digitized output of [music source 1 via analog-to-digital converter 4], and generates control signals by processing the music signal (or both the music signal and the control tracks). The control signals output from analyzer 5 are *supplied* through interface 6 to VR processor 7 for use within processor 7 for controlling generation of the virtual environment.

Ex. 1001, 8:33–44 (emphasis added); *see also id*. at 11:21–24 ("[i]n operation, the [Acoustic Edge device used in the Figure 1 system] takes in music and processor 5 [within the Acoustic Edge] processes it to produce control information [that is] passed on to the VR computer"). Likewise, referring to Figure 6, the Specification states that

> Microprocesor unit 240 is programmed with software for generating control signals for VR graphics system 250 in response to one or both of data streams 221Y and 221X, and outputs a serial data stream indicative of such control signals to virtual reality (VR) graphics system 250. . . . Microprocessor unit 240 . . . combines both control signals 221Y and 221X and converts this digital data into a serial data stream suitable for processing by the VR system, for example in the format of a RS232 or MIDI data stream.

Id. at 14:2–7, 16:62–65.

The Specification contemplates several possible sources for the music or control track, such as a four-track audio tape, video game cartridge, CD, Digital Audio Tape (DAT), or live performance. Ex. 1001, 4:41–44, 8:62–

[11] The Specification uses "analyzer" and "processor" interchangeably. Ex. 1001, 11:28–30.

65, 17:7–22, 20:10–13, Figs. 1, 2, 5, 6. The Specification also contemplates that the processor that receives the music signal and/or control tracks and generates control signals therefrom may be separate from the VR processor, or may be "embodied in the VR processor." *Id*. at 8:44–51, Figs. 1, 6.

The Specification discusses additional components that may be used in some configurations, but not in others. For example, depending on the specific music or control-track source—e.g., tape player, CD, video-game cartridge, or live performance—components such as sound processors, amplifiers, analog-to-digital converters, Tape IF converters, and microphones may be used. *Id*. at 9:56–10:2, 10:51–65, 11:11–17, 16:56–61, 17:7–22, 19:15–22, Figs. 4, 6, 9. We do not consider these optional components to be corresponding structure in all cases, because they are not necessary for every implementation of the invention. *See Wenger Mfg., Inc. v. Coating Mach. Sys., Inc.*, 239 F.3d 1225, 1233 (Fed. Cir. 2001) (holding that it is improper to "import . . . structural limitations from the written description that are unnecessary to perform the claimed function") (internal citation omitted).

b. "means for receiving the first signal and influencing action within a virtual environment in response to said first signal" (claim 12)

The recited function is "receiving the first signal and influencing action within a virtual environment in response to said first signal." Patent Owner contends that the corresponding structure is "a virtual reality system connected to the microprocessor and outputting video signals and a virtual reality display connected to the virtual reality system," e.g., VR system 250 and display unit 260 depicted in Figure 6. PO Resp. 14–15 (internal quotation marks omitted). Petitioner disagrees that a virtual reality display

is necessary structure for performing the recited function. Pet. Reply 4–5. We agree with Petitioner. It is VR processor 7 (Figures 1 and 2) or VR system 250 (Figure 6) that receives the control information and generates the virtual environment. Ex. 1001, 8:38–44, 11:21–24, 14:2–7, 16:62–65. Accordingly, the structure necessary to perform the recited function is a processor suitably programmed to carry out the function.[12]

c. "means for prerecording a control track having music and/or control information corresponding to a music signal" (claim 16); "means for prerecording a control track having audio and/or control information corresponding to an audio signal" (claim 22)

The recited function for the limitation in claim 22 is "prerecording a control track having audio and/or control information corresponding to an audio signal." As Patent Owner notes, the recited function for claim 16 "is the same except that the term 'audio' is replaced with 'music,' a particular type of audio." PO Resp. 17. Patent Owner argues that the structure corresponding to these functions is that depicted in Figure 5, i.e.,

> [A] first media player unit, one or more input devices, one or more microprocessors programmed with software to generate a control track from audio data and other input data and connected to the input devices, one or more interface converters connected to the one or more microprocessors, a second media player unit, a synchronizer connected to the first and second media player units, and a media recorder connected to the one or more interface converters and the second media player unit.

[12] The same analysis and result apply to the limitation in claim 16 requiring a "means for producing the virtual environment in response to said prerecorded control track."

PO Resp. 17. Petitioner responds that Figure 5 "encompasses multiple disclosed structural embodiments, any of which can perform these claimed functions," and that not all of the components depicted in Figure 5 are necessary for each embodiment. Pet. Reply 6.

As we noted in the Final Written Decision in the '155 IPR (Paper 26, 11), the Specification does not describe prerecording a *control track* having audio, but rather distinguishes prerecorded *control tracks* from prerecorded *audio*. *See* Ex. 1001, 4:41–45 ("The system includes means for interfacing between the computer software which controls production of the virtual world, and live or prerecorded music (and/or prerecorded control tracks)."); *id*. at 5:11–20 ("As an alternative (or in addition [to)] extracting signals from music itself . . . [,] one or more prerecorded control tracks corresponding to the music [can be supplied]."); *id*. at 9:61–63 ("Acoustic Etch unit 3´´ of FIG. 4 can receive digital prerecorded music and/or control track or analog prerecorded music and/or control track."). Therefore, we focus on the function of prerecording a control track having control information corresponding to an audio (or music) signal.

We determine that the structure identified in the Specification as necessary to perform the function of prerecording a control track having control information corresponding to an audio (or music) signal includes: (i) a first media player unit (e.g., four-track tape player, CD or DAT playback device), a microprocessor for generating a control track from the received data from the media player unit, and a media recorder (*id*. at 13:11–31, 20:10–13); *or* (ii) one or more input devices for inputting signals, a microprocessor for generating a control track from the received signals, and a media recorder (*id*. at 13:32–48, 20:10–13).

We disagree with Patent Owner that interface converters, e.g., tape IF converters 140X, 140Y, are always necessary for this function. The Specification indicates that "[t]he recording medium for the inventive prerecorded control tracks does not need to be a four-track audio tape" and that" [CD] and Digital Audio Tape (DAT) formats already offer control track capabilities." Ex. 1001, 20:10–14. We also disagree with Patent Owner that a second media player unit, e.g., element 170, and synchronizer, e.g., element 190, are necessary, because these particular structures relate to the audio component, as opposed to the control track component. Ex. 1001, 13:50–59, Fig. 5.

d. "means for supplying the audio signal to the processor" (claim 23)

The recited function is "supplying the audio signal to the processor." Patent Owner argues that the corresponding structure comprises "an analyzer [5] connected to an audio source [1] and an interface [6] connected to the analyzer [5] and to a processor [7]." PO Resp. 22–23 (citing Ex. 1001, 8:38–40, 43–45, 9:4–6, Fig. 2; Ex. 2006 ¶ 19). Petitioner counters that Patent Owner is attempting to import unnecessary structure, and that the only required structure is a music source and general purpose computer. Pet. Reply 8.

In light of the Specification's disclosure of an embodiment in which the music signal goes directly to the processor (Ex. 1001, 8:45–47), we disagree with Patent Owner that the analyzer and interface of Figure 2 are always necessary to perform the claimed function of supplying the audio signal to the processor. We determine, instead, that the structure disclosed in the Specification necessary to perform the claimed function of supplying

the audio signal to the processor includes: (i) four-track tape and four-track tape playing unit and a multichannel audio digitizer, (ii) a live microphone and a multichannel audio digitizer, *or* (iii) a CD or DAT playback device.

B. Claims 10 and 11—Anticipation by Tsumura

Petitioner contends that Tsumura anticipates claims 10 and 11.

1. Tsumura

Tsumura describes a vocal display device that displays both lyrics and "data useful for the enhancement of the singer's presentation[,] such as the strength of the vocals and the pitch." Ex. 1002, Abstr. The basic configuration includes memory means 110, vocal data reading means 120, current lyric position indicator 130, and image control means 140. *Id*. at Fig. 1. Memory means 110 stores music data for a large number of different pieces of music. *Id*. at 2:39–43. On receipt of output from vocal data reading means 120 and current lyric position indicator 130, image control means 140 "controls . . . visual display medium 150 in such a way that it displays the strength data extracted from the vocal data relating to a given block in advance of the corresponding music while at the same time displaying the lyric position within said block in time with the corresponding music." *Id*. at 4:57–64. In one embodiment, the configuration further includes comparator 541 which can "compar[e] the strength levels of actual vocal renditions with strength data and display[] an appropriate instruction on screen in accordance with the results of said comparison," such as "sing more quietly," "as you are," or "sing more loudly." *Id*. at 11:38–60. Tsumura discloses a means for "extract[ing] the vocal data" from memory, and an "image generating means" that "synchronizes and compares stored pitch data with a detected frequency of the user's vocal performance to

generate "control messages displayed to the user," such as "lower your pitch[]," "as you are," or "raise your pitch."

2. Analysis

Claim 10 recites a "method for controlling a computer system," including the steps of "(a) prerecording a control track having audio and/or control information corresponding to an audio signal; and (b) operating the computer system in response to said prerecorded control track." Petitioner contends that Tsumura describes storing "music data for a large number of different pieces of music," each item of music data containing "vocal data," including "stored pitch data," relating to the vocal features of the music. Pet. 18–19 (citing Ex. 1002, 2:40–65, Figs. 2, 3). According to Petitioner, this disclosure corresponds to claim 10's "prerecording" step. *Id*. at 20. Petitioner further contends that comparing the strength and pitch of actual vocal renditions with strength and pitch data in memory, and then generating control messages based on that comparison and displaying them to a user, corresponds to claim 10's "operating" step. *Id*. at 20.

Patent Owner disputes that Tsumura teaches the limitations of claim 10. Patent Owner quotes its declarant, Dr. Jay P. Kesan, as stating that "Tsumura does not disclose that the computer system is operated in response to a prerecorded control track having audio or control information; it instead merely discloses the display of the words of a song along with suggestions to a singer while playing the music." PO Resp. 44–45 (quoting Declaration of Dr. Jay P. Kesan, Ex. 2002 ¶ 42). Petitioner responds that Tsumura "changes [the] display" in accordance with prerecorded music and vocal data, and in that sense operates the computer system in accordance with that data. Pet. Reply 11–12.

There is no dispute that Tsumura's teaching of storing music data, including "stored pitch data" and other vocal data relating to the vocal features of the music, corresponds to claim 10's step of "prerecording a control track having audio and/or control information corresponding to an audio signal;" stored music data constitute the control track, and the vocal data, including the pitch and strength data, constitute the claimed control information that corresponds to an audio signal. Further, we agree with Petitioner that Tsumura teaches operating the computer system in accordance with this control track, in that, among other things, the computer system will display messages to a user that depend on a comparison of the stored data and the user's vocal performance.

We have considered Patent Owner's contrary evidence and arguments, but do not find them persuasive. Neither Patent Owner nor Dr. Kesan explains why generating and displaying messages to a user based on the comparison of stored music data and the user's actual voice does not constitute "operating the computer system in response to said prerecorded control track," as recited in claim 10. Given Dr. Kesan's failure to support his position with any analysis, we accord that position little weight. *See Velander v. Garner*, 348 F.3d 1359, 1371 (Fed. Cir. 2003) (affirming the Board's determination to give little weight to an expert's "broad conclusory statements").

Claim 11 depends from claim 10 and additionally recites the steps of "(c) supplying the audio signal to the computer system; and (d) operating the computer system in response to both the audio signal and the prerecorded control track." Petitioner asserts that Tsumura discloses supplying the music to a music reproduction means of the disclosed system, which corresponds

to the "supplying step," and discloses reproducing the music in synchronization with displayed lyrics and vocal instructions by using a delay circuit to compensate for system lag, which corresponds to the "operating" step. Pet. 20–21 (citing Ex. 1002, 3:22–24, 61–64, 8:24–50, 12:3–6, Fig. 15). Patent Owner responds that Tsumura does not meet claim 11's additional limitations because its system "merely plays the audio (i.e., music)." PO Resp. 45 (citing Ex. 2002 ¶ 42). But Patent Owner does not address Petitioner's contention that Tsumura does not merely play the music, but synchronizes the playback with the display of lyrics and vocal instructions to the user. We agree with Petitioner that this synchronized playback corresponds to the step of operating the computer system in response to the audio signal and the prerecorded control track.

For the above reasons, we determine that Petitioner has shown by a preponderance of the evidence that Tsumura anticipates claims 10 and 11.

C. Claims 5–7, 9–12, 16–18, 22, and 23—Anticipation by Lytle

Petitioner contends that claims 5–7, 9–12, 16–18, 22, and 23 are anticipated by Lytle.

1. Lytle

Lytle describes a method and system—the "Computer Graphics/Electronic Music System" (CGEMS)—for "algorithmically controlling computer graphics animation from a musical score" to create video work "consisting entirely of visually simulated musical instruments synchronized to their synthesized soundtrack counterparts." Ex. 1003, 644–45. CGEMS "perform[s] the music-to-graphics mapping operation[], receiv[es] a MIDI [musical instrument digital interface] file as input and produc[es] as output a series of parameter files which are passed to the

graphics application" to animate musical instruments. *Id*. at 656. "A variety of different mapping modules can be built, each tailored to the characteristics of a specific instrument." *Id*. The CGEMS "produce[s] an animation of a completely synthetic graphical concert entitled *More Bells and Whistles*." *Id*. at 665. Figure 200 of Lytle is reproduced below.

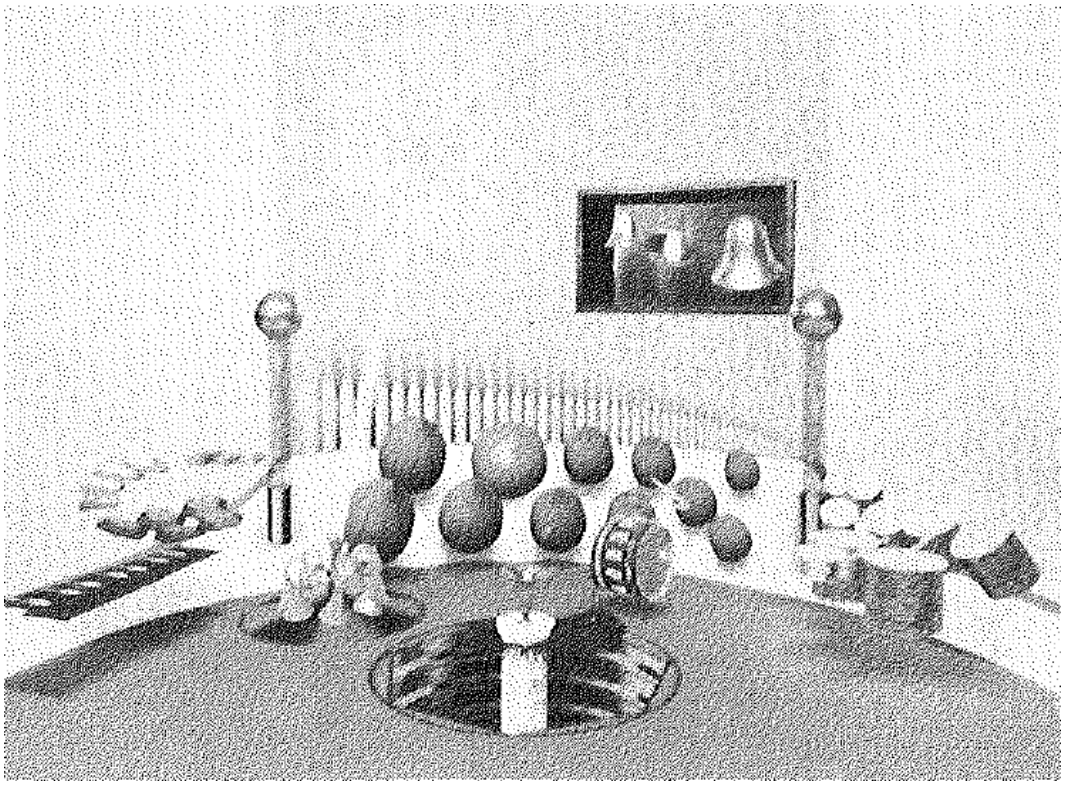

Figure 200 depicts an animation frame from *More Bells and Whistles* animated concert. *Id*. at 649, 672. The frame depicts an arrangement of musical instruments including a pipe organ, drums, and bells. *Id*. at Fig. 200. Lytle's generated environment comprises graphical instruments ranging from realistic to abstract or cartoon-like. *Id*. at 647, 666. Figure 202, reproduced below, shows several different graphical depictions of the same three-note phrase:

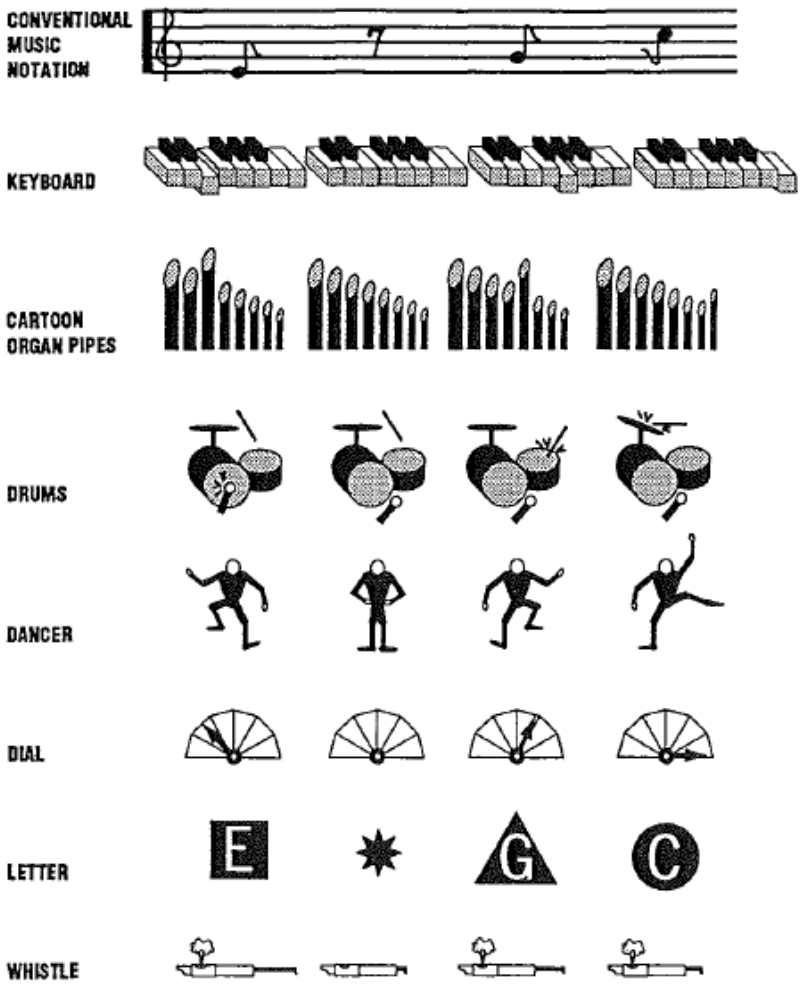

Figure 202. Possible Mappings for a Three-Note Phrase

As shown in Figure 202, a musical phrase can be graphically represented by the movement of piano keys, a dancer, etc.

2. Analysis

a. Independent Claims 5 and 10

Claim 5 recites a "method for controlling production of a virtual environment by a virtual reality computer system" including the steps of "(a) prerecording a control track having audio and/or control information corresponding to an audio signal; and (b) operating the virtual reality computer system in response to said prerecorded control track to generate

said virtual environment." Claim 10 contains similar "prerecording" and "operating" steps but is drawn more broadly to a method of controlling a computer system.

With respect to independent claim 5, Petitioner alleges that Lytle discloses a method for controlling production of a virtual environment by a virtual reality computer system in that Lytle discloses "[a] method for algorithmically controlling computer graphics animation from a musical score." Pet. 23 (citing Ex. 1003, 644). Petitioner alleges that Lytle discloses prerecording a control track having audio and/or control information corresponding to an audio signal in that Lytle discloses that "[s]equencers store encoded musical scores as MIDI data files, which contain timing information relating to each musical aspect." *Id*. at 25 (citing Ex. 1003, 646).

Petitioner further alleges that Lytle discloses operating the virtual reality computer system in response to said prerecorded control track to generate said virtual environment because "Lytle discloses a workstation computer and supercomputer programmed with software for creating and controlling computer graphics animation in a computer-simulated environment by mapping musical MIDI data from the MIDI input file to 3D instrument objects." Pet. 26. As Petitioner notes, Lytle discloses that the MIDI data file is transferred to a supercomputer, where "CGEMS reads the MIDI file, performs mapping operations, and produces graphics parameter files," which are "directed to object generator programs that construct completed instrument objects." *Id*. at 26 (citing Ex. 1003, 664); *see also* Ex. 1003, 665–666, Figs. 199, 215, 216 (discussing implementation of percussion element animation). The completed instrument objects, "along

with the remaining static objects, reflectance information, lighting, and other environment description data are passed to the image generator that produces the given frame." *Id*. at 27 (citing Ex. 1003 at 664, 666–667). Petitioner asserts that "Lytle illustrates that the computer-simulated environment is rendered from a perspective similar to what a person's avatar would see through their own eyes, if they were playing the animated instrument objects (i.e., first person perspective)." *Id*. at 24–25 (citing Ex. 1003, cover, Figs. 215, 216). Petitioner makes similar allegations with respect to claim 10. *Id*. at 29–30.

Patent Owner responds with several counter arguments. First, Patent Owner argues that Lytle does not disclose operating the virtual reality computer system in response to said prerecorded control track *to generate said virtual environment*. PO Resp. 31–34. Patent Owner asserts that "the claimed 'virtual environment' requires much more," i.e., "the display of the environment from the user's perspective such that the user feels that he or she is part of the environment." *Id*. at 33. According to Patent Owner, "there is no indication in Lytle that the displayed video would change to match a corresponding change in a user's perspective." *Id*. Patent Owner argues that it is not enough that Lytle's video be "inspirational" or "mesmeriz[ing]" to children, as even a book or a video can have such effects to some people. *Id*. at 34.

In its Reply, Petitioner responds that Patent Owner's "narrow interpretation of a 'virtual environment' is inconsistent with the '129 patent specification," noting, e.g., that the '129 patent discloses that a virtual environment may be displayed on a non-stereoscopic, two-dimensional display, may consist only of cylinders that change height in response to a

control track, or the display of song lyrics as the song is being sung. Pet. Reply 9.

We agree with Petitioner that this argument is based on an overly narrow construction of "virtual environment." The ''129 patent does not expressly define "virtual environment" to have the characteristic of changing a video display to match a corresponding change in a user's perspective. Thus, Lytle's alleged failure to teach this feature is not dispositive. Further, we construed "virtual environment" above to encompass the examples that Petitioner notes. Lytle discloses displays that are similar to, and at least as "immersive" as, these embodiments in the '129 patent. For example, as with the '129 patent, Lytle discloses moving an animated dancer in response to the beat of from a control track. For these reasons, we find that Lytle discloses "operating the virtual reality computer system in response to said prerecorded control track to generate said virtual environment," as recited in claim 5.[13]

Patent Owner next argues that Petitioner "improperly picked and chose different parts from different systems from Lytle" in arguing that Lytle anticipates claims 5 and 10. PO Resp. 36. According to Patent Owner, Petitioner combined parts from "i) a system that did not even exist (i.e., an imagined, ideal music graphics production environment) and ii) the system of FIG. 199 of Lytle." *Id*. (citing Pet. 24). Relying on the testimony of its expert, Dr. Kesan, Patent Owner contends that "the two systems

[13] Patent Owner also argues that Lytle does not disclose a "virtual reality computer system" because Lytle does not disclose producing a virtual environment. PO Resp. 35. Because, for the reasons stated above, we find that Lytle discloses producing a virtual environment, we also find that Lytle discloses a virtual reality computer system.

referenced by the Petitioner are significantly different and incompatible," in that in the "ideal environment," the "music, mapping, and graphics applications would all run concurrently on a single machine, allowing simultaneous editing of musical, graphical, and mapping parameters," whereas the system depicted in Figure 199 "separately records audio and video on two separate tapes, and then combines the audio and video from the two separate tapes onto a third tape." *Id*. at 36–37 (citing Ex. 2002 ¶ 57; Ex. 1003, 655–656) (internal quotation marks omitted).

Petitioner disagrees with this characterization of its anticipation argument based on Lytle. Petitioner asserts that it "never suggested merging components from two systems," but rather "rel[ies] on the system of Fig. 199 in Lytle." Pet. Reply 9. According to Petitioner, "since claim 5 'does not require that a single machine handle music input and graphic applications,' whether or not the Fig. 199 system in Lytle can be performed on a single machine is irrelevant." *Id*. at 10.

We agree with Petitioner. We have reviewed Petitioner's analysis supporting its contention that Lytle anticipates claims 5 and 10, and are persuaded that Petitioner relies on the actual system depicted in Figure 199—which utilizes a workstation to design and preview instrument element motion and a supercomputer to render the animation segments—rather than any idealized system in which the music, mapping, and graphics applications would run concurrently on a single machine. In other words, Petitioner relies on the system depicted in Figure 199 as performing both steps recited in claims 5 and 10. Pet. 23–30. For example, in asserting that Lytle teaches the prerecording step in claim 5, Petitioner refers to Lytle's teaching of using a computer to produce a MIDI file, and then transferring the MIDI data file

to a supercomputer to render the animation in accordance with the MIDI data file. Pet. 25–26. This is consistent with the workflow depicted in Figure 199. Likewise, in discussion of the operating step in claim 5, Petitioner discusses using a separate workstation computer and supercomputer, as depicted in Figure 199. *Id*. at 26–27 (citing, e.g., Fig. 199).

Having considered the record before us, as well as the parties arguments , we determine that Petitioner has shown by a preponderance of the evidence that Lytle anticipates claims 5 and 10.

b. Dependent claims 6, 7, 9, and 11

Petitioner alleges that Lytle anticipates claims 6, 7, and 9, which depend from claim 5, and claim 11, which depends from claim 10. Pet. 27–30. Patent Owner does not raise separate arguments in support of the patentability of these claims. We have reviewed the record and find that Petitioner has shown by a preponderance of the evidence that Lytle anticipates claims 6, 7, 9, and 11.

c. Independent claim 12

Independent claim 12 is drawn to a "virtual reality computer system," including "means for supplying a first signal selected from a group consisting of a control signal having music and/or control information generated in response to a music signal, a prerecorded control track having music and/or control information corresponding to the music signal, and a control signal having music and/or control information generated in response to the prerecorded control track"; and "means for receiving the first signal and influencing action within a virtual environment in response to said first signal." Petitioner asserts that Lytle anticipates claim 12. Pet. 30.

According to Petitioner, Lytle discloses a means for supplying a "first signal" in the form of a prerecorded control track having music and/or control information corresponding to the music signal, in that Lytle describes using a personal computer programmed with music sequencing software to supply a MIDI file to a supercomputer. *Id*. at 25–26, 30 (citing Ex. 1003, 644, 646, 648–650, Fig. 199). Petitioner further asserts that Lytle discloses a means for receiving this first signal and influencing action within a virtual environment in response to it, in that Lytle describes a supercomputer programmed to read the MIDI file and create, move, and modify the 3D virtual instrument objects in the virtual environment in response to the MIDI file. *Id*. at 26–27, 30.

Patent Owner argues that Lytle does not anticipate claim 12 for many of the same reasons as addressed for claims 5 and 10 above, i.e., Lytle's alleged failure to disclose a virtual environment, and Petitioner's alleged reliance on a combination of incompatible Lytle embodiments to support its anticipation case. As with claims 5 and 10, we are equally unpersuaded by Patent Owner's arguments with respect to claim 12.

In addition, Patent Owner disputes that Lytle discloses structure corresponding to the means for supplying a first signal, because Lytle does not disclose "a sound processor connected to a media player, an audio amplifier connected to the sound processor, a tape IF converter, an audio source, a multichannel audio digitizer with serial output connected to a media player and the audio source, or a microprocessor having inputs connected to the tape IF converters and programmed to generate control signals." PO Resp. 27. Petitioner responds that this position is based on

Patent Owner's "faulty means plus function claim construction analysis." Pet. Reply 8.

We agree with Petitioner's arguments. As discussed above in construing this limitation, we determined that the components that Patent Owner alleges are missing from Lytle are not, in fact, structure that corresponds to the "supplying" function, because they are not needed in every implementation of the invention. Moreover, we agree with Petitioner that Lytle describes the required structure, e.g., a media player or source and a processor programmed with music sequencing software. [14]

Having considered the record before us, we determine that Petitioner has shown by a preponderance of the evidence that Lytle anticipates claim 12, as well as its dependent claims 13–15.

d. Independent Claims 16 and 22

Independent claim 16 is drawn to a "virtual reality computer system" comprising "means for prerecording a control track having music and/or control information corresponding to a music signal," and "means for producing the virtual environment in response to said prerecorded control track." Claim 22 contains a similar "prerecording" limitation, and a "processor which receives the control track and which is programmed with software for operating the computer system in response to said control track."

[14] Patent Owner raises essentially the same argument with respect to its assertion that Lytle does not disclose the "means for supplying the music signal to the means for producing the virtual environment" limitation of claim 18, and the "means for supplying the audio signal to the processor" limitation of claim 23. PO Resp. 30–31. For the reasons set forth above, we reject these arguments as well.

Petitioner alleges that Lytle anticipates these claims. Concerning the "prerecording" limitations of claims 16 and 22, Petitioner asserts that (1) Lytle discloses a computer running music sequencing software that produces a MIDI file that is transferable to a supercomputer, and (2) the disclosed structure is the personal computer programmed with music sequencing software and associated synthesizers. Pet. 30 (citing Ex. 1003, 644, 646, 648–650, Fig. 199). Petitioner also asserts that Lytle discloses the claimed means for producing the virtual environment in response to the prerecorded control track, as set forth in its analysis with respect to claim 5. *Id*. at 30–31. Finally, Petitioner contends that Lytle teaches the processor of claim 22, i.e., the supercomputer that receives the MIDI input file and is programmed with software to control computer graphics animation in a computer-simulated environment using mappings of MIDI data to instrument objects. *Id*. at 32.

Patent Owner argues that Lytle does not anticipate claim 16 for many of the same reasons as addressed for claims 5 and 10 above. As with claims 5 and 10, we are equally unpersuaded by Patent Owner's arguments with respect to claim 16.

Further, Patent Owner argues that Lytle does not disclose structure corresponding to the "prerecording" functions of claims 16 and 22. According to Patent Owner, Lytle does not disclose "a sound processor connected to an output of a media player, an audio amplifier connected to the sound processor, one or more tape IF converters connected to an output of the media player, a multichannel audio digitizer with serial output connected to an output of the media player, a microprocessor having inputs connected to the tape IF converters." PO Resp. 29 (quoting Ex. 2002 ¶ 46).

Petitioner responds that this position is based on Patent Owner's "faulty means plus function claim construction analysis." Pet. Reply 8. We agree with Petitioner. In construing these limitations, we determined that the components that Patent Owner alleges Lytle does not disclose are not, in fact, structure that corresponds to the "prerecording" functions, because they are not necessary for every implementation of the invention. Moreover, we agree with Petitioner that Lytle discloses the required structure. Pet. 30–32. Therefore, we find Patent Owner's argument unpersuasive.

Finally, Patent Owner argues that Lytle does not disclose structure corresponding to the function recited in the "means for producing a virtual environment in response to the prerecorded control track" limitation of claim 16. PO Resp. 28–29. Relying on Dr. Kesan's testimony, Patent Owner asserts that Lytle fails to disclose "a sound processor connected to an output of a media player, an audio amplifier connected to the sound processor, one or more tape IF converters connected to an output of the media player, a multichannel audio digitizer with serial output connected to an output of the media player, a microprocessor having inputes connected to the tape IF converters." *Id*. at 29 (quoting Ex. 2002 ¶ 46). We disagree. As an initial matter, Patent Owner did not argue that the corresponding structure included all of these allegedly missing components. In any event, we agree with Petitioner that Lytle does disclose corresponding structure, i.e., a supercomputer programmed to read the MIDI files and create, move, and modify the virtual musical instruments accordingly.

Accordingly, having considered the record before us, we determine that Petitioner has shown by a preponderance of the evidence that Lytle

anticipates claims 16 and 22, as well as claims 17 and 18, which depend from claim 16, and claim 23, which depends from claim 22.

D. Claims 1, 12, 13, 15, and 21—Anticipation by Adachi

Petitioner contends that claims 1, 12, 13, 15, and 21 are anticipated by Adachi. Pet. 33–37.

1. Adachi

Adachi discloses a "tone visualizing apparatus for visualizing an inputted audio signal to thereby display an image corresponding to this audio signal." Ex. 1004, Abstr. Envelope detecting circuit 5 detects audio signal characteristics, and "display control circuit 9 displays an image including a predetermined object and its background on the display screen of . . . display unit 11." *Id*. at 5:8–9, 35–37. Display control circuit 9 can "magnify or reduce the scale of displayed background image in response to the amplitude of envelope indicated by the envelope information . . . so that mutual relation between the object and background will be changed and therefore sense of distance of the object will be controlled." *Id*. at 5:45–51. In an example involving display of a singer singing a song in front of a band, "it is possible to express the sense of distance of the singer from audience side by moving position of the singer to the center position or backward position." *Id*. at 5:59–64.

2. Analysis

With respect to independent claim 1, Petitioner alleges that Adachi discloses a method for controlling production of a virtual environment by a virtual reality computer system, in that Adachi discloses a tone visualizing apparatus that adjusts the sense of distance of an object three-dimensionally. Pet. 33–34 (citing Ex. 1004, Abstr., 1:60–2:11, 5:22–64, 16:33–36).

Petitioner further alleges that Adachi discloses processing music signals to generate control signals having music and/or control information, in that Adachi discloses envelope detecting circuit 5 receiving an audio signal and the audio signal being "effected by AM detection and integration so that an envelope signal corresponding to scale (i.e., level or amplitude) of this inputted audio signal is generated." *Id*. at 35 (citing Ex. 1004, 5:6–30) (emphasis omitted). Petitioner also alleges that Adachi discloses operating the virtual reality computer system in response to the control signals to generate the virtual environment, in that Adachi discloses generating a three-dimensional environmental in which the perceived distance between an object and its background image can be controlled. *Id*. (citing Ex. 1004, 5:2–64, 16:15–36).

With respect to claim 12, Petitioner alleges that Adachi discloses the function of supplying a "first signal" that is a "control signal having music and/or control information generated in response to a music signal," as well as the required structure to perform that function. That is, according to Petitioner, Adachi uses an "audio input" and "envelope detecting circuit" or "Fast Fourier Transform circuit" (the required structure) for processing a musical tone signal to detect musical parameters such as level/amplitude, tone color, tone volume, and/or frequency (by detecting spectrum signal components) (i.e., control information) and pass the musical parameters on to a CPU. Pet. 35–36 (citing Ex. 1004, 5:6–30, 5:65–6:2, 8:63–9:5, Figs. 1, 5). Petitioner further asserts that Adachi discloses means for receiving the first signal and influencing action within a virtual environment in response to it, in that Adachi discloses a CPU and display control unit programmed to use detected musical parameters (i.e., a control signal) to select objects for

display on a three-dimensional image display unit such as a stereoscopic television, and to control the perceived distance between an object and its background image in a three-dimensional computer-simulated environment. *Id*. at 36 (citing Ex. 1004, 5:2–6:64, 16:15–36, Fig. 1).

With respect to claim 21, Petitioner contends that Adachi discloses a source of a music signal, i.e., an "audio input" that produces a musical tone analog signal. *Id*. at 37 (citing Ex. 1004, 5:5–12, 5:22–30, Fig. 1). According to Petitioner, "Adachi discloses the source of a musical signal as, for example, an electric musical instrument (e.g., keyboard) or a non-electric musical instrument (e.g., violin, guitar, piano, etc.)." *Id*. (citing 6:26–32, 10:21–22, 12:25–26, Figs. 2, 3, 10). Petitioner also contends that Adachi teaches an apparatus for extracting information from the music signal for modification of objects in a virtual environment, relying on essentially the same disclosure as for the required structure of the "supplying" means-plus-function limitation of claim 12. *Id*. (citing Ex. 1004, Abst., 5:6–30, 5:65–6:2, 8:63–9:5).

Patent Owner responds that Adachi does not disclose the "means for supplying" limitation of claim 12. According to Patent Owner, Adachi does not disclose a number of components that are part of the corresponding structure or equivalents thereof for the recited function. Petitioner responds that Patent Owner's argument is based on a flawed construction of claim 12's "supplying" limitation. Pet. Reply 10. We agree, for the reasons set forth above in our construction of this limitation and in the discussion of Lytle's anticipation of claim 12. Further, we agree with Petitioner that Adachi discloses corresponding structure, i.e., "audio input" and "envelope

detecting circuit" or "Fast Fourier Transform circuit." Pet. 35–36 (citing Ex. 1004, 5:6–30, 5:65–6:2).

Patent Owner further argues that Adachi does not disclose generating a virtual environment or operating a virtual reality computer system as recited in claims 1, 12, and 21. PO Resp. 40–43. Patent Owner initially notes that in the Decision on Institution, we determined that Adachi discloses a virtual environment because "[i]n an example involving display of a singer singing a song in front of a band, 'it is possible to express the sense of distance of the singer from audience side by moving position of the singer to the center position or backward position." *Id*. at 41 (quoting Dec. on Inst. 16). But, according to Patent Owner, the claimed "virtual environment' requires the display to change with a change in the perspective of the user in particular (e.g., user's position, user's viewing angle), not a change in the perspective of just anything." *Id*. In Patent Owner's view, "[t]here is no disclosure in Adachi of a change in the display based on a change in the position of a user in the audience," e.g., "there is no disclosure in Adachi of a singer appearing larger in a display in response to a user in the audience moving toward the singer." *Id*. at 42. But, as discussed above, a "virtual environment," as properly construed in light of the Specification, does not require such a change in perspective. The absence of any such teaching in Adachi is, therefore, of no moment. Moreover, we maintain our conclusion that the disclosure of moving the position of singer toward or away from the audience based on the music volume falls within the meaning of the claimed "virtual environment."

Having considered the record before us, we determine that Petitioner has shown by a preponderance of the evidence that claims 1, 12, 13, 15, and 21 are anticipated by Adachi.

E. Claims 1, 8, 12, 13, 15, and 21—Obviousness over Lytle and Adachi

We find that independent claims 1, 12, and 21 and dependent claims 8, 13, and 15 would have been obvious over Lytle and Adachi. Pet. 46–50. Petitioner relies on Lytle's disclosure of utilizing MIDI data to animate virtual objects and its recognition that musical encoding schemes other than MIDI can be utilized (Pet. 46 (citing Ex. 1003, 646, 649–651, 667)), and Adachi's disclosure of detecting musical parameters using a circuit and processing music signals to generate a digital signal supplied to a computer (*id*. (citing Ex. 1004, 5:6–30, 5:65–6:2, 8:63–9:5, Figs. 1, 5)). Petitioner further states that "a skilled artisan would have recognized that modifying Lytle to process a music signal to generate a control signal that is transmitted to a computer system as described by Adachi would be beneficial," would not affect operation, and would have yielded predictable results. Pet. 46–47 (citing Ex. 1007 ¶¶ 56, 57); *see* Ex. 1007 ¶ 57 ("Lytle recognized that a direct music signal could be used to drive the animations in his system, but . . . did not expressly describe[] such a technique. . . . [T]he combination of Lytle and Adachi is nothing more than providing the step of processing a direct music signal and using that data to operate the virtual environment of Lytle.").

In response, Patent Owner first argues that the combination of Lytle and Adachi does not teach or suggest a "method of controlling production of a virtual environment," or "generat[ing] said virtual environment," as

required by independent claims 1 and 5; does not teach or suggest "influencing action within a virtual environment" as recited in independent claim 12; and does not teach or suggest "modification of objects in a virtual environment," as recited in independent claim 21. *Id*. at 47–48. Patent Owner bases this argument on the same construction of "virtual environment" that we rejected above. Accordingly, we find this argument unpersuasive.[15] We also find unpersuasive Patent Owner's argument that the combination of Lytle and Adachi does not teach the "supplying" limitation of claim 12, for the reasons set forth above in discussing the same argument made with respect to each of the references individually.

Having reviewed the parties' contentions and the evidence of record, we agree with Petitioner that the combination teaches all of the limitations of claims 1, 8, 12, 13, 15, and 21, and that a person of ordinary skill in the art would have been motivated to combine Lytle with the Adachi's method of processing music signals. Accordingly, we determine that Petitioner has shown by a preponderance of the evidence that that claims 1, 8, 12, 13, 15, and 16 would have been obvious over the combination of Lytle and Adachi.

F. Claims 1–4, 12, 13, 15, and 21—Obviousness over Thalmann and Williams

Petitioner contends that claims 1–4, 12, 13, 15, and 21 would have been obvious over Thalmann and Williams. Pet. 50–58.

[15] For this reason, Patent Owner also contends that the combination of Lytle and Adachi does not teach or suggest a "virtual reality computer system." PO Resp. 48–50. We also find this argument unpersuasive.

1. Thalmann

Thalmann describes virtual reality devices like audio input devices for use with animation techniques, stating that "[a]udio input may be . . . considered as a way of interactively controlling animation." Ex. 1006, 2, 4. In connection with real-time audio input, input data might include "sounds, speech," and the application might be "facial animation (speech)." *Id*. at 5.

2. Williams

Williams describes a method for synchronizing actions and sounds for display on the visual display of a computer system. Ex. 1005, Abstr., 1:9–11. The method includes the steps of playing a sound recording, determining the locations in the recording where predetermined actions are to be displayed, and measuring the time that elapses when the recording is played from a reference point (e.g., the beginning of the recording) to the locations where the predetermined actions are to be displayed. *Id*. at 2:48–53. The predetermined actions can be associated with the time positions or locations in the recording manually or automatically. *Id*. at 4:37–39. In the case of automatic association, "different sound features or combinations of features, such as intensity, frequency, percussive or fricative sounds, can signal which actions should be associated with which time positions." *Id*. at 4:41–46. In other words, the sound at a particular time position associates a certain action display at that same time position. *Id*. at 4:55–58.

3. Analysis

Having reviewed the parties' contentions and the evidence of record, we agree with Petitioner that the combination of Thalmann and Williams teaches all of the limitations of claims 1–4, 12, 13, 15, and 21, and that a person of ordinary skill in the art would have been motivated to combine

Thalmann with Williams. With respect to independent claim 1, we agree with Petitioner that Williams discloses processing music signals to generate control signals having music and/or control information in that Williams discloses "processing a sound recording . . . and automatically associating predetermined animations . . . with time positions in the sound recording by analyzing features of the recording." *Id*. at 53. Further, we agree with Petitioner that the combination of Thalmann and Williams renders obvious the step of operating the virtual reality computer system in response to the control signals to generate the virtual environment in that Thalmann describes generation of computer-simulated animations in response to sound and/or speech input, and Williams discloses a specific example of operating a computer system to measure elapsed time in a sound recording and display predetermined actions associated with time positions in the sound recording. *Id*. at 53–54. We agree that "one of ordinary skill in the art would have recognized that modifying Thalmann to process a music signal to generate a control signal, as taught by Williams . . . would achieve the result described by Thalmann." *Id*. at 51 (citing Ex. 1007 ¶ 33) ("[M]odifying Thalmann to be used with the audio processing described in Williams would be desirable in order to achieve Thalmann's stated goal of using audio input to drive animation in a virtual world.").

We are not persuaded by Patent Owner's arguments in response. Specifically, we are not persuaded that: the combination of Thalmann and Williams does not teach or suggest (1) the "supplying" limitation of claim 12; and (2) "processing music signals to generate control signals having music and/or control information" and "operating the virtual reality computer system in response to the control signals to generate said virtual

environment" as recited in independent claim 1 and similarly recited in independent claims 12 and 21. We have reviewed the evidence of record and the parties' contentions in this regard, and find these arguments unpersuasive. We also find unpersuasive Patent Owner's argument that the combination of Thalmann and Williams does not teach or suggest the limitation in claim 3 that "at least one characteristic of the virtual object changes in response to at least one of the music signals" (*see* PO Resp. 54–55) because we find that Williams discloses that movements of a character's mouth, face, and body are synchronized with music, and Williams teaches processing of music signals.

Accordingly, we determine that Petitioner has shown by a preponderance of the evidence that claims 1, 8, 12, 13, 15, and 16 would have been obvious over the combination of Thalmann and Williams.

III. CONCLUSION

For the reasons stated above, we determine that Petitioner has shown by a preponderance of the evidence that claims 1–13, 15–18, and 21–23 are unpatentable.

IV. ORDER

For the reasons given, it is

ORDERED that claims 1–13, 15–18, and 21–23 of the '129 patent are held unpatentable.

This is a Final Decision. Parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

PETITIONER:

Eric A. Buresh
Mark C. Lang
ERISE IP, P.A.
eric.buresh@eriseip.com
mark.lang@eriseip.com

PATENT OWNER:

Dr. Gregory J. Gonsalves
gonsalves@gonsalveslawfirm.com

Robert R. Axenfeld
O'KELLY ERNST & BIELLI, LLC
raxenfeld@oeblegal.com