

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC., META PLATFORMS TECHNOLOGIES, LLC, and
TWISTED PIXEL GAMES, LLC,

Petitioners

v.

EIGHT KHZ, LLC,

Patent Owner

IPR2023-01003
Patent 9,226,090

PATENT OWNER'S NOTICE OF CROSS-APPEAL

Pursuant to 35 C.F.R. §§ 141–143 and 319; 37 C.F.R. §§ 90.2 and 90.3; and Federal Circuit Rule 15, Patent Owner Eight kHz, LLC (“Patent Owner”) provides notice of cross-appeal to the United States Court of Appeals for the Federal Circuit from the Final Written Decision entered on January 7, 2025 (Paper 61) in IPR2023-01003 (the “Final Written Decision,” attached hereto as Exhibit A) and from all prior and/or underlying findings, orders, decision, determinations, rulings, and opinions adverse to Patent Owner.

Pursuant to 37 C.F.R. § 90.2(a)(3)(ii), Patent Owner identifies the issues on appeal as including, but not limited to, whether the Board erred in finding:

1. Claims 1, 3, 6, 15, and 16 are unpatentable based on combination of Bedingfield and Andrea as well as any finding or determination supporting or related to this issue; and
2. Claim 19 is unpatentable based on combination of Bedingfield, Andrea, and Sandgren.
3. Any finding or determination, evidentiary or otherwise, supporting or related to the issues above, or otherwise adversely impacting the Patent Owner.

This notice of Patent Owner’s cross-appeal is timely filed within 14 days of Petitioner’s notice of appeal. 37 C.F.R. § 90.3(a)(1); Fed. R. App. P. 4(a)(3).

Pursuant to 35 U.S.C. § 142, 37 C.F.R. § 90.2(a), and Federal Circuit Rule 15, a copy of this Notice of Cross-Appeal is being filed with the Patent Trial and Appeal Board, the Clerk's Office for the United States Court of Appeals for the Federal Circuit (along with the required docketing fees), and the Director of the Patent and Trademark Office c/o the Office of the General Counsel.

Date: March 20, 2025

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CERTIFICATE OF FILING

The undersigned hereby certifies that in addition to being filed electronically through the Patent Trial and Appeal Case Tracking System (P-TACTS), a true and correct copy of the foregoing was emailed to the Director of the United States Patent and Trademark Office at efilesSO@uspto.gov.

In addition, the undersigned hereby certifies that the foregoing document was electronically filed with the United States Court of Appeals for the Federal Circuit via CM/ECF and accompanied by the requisite fee.

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CERTIFICATE OF SERVICE

I hereby certify that on March 20, 2025, I caused a true and correct copy of the foregoing Patent Owner's Notice of Cross-Appeal to be served via electronic mail to PH-Meta-Eight-KHZ-IPR@paulhastings.com upon the following attorneys of record for the Petitioner:

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EXHIBIT A

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

META PLATFORMS, INC.,
Petitioner,

v.

EIGHT KHZ, LLC,
Patent Owner.

IPR2023-01003
Patent 9,226,090 B1

Before JUSTIN T. ARBES, LYNNE H. BROWNE, and
SCOTT RAEVSKY, *Administrative Patent Judges*.

ARBES, *Administrative Patent Judge*.

JUDGMENT

Final Written Decision

Determining Some Challenged Claims Unpatentable

Denying Petitioner's Motion to Strike

Dismissing Petitioner's Motion to Exclude

Dismissing-in-Part and Denying-in-Part Patent Owner's Motion to Exclude

35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background and Summary

Petitioner Meta Platforms, Inc. filed a Petition (Paper 1, “Pet.”) requesting *inter partes* review of claims 1–3, 6, 8–10, 12, and 14–19 of U.S. Patent No. 9,226,090 B1 (Ex. 1001, “the ’090 patent”) pursuant to 35 U.S.C. § 311(a). On January 9, 2024, we instituted an *inter partes* review as to all challenged claims on all grounds of unpatentability asserted in the Petition. Paper 9 (“Decision on Institution” or “Dec. on Inst.”). Patent Owner Eight kHz, LLC filed a Patent Owner Response (Paper 19, “PO Resp.”), Petitioner filed a Reply (Paper 22, “Reply”), and Patent Owner filed a Sur-Reply (Paper 35, “Sur-Reply”). With our authorization (Paper 56), the parties also filed supplemental briefs addressing certain claim interpretation issues. *See* Papers 58 (“Pet. Supp. Br.”), 59 (“PO Supp. Br.”).

Petitioner filed a Motion to Exclude (Paper 41, “Pet. Mot.”) certain evidence submitted by Patent Owner, to which Patent Owner filed an Opposition (Paper 42, “PO Opp.”) and Petitioner filed a Reply (Paper 44). Patent Owner filed a Motion to Exclude (Paper 40, “PO Mot.”) certain evidence submitted by Petitioner, to which Petitioner filed an Opposition (Paper 43, “Pet. Opp.”) and Patent Owner filed a Reply (Paper 46, “PO Mot. Reply”).

With our authorization provided by email, Petitioner filed a Motion to Strike (Paper 45, “Mot. to Strike”), to which Patent Owner filed an Opposition (Paper 47, “Mot. to Strike Opp.”).

An oral hearing was held on October 29, 2024, and a transcript of the hearing is included in the record (Paper 57, “Tr.”).

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a). For the reasons that

follow, we determine that Petitioner has shown, by a preponderance of the evidence, that claims 1, 3, 6, 15, 16, and 19 of the '090 patent are unpatentable, but has not shown, by a preponderance of the evidence, that claims 2, 8–10, 12, 14, 17, and 18 of the '090 patent are unpatentable.

B. Related Matters

The parties indicate that the '090 patent is the subject of *Eight kHz, LLC v. Meta Platforms, Inc.*, No. 6:22-cv-00575 (W.D. Tex.) (“the district court case”). *See* Pet. 2–3; Paper 4, 2. Petitioner filed petitions challenging patents related to the '090 patent in IPR2023-01004 (denied) and IPR2023-01005 (instituted and later terminated), and petitions challenging unrelated patents asserted in the district court case in IPR2023-01019 (instituted), IPR2023-01020 (instituted), IPR2023-01021 (instituted and later terminated), IPR2023-01022 (instituted and later terminated), IPR2023-01023 (instituted), and IPR2023-01024 (instituted and later terminated).

C. The '090 Patent

The '090 patent states that electronic devices, such as telephones, “typically provide monophonic or stereophonic sound,” which has “good speech intelligibility” but “is not comparable in quality to sound that the listeners would hear if they were communicating face-to-face with each other.” Ex. 1001, col. 1, ll. 6–14. The '090 patent discloses an improved “computer system in which two electronic devices communicate with each other during a telephone call between two people” and “[t]he computer system positions a voice of one person at a sound localization point that is proximate to the other person.” *Id.* at col. 2, ll. 42–46.

In order to determine a location of sound, humans process and compare monaural cues from each ear. This comparison reveals difference cues or binaural cues that enable sound localization. These cues include interaural time differences (ITDs), interaural level differences (ILDs), and head-related transfer functions (HRTFs). Cues thus result from changes to the sound wave from an interaction with the human anatomy. Humans process these changes as impulse responses or head-related impulse responses (HRIRs). Once the HRIRs for an individual are known, the associated or transformed HRTFs can be calculated. The HRIRs and transformed HRTFs enable sound to be convolved such that a location of the sound or sound localization point can be changed. A listener hears the convolved sound as if it had originated from the sound localization point.

Id. at col. 2, ll. 53–67.

The '090 patent describes, with reference to Figure 1, a method of “provid[ing] sound that is localized at a sound localization point.” *Id.* at col. 3, ll. 1–2. Step 100 is to “capture sound that will be provided to a listener,” where the “sound can be provided in real-time to a listener, processed and delayed, or stored in memory.” *Id.* at col. 3, ll. 3–9. Step 110 is to “designate a sound localization point at a location in empty space that is away from and proximate to a location of the listener such that the sound localization point simulates an origin of the sound that the listener hears.” *Id.* at col. 3, ll. 33–36. The sound localization point (SLP) can be a three-dimensional or two-dimensional position. *Id.* at col. 3, ll. 46–54. Step 120 is to “adjust the sound so the sound originates from the sound localization point at the location in empty space that is away from and proximate to the location of the listener.” *Id.* at col. 4, ll. 16–19.

For example, the sound can be “processed to alter, add, or generate head-related transfer functions (HRTFs), interaural time differences, and/or interaural level differences to correspond to a fixed or variable distance from

the listener, a coordinate location or a GPS location of the sound localization point.” *Id.* at col. 4, ll. 24–29. Lastly, step 130 is to “provide the sound to the listener such that the listener localizes the origin of the sound at the sound localization point in empty space.” *Id.* at col. 4, ll. 30–32. The SLP can be “an empty space” or an occupied space where a physical or virtual object or character exists. *Id.* at col. 4, ll. 33–60.

Similarly, the ’090 patent describes, with reference to Figure 9, a method of “adust[ing] HRTFs of an individual during an electronic call.” *Id.* at col. 21, ll. 7–8. Step 900 is to “execute an electronic call between a first individual and a second individual such that an origin of a voice of the second individual appears to the first individual to originate from a sound localization point that simulates a location in empty space of the second individual.” *Id.* at col. 21, ll. 9–13. Step 910 is to “monitor, during the electronic call, movements of a head location and/or head orientation of the first individual in response to the first individual localizing sounds,” for example, using an electronic device that determines “when the [first individual’s] head turns left or right, turns up or down, or rotates back and forth.” *Id.* at col. 21, ll. 24–32. Lastly, step 920 is to “adjust, during the electronic call, stored [HRTFs] of the first individual to more accurately simulate real HRTFs of the first individual in response to the movements of the head location and/or head orientation of the first individual.” *Id.* at col. 21, ll. 43–47. The HRTFs can be adjusted in real time. *Id.* at col. 21, ll. 51–53.

Figure 17 of the '090 patent is reproduced below.

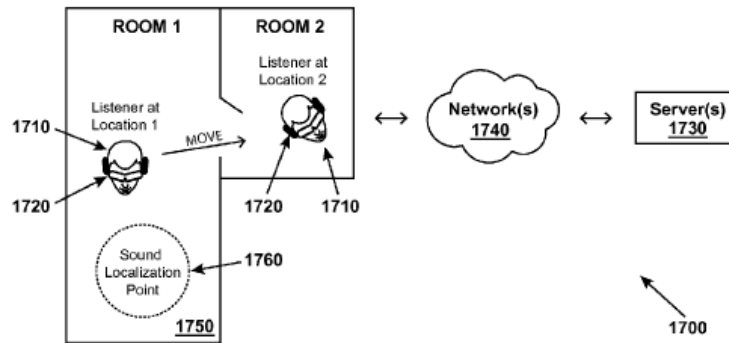


Figure 17

Figure 17 depicts listener 1710 wearing wearable electronic device (WED) 1720 that plays sound, displays corresponding images, and tracks the location and head orientation of the listener. *Id.* at col. 30, ll. 3–6, 14–18, 37–43. Sound from WED 1720 initially localizes at SLP 1760 in empty space of room 1. *Id.* at col. 30, ll. 6–10. When the listener moves, SLP 1760 “remains fixed at the location in room 1” and the sound “automatically adjusts to compensate for changes to the head orientation and the location of the listener as the listener moves about rooms 1 and 2.” *Id.* at col. 30, ll. 10–35. “For example, amplitude and localization cues (e.g., ITD and ILD) change in real-time as the listener 1710 moves from room 1 to room 2.” *Id.* at col. 30, ll. 35–37.

Figure 18 of the '090 patent is reproduced below.

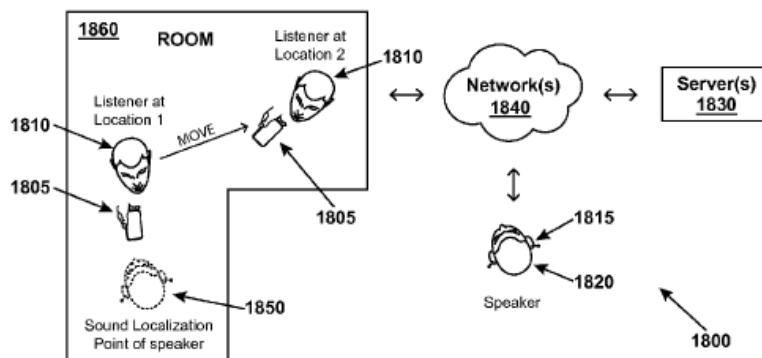


Figure 18

Figure 18 depicts a similar arrangement involving listener 1810 conducting an electronic call with handheld portable electronic device (HPED) 1805 that captures and emits binaural sound and tracks the location and head orientation of the listener. *Id.* at col. 30, l. 60–col. 31, l. 4. SLP 1850 “has a size, a shape, and an orientation of a head that emulates a size, a shape, and an orientation of a head of the speaker 1820” such that “[w]hen the speaker 1820 moves his head (such as changing location, yaw, pitch, or roll), then a head of the sound localization point 1850 simultaneously changes to emulate or copy this movement” and “[a] direction or source of the sound from the sound localization point emulates sound from the mouth of the speaker 1820.” *Id.* at col. 31, ll. 5–12. Likewise,

[w]hen the listener 1810 moves his head with respect to the sound localization point 1850 (such as changing location, yaw, pitch, or roll), then adjustments are simultaneously made to the sound of the voice of the speaker to compensate for these movements. These adjustments change the sound so the sound that the listener hears emulates the sound that the listener would hear if the speaker were physically present at the sound localization point 1850. For instance, the listener 1810 continues to hear the voice of the speaker 1820 at the sound localization point as the listener moves from location 1 in the room 1860 to location 2 in the room 1860.

Id. at col. 31, ll. 21–31.

Finally, the '090 patent discloses an embodiment in which a user speaks with others on a conference call and the system localizes the voice of each user at different SLPs around a table (e.g., at empty spaces or chairs at the table). *Id.* at col. 34, l. 58–col. 35, l. 44, Fig. 23. “Adjustments are made to the sound for each of the[] users since they are located at different locations around the table with respect to the sound localization points” (e.g., adjustments “based on movements to head orientation and location for

each user”). *Id.* at col. 35, ll. 49–63. The ’090 patent also discloses an example in which a user is speaking to four others that “are not people but computer programs with interactive audio input/output interfaces.” *Id.* at col. 35, l. 64–col. 36, l. 1. The user “can hear each of his programs running in a different spot on his large desk” and “can move the SLPs of a window/process using, for example, a voice command, a mouse, a head or other body gesture, or other method.” *Id.* at col. 36, ll. 12–17.

D. Illustrative Claim

Challenged claims 1, 8, and 15 of the ’090 patent are independent. Claims 2, 3, and 6 depend from claim 1, claims 9, 10, 12, and 14 depend from claim 8, and claims 16–19 depend from claim 15. Claim 1 recites (with letter designations used in the Petition to refer to the various limitations):

1. [pre] A method, comprising:

[a] capturing, with an electronic earphone located at a head of a talking person, binaural sound that will be provided to a listening person during a telephone call;

[b] designating, with a computer system, a sound localization point in empty space that is away from and proximate to the listening person such that the sound localization point simulates an origin of the binaural sound at the empty space that the listening person hears during the telephone call;

[c] adjusting, with the computer system, the binaural sound captured at the earphone of the talking person so the binaural sound originates during the telephone call from the sound localization point in empty space that is away from and proximate to the listening person; and

[d] providing, with an electronic earphone located at a head of the listening person, the binaural sound to the listening person during the telephone call such that the origin of the

binaural sound for the listening person occurs at the sound localization point in empty space that is away from and proximate to the listening person.

E. Evidence

The pending grounds of unpatentability in the instant *inter partes* review are based on the following prior art:

U.S. Patent No. 8,406,439 B1, issued Mar. 26, 2013 (Ex. 1005, “Bedingfield”);

U.S. Patent No. 8,818,000 B2, filed Oct. 29, 2010, issued Aug. 26, 2014 (Ex. 1007, “Andrea”);

U.S. Patent No. 9,131,305 B2, filed Jan. 17, 2013, issued Sept. 8, 2015 (Ex. 1006, “Li”);

U.S. Patent Application Publication No. 2003/0059070 A1, published Mar. 27, 2003 (Ex. 1008, “Ballas”); and

U.S. Patent Application Publication No. 2008/0273708 A1, published Nov. 6, 2008 (Ex. 1017, “Sandgren”).

Petitioner filed a declaration from Chris Kyriakakis, Ph.D. (Ex. 1003) with its Petition and a reply declaration from Dr. Kyriakakis (Ex. 1055) with its Reply. Patent Owner filed a declaration from Durand R. Begault, Ph.D. (Ex. 2011) with its Response. Also submitted as evidence are transcripts of the depositions of Dr. Kyriakakis (Exs. 2016, 2031) and Dr. Begault (Ex. 1051).

F. Asserted Grounds

This *inter partes* review involves the following grounds of unpatentability (Pet. 5–6):

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–3, 6, 15–17	103	Bedingfield, Andrea

Claim(s) Challenged	35 U.S.C. §	References/Basis
18	103	Bedingfield, Andrea, Ballas
19	103	Bedingfield, Andrea, Sandgren
8–10, 12, 14	103	Bedingfield, Ballas
1, 3, 6, 15–17	103	Li, Andrea
2, 18	103	Li, Andrea, Ballas
19	103	Li, Andrea, Sandgren
8–10, 12, 14	103	Li, Ballas

II. ANALYSIS

A. Level of Ordinary Skill in the Art

In determining the level of ordinary skill in the art for a challenged patent, we look to “1) the types of problems encountered in the art; 2) the prior art solutions to those problems; 3) the rapidity with which innovations are made; 4) the sophistication of the technology; and 5) the educational level of active workers in the field.” *Ruiz v. A.B. Chance Co.*, 234 F.3d 654, 666–667 (Fed. Cir. 2000). “Not all such factors may be present in every case, and one or more of them may predominate.” *Id.* at 667.

Petitioner argues that at the time of the ’090 patent (June 2014), a person of ordinary skill in the art would have had “at least a bachelor’s degree in computer science or engineering with a focus on audio signal processing and sound localization, with at least two years of relevant experience,” where “[a]dditional experience could substitute for less education, and additional education could likewise substitute for less experience.” Pet. 15 (citing Ex. 1003 ¶¶ 32–34). Patent Owner states that “[f]or this proceeding, Patent Owner accepts Petitioner’s definition.”

PO Resp. 4. In the Decision on Institution, we agreed with and applied Petitioner’s proposed definition, except that we removed the term “at least” to eliminate vagueness as to the amount of education and practical experience. Dec. on Inst. 14.

Based on the full record developed during trial, including our review of the ’090 patent and the types of problems and solutions described in the ’090 patent and cited prior art, we maintain the previously adopted definition of the level of ordinary skill in the art and apply it for purposes of this Decision.

B. Claim Interpretation

We interpret the claims of the challenged patent

using the same claim construction standard that would be used to construe the [claims] in a civil action under 35 U.S.C. 282(b), including construing the [claims] in accordance with the ordinary and customary meaning of such [claims] as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent.

37 C.F.R. § 42.100(b). “In determining the meaning of [a] 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). Claim terms are given their plain and ordinary meaning as would be understood by a person of ordinary skill in the art at the time of the invention and in the context of the entire patent disclosure. *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313 (Fed. Cir. 2005) (en banc). “There are only two exceptions to this general rule: 1) when a patentee sets out a definition and acts as his own lexicographer, or

2) when the patentee disavows the full scope of a claim term either in the specification or during prosecution.” *Thorner v. Sony Comput. Entm’t Am. LLC*, 669 F.3d 1362, 1365 (Fed. Cir. 2012).

Petitioner in its Petition did not propose express interpretations of any claim terms and stated that “[t]he prior art relied on in this Petition discloses the subject matter of the challenged claims under any reasonable construction, including their plain meaning.” Pet. 15. Petitioner also stated that Patent Owner argued in the district court case that “processor” in claim 15 is not a means-plus-function limitation under 35 U.S.C. § 112(f) and, “[s]olely for this [*inter partes* review], Petitioner adopts [Patent Owner’s] constructions of these terms.” *Id.* at 16. We did not interpret any terms in the Decision on Institution. Dec. on Inst. 15. Patent Owner argued in its Response that “no express constructions of the claims are necessary.” PO Resp. 3. The parties, however, discussed various claim interpretation issues in their papers during trial. *See id.* at 35–49; Reply 2–12; Sur-Reply 2–13; Pet. Supp. Br. 1–7; PO Supp. Br. 1–7.

The district court in the district court case construed “electronic call,” “electronic phone call,” “away from and proximate to,” and “wearable electronic device” to each have their “[p]lain and [o]rdinary [m]eaning”; determined that “away from and proximate to” is “[n]ot indefinite”; and determined that the “processor” limitation in claim 15 is not a means-plus-function limitation under 35 U.S.C. § 112(f) and has its “[p]lain and [o]rdinary [m]eaning.” Ex. 2012, 1–3; *see* PO Resp. 3 (citing Exs. 2012, 2013).

We conclude that interpretation of two sets of phrases in the claims is necessary to determine whether Petitioner has met its burden to prove unpatentability of the challenged claims in this proceeding. *See Nidec*

Motor Corp. v. Zhongshan Broad Ocean Motor Co., 868 F.3d 1013, 1017 (Fed. Cir. 2017) (“Because we need only construe terms ‘that are in controversy, and *only to the extent necessary* to resolve the controversy,’ we need not construe [a particular claim limitation] where the construction is not ‘material to the . . . dispute.’” (citation omitted) (emphasis added)).

1. “Call” Terms (Claims 1, 8, and 15)

The parties, and their respective experts, agree that “telephone call” (claim 1), “electronic call” (claim 8), and “electronic phone call” (claim 15) should be interpreted to mean “voice communication over an electronic network between at least two parties,” which was Patent Owner’s proposal in the district court case. *See* Pet. 16, 19 n.8, 58 (citing Ex. 1027, 9);¹ Ex. 1003 ¶ 82; Ex. 2011 ¶¶ 51–53; Ex. 2016, 176:10–177:6 (Dr. Kyriakakis agreeing that “there is live voice exchange during a telephone call” (in addition to “background noise”)), 180:22–181:11 (same). Based on our review of the ’090 patent, we agree as well and adopt that interpretation for purposes of this Decision. *See, e.g.*, Ex. 1001, col. 3, l. 1–col. 5, l. 44 (“Consider an example in which a listener sits at his kitchen table and has an electronic telephone call with his mother.”), Fig. 1.

¹ When citing non-patent references, we refer to page numbers added by Petitioner in the bottom-right corner of the exhibit.

2. *“Sound Localization Point . . . Away From and Proximate to the Listening Person” (Claim 1) and “Sound Localization Point . . . Away From and Proximate to the First Person” (Claim 15)*

a) Procedural History

As explained above, the parties did not propose any express interpretations in their Petition and Response. *See* Pet. 15; PO Resp. 3. Patent Owner argued, however, that “Petitioner and Dr. Kyriakakis misapprehend the scope and meaning of the [c]hallenged [c]laims.” PO Resp. 35–49. For example, Patent Owner argued that they “mischaracterize [c]laim 1’s scope as exclusively directed at binaural recording (but not binaural synthesis),” claim 8 “inherently us[es] binaural synthesis and HRTF processing,” and “binaural synthesis methods must be employed” for claim 15. *Id.* at 36, 46, 48–49 (emphasis omitted). In its Reply, Petitioner characterized the dispute between the parties as pertaining to the phrase “away from and proximate to,” where Petitioner proposed an interpretation of “a distance from” and Patent Owner allegedly was proposing “externalization of sound through HRTFs and [6 degree of freedom (6DOF)] tracking of the listener relative to the SLP that represents the talker.” Reply 2–12. Patent Owner responded in its Sur-Reply by stating that Petitioner “mischaracterizes” Patent Owner’s arguments, Petitioner “disputes constructions that [Patent Owner] never proposed,” and Petitioner’s focus on certain claim language for which Patent Owner “never proposed construction” was “misplaced.” Sur-Reply 1–2, 11. Patent Owner agreed, though, that the parties’ disagreement was “whether the claims require HRTF processing and whether [the] prior art teaches such processing.” *Id.* at 5; *see* Tr. 49:19–21 (Patent Owner agreeing that the dispute is “whether the claims require . . . processing with HRTFs”).

Following the hearing, we authorized additional briefing to clarify the dispute between the parties, as many of the arguments regarding claim interpretation in the parties’ papers were interspersed with discussions of the prior art, the state of the art, and related declarant testimony. Paper 56, 3–4. In particular, we requested that the parties identify “the specific claim language that allegedly does or does not require HRTF processing” and the support in the record for each party’s interpretation. *Id.* at 4. Patent Owner responded that all of the challenged claims “require HRTF processing” because they recite the phrase “sound localization point . . . away from and proximate to the [listener].”² PO Supp. Br. 1 (emphasis omitted). Petitioner disagreed. Pet. Supp. Br. 1. Accordingly, we interpret that phrase as it appears in independent claims 1 and 15 and, specifically, address whether the phrase requires HRTF processing.³

b) Claim Language

We begin with the language of the claims. Claim 1 recites (emphasis added):

² Patent Owner argued in its Sur-Reply, however, that it “never injected HRTFs . . . into ‘away from and proximate to.’” Sur-Reply 2. Nevertheless, we have reviewed all arguments in the parties’ papers and explain the basis for our Decision herein.

³ The parties also address the phrase as it appears in independent claim 8 (“sound localization point . . . away from and proximate to the first individual”). *See* PO Supp. Br. 1–2; Pet. Supp. Br. 2–3. We need not address claim 8’s specific language, however, because Petitioner’s asserted grounds as to claim 8 fail for other reasons. *See infra* Sections II.G, II.I. For the same reason, we also need not address Patent Owner’s contention that claim 8 should be interpreted to require 6DOF tracking. *See* PO Resp. 43–45; Reply 2–9; Sur-Reply 2–4.

[a] capturing, with an electronic earphone located at a head of a talking person, binaural sound that will be provided to a listening person during a telephone call;

[b] designating, with a computer system, a *sound localization point in empty space that is away from and proximate to the listening person* such that the sound localization point simulates an origin of the binaural sound at the empty space that the listening person hears during the telephone call;

[c] adjusting, with the computer system, the binaural sound captured at the earphone of the talking person so the binaural sound originates during the telephone call from the *sound localization point in empty space that is away from and proximate to the listening person*; and

[d] providing, with an electronic earphone located at a head of the listening person, the binaural sound to the listening person during the telephone call such that the origin of the binaural sound for the listening person occurs at the *sound localization point in empty space that is away from and proximate to the listening person*.

Claim 15 similarly recites (emphasis added):

[b] a second wearable electronic device that a second person wears and that captures a binaural voice of the second person during an electronic phone call with the first wearable electronic device that the first person wears; [and]

...

[d] a processor that executes the instructions to adjust the binaural voice of the second person during the electronic phone call in order to *position a sound localization point of the binaural voice to a location that is away from and proximate to the first person*, wherein the sound localization point represents an origin of the binaural voice of the second person to the first person.

Patent Owner argues in its supplemental briefing that “[a]ltering a binaural sound’s SLP to a location [away from and proximate to the listener] . . . requires HRTF processing.” PO Supp. Br. 1 (emphasis omitted).

Regarding claim 1, Patent Owner asserts that “the binaural sound captured in

1[a] is adjusted to alter its SLP from ‘in the middle in front of [the listener’s] face’ to the SLP designated in 1[b], such that ‘the binaural sound originates . . . from the [SLP]’ designated.” *Id.* (emphasis omitted). Therefore, in Patent Owner’s view, “HRTF processing is inherent in 1[c] to alter the SLP of the captured binaural voice to” a SLP away from and proximate to the listener. *Id.* (emphasis omitted). Similarly, regarding claim 15, Patent Owner argues that “HRTF processing is inherent in [limitation] 15[d]” because it “alters the SLP of the captured binaural voice from inside the listener’s head to a location” away from and proximate to the listener. *Id.* at 2 (emphasis omitted).

We disagree. Claims 1 and 15 never use the term “head-related transfer function” or the acronym “HRTF” and do not recite a particular way in which the “adjusting” of limitations 1[c] and 15[d] relied upon by Patent Owner is performed. We see no basis to read in HRTF processing as the required method of adjusting.

To the contrary, the record reflects that when the applicant intended to limit a claim to processing with HRTFs, it knew how to do so, but did not for claims 1 and 15. *See* Reply 3–5; Pet. Supp. Br. 2. For example, dependent claim 17 recites “execut[ing] the instructions to change an interaural time difference (ITD), an interaural level difference (ILD), and a head-related transfer function (HRTF) in order to position the sound localization point of the binaural voice to the location that is away from and proximate to the first person.” *See* Sur-Reply 10 (agreeing that “claim 17 discloses methods to adjust the synthesized binaural voice, including with HRTF”). Thus, claim 15, from which claim 17 depends, would encompass different types of adjustments “to position” the SLP away from and proximate to the listener, and one way “to position” the SLP is to change an

ITD, ILD, and HRTF as recited in claim 17. If HRTF processing were already required in claim 15, then the recitation of changing a HRTF in claim 17 would be superfluous. Similarly, dependent claims 2 and 5 recite “adjusting” an ITD and ILD, respectively, and claim 18 also recites changing an ITD, ILD, and HRTF to maintain the SLP.

“[T]he presence of a dependent claim that adds a particular limitation raises a presumption that the limitation in question is not found in the independent claim,” but the presumption “can be overcome if the circumstances suggest a different explanation, or if the evidence favoring a different claim construction is strong.” *Liebel-Flarsheim Co. v. Medrad, Inc.*, 358 F.3d 898, 910 (Fed. Cir. 2004); *see Littelfuse, Inc. v. Mersen USA EP Corp.*, 29 F.4th 1376, 1380 (Fed. Cir. 2022) (“the presumption of differentiation in claim scope is ‘not a hard and fast rule’”; “any presumption created by the doctrine of claim differentiation ‘will be overcome by a contrary construction dictated by the written description or prosecution history’”). The presence in the dependent claims of particular ways of adjusting binaural sound to position a SLP (i.e., changing an ITD, ILD, or HRTF) provides support for Petitioner’s view that the language of independent claims 1 and 15 is not limited to HRTF processing. And the Specification and prosecution history do not suggest otherwise.⁴ *See infra* Sections II.B.2.c–d.

⁴ We also note that a child of the ’090 patent, U.S. Patent No. 9,674,628 B1 (“the ’628 patent”), was challenged by Petitioner in IPR2023-01005. *See* PO Resp. 9, 33–35 (discussing IPR2023-01005); Reply 22 (same). Claim 9 of the ’628 patent, for example, recites “processing, during the telephone call, . . . a voice of the calling party with head related transfer functions (HRTFs) so the voice of the calling party localizes to the called party as binaural sound at a sound localization point (SLP) that is one meter to two

Finally, Patent Owner appears to have made a slightly different argument in its Response and Sur-Reply, arguing that “HRTFs are implicit in the claims” because they require binaural synthesis “to initially position the sound at [a] SLP,” i.e., prior to adjusting “already-synthesized binaural sound.” *See* PO Resp. 36–43, 48–49; Sur-Reply 5–10. We address Patent Owner’s additional arguments in Section II.B.2.e below.

c) Specification

We depart from the plain and ordinary meaning of claim terms based on the Specification in only two instances: lexicography and disavowal. *Thorner*, 669 F.3d at 1365. The standards for finding lexicography or disavowal are “exacting.” *Id.* at 1365–66. “To act as its own lexicographer, a patentee must clearly set forth a definition of the disputed claim term other than its plain and ordinary meaning” and “must clearly express an intent to redefine the term.” *Id.* at 1365 (internal quotation marks omitted). Patent Owner argues that it did so in defining “sound localization point” to mean a “position that is determined to be a location, an origin, or a place of emanation of sound.” PO Supp. Br. 2–3 (quoting Ex. 1001, col. 41, ll. 42–44 (“As used herein, ‘sound localization point’ is a particular location or position that is determined to be a location, an origin, or a place of

meters away from the called party.” *See* Ex. 2023 ¶ 122 (quoting the ’628 patent, IPR2023-01005, Ex. 1001, col. 44, ll. 49–54). Thus, similar to claim 1 of the ’090 patent, which recites designating a SLP “away from and proximate to the listening person,” claim 9 of the ’628 patent recites localization at a SLP “away from the called party,” but, importantly, also recites doing so by “processing . . . a voice of the calling party with head related transfer functions (HRTFs).” That claim 9 of the ’628 patent recites processing with HRTFs further demonstrates that the patentee knew to recite HRTF processing when it meant to do so.

emanation of sound.”)). Petitioner agrees. Pet. Supp. Br. 4. But that definition does not mention HRTF processing. The other claim phrase “away from and proximate to the [listener]” appears in the Specification in portions that largely mirror the claim language, but Patent Owner does not point to any express definition or other indication that the applicant intended to define this phrase to require HRTF processing.⁵ See, e.g., Ex. 1001, col. 3, ll. 33–36, col. 4, ll. 16–19.

Turning to disavowal, “[d]isavowal requires that ‘the specification . . . make[] clear that the invention does not include a particular feature’ . . . or is clearly limited to a particular form of the invention.” *Hill-Rom Servs., Inc. v. Stryker Corp.*, 755 F.3d 1367, 1372 (Fed. Cir. 2014). The parties focus heavily on the following portion of the ’090 patent Specification:

For example, if a position and a shape of the ears of a listener are known or estimated to a suitable degree of accuracy, binaural sound delivered to this listener can be altered in order to create, move, and/or adjust the sound localization point. A location of sound and/or a direction to the sound can be altered or created *using one or more of head-related transfer functions (HRTFs), accounting for* differences in arrival times between the ears (interaural time differences), differences in amplitude or level of the sound between the ears (interaural level differences), asymmetrical spectral reflections from parts of the body (such as torso, shoulders, and pinnae), phase delays, group delays, and a ratio of the direct signal to the reverberated signal.

⁵ In the district court case, the parties agreed that “sound localization point” means the “location where a listener localizes sound.” Ex. 1027, 8. Petitioner argued that “away from and proximate to” is indefinite, Patent Owner proposed that the phrase should be given its ordinary and customary meaning or construed to mean “a distance from,” and the district court determined that the phrase is not indefinite. Ex. 2012, 2; see PO Resp. 3 (citing Exs. 2012, Ex. 2013).

Ex. 1001, col. 3, ll. 55–67 (emphasis added). Patent Owner reads the “accounting for” clause as modifying the preceding “one or more of head-related transfer functions”; in other words, sound location can be altered or created using HRTFs, which “account[] for” everything appearing after the “accounting for” clause. PO Supp. Br. 3–4 & n.2 (emphasis omitted). Petitioner, by contrast, emphasizes the “one or more of” clause and reads the sentence as a list of ways of altering or creating a sound location, i.e., using HRTFs, ITDs, ILDs, spectral reflections, phase delays, group delays, and the ratio of the direct to reverberated signal. Reply 5–6; Pet. Supp. Br. 4–5.

After reviewing the full trial record, we conclude that Petitioner’s reading of the column 3 passage is the more accurate one. “[O]ne or more of” typically precedes a word or phrase referring to multiple things (e.g., a list of things). Patent Owner’s position ignores the word “of”; in effect, Patent Owner reads the sentence as “. . . altered or created using one or more . . . head-related transfer functions (HRTFs)” *See* Pet. Supp. Br. 5; Tr. 67:6–7 (Patent Owner arguing that “the accounting for clause modifies HRTFs” and referring to “[o]ne or more HRTFs”). Petitioner’s reading also is consistent with other portions of the Specification describing HRTF processing as merely exemplary. For example, the Specification discloses that adjustments to sound for users on a conference call “include, *but are not limited to*, calculations for and changes to ITDs, ILDs, *HRTFs*, attenuation, reverberations, and *other aspects of sound* discussed herein.” Ex. 1001, col. 35, ll. 52–55 (emphasis added). Also, in describing block 120 of Figure 1, which is worded similarly to limitation 1[c] that is relied on by Patent Owner, the Specification states:

Adjustments to the sound are made so the sound emanates or originates from the sound localization point. For example, the sound is processed so sound localization occurs for the listener to emanate from or originate at the sound localization point. *For instance*, the sound is processed to alter, add, or generate *head-related transfer functions (HRTFs)*, interaural time differences, and/or interaural level differences to correspond to a fixed or variable distance from the listener, a coordinate location or a GPS location of the sound localization point.

Id. at col. 4, ll. 16–29 (emphasis added); *see also id.* at col. 6, ll. 56–62 (“[f]or example . . .”), col. 9, ll. 54–60 (“[f]or example . . .”), col. 38, ll. 15–17 (“A SLP is designated to the right of the listener by adjusting an ITD . . . and by adjusting the ILD.”). These portions of the Specification support Petitioner’s view that “multiple techniques,” not just HRTF processing, “apply to both SLP creation and adjustment.” *See* Pet. Supp. Br. 5. They also are consistent with the dependent claims discussed above that recite some of those techniques, such as changing an ITD or ILD. *See supra* Section II.B.2.b.

We agree with Petitioner’s reading of the column 3 passage above. At most, though, the language in column 3 of the Specification is susceptible to multiple readings, which would still be insufficient for disavowal. *See Poly-America, L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016) (“Ambiguous language cannot support disavowal.”).

Patent Owner also points to the following passage in the Specification as allegedly supporting its position:

Consider an example in which a listener and a talking person wear or use an electronic device that captures, transmits, and/or provides binaural sound during a telephone call. In the first part of the call, a [virtual microphone point (VMP)] at the location of the speaker is designated to be at the point of the actual physical microphones being worn by the speaker (e.g.,

being at the ears of the speaker). As such, *various sounds in the environment of the speaker are perceived by the listener to emanate from locations relative to the ears of the listener, and the SLP of the speaker's voice is perceived by the listener as approximately at the point of the mouth of the listener. Later in the call it is determined that the vocal part of the sound being sent by the speaker should be moved to a SLP off to the right side of the face of the listener.* By way of example, the vocal part of the sound captured by the device worn by the speaker can be identified by the intersection of the set of frequencies associated with voice and with amplitudes and sound pressures matching those that likely emanated from the oral cavity a few inches away from the microphones The identified vocal component of the sound captured from the speaker is removed from the sound sent directly to the headphones of the listener, and the SLP of the vocal component is designated to the right side of the face of the listener using an ITD and an ILD. At this time, the listener's voice is also designated at a SLP to the left of the face of the speaker, and both the speaker and the listener have the perception that they are positioned side-by-side with the listener to the left of the speaker.

Ex. 1001, col. 38, l. 57–col. 39, l. 24 (emphasis added); *see* PO Resp. 41–42.

Patent Owner argues that this shows that the vocal component of sound captured binaurally needs further processing with HRTFs for the listener to be able to perceive it at a SLP away from and proximate to the listener.

PO Resp. 41–42 (citing Ex. 2011 ¶¶ 68–69). We do not agree because the passage above merely describes an exemplary embodiment, does not mention HRTFs, and states after the highlighted portion that the SLP is designated to the right of the listener “using an ITD and an ILD,” which is consistent with the other disclosures discussed above that support

Petitioner's broader view. *See* Ex. 1001, col. 38, l. 57–col. 39, l. 24.

We address Patent Owner's additional arguments regarding binaural synthesis below. *See infra* Section II.B.2.e.

For the reasons explained above, we conclude that the Specification does not make clear that the phrase “sound localization point . . . away from and proximate to the [listener]” limits claims 1 and 15 to HRTF processing.

d) Prosecution History

Neither party relies on the prosecution history of the ’090 patent for its claim interpretation arguments.

e) Extrinsic Evidence

We now turn to the remainder of the parties’ claim interpretation arguments, which are based primarily on the testimony of Dr. Begault and Dr. Kyriakakis, and other extrinsic evidence that they cite. *See* PO Resp. 36–43 (claim 1), 48–49 (claim 15); Reply 7–9; Sur-Reply 5–10; PO Supp. Br. 6–7; Pet. Supp. Br. 7.

Patent Owner argues that Petitioner mischaracterizes claim 1 as “exclusively directed at binaural recording,” i.e., “using two microphones . . . spaced at the same distance as the width of a human head.” PO Resp. 36–37 (quoting Ex. 1003 ¶ 54; citing Ex. 2011 ¶¶ 23, 74–77). According to Patent Owner and Dr. Begault, a person of ordinary skill in the art “would comprehend that [c]laim 1 does not solely encompass the concept of capturing sound binaurally through two microphones.” *Id.* at 38 (citing Ex. 2011 ¶ 67). Patent Owner explains that when microphones are located on either side of the head of the talker (as in Andrea), the captured sound will have two components: the “talker’s voice” and the “sound of [the] environment” (e.g., a chirping bird). *Id.* at 38–39 (citing Ex. 2011 ¶¶ 60, 63–64, 66, 69) (but acknowledging that claim 15 recites capturing “binaural

voice” of a talker, whereas claim 1 recites capturing “binaural sound”).

Patent Owner further argues that

[t]his distinction is important, because an electronic earphone worn by a talker captures the spatial perspective of the talker. . . . This spatial perspective is transmitted to the listener during a call. . . . [W]hile the electronic earphone worn by the talker can capture the talker’s voice binaurally, the listener would not perceive it binaurally, or, as [c]laim 1 recites, as being originated “at the sound localization point in empty space that is away from and proximate to the listening person.” . . . This is because the listener would hear the talker’s voice from the spatial perspective of the talker, which is *inside of their head or in front of their mouth*. . . . As Dr. Begault explains, the means of providing the talker’s voice to the listener binaurally—in cases where the microphones capturing the talker’s voice are worn by the talker—is *binaural synthesis*.

Id. at 40 (citing Ex. 2011 ¶¶ 60, 64, 85) (emphasis added). Patent Owner contends that “[t]o provide the talker’s voice binaurally to a listener, one must process (i.e., adjust) the captured voice by HRTFs—which is the processes described in limitations 1[b] and 1[c],” whereas for other sounds in the environment, “the listener could perceive them as externalized as the talker perceives them as externalized.” *Id.* at 41 (citing Ex. 2011 ¶¶ 68–71).

From this, Patent Owner concludes that “[c]laim 1 discloses both binaural recording (for sounds other than the talker’s voice) and binaural synthesis (for the talker’s voice).” *Id.* In other words, claim 1 recites “a mixed recording-synthesis method wherein the captured binaural sound is overlaid with binaural synthesis to fully externalize the sound for the listener.” *Id.* at 42 (citing Ex. 2011 ¶¶ 68–69). Patent Owner argues that this reading is supported by the language of claim 1 reciting that the SLP is located in “empty space that is away from and proximate to” the listener, the SLP “simulates an origin of the binaural sound” at the empty space, and the

binaural sound is adjusted to “originate[]” from the SLP during the telephone call, which in Patent Owner’s view “describes an externalization process . . . which can only be accomplished by binaural synthesis.” *Id.* at 42–43 (citing Ex. 2011 ¶¶ 9–22, 45) (emphasis omitted); *see also* PO Supp. Br. 6 (arguing that “Dr. Begault has repeatedly testified that without binaural sound and HRTF processing one cannot have externalization, notably over headphones,” and in his view, “HRTF processing is inherent in” the claims) (citing Ex. 2011 ¶¶ 9, 22, 62, 70, 79, 86).

Patent Owner likewise contends that “binaural synthesis methods *must* be employed” for claim 15, which has language similar to claim 1, noting that claim 15 is even more specific because it recites “binaural voice.” PO Resp. 48–49 (citing Ex. 2011 ¶¶ 17, 46, 84–87). Again, according to Patent Owner and Dr. Begault, “while a system equipped with a microphone array worn by a talker is capable of capturing a talker’s voice binaurally, it cannot *provide* the captured voice to the listener [binaurally].” *Id.* at 48 (citing Ex. 2011 ¶ 85).

Petitioner responds that Dr. Begault’s opinion that the claims require HRTF processing is “contrary to the intrinsic evidence” and also “contrary to Dr. Begault’s own statements and other extrinsic evidence.” Reply 2–9. According to Petitioner, “Dr. Begault never explains why binaural synthesis needs to be achieved through HRTFs, . . . particularly when the ’090 [p]atent expressly identifies adjustments of other aspects of sound to create a virtual sound source,” and “fails to tie” the alleged requirement to use HRTFs to language in the claims. *See id.* at 8; Pet. Supp. Br. 7. Petitioner cites as support the reply declaration of Dr. Kyriakakis where he explains his disagreement with Dr. Begault and opines that “externalization and binaural synthesis do not require HRTFs.” Ex. 1055 ¶¶ 3–14, 23–35. Specifically,

“[b]ased on the discussion in the ’090 [p]atent, binaural synthesis can encompass any method that creates a virtual sound source with respect to a head of a listener. . . . Binaural synthesis synthesizes binaural sound. There is no restriction as to how that binaural sound is synthesized.” *Id.* ¶ 30.

At the outset, we note that “extrinsic evidence in general, and expert testimony in particular, may be used only to help the [Board] come to the proper understanding of the claims; it may not be used to vary or contradict the claim language. . . . Nor may it contradict the import of other parts of the specification.” *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1584 (Fed. Cir. 1996). “Indeed, where the patent documents are unambiguous, expert testimony regarding the meaning of a claim is entitled to no weight.” *Id.*; *see Phillips*, 415 F.3d at 1318 (“a court should discount any expert testimony ‘that is clearly at odds with the claim construction mandated by the claims themselves, the written description, and the prosecution history, in other words, with the written record of the patent’”). We have reviewed the testimony of Dr. Begault and Dr. Kyriakakis relied upon by the parties, as well as the other extrinsic evidence cited. We conclude, based on the full trial record, that the claim language and Specification clearly indicate that claims 1 and 15 are not limited to HRTF processing and cannot be contradicted by the extrinsic evidence of record.

Claims 1 and 15 do not recite “binaural synthesis,” “synthesizing” binaural sound, sound “externalization,” “HRTFs,” or any similar language, and instead are worded more broadly. *See supra* Section II.B.2.b. The only claim language Patent Owner and Dr. Begault point to as supporting their reading is the SLP being located in “empty space that is away from and proximate to the [listener],” the SLP “simulat[ing] an origin of the binaural sound at the empty space,” and the binaural sound being adjusted to

“originate[]” from the SLP during the telephone call (claim 1), and the SLP “represent[ing] an origin of the binaural voice” (claim 15). *See* PO Resp. 42–43, 48–49; Ex. 2011 ¶¶ 22, 45, 62, 70. Patent Owner and Dr. Begault, however, do not explain sufficiently why those broad phrases require binaural synthesis or HRTF processing, and we do not find anything in the intrinsic evidence tying them together. Claims 1 and 15 simply “capture binaural sound/voice and adjust it. Thus, these claims create binaural sound/voice through capture, *not synthesis*.” Pet. Supp. Br. 3. We disagree with Patent Owner that the claims must be read as “mixed recording-synthesis” where captured binaural sound is “overlaid with binaural synthesis,” given the two claimed steps of capturing and adjusting. *See* PO Resp. 42. And, as explained above, the Specification describes multiple ways of performing the adjusting, not just HRTF processing. *See supra* Section II.B.2.c.

Further, the extrinsic evidence is not uniform as Patent Owner contends. *See* Sur-Reply 6 (arguing that “[v]irtually all evidence Petitioner presented confirms HRTF processing is indispensable for externalization”). Petitioner cites U.S. Patent No. 4,136,260 (Ex. 1052, “Asahi”), which discloses an “out-of-head localized sound reproduction system for headphone[s]” that utilizes a “dip filter” (i.e., not HRTFs). Ex. 1052, codes (54), (57); *see* Reply 8; Ex. 1055 ¶¶ 8, 35. Petitioner also points to Dr. Begault’s book stating that “reverberation . . . is key for the effective simulation of distance and the perception of an environmental context.” Ex. 1036, 79; *see* Reply 8; Ex. 1055 ¶ 33. That passage appears to be consistent with the Specification of the ’090 patent. *See* Ex. 1001, col. 10, ll. 46–50 (“By way of example, one or more adjustments are made to a HRTF, an interaural time difference, and an interaural level difference of the

sound provided to the listener. Sound can also be adjusted based on calculations made for sound attenuation and *sound reverberation*.” (emphasis added)), col. 35, ll. 49–55 (“Adjustments are made to the sound for each of these users since they are located at different locations around the table with respect to the sound localization points. These adjustments include, but are not limited to, calculations for and changes to ITDs, ILDs, HRTFs, attenuation, *reverberations*, and other aspects of sound discussed herein.” (emphasis added)). Thus, at least some extrinsic evidence of record contradicts Patent Owner’s view and suggests that externalization can be accomplished in ways other than HRTF processing.

We also note, with respect to ITDs and ILDs in particular, Dr. Begault’s testimony that ITD and ILD cues can “only crudely approximate the cues evoked by sources that are physically placed at the auditory event positions.” Ex. 2011 ¶ 16 (quoting Ex. 2026, 3–4). Petitioner argues, and we agree, that “crude or not, . . . ITD, ILD, and adjustments to other aspects of sound still localize that sound to a point that is ‘away from and proximate to’ the listener.” See Reply 9; Ex. 1055 ¶ 7. That view is amply supported by the dependent claims and multiple passages in the Specification, as explained above. See *supra* Sections II.B.2.b–c. Patent Owner discusses the column 3 disclosure and one other portion of the Specification relied upon by Petitioner, but does not address the others. See PO Supp. Br. 3–6 (citing Ex. 1001, col. 3, ll. 59–67, col. 38, ll. 10–56).

Finally, Patent Owner makes various arguments pertaining to Dr. Kyriakakis’s testimony. For instance, Patent Owner argues that Dr. Kyriakakis allegedly “conceded that binaural synthesis is implicit in the last limitation in claim 15.” Sur-Reply 9 (emphasis omitted). We have reviewed the portions of his cross-examination cited by Patent Owner,

however, and do not see any such concession. Dr. Kyriakakis merely testified as to how binaural sound would be heard if captured with two microphones at the ears and then played back without any adjusting, but limitation 15[d] recites adjusting. *See* Ex. 2031, 33:18–36:12. Similarly, Patent Owner argues that Dr. Kyriakakis allegedly admitted that HRTF processing is required by testifying that “[i]t was well-known that binaural sound or binaural audio was commonly used to refer to systems or techniques that capture or simulate head-related signals containing natural acoustic differences between the two ears.” Ex. 1003 ¶ 46 (internal quotation marks removed); *see* PO Resp. 49; Sur-Reply 6; PO Supp. Br. 7. The cited testimony, however, describes “head-related signals,” not HRTFs, and thus can encompass other things like ITDs and ILDs “containing natural acoustic differences between the two ears,” consistent with the broader disclosure in the Specification discussed above. *See* Ex. 1003 ¶ 46.

Patent Owner also asserts that Petitioner’s declarants in two other proceedings, Gregory Welch, Ph.D., in IPR2023-01023 and Agnieszka Roginska, Ph.D., in IPR2023-01019, “agreed with Dr. Begault that sound externalization requires binaural synthesis—only Dr. Kyriakakis disagrees.” Sur-Reply 5, 7, 11, 20, 21 (citing Ex. 2031, 66:7–72:6, 73:19–74:18, 78:5–79:10). We have reviewed the cited testimony and do not find Patent Owner’s argument persuasive. The other declarants were testifying in other proceedings regarding unrelated patents, whereas the issue here is whether the specific language of claims 1 and 15 of the ’090 patent requires HRTF processing. We also find the cross-examination testimony of limited relevance, as it appears that Dr. Kyriakakis was asked about individual statements without sufficient information to review the full context in which they were made. *See, e.g.*, Ex. 2031, 71:9–22 (“I’m reading it out of

context, so I’m not sure what she means by three-dimensional space. . . . So I’m not quite sure what she’s referring to.”), 74:8–18 (“I would disagree . . . if this implied that this is the only way to externalize. But I doubt that that’s what she’s saying. I don’t know the context.”).

For the reasons explained above, we are not persuaded that the extrinsic evidence supports reading the claim phrase “sound localization point . . . away from and proximate to the [listener]” to require HRTF processing as Patent Owner contends, particularly given that the intrinsic record clearly suggests a broader interpretation.

f) Conclusion

Based on the full trial record, we interpret the phrases “sound localization point . . . away from and proximate to the listening person” in claim 1 and “sound localization point . . . away from and proximate to the first person” in claim 15 to not require HRTF processing, and conclude that no further interpretation is necessary to decide the issues presented during trial. *See Nidec*, 868 F.3d at 1017.

C. Legal Standards

To prevail in its challenges to the patentability of claims 1–3, 6, 8–10, 12, and 14–19 of the ’090 patent, Petitioner must demonstrate, by a preponderance of the evidence, that the claims are unpatentable. 35 U.S.C. § 316(e). “In an [*inter partes* review], the petitioner has the burden from the onset to show with particularity why the patent it challenges is unpatentable.” *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016). This burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378

(Fed. Cir. 2015); *see also In re Magnum Oil Tools Int'l, Ltd.*, 829 F.3d 1364, 1376 (Fed. Cir. 2016) (“Where, as here, the only question presented is whether due consideration of the four *Graham* factors renders a claim or claims obvious, no burden shifts from the patent challenger to the patentee.”).

A claim is unpatentable for obviousness if, to one of ordinary skill in the pertinent art, “the differences between the [claimed invention] and the prior art are such that the [claimed invention] as a whole would have been obvious [before the effective filing date of the claimed invention] to a person having ordinary skill in the art to which [the claimed invention] pertains.”

KSR Int'l Co. v. Teleflex Inc., 550 U.S. 398, 406 (2007); *see* 35 U.S.C.

§ 103. The question of obviousness is resolved on the basis of underlying factual determinations, including “the scope and content of the prior art”; “differences between the prior art and the claims at issue”; and “the level of ordinary skill in the pertinent art.” *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). Additionally, objective indicia of nonobviousness, such as “commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.”⁶ *Id.* When conducting an obviousness analysis, we consider a prior art reference “not only for what it expressly teaches, but also for what it fairly suggests.” *Bradium Techs. LLC v. Iancu*, 923 F.3d 1032, 1049 (Fed. Cir. 2019) (citation omitted).

⁶ Patent Owner does not present any evidence of objective indicia of nonobviousness in this proceeding.

A patent claim “is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art.” *KSR*, 550 U.S. at 418. An obviousness determination requires finding “both ‘that a skilled artisan would have been motivated to combine the teachings of the prior art references to achieve the claimed invention, and that the skilled artisan would have had a reasonable expectation of success in doing so.’” *Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd.*, 821 F.3d 1359, 1367–68 (Fed. Cir. 2016) (citation omitted); *see KSR*, 550 U.S. at 418 (for an obviousness analysis, “it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does”).

“Although the *KSR* test is flexible, the Board ‘must still be careful not to allow hindsight reconstruction of references . . . without any explanation as to *how* or *why* the references would be combined to produce the claimed invention.’” *TriVascular, Inc. v. Samuels*, 812 F.3d 1056, 1066 (Fed. Cir. 2016). Further, an assertion of obviousness “cannot be sustained by mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness.” *KSR*, 550 U.S. at 418 (quoting *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)); *accord In re NuVasive, Inc.*, 842 F.3d 1376, 1383 (Fed. Cir. 2016) (stating that “conclusory statements” amount to an “insufficient articulation[] of motivation to combine”; “instead, the finding must be supported by a ‘reasoned explanation’” (citation omitted)); *Magnum Oil*, 829 F.3d at 1380 (“To satisfy its burden of proving obviousness, a petitioner cannot employ mere conclusory statements. The petitioner must instead articulate specific reasoning, based on evidence of record, to support the legal conclusion of obviousness.”).

*D. Obviousness Ground Based on Bedingfield and Andrea
(Claims 1–3, 6, and 15–17)*

1. Bedingfield

Bedingfield discloses “[a]n improved telephone or network-based communication system” that “simulate[s] an in-person conference setting.” Ex. 1005, col. 3, ll. 25–27. The disclosed system “provide[s] multi-channel sound to a listener by modifying a single channel signal provided by another participant’s system,” and “assign[s] each participant a virtual position within a virtual sound field” where “[e]ach participant is heard by the listener in multi-channel audio based on the participant’s virtual location in the sound field.” *Id.* at col. 3, ll. 27–34.

Figure 1 of Bedingfield is reproduced below.

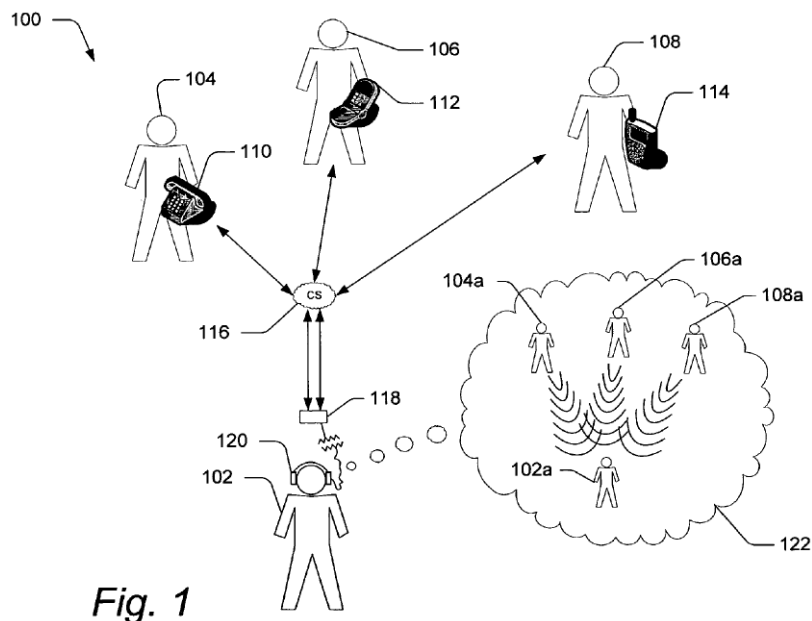


Figure 1 depicts “overall environment 100 for providing a synthetic audio placement to a listener 102” conducting a conference call with participants 104, 106, and 108 having, respectively, communication devices 110, 112, and 114 (e.g., telephones, mobile phones). *Id.* at col. 4, ll. 18–30. Multi-channel processing device 118 receives signals from the

communication devices of speaking participants and creates sound field 122 when listener 102 hears audio through speaker system 120 (e.g., stereo headphones). *Id.* at col. 4, ll. 40–45, col. 13, ll. 34–36. As shown in Figure 1, sound field 122

represents the perception resulting from the audio output of the multi-channel processing device 118 through the multi-channel speaker system 120 as heard by the listener 102. For example, if a listener 102a and participants 104a, 106a, 108a were in the same location and speaking to each other directly (without the communication system 116), then the listener 102a would hear sounds from the participants 104a, 106a, 108a through both of the listener's 102a ears, and thus have a specific balance, volume, and timbre for each speaker.

Id. at col. 4, ll. 52–61. In that way, created sound field 122 “is substantially similar (or approximately similar) to an actual sound field where the listener 102 is present between all of participants 104, 106, 108.” *Id.* at col. 4, l. 66–col. 5, l. 3, col. 5, ll. 27–32, col. 9, ll. 20–23, col. 16, ll. 36–48.

Figure 19a of Bedingfield, reproduced below, shows an exemplary sound field.

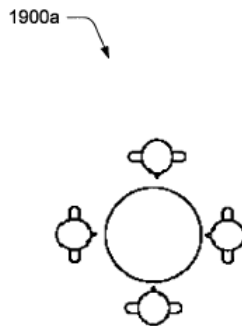


Fig. 19a

Figure 19a depicts circular sound field 1900a with participants, including the listener, “arranged in a circular configuration.” *Id.* at col. 16, ll. 36–40.

The sound effects produced for the sound field can be accomplished “using various audio techniques such as volume, balance, parametric equalization, delay, echo and the like.” *Id.* at col. 5, ll. 35–41. Bedingfield further describes “selections a listener may make” using multi-channel processing device 118. *Id.* at col. 5, ll. 51–53. For example, the listener can “change a participant’s location” by “select[ing] a participant and then select[ing] a new location for the participant within the sound field.” *Id.* at col. 6, ll. 29–32, 43–45, col. 17, ll. 6–14, 20–25, Fig. 3 (block 328). Bedingfield also discloses detecting movement of the listener (e.g., turning his head) and changing the sound field accordingly for the listener’s new orientation. *Id.* at col. 13, l. 34–col. 14, l. 43, Figs. 13–15.

2. *Andrea*

Andrea discloses “a stereo headset or stereo earbuds with an integrated array of microphones” with improved noise cancellation. Ex. 1007, col. 2, ll. 37–40. Two microphones are “mounted on the left and right earphones” of a headset or set of earbuds. *Id.* at col. 11, ll. 25–27, Fig. 10. Andrea discloses that

[t]he stereo microphone spacing allows for determining different time of arrival and direction of the acoustic signals to the microphones. From the centered position of the mouth, the voice signal 210 will look like a plain wave and arrive in-phase at same time with equal amplitude at both the microphones, while noise from the sides will arrive at each microphone in different phase/time and be cancelled by the adaptive processing of the algorithm.

Id. at col. 11, ll. 6–13. Andrea describes a dual-channel earbud embodiment and states:

While a user is wearing the earbuds, the audio receiving means on each earbud may pick up the same sound emanating from a single sound source (i.e., the respective audio receiving means may create a binaural recording). Because of the spatial discrepancy between each of the audio receiving means, a distinct audio signal may be produced in each of the channels corresponding to the same sound.

Id. at col. 14, ll. 55–61. “[T]he dual-channel earbud embodiment allows for the application of audio enhancement techniques, such as active noise reduction (ANR) . . . for reducing unwanted sound.” *Id.* at col. 15, ll. 18–22.

3. *Claim 1*

Petitioner argues that claim 1 is unpatentable over Bedingfield and Andrea under 35 U.S.C. § 103, relying on the testimony of Dr. Kyriakakis as support. Pet. 16–27 (citing Ex. 1003). Patent Owner makes various arguments in response, relying on the testimony of Dr. Begault. PO Resp. 4–17, 31–33, 36–43, 48–58 (citing Ex. 2011); Sur-Reply 13–20.

a) Petitioner’s Arguments

Petitioner argues that Bedingfield and Andrea collectively teach all of the limitations of claim 1 and that it would have been obvious to combine the references’ disclosures to achieve the method of claim 1. Pet. 16–27. With respect to limitation 1[a], “capturing, with an electronic earphone located at a head of a talking person, binaural sound that will be provided to a listening person during a telephone call,” Petitioner contends that Bedingfield teaches participants 104, 106, and 108 (each a “talking person”) with respective communication devices 110, 112, and 114 (e.g., mobile phones, wearable speakers) that capture sound with a microphone, and it would have been obvious to use well-known earbuds or headphones. *Id.* at

19–21. Sound from the participants is captured and provided to listener 102 (a “listening person”) via multi-channel processing device 118 and multi-channel speaker system 120 during a telephone call with the participants. *Id.*

Petitioner acknowledges that “Bedingfield does not expressly teach capturing a binaural sound,” but argues that doing so would have been obvious based on Andrea, which teaches “earbuds . . . worn by a user at left and right ears that ‘create a binaural recording.’” *Id.* at 22 (quoting Ex. 1007, col. 14, ll. 55–58) (emphasis omitted). Petitioner asserts, with supporting testimony from Dr. Kyriakakis, that a person of ordinary skill in the art would have been motivated to modify Bedingfield’s system based on Andrea for multiple reasons. *Id.* at 16–18 (citing Ex. 1003 ¶¶ 96–106). For example, a person of ordinary skill in the art “would have recognized that capturing binaural sound (including binaural voice) and providing it to the listener would advance Bedingfield’s stated goal of ‘allow[ing] a person to hear the speaker better’ during an electronic call, such as the exemplified conference call.” *Id.* at 17 (quoting Ex. 1005, col. 1, ll. 44–46).

Petitioner further contends that “Andrea discloses improving call quality through a noise-canceling solution for ‘directional listening.’” *Id.* (quoting Ex. 1007, col. 1, ll. 44–51; citing, *inter alia*, Ex. 1007, col. 15, ll. 18–31 (describing active noise reduction as a benefit of the dual-channel earbud device)). Petitioner also argues that an ordinarily skilled artisan “would have known that capturing binaural sound, as Andrea teaches, made it easier for the listener to distinguish between signal and noise, and improved call quality, providing spatialized sound to the listener and allowing for a more life-like conversation,” and, therefore, “applying Andrea’s capturing binaural sound to Bedingfield would have enhanced the

participants’ experience on the electronic call.” *Id.* (emphasis omitted).
Petitioner further asserts that the proposed “modification would have been a natural extension of Bedingfield’s WED,” given that Bedingfield already discloses a headset with a microphone input and speaker output, and “[c]apturing binaural voice to reduce noise would improve the simulated conference by improving sound quality and increasing SLP fidelity.” *Id.* at 17–18 (citing, *inter alia*, Ex. 1005, col. 3, ll. 25–27, col. 11, ll. 5–6).

Finally, Petitioner argues that a person of ordinary skill in the art would have had a reasonable expectation of success in making the combination because both references relate to electronic communications and audio transmitting/receiving devices; “[m]odifying Bedingfield would have been as simple as adding a second microphone to Bedingfield’s WED for capturing binaural voice”; Andrea contemplates that its devices can be used in a variety of applications; “[i]t would have been straightforward and beneficial to use a second microphone, which was well-known by 2014”; and the modification involves using known elements, known techniques, and predictable results. *Id.* at 18–19 (citing, *inter alia*, Ex. 1007, col. 1, ll. 49–51; Ex. 1003 ¶¶ 107–112).

With respect to limitation 1[b], “designating, with a computer system, a sound localization point in empty space that is away from and proximate to the listening person such that the sound localization point simulates an origin of the binaural sound at the empty space that the listening person hears during the telephone call,” Petitioner argues that multi-channel processing device 118 in Bedingfield simulates a sound field and allows the listener to select a participant’s location within the sound field (the “sound localization point” simulating the origin from which the listener hears the participant speaking). *Id.* at 22–23. Petitioner contends that it would have been

obvious to position the SLP “in empty space, i.e., at a location where no physical object exists,” because Bedingfield discloses positioning the participants “around a circular conference table,” as shown in Figure 19a, for example. *Id.* at 24–25 (quoting Ex. 1005, col. 9, ll. 20–23) (emphasis omitted).

Next, limitation 1[c] recites “adjusting, with the computer system, the binaural sound captured at the earphone of the talking person so the binaural sound originates during the telephone call from the sound localization point in empty space that is away from and proximate to the listening person” and limitation 1[d] recites

providing, with an electronic earphone located at a head of the listening person, the binaural sound to the listening person during the telephone call such that the origin of the binaural sound for the listening person occurs at the sound localization point in empty space that is away from and proximate to the listening person.

Petitioner argues that multi-channel processing device 118 processes the audio signals received from the participants to create the sound field and the listener hears the speaking participants at their respective locations within the sound field using a “wearable headset or headphones.” *Id.* at 26–27.

We are persuaded by Petitioner’s analysis, as explained above and supported by the testimony of Dr. Kyriakakis, notwithstanding Patent Owner’s arguments to the contrary, which we address below.

b) Patent Owner’s Arguments

(1) Credibility of Dr. Kyriakakis

Patent Owner argues that “the Board should assign no weight to [Dr. Kyriakakis’s] declaration” for various reasons, including that his

testimony is allegedly conclusory and unsupported, internally inconsistent, and inconsistent with testimony in other proceedings. PO Resp. 17–35.

Many of Patent Owner’s arguments pertain to disputes between the parties about what the asserted prior art teaches. For example, Patent Owner argues that “[c]ontrary to Dr. Kyriakakis’s unsupported opinion[s],” (1) Bedingfield does not teach changing an ITD, and (2) Li does not teach a telephone call or electronic call involving a live voice exchange. *Id.* at 17–30 (disputing Ex. 1003 ¶¶ 147, 243). As explained below, we agree with Patent Owner on the merits for these points. *See infra* Sections II.D.6, II.H.2. Similarly, some of Patent Owner’s arguments challenging Dr. Kyriakakis’s testimony pertain to issues that we need not reach in this decision. *See* PO Resp. 11–17, 33–35 (disputing Ex. 1003 ¶¶ 87, 173, 245; Ex. 2016, 252:9–251:1).

Patent Owner, however, does not provide—and we do not see—any reason why our factual determinations on these individual issues mean that we should disregard the entirety of Dr. Kyriakakis’s testimony. *See* Patent Trial and Appeal Board Consolidated Trial Practice Guide (Nov. 2019) (“Trial Practice Guide”), 35, 40, *available at* <https://www.uspto.gov/TrialPracticeGuideConsolidated> (“The Board has broad discretion to assign weight to be accorded expert testimony,” but “[o]pinions expressed without disclosing the underlying facts or data may be given little or no weight.”); 37 C.F.R. § 42.65(a). The expert witnesses in this proceeding provide opinions on multiple issues regarding multiple claims and asserted grounds. We credit some of those and do not credit others, based on our evaluation of the full trial record, and explain the reasons why in this Decision. Without more, we are not persuaded that we should give no weight to Dr. Kyriakakis’s entire testimony based on our disagreement with certain individual points.

Patent Owner also argues that Dr. Kyriakakis misled the Board by implying that he was giving the term “HRTFs” its plain and ordinary meaning, when in fact he used Patent Owner’s proposed interpretation from IPR2023-01005 and allegedly “conceded” that the plain and ordinary meaning is different than that interpretation. PO Resp. 8–11 (citing Ex. 1003 ¶¶ 23, 82; Ex. 2016, 78:8–81:9, 90:16–91:6, 99:2–20); *see* Ex. 2023 ¶ 83 (IPR2023-01005 declaration stating Patent Owner’s interpretation of “functions that describe transformation of sound that modify the spectrum and time of arrival at a listener’s ears”). HRTFs are only recited in dependent claims 10, 17, and 18. Thus, there is no controversy as to the scope of the term for purposes of assessing the parties’ arguments regarding independent claims 1 and 15. *See* Reply 13. Even if there was, Patent Owner argued in the district court case that its proposed interpretation is the “[o]rdinary and customary meaning.” Ex. 1027, 21. And Dr. Kyriakakis did not concede that he was not applying the plain and ordinary meaning; rather, he merely stated what the acronym “HRTF” stands for. *See* Ex. 2016, 90:16–20.

We decline to give Dr. Kyriakakis’s testimony no weight, and instead credit and do not credit certain portions for the reasons stated herein.

(2) HRTF Processing

Patent Owner argues that “Petitioner misunderstands the correct scope and meaning” of the claims and, under the “correct understanding,” the combination of Bedingfield and Andrea does not render independent claims 1 and 15 unpatentable. PO Resp. 49–50. Similarly, Patent Owner argues that Petitioner’s asserted ground fails because “Bedingfield discloses neither binaural synthesis nor HRTF processing of captured sound” and “Andrea

does not disclose binaural synthesis and HRTF processing.” *Id.* at 50; Sur-Reply 13–15. We address Patent Owner’s claim interpretation arguments above and, for the reasons stated, disagree that claims 1 and 15 are limited to HRTF processing. *See supra* Section II.B.2. Thus, we disagree that Petitioner’s contentions are deficient on that basis.

(3) Combination of Bedingfield and Andrea

Patent Owner argues that “even under” Petitioner’s interpretation of the claims as not requiring HRTF processing, Petitioner’s obviousness arguments fail for four reasons. PO Resp. 50–58.

First, Patent Owner argues that “Andrea’s two microphones work together to cancel . . . noise while providing direction for the talker’s voice,” so “integrating Andrea’s noise cancellation microphone system into Bedingfield’s headphones would cancel or minimize the environment sounds in the talker’s room,” which “contradicts [c]laim 1’s goal . . . to capture the talker’s voice and all other sounds present in the talker’s room environment (e.g., chirping bird).” *Id.* at 50–51 (citing Ex. 1007, col. 11, ll. 6–24; Ex. 2011 ¶ 76); *see* Sur-Reply 11–13. In Patent Owner’s view, claim 1 requires capturing “every possible sound wave—not just the talker’s voice.” PO Resp. 1, 38–41, 51. That is not what the claim recites, though.

Claim 1 recites “capturing . . . binaural sound” and “adjusting . . . *the* binaural sound captured . . . so *the* binaural sound originates during the telephone call from the sound localization point in empty space that is away from and proximate to the listening person” (emphasis added). Thus, limitations 1[a] and 1[c] are satisfied by capturing binaural sound and adjusting that sound to originate from a SLP, not capturing and adjusting *all* sounds present in the talker’s environment. *See* Reply 10–11. We also see

no reason why the claim language would preclude noise cancellation of the type described in Andrea. *See id.* at 12, 15. Indeed, the '090 patent contemplates noise removal in various exemplary embodiments. *See* Ex. 1001, col. 25, ll. 39–41 (“Ambient noise and attenuation due to environmental conditions can be filtered.”), col. 39, l. 65–col. 40, l. 3.

Regardless, even under Patent Owner’s view, Andrea teaches capturing all sounds in the speaker’s environment (i.e., the voice of the speaker and “unwanted sound perceived by the user”) and, optionally, removing noise from “the sound picked up” by the earbuds. *See, e.g.*, Ex. 1007, col. 14, ll. 55–61, col. 15, ll. 32–38, col. 16, ll. 10–27 (“In *some embodiments*, the audio transmitting/receiving device allows for the application of other audio enhancement techniques. . . . [B]eamforming *may* be applied in a manner similar to the application of ANR. That is, the sound picked up by the audio receiving means on the earbuds may be converted to audio signals that are transmitted to an external device comprising a processor for processing. The processor *may* execute executable instructions causing it to generate an audio signal that substantially fails to reflect noise generated from an area outside of the beam width.” (emphasis added)). We credit Dr. Kyriakakis’s testimony, which is consistent with the disclosure of Andrea, and do not find Patent Owner’s arguments persuasive. *See* Ex. 1055 ¶¶ 39–41.

Second, regarding “adjusting” limitation 1[c], Patent Owner argues that Petitioner’s asserted modification of “adding a second microphone to Bedingfield [for capturing binaural sound] merely enables listening to the captured binaural voice with Bedingfield’s stereo headphones; whereas [claim 1] require[s] adjusting the captured binaural voice of the talker *before*

providing it to the listener.” PO Resp. 51–52 (citing Ex. 1003 ¶ 110; Ex. 2011 ¶ 65; Ex. 1001, col. 29, ll. 4–8).

We disagree. In Petitioner’s proposed combination, the combined Bedingfield-Andrea system “does not simply reproduce the captured binaural sound; rather, [it] captures binaural sound, adjusts that sound, then provides it to the listener.” *See* Reply 15. With respect to capturing binaural sound, Petitioner relies on specific teachings (1) in Bedingfield of communication devices that capture sound, and (2) in Andrea of dual microphones, worn at the left and right ears to capture binaural sound, for improved noise cancellation. *See* Pet. 17–22. Petitioner further cites the supporting testimony of Dr. Kyriakakis, who explains why a person of ordinary skill in the art would have found it straightforward and simple to “modify[] the system of Bedingfield to include a wearable device that implements Andrea’s second microphone for noise cancellation.” Ex. 1003 ¶¶ 105, 107–112; *see* Pet. 16–19. The referenced noise cancellation in Andrea plainly involves processing the sound that has been captured. *See* Pet. 17–18 (citing, *inter alia*, Ex. 1007, col. 15, ll. 18–31 (“the dual-channel earbud embodiment allows for the application of audio enhancement techniques, such as active noise reduction (ANR)”)); Ex. 1003 ¶¶ 123 (same), 125.

Further, with respect to adjusting the captured binaural sound, Petitioner relies on Bedingfield’s disclosure of multi-channel processing device 118 that “receives the audio signals (sound) and ‘process[es] the signals’ (adjust[s] the sound) to ‘creat[e] a sound field 122’ so that ‘the listener 102 [] hear[s] the speaking participant in the sound field 122.’” Pet. 26 (quoting Ex. 1005, col. 4, ll. 33–51; citing Ex. 1003 ¶ 138 (“This processing is *adjusting* the binaural sound, because it involves transforming

the sound so that it appears to originate from a specific location.”)). Thus, we are not persuaded that incorporating Andrea’s teachings into Bedingfield would merely reproduce the captured sound rather than adjust the sound before providing it.

Third, regarding “adjusting” limitation 1[c] and “providing” limitation 1[d], Patent Owner makes a similar argument that Bedingfield does not teach binaural sound, so “[i]f binaural sound captured by Andrea’s two-microphone system is added to Bedingfield, all Bedingfield can do with it is play it for the listener—as captured and without manipulation—through the disclosed stereo headphones.” PO Resp. 52–53 (citing Ex. 2011 ¶ 43). According to Patent Owner and Dr. Begault, “Bedingfield’s listener will not hear the captured voice as binaural” because although “the listener might hear the captured voice via Bedingfield’s stereo headphones inside their head, . . . they would not perceive the talker at an externalized SLP away from and proximate to the listener.” *Id.* at 53 (citing Ex. 2011 ¶¶ 60, 85) (emphasis omitted). Rather, in Petitioner’s proposed combination, “the resulting spatial perspective for the listener will be fixed to the spatial perspective of the talker, i.e., from *inside their head*, even if the listener moves their head or their position.” *Id.* (emphasis added).

Again, Petitioner’s obviousness ground is premised on the combined teachings of Bedingfield and Andrea. Binaural sound is first captured, according to the teachings of Andrea, then processed, using the methods of Bedingfield, to designate a SLP, adjust the captured binaural sound, and provide that adjusted binaural sound to the listener. *See* Pet. 19–27.

As Petitioner and Dr. Kyriakakis point out, Bedingfield teaches doing so by adjusting volume differences in the right and left audio channels to simulate the origin of another speaker in the sound field. *See id.* at 22–26;

Reply 16–19; Ex. 1003 ¶¶ 120–122, 130, 138, 140; Ex. 1055 ¶¶ 45–49.

Bedingfield discloses:

In an example, a sound field may include four participants configured in a circular configuration. With respect to a listener equipped with a multi-channel audio communication system, the listener may focus on a first speaker located at the 12 o'clock position relative to the listener and hear the speaker in stereo sound with both the right and left audio channels delivering substantially even volume levels. The listener may hear a second speaker, located at the 3 o'clock position relative to the listener, in stereo sound with an increased volume level in the right audio channel and a decreased volume level in the left audio channel, as compared to the right and left volume levels received from the first speaker. Therefore, the multi-channel audio communication system may render single channel sound detected by a speaker's microphone into a synthetic audio placement allowing a listener to sense the location (within the sound field) of the speaker through the modified audio signal presented to the listener.

Ex. 1005, col. 3, l. 62–col. 4, l. 12; *see also* Tr. 10:11–19 (explaining a simple scenario, premised on Ex. 1005, col. 9, ll. 52–57, where the volume level of binaural sound (captured based on the teachings of Andrea) is originally “50, 50, left, right,” then adjusted (based on the teachings of Bedingfield) to “level 67 and level 33” to position the speaker on the left), 13:15–14:2.

Figures 14 and 15 of Bedingfield, reproduced below, show a sound field with multiple speakers.

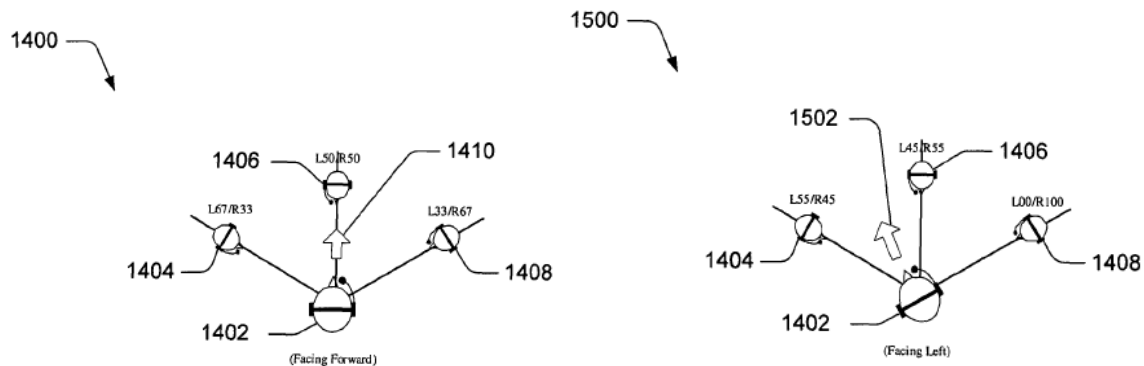


Fig. 14

Fig. 15

Figures 14 and 15 depict listener 1402 placed in a sound field with a group of participants 1404, 1406, and 1408, with listener 1402 facing forward in Figure 14 and facing left in Figure 15. Ex. 1005, col. 14, ll. 11–19; *see also id.*, Fig. 19a (depicting sound field participants in a similar circular configuration). In Figure 15, for example, “participant 1408 that is now speaking will sound as if the speaker were *located behind* the listener 1402.” *Id.* at col. 14, ll. 11–43 (emphasis added). Thus, we disagree with Patent Owner that the spatial perspective of the listener in the proposed combination would be “inside their head.” *See* PO Resp. 53; Ex. 2011 ¶ 82 (referencing a modified version of Figures 14 and 15 of Bedingfield). The above disclosures support Dr. Kyriakakis’s opinion, which we credit, that “Bedingfield teaches that the volume change will localize the sound behind the listener” and a person of ordinary skill in the art “reading Bedingfield would have understood that perceiving the speaker behind the listener is externalized and not inside the head.” *See* Ex. 1055 ¶¶ 45–49.

Fourth, regarding “designating” limitation 1[b], Patent Owner argues that “Petitioner relies on [the] ‘change a participant’s location’ feature,” but “the SLP designated by Bedingfield cannot truly externalize the sound, because it is a stereo-based system.” PO Resp. 55–56. Thus, according to Patent Owner and Dr. Begault, “while Bedingfield’s listener may be able to designate [a] SLP, that SLP does not ‘simulate[] an origin of the binaural sound at the empty space,’ and the listener does not perceive the sound originating from that SLP as ‘away from and proximate to’ them.” *Id.* at 56 (citing Ex. 2011 ¶ 46). Patent Owner contends that in the circular sound field of Figure 19a, relied upon by Petitioner, “the imagination of the listener—as opposed to manipulation of auditory cues—allows the listener to perceive the stereo sound as externalized.” *Id.* at 56–57 (citing Ex. 2011 ¶¶ 45–46). The user’s perception, in Patent Owner’s view, is “guided by either memory and familiarity or visual cues,” and “Bedingfield’s auditory cues do not guide the perception of externalization, because stereo sound is naturally heard inside the head.” *Id.* at 57 (citing Ex. 2011 ¶¶ 15–20, 45–46). Patent Owner argues that “[t]his is different from [the] externalization process claimed in [c]laim 1, where the auditory cues alone—without images or reliance on memory or familiarity—simulate [a] SLP at an empty space away from and proximate to the listener.” *Id.* at 57–58; *see* Sur-Reply 17–20.

We disagree. Patent Owner appears to acknowledge that Bedingfield’s examples (as depicted in Figures 14, 15, and 19 discussed above, for instance) allow the listener to perceive sound as “externalized,” but just asserts that the listener’s perception stems from the listener’s “imagination” rather than “manipulation of auditory cues.” *See* PO Resp. 56–57. Patent Owner and Dr. Begault, however, do not cite supporting

evidence for the assertion that Bedingfield’s volume adjustments would externalize sound based only on the listener’s imagination. *See id.*; Ex. 2011 ¶¶ 17, 45–46; Reply 20. Their view also is contradicted by Bedingfield’s disclosure, discussed above, that making volume changes to alter the sound field results in a speaker sounding as if he or she were located “behind the listener.” *See* Ex. 1005, col. 14, ll. 11–43. Thus, we do not credit Dr. Begault’s testimony, and we find Petitioner’s analysis of “designating” limitation 1[b] persuasive.

c) Conclusion

Petitioner has shown sufficiently that Bedingfield and Andrea collectively teach all of the limitations of claim 1 and a person of ordinary skill in the art would have been motivated to combine the references’ disclosures to arrive at the method of claim 1 with a reasonable expectation of success. *See* Pet. 16–27; Ex. 1003 ¶¶ 96–140. Based on all of the evidence of record, we determine that Petitioner has proven, by a preponderance of the evidence, that claim 1 would have been obvious based on Bedingfield and Andrea under 35 U.S.C. § 103.

4. Claim 15

Independent claim 15 is somewhat similar to claim 1, but recites a computer system rather than a method. Petitioner argues that Bedingfield teaches a “first wearable electronic device” (i.e., multi-channel speaker system 120) for a “first person” (i.e., listener 102), “second wearable electronic device” (i.e., communication device 114) for a “second person” (i.e., participant 108) that captures sound during an electronic phone call, “memory” that stores instructions, and a “processor” that executes the

instructions to adjust the voice of the second person to position a SLP representing the origin of the voice. Pet. 32–36. Petitioner further asserts that “Bedingfield-Andrea renders obvious” capturing “binaural sound” or “binaural voice” from the second person. *Id.* at 33. In its analysis, Petitioner refers to many of its earlier arguments regarding similar limitations 1[a] (capturing binaural sound), 1[c] (adjusting the binaural sound), and 1[d] (providing the binaural sound). *See id.* at 32–36.

Patent Owner argues claims 1 and 15 together, asserting that “[c]laim 15 is exclusively directed at binaural synthesis” and noting that claim 15 is even “more specific” than claim 1 because it recites “binaural voice” (rather than “binaural sound”) and thus “focus[es] only on the vocal component of the sound in the talker’s room.” *See* PO Resp. 48–58; Sur-Reply 13–20. We disagree with those arguments for the reasons explained above. *See supra* Section II.D.3.

We have reviewed Petitioner’s contentions and supporting evidence, including the testimony of Dr. Kyriakakis, and are persuaded that Petitioner has proven, by a preponderance of the evidence, that claim 15 would have been obvious based on Bedingfield and Andrea under 35 U.S.C. § 103, for the reasons stated by Petitioner. *See* Pet. 32–36; Ex. 1003 ¶¶ 96–112, 155–165.

5. Claims 3, 6, and 16

Claim 3 depends from claim 1 and recites “receiving, from the listening person, a location that specifies a distance from the listening person where to position the sound localization point in empty space that is proximate to and away from the listening person.” Petitioner argues that Bedingfield teaches the listener “provid[ing] input to ‘change a participant’s

location’ 104a, 106a, 108a in the sound field 122” and “[b]y tracking the listening person’s orientation and relative location, and the listening person selecting a location for a participant, the location specifies a distance from the listening person within the sound field.” Pet. 29–30 (quoting Ex. 1005, col. 6, ll. 29–45) (emphasis omitted).

Claim 6 depends from claim 1 and recites

capturing binaural sound from a second talking person;

designating a second sound localization point in empty space that is away from and proximate to the listening person such that the second sound localization point simulates an origin of the binaural sound from the second talking person that the listener hears; [and]

positioning the second sound localization point adjacent to the sound localization point such that the binaural sound captured from the talking person appears to originate from the sound localization point and the binaural sound captured from the second talking person appears to originate from the second sound localization point.

For these limitations, which are similar to those of claim 1 but with respect to a “second talking person,” Petitioner points to Bedingfield’s disclosure of multiple participants, such as participant 106 at location 106a, in sound field 122. *Id.* at 30–31.

Claim 16 depends from claim 15 and recites that “the processor further executes the instructions to determine a location of an empty chair that is proximate to the first person and position the sound localization point at the empty chair.” Petitioner argues that Bedingfield’s “sound field is provided to remote participants as if they were arranged ‘around a circular conference table,’” as shown in Figure 19a, and “[b]ecause conference participants are typically seated in chairs around conference tables,” a person of ordinary skill in the art “would have known to position the SLP for a

remote participant at an empty chair, and therefore determine a location of an empty chair, and position the SLP at the empty chair.” *Id.* at 37–38 (emphasis omitted).

Patent Owner does not argue dependent claims 3, 6, and 16 separately from their respective parent claims. *See* PO Resp. 58. We disagree with Patent Owner’s arguments regarding parent claims 1 and 15 for the reasons explained above. *See supra* Sections II.D.3, II.D.4. We have reviewed Petitioner’s contentions and supporting evidence, including the testimony of Dr. Kyriakakis, and are persuaded that Petitioner has proven, by a preponderance of the evidence, that claims 3, 6, and 16 would have been obvious based on Bedingfield and Andrea under 35 U.S.C. § 103, for the reasons stated by Petitioner. *See* Pet. 29–31, 37–38; Ex. 1003 ¶¶ 148–154, 166–169.

6. *Claims 2 and 17*

Claim 2 depends from claim 1 and recites

tracking a head orientation of the listening person with respect to the sound localization point; [and]

adjusting an interaural time difference of the sound that the listening person hears in response to the listening person changing the head orientation with respect to the sound localization point.

With respect to the “tracking” limitation, Petitioner argues that Bedingfield discloses wearable speakers 1312, depicted in Figure 13 as a headset, that “‘sense . . . movements of the listener’s 104 head’ and the direction the listener is facing.” Pet. 27–28 (quoting Ex. 1005, col. 13, ll. 39–57). Petitioner further contends that the “perceived location[]” (i.e.,

SLP) in Bedingfield is “fixed, meaning the listener’s head orientation and movement is with respect to the SLP.” *Id.* at 28 (emphasis omitted).

With respect to the “adjusting” limitation, Petitioner argues that

Bedingfield also discloses adjusting an ITD of the sound that the listening person hears in order to orient the listener within the sound field 112. [Ex. 1003] ¶ 147. Bedingfield uses “various audio techniques” such as “delay” to place the different participants in different “configurations within the sound field.” [Ex. 1005], 5:35–41. Bedingfield further describes applying “changes to delay” to enhance the “impression that a sound source has moved” relative to the listener. *Id.*, 3:56–59. The “delay” in this context is an ITD, commonly used to manipulate the perceived origin of a sound source in an audio scene. [Ex. 1003] ¶ 147; [Ex. 1027], 39–40. Thus, Bedingfield discloses adjusting an ITD of the sound delivered to the listener.

Pet. 29 (emphasis omitted). Thus, Petitioner’s position is that, although Bedingfield does not use the term “interaural time difference” or the acronym “ITD,” two portions of Bedingfield that use the word “delay”⁷ are really referring to ITD. *Id.*; *see* Reply 22–25. Patent Owner opposes, arguing that, “[c]ontrary to Dr. Kyriakakis’s unsupported opinion, Bedingfield does not disclose ITD.”⁸ *See* PO Resp. 17–21, 59–60; Sur-Reply 22–24.

⁷ Patent Owner also addresses a third use of the word “delay” in Bedingfield and asserts that all three are “in the context of possible sound effects, [not] concerning ITD.” PO Resp. 18, 20–21; Sur-Reply 24. We need not consider these arguments, though, as Petitioner only relies on the first two instances of “delay.” *See* Pet. 29; Reply 24–25; Tr. 20:20–21 (Petitioner stating that “the last one we acknowledge is not actually talking about ITD”).

⁸ Petitioner addresses whether Bedingfield teaches adjusting an ITD in discussing claim 2, then cross-references that analysis for similar limitations in claims 8, 17, and 18. *See* Pet. 29, 38, 41, 52. Patent Owner disputes Petitioner’s contentions regarding claim 2 (PO Resp. 17–21 (citing Pet. 29)),

As an initial matter, Petitioner’s showing is insufficient because Petitioner does not explain *why* the “delay” referenced in Bedingfield refers to ITD, other than to quote Bedingfield and simply assert that the disclosed delay “is” an ITD. *See* Pet. 29. Dr. Kyriakakis similarly cites the same two passages of Bedingfield and opines that a person of ordinary skill in the art “would have readily understood that the ‘delay’ in this context is an ITD, which is the delay in arrival time of a sound between two ears and is commonly used to manipulate the perceived origin of a sound source in an audio scene.” Ex. 1003 ¶ 147 (emphasis omitted). Dr. Kyriakakis does not provide further explanation, nor does he address the full context in which “delay” is used in the two passages or cite supporting evidence for his reading of Bedingfield. As a result, we give little weight to his conclusory opinion for these claims. *See* 37 C.F.R. § 42.65(a); *Xerox Corp. v. Bytemark, Inc.*, IPR2022-00624, Paper 9 at 15 (PTAB Aug. 24, 2022) (precedential) (concluding that where an expert did “not cite to any additional supporting evidence or provide any technical reasoning to support his statement,” the expert’s testimony “is conclusory and unsupported, adds little to the conclusory assertion for which it is offered to support, and is

then references its earlier arguments when addressing Petitioner’s asserted ground based on Bedingfield and Ballas as to claim 8, which similarly recites “alter[ing] an interaural time difference of the voice that the first individual hears in response to the first individual moving the head orientation with respect to the sound localization point” (PO Resp. 59–60 (citing Section II.A.3 of the Response)). We first address the parties’ arguments in the context of claim 2, then refer to that analysis when addressing the other claims. *See infra* Sections II.E.2, II.G; *Dynamic Drinkware*, 800 F.3d at 1378–79 (“In an *inter partes* review, the burden of persuasion is on the petitioner to prove ‘unpatentability by a preponderance of the evidence,’ . . . and that burden never shifts to the patentee.”).

entitled to little weight”); PO Resp. 17. Importantly, as Dr. Kyriakakis acknowledges, the word “delay” by itself can “encompass a broad range of concepts in audio engineering and audio signal processing.” Ex. 2031, 79:17–80:1; *see also* Ex. 1055 ¶ 32 (listing “ITD,” “group delay,” and “phase delay” as different “aspects of sound”). As such, whether Bedingfield’s “delay” refers to ITD may depend on the context in which the term is used.⁹

The first use of “delay” appears at the beginning of the “Detailed Description” where Bedingfield states:

One way the human hearing mechanism (including the ears, nerves and brain processing, subsequently referred to as “the ear”) detects placement of a speaker (or source of sound) is by detecting the relative volume perceived by the listener’s two ears. . . . Another way the placement of a sound source is determined is by relative volume. . . . A third way the human ear detects the position of a signal is a change in frequencies heard as a sound moves from the front of a listener’s ear, where most frequencies are received with equal strength, to a position behind the listener’s ear, where the higher frequencies are attenuated and the lower frequencies seem more apparent. In a virtual environment, this effect, combined with a decrease in volume and left-right positioning, may give the listener the impression that a sound source has moved “behind” the listener, even with a two channel stereo system. Additionally, changes to *delay* and echo may heighten this effect. Further, other parameter changes may provide the sensation that one participant is located behind another participant.

⁹ The parties appear to agree on what ITD is. *See* PO Resp. 13 (quoting Ex. 2011 ¶ 34, where Dr. Begault describes ITD as “the difference in time arrival at the two ears of a sound source wavefront”); Reply 22 (quoting Ex. 1001, col. 3, ll. 59–67, describing ITD as the “difference[] in arrival times between the ears”); Ex. 1003 ¶¶ 50, 147 (Dr. Kyriakakis describing ITD as “the delay in arrival time of a sound between two ears”).

Ex. 1005, col. 3, ll. 35–61 (emphasis added). Bedingfield in this paragraph discusses three ways of “detect[ing] placement of a speaker,” the third of which is to attenuate higher frequencies so the sound appears to move from in “front” of the listener to “behind” the listener, where changes to “delay and echo” can “heighten this effect.” *Id.* But Dr. Begault explains that a person of ordinary skill in the art “would recognize that ITD could not be useful for discrimination or disambiguating ‘front’ from ‘rear’ positions” because “the ITD would be the same for a front and rear position” at the same distance. Ex. 2011 ¶ 49 (citing as support Ex. 1036, 51, Fig. 2.8, showing a “cone of confusion” where ITD values are identical “for a sound source in space anywhere on a conical surface extending out from the ear” and illustrating “front-back ambiguity”). Therefore, “delay” in the paragraph above does not refer to ITD because ITD would not allow the listener to differentiate sound in “front” from sound “behind” the listener. Ex. 2011 ¶ 49. We find Dr. Begault’s explanation to be supported by evidence in the record and persuasive.

Petitioner responds that Dr. Begault’s view is inconsistent with the statement earlier in the above Bedingfield passage describing the human ear “detect[ing] placement of a speaker” generally. Reply 24. The sentence immediately preceding the sentence with “delay,” however, describes “giv[ing] the listener the impression that a sound source has moved ‘behind’ the listener” (i.e., from “front” to “behind”), and we agree with Dr. Begault that ITD cannot create that impression. *See* Ex. 1005, col. 3, ll. 35–61. Petitioner also faults Patent Owner for failing to “explain what ‘delay’ in this context means if it does not refer to ITD.” Reply 24. But it is Petitioner’s burden to prove unpatentability, which in this case includes establishing how a person of ordinary skill in the art would have understood

Bedingfield’s “delay.” *See Harmonic*, 815 F.3d at 1363; *Dynamic Drinkware*, 800 F.3d at 1378–79. Regardless, Dr. Begault testifies, and we agree, that the instances of “delay” in Bedingfield relied upon by Petitioner refer to “simple sound effects” rather than ITD specifically. *See* Ex. 2011 ¶ 49.

The second use of “delay” appears in Bedingfield’s discussion of Figure 2 where additional participants can be added to the sound field with the listener:

Additional participants may be added to the sound field by distributing the participants in any number of positions within the sound field. For example, the participants may be placed in a circular configuration within the sound field. In other embodiments, the participants may be placed in other configurations within the sound field such as in a rectangular configuration or along a linear axis, using various audio techniques such as volume, balance, parametric equalization, *delay*, echo and the like to produce the effects described above with reference to FIG. 1.

Ex. 1005, col. 5, ll. 32–41 (emphasis added). We are not persuaded that the mere inclusion of the word “delay” in a “laundry list” of techniques to produce sound “effects” is sufficient to show that Bedingfield is referring to ITD in particular. *See* PO Resp. 19. Bedingfield does not use the term ITD, or even “interaural delay”—just “delay,” which the parties agree is a broad term that encompasses a range of concepts. *See* Ex. 2011 ¶ 47; Ex. 2031, 79:17–80:1.

Further, the excerpt above indicates that “delay” may be used to produce the sound “effects” of Figure 1, which Bedingfield describes as the creation of sound field 122 representing the listener’s “perception” that he or she is “present between all of the participants,” not anything pertaining to tracking the listener’s head orientation or making any adjustment in response

(as recited in the “adjusting” limitation of claim 2). *See* Ex. 1005, col. 4, l. 52–col. 5, l. 3, col. 5, ll. 35–41; Ex. 2011 ¶ 49. Petitioner argues that Bedingfield’s disclosure mirrors that of the ’090 patent, but as Patent Owner points out, Bedingfield does not discuss localization to a SLP in the excerpt above, whereas the ’090 patent describes in detail localization of sound by changing ITDs. *See* Reply 25 (citing Ex. 1001, col. 9, ll. 24–29); Sur-Reply 24 (citing Ex. 1001, col. 37, ll. 50–53 (“The sound can be adjusted (such as changing ITDs) . . . to move a localization point of this sound for the listener”)).

Ultimately, given the lack of explanation by Petitioner and conclusory testimony of Dr. Kyriakakis, we are not persuaded that a person of ordinary skill in the art would have understood Bedingfield’s two isolated uses of the broad term “delay” to teach adjusting an ITD. Instead, we credit Dr. Begault’s explanation for why an ordinarily skilled artisan, reading the word “delay” in context in each of the two instances, would not have understood Bedingfield to be referring to ITD specifically. *See* Ex. 2011 ¶¶ 47–49.

We also note that, even if “delay” in Bedingfield could be read as Petitioner contends, Petitioner has not shown that Bedingfield teaches adjusting an ITD “in response to the listening person changing the head orientation with respect to the sound localization point,” as Petitioner does not tie either of Bedingfield’s references to “delay” to Bedingfield’s disclosure of wearable speakers 1312 sensing head movements. *See* Pet. 27–29. Thus, Petitioner has not shown sufficiently that Bedingfield teaches the “adjusting” limitation of claim 2 for that reason as well.

Claim 17 depends from claim 15 and recites, in relevant part, that “the processor further executes the instructions to change an interaural time

difference (ITD) . . . in order to position the sound localization point of the binaural voice to the location that is away from and proximate to the first person.” Petitioner refers to its earlier arguments regarding claim 2. *Id.* at 38; *see* Ex. 1003 ¶ 172. As explained above, we are not persuaded that Bedingfield teaches “adjusting” (or “chang[ing]”) an ITD.

Based on the full trial record, Petitioner has not proven, by a preponderance of the evidence, that claims 2 and 17 would have been obvious based on Bedingfield and Andrea under 35 U.S.C. § 103.

E. Obviousness Ground Based on Bedingfield, Andrea, and Ballas (Claim 18)

1. Ballas

Ballas discloses a system for “producing virtual sound sources that are externally perceived and positioned at any orientation in azimuth and elevation from a listener.” Ex. 1008, code (57). The system comprises

a pair of speakers . . . mounted in a location near the temple of a listener’s head, such for example, on an eyeglass frame or inside a helmet, rather than in headphones. A head tracking system also mounted on the frame where speakers are mounted determines the location and orientation of the listener’s head and provides the measurements to a computer system for audio signal processing in conjunction with a head related transfer function (HRTF) filter to produce spatialized audio. The HRTF filter maintains [the] virtual location of the audio signals, thus allowing the listener to change locations and head orientation without degradation of the audio signal.

Id. ¶ 17. Ballas discloses that the amplified, spatialized audio signals “are binaural in nature (i.e., left channel signals are supplied to the left ear and right channel signals are supplied to the right ear[]).” *Id.* ¶ 25. “The

speakers may also be mounted on a virtual reality head mounted visual display system.” *Id.*

2. Analysis

Similar to claims 2 and 17 discussed above, claim 18 depends from claim 15 and recites, in relevant part (emphasis added), that

the processor further executes the instructions to change an *interaural time difference* . . . in order to maintain the sound localization point fixed at the location during the electronic phone call while the first person physically moves away from the location and changes a head orientation with respect to the location.

Petitioner relies on its earlier arguments regarding claim 17. Pet. 41; *see* Ex. 1003 ¶ 184 (citing earlier analysis of Bedingfield). Petitioner further contends that a person of ordinary skill in the art “would have been motivated to apply Ballas’s wearable frame with head tracking and HRTF processing to Bedingfield-Andrea’s headphones” to “provide[] a more realistic virtual experience,” but does not make any argument that Ballas teaches changing an ITD. Pet. 39–43; *see* Ex. 1003 ¶¶ 175–191. For the reasons explained above, we are not persuaded that Bedingfield teaches changing an ITD. *See supra* Section II.D.6. Accordingly, Petitioner has not proven, by a preponderance of the evidence, that claim 18 would have been obvious based on Bedingfield, Andrea, and Ballas under 35 U.S.C. § 103.

*F. Obviousness Ground Based on Bedingfield, Andrea, and Sandgren
(Claim 19)*

Claim 19 depends from claim 15 and recites that

the processor further executes the instructions to change attenuation and reverberation of the binaural sound in order to add artificial audial cues of virtual objects near the second person, wherein the virtual objects do not actually exist near the second person but are perceived to exist by the first person from the artificial audial cues.

Petitioner contends that Sandgren teaches “simulat[ing] sound-reflecting objects (virtual objects) to enhance the ‘[e]xternalization of [a] simulated sound source,’” using “early-reverberation generators” to simulate a “dynamic 3D audio scene,” and changing attenuation by “updating parameters for a reverberation generator to simulate moving objects.”

Pet. 46–48 (emphasis omitted). Petitioner further contends that a person of ordinary skill in the art would have been motivated to modify the system of Bedingfield and Andrea to simulate virtual objects as taught by Sandgren to, for example, “provide a more realistic and immersive experience for the user, resulting in good externalization,” with a reasonable expectation of success. *Id.* at 44–46.

Patent Owner does not argue dependent claim 19 separately from parent claim 15. *See* PO Resp. 58. We disagree with Patent Owner’s arguments regarding parent claim 15 for the reasons explained above. *See supra* Section II.D.4. We have reviewed Petitioner’s contentions and supporting evidence, including the testimony of Dr. Kyriakakis, and are persuaded that Petitioner has proven, by a preponderance of the evidence, that claim 19 would have been obvious based on Bedingfield, Andrea, and Sandgren under 35 U.S.C. § 103, for the reasons stated by Petitioner. *See* Pet. 43–48; Ex. 1003 ¶¶ 192–205.

G. Obviousness Ground Based on Bedingfield and Ballas (Claims 8–10, 12, and 14)

Petitioner contends that claims 8–10, 12, and 14 are unpatentable over Bedingfield and Ballas under 35 U.S.C. § 103. Pet. 48–56. Similar to claims 2, 17, and 18 discussed above, claim 8 recites “maintain[ing] the origin of the voice of the second individual at the sound localization point but *alter[ing] an interaural time difference* of the voice that the first individual hears in response to the first individual moving the head orientation with respect to the sound localization point” (emphasis added).

Petitioner relies on its earlier arguments regarding claims 2, 17, and 18. Pet. 52; *see* Ex. 1003 ¶ 218 (citing earlier analysis of Bedingfield). Petitioner further contends that, “[f]or the same reasons as explained for the Bedingfield-Andrea and Ballas combination, it would have been obvious . . . to implement the Bedingfield-only system to track the user’s head orientation and adjust the sound so that the sound appears fixed even as the user’s head moves, as taught in Ballas.” Pet. 48–52; *see* Ex. 1003 ¶¶ 206–218. Petitioner also asserts, without explanation, that a person of ordinary skill in the art “would have appreciated it was commonplace to alter ITDs to maintain the origin of a sound while the user moves head orientation,” but does not make any argument that Ballas teaches changing an ITD. Pet. 51–52. For the reasons explained above, we are not persuaded that Bedingfield teaches altering an ITD.¹⁰ *See supra* Section II.D.6; PO Resp. 60. Claims 9, 10, 12, and 14 depend from claim 8. Accordingly, Petitioner has not proven, by a preponderance of the evidence, that claims

¹⁰ Given this determination, we need not address Patent Owner’s other arguments regarding independent claim 8. *See* PO Resp. 58–59.

8–10, 12, and 14 would have been obvious based on Bedingfield and Ballas under 35 U.S.C. § 103.

*H. Obviousness Ground Based on Li and Andrea
(Claims 1, 3, 6, and 15–17)*

1. Li

Li discloses a 3D sound processing application (3DSPA) that “generates a configurable sound field on a graphical user interface using recorded or pre-recorded sound tracks,” “acquires user selections of configurable parameters associated with sound sources from the configurable sound field,” and “dynamically processes the sound tracks using the user selections to generate a configurable 3D binaural sound . . . by processing the sound tracks with . . . HRTFs based on the user selections.” Ex. 1006, code (57). Li describes a method of measuring HRTFs using a “simulator apparatus configured to simulate an upper body of a human” (shown in Figure 3A) with microphones in each ear canal that detect impulse sounds from a loudspeaker. *Id.* at col. 9, l. 48–col. 14, l. 4, Figs. 1–6.

Li then describes, with reference to Figure 7, a “method for simultaneously generating configurable three-dimensional (3D) sounds using a microphone array system.” *Id.* at col. 14, ll. 5–7. The 3D sound (e.g., music, speech) may be “3D binaural sound” and may be presented with or without “3D images, 3D movies, and 3D videos.” *Id.* at col. 14, ll. 7–11. The method provides a “3D sound processing application on a computing device” (e.g., laptop) (step 102) and provides a “microphone array system compris[ing] an array of microphone elements . . . configured to form multiple acoustic beam patterns pointing to different positions of

multiple sound sources in . . . 3D space” (step 701). *Id.* at col. 14, ll. 19–40. The sound sources may be “similar or different sound generating devices or sound emitting devices, for example, musical instruments, loudspeakers, televisions, music systems, home theater systems, theater systems, a person’s voice, pre-recorded multiple sound tracks, pre-recorded stereo sound tracks, etc.” *Id.* at col. 14, ll. 40–46.

The microphone array system “records sound tracks from the acoustic beam patterns” at the different directions (step 702) and the 3D sound processing application generates a “configurable sound field on a graphical user interface (GUI),” i.e., a “graphical simulation of the source sources in the 3D space” (step 703). *Id.* at col. 14, l. 58–col. 15, l. 3. The GUI “allow[s] the user the freedom to configure the positions and movements of sound sources, in order to generate customized 3D sound.” *Id.* at col. 15, ll. 29–32. The 3D sound processing application allows the user to select, using the GUI, among “configurable parameters associated with the sound sources,” such as location, azimuth, distance, volume, and “trace of movement” (step 704). *Id.* at col. 15, ll. 32–42. For example, the user can “place the sound sources in specific locations” or “dynamically move the sound sources.” *Id.* at col. 15, ll. 44–48, col. 27, ll. 15–30, Figs. 30A–30B. The 3D sound processing application then dynamically processes “the recorded sound tracks using the acquired user selections to generate one or more of a configurable 3D binaural sound, a configurable 3D surround sound, and a configurable 3D stereo sound.” *Id.* at col. 15, ll. 48–52. For example, the application may process the recorded sound tracks using the HRTFs measured using the simulator apparatus described earlier. *Id.* at col. 15, l. 53–col. 16, l. 11.

Figure 9 of Li is reproduced below.

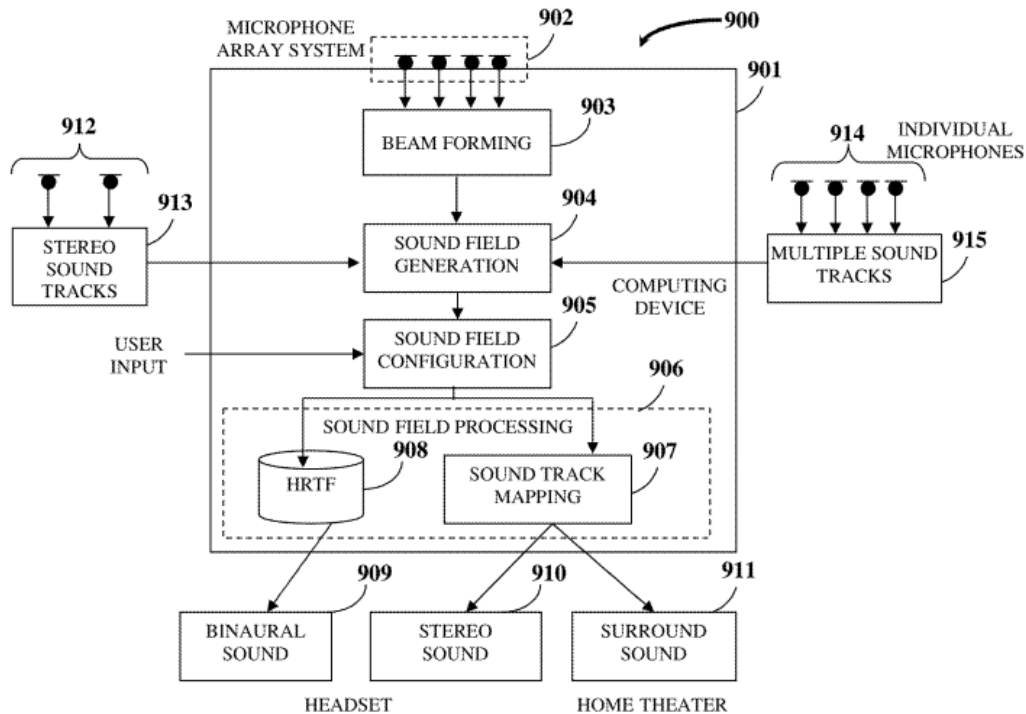


FIG. 9

Figure 9 is a process flow diagram for the steps described above. *Id.* at col. 16, ll. 58–61. Configurable 3D sound system 900 comprises a “3D sound processing application provided on a computing device 901.” *Id.* at col. 17, ll. 1–4. Sound tracks are obtained from microphone array system 902, dual microphones 912, or individual microphones 914. *Id.* at col. 17, ll. 41–42, 60–63. “The 3D sound processing application is configured to generate 904, configure 905, and process 906 the configurable sound field.” *Id.* at col. 17, ll. 4–6. The 3D sound processing application then, for example, “performs sound track mapping 907 by convolving each of the sound tracks with corresponding HRTFs stored in the HRTF database 908 to synthesi[ze] 3D binaural sound 909 for a headset user.” *Id.* at col. 17, ll. 33–37.

Figure 16 of Li is reproduced below.

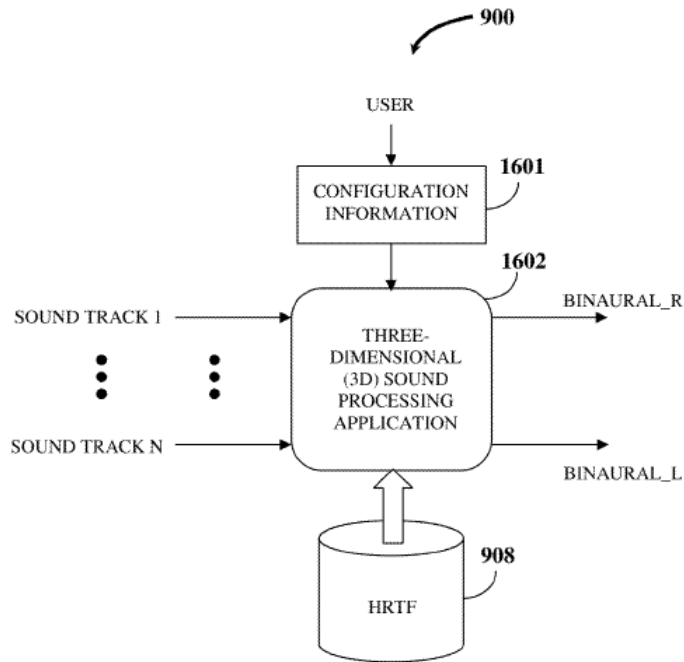


FIG. 16

Figure 16 depicts an exemplary embodiment of configurable 3D sound system 900. *Id.* at col. 20, ll. 18–20. As shown in the figure, 3D sound processing application 1602 takes as input configuration information 1601, such as “user selections of configurable parameters,” “sound tracks” 1 to N, and HRTFs from HRTF database 908, and “generates a configurable sound field that provides an interface to give the user the freedom of configuring the positions and movements of multiple sound tracks, in order to render a customized 3D binaural sound.” *Id.* at col. 20, ll. 20–31. 3D sound processing application 1602 “accurately places the acoustic sound source on the exact location that the user prefers using the” HRTFs. *Id.* at col. 20, ll. 32–36.

Figures 17 and 19 of Li are reproduced below.

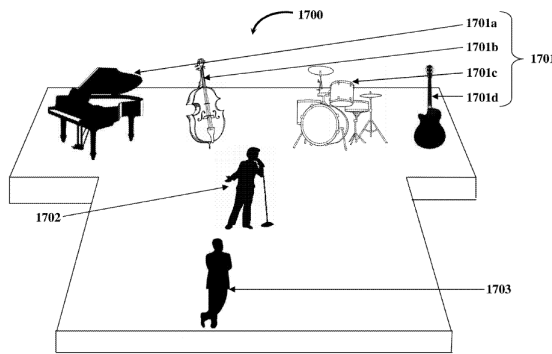


FIG. 17

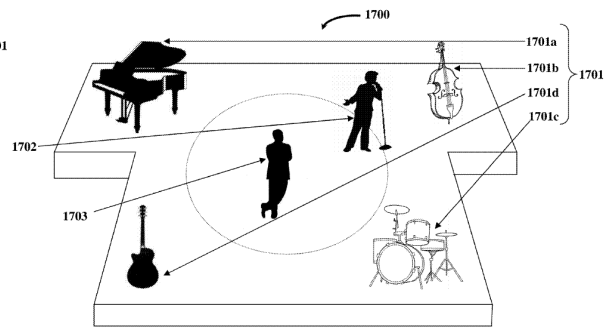


FIG. 19

Figure 17 depicts configurable sound field 1700 that is “a reconstruction of a scene of a concert stage at a music concert” with musical instruments 1701 (piano 1701a, cello 1701b, drums 1701c, and guitar 1701d) and singer 1702; Figure 19 depicts configurable sound field 1700 after user 1703 has altered the positions of the musical instruments and singer using the GUI of the 3D sound processing application. *Id.* at col. 20, l. 53–col. 21, l. 9, col. 21, ll. 38–57.

2. Claim 1

Petitioner argues that claim 1 is unpatentable over Li and Andrea under 35 U.S.C. § 103, relying on the testimony of Dr. Kyriakakis as support. Pet. 56–66 (citing Ex. 1003). Patent Owner makes various arguments in response, relying on the testimony of Dr. Begault. PO Resp. 21–30, 60–62 (citing Ex. 2011); Sur-Reply 26–28.

Claim 1 recites (emphasis added):

[a] capturing, with an electronic earphone located at a head of a talking person, binaural sound that will be provided to a listening person *during a telephone call*;

[b] designating, with a computer system, a sound localization point in empty space that is away from and

proximate to the listening person such that the sound localization point simulates an origin of the binaural sound at the empty space that the listening person hears *during the telephone call*;

[c] adjusting, with the computer system, the binaural sound captured at the earphone of the talking person so the binaural sound originates *during the telephone call* from the sound localization point in empty space that is away from and proximate to the listening person; and

[d] providing, with an electronic earphone located at a head of the listening person, the binaural sound to the listening person *during the telephone call* such that the origin of the binaural sound for the listening person occurs at the sound localization point in empty space that is away from and proximate to the listening person.

Thus, claim 1 requires capturing binaural sound that will be provided to a listener “during a telephone call” and then performing various actions during that “telephone call”—namely, designating a SLP, adjusting the captured binaural sound so it originates from the SLP, and providing the binaural sound such that its origin is at the SLP.

With respect to limitation 1[a], Petitioner contends that a person of ordinary skill in the art would have “understood that Li’s headset in Fig. 9 includes a microphone and headphone” that two users would have used to communicate with each other. Pet. 58–60. Petitioner contends that “Li’s system also enables simultaneous recording of binaural sound using a microphone array,” but “[t]o the extent Li does not expressly disclose capturing binaural sound,” doing so would have been obvious based on Andrea “for the same reasons” as Petitioner’s asserted ground based on Bedingfield and Andrea. *Id.* at 56–58, 60 (emphasis omitted).

With respect to limitation 1[b], Petitioner again relies on configurable 3D sound system 900 in Figure 9 and asserts that a person of ordinary skill in the art “would have found it obvious to seat the listener (listening person)

at a physical conference table, where an empty seat at the table (empty space) is allocated for a virtual participant, as was commonly done in the field.” *Id.* at 60–62 (emphasis omitted). Petitioner also argues that “[b]ecause the sound sources [in Li] are placed ‘at different spots to mimic a real conference room environment,’ such as seats around a conference table located ‘a distance from’ the listener, . . . the SLP at a first location is away from and proximate to the user.” *Id.* at 62–63 (emphasis omitted).

With respect to limitation 1[c], Petitioner relies on Figure 16 and argues that “Li’s configurable 3D sound system 900 includes a computing device 901, on which a ‘3D sound processing application’ uses HRTFs to reproduce 3D binaural sound 909.” *Id.* at 63–65.

Finally, with respect to limitation 1[d], Petitioner refers to its previous analysis for limitations 1[a]–[c]. *Id.* at 65–66.

As explained above, the parties agree that a “telephone call” in claim 1 requires “voice communication over an electronic network between at least two parties.” *See supra* Section II.B.1. When addressing the “telephone call” aspect of the above limitations, Petitioner and Dr. Kyriakakis rely on the following disclosure of Li:

[T]he configurable 3D sound system 900 disclosed herein allows music artists to present their music to the user in an enhanced manner, and also enhances the performance of radio dramas and conference calls. The 3D binaural sound recording performed by the configurable 3D sound system 900 disclosed herein provides special effects and acoustic experiences to a user, for example, by allowing the user to move the sound source around the user 1703, move the sound source up and down, etc., on the configurable sound field 1700. The configurable 3D sound system 900 enhances the dramatic performance of radio drama shows and podcasts. Moreover, the configurable 3D sound system 900 provides a method of communication among multiple people, for example, *in a conference call, by placing*

different speaking users at different spots to mimic a real conference room environment.

Ex. 1006, col. 21, l. 57–col. 22, l. 5 (emphasis added); *see* Pet. 58, 61–63; Ex. 1003 ¶¶ 242, 243, 250, 252, 258, 259. As to the specific actions required to be performed “during” the telephone call, Petitioner relies on other portions of Li, in particular those pertaining to Figures 9 and 16. *See* Pet. 58–65. Essentially, Petitioner contends that Li’s other disclosures regarding processing and providing binaural sound with respect to a particular sound localization point apply to a “conference call” between multiple parties. *See id.*

The problem with Petitioner’s position, however, is that Li’s other disclosures all involve *recording* sound tracks and providing a GUI that allows the user to configure the sound that will *later* be played back (e.g., as a music performance)—they do not involve a live exchange of voices between two parties communicating with each other. For example, in describing Figure 9, Li states that “microphone array system 902 records multiple sound tracks corresponding to the multiple acoustic beam pattern directions. The sound tracks recorded by the microphone array system 902 are stored in a memory or a storage device (not shown).” Ex. 1006, col. 17, ll. 18–22; *see* Ex. 2016, 283:1–284:1 (Dr. Kyriakakis agreeing that the cited passage describes “storing [a] recording” that is “not live”), 284:2–285:4 (similar example uses of “recording”/“recorded” in Li that are “not live”). “Each sound source in the configurable sound field corresponds to one sound track.” Ex. 1006, col. 17, ll. 25–27. The 3D sound processing application “performs sound track mapping 907 by convolving each of the sound tracks with corresponding HRTFs . . . to synthesi[ze] 3D binaural sound 909 for a headset user.” *Id.* at col. 17, ll. 30–37. Likewise, in

describing Figure 16, Li states that “3D sound processing application 1602 generates a configurable sound field that provides an interface to give the user the freedom of configuring the positions and movements of multiple sound tracks, in order to render a customized 3D binaural sound.” *Id.* at col. 20, ll. 27–31.

Other passages similarly disclose the recording of sound tracks and processing those sound tracks, based on user selections, for later playback. *See, e.g., id.*, code (57) (“The 3DSPA generates a configurable sound field on a graphical user interface using recorded or pre-recorded sound tracks.”), col. 5, ll. 7–26 (“The 3D sound processing application generates a configurable sound field on a graphical user interface (GUI) provided by the 3D sound processing application using the recorded sound tracks,” “acquires user selections of one or more of multiple configurable parameters,” and “dynamically processes the recorded sound tracks using the acquired user selections to generate a configurable 3D binaural sound”), col. 7, ll. 33–37 (“The configurable 3D sound system disclosed herein allows individual users to record and reproduce 3D sound for playback”), col. 18, ll. 16–19 (“The 3D sound processing application records both audio and spatial information such that the recorded sound can be processed and reproduced to 3D sound.”), col. 19, ll. 52–56 (“The sound tracks are obtained from the microphone array system 902 exemplarily illustrated in FIGS. 9–10 or from a studio. In the studio recording, each sound track represents, for example, one musical instrument or one singer’s voice.”), col. 22, ll. 53–60 (“[c]onfigurable 3D sound system 900 exemplarily illustrated in FIG. 9 . . . converts the separated source sounds into separate sound tracks and then into 3D binaural sound with configurable binaural rendering technologies, using the collected bank of accurate HRTFs,” and

“allows the user to enjoy the audio or music from an individually customized virtual scene, and to experience the synthesized and personalized 3D binaural sound”), col. 23, ll. 27–43 (describing the acquisition and processing of “multiple different sound tracks”), Fig. 7 (steps 702 and 703), Fig. 8 (steps 801 and 703), Fig. 9 (depicting “sound tracks” from various sources as inputs), Fig. 16 (depicting “sound track[s]” 1 to N as inputs), Fig. 20 (steps 2001, 2002, and 703), Fig. 25 (steps 2501, 2502, and 703), Fig. 27 (steps 702 and 703).

Again, Petitioner relies on a single sentence in Li that “the configurable 3D sound system 900 provides a method of communication among multiple people, for example, in a conference call, by placing different speaking users at different spots to mimic a real conference room environment.” *Id.* at col. 22, ll. 1–5; *see* Pet. 58, 61–63. Petitioner does not provide any further explanation as to how voice communication between two parties would occur during such a “conference call” when using the processed voice of a speaker—which the remainder of Li describes as recorded in advance in sound tracks. We agree with Patent Owner that Li’s “passing reference” to a “conference call” is insufficient under the circumstances, and credit Dr. Begault’s testimony in that regard, which is consistent with the full disclosure of Li.¹¹ *See* PO Resp. 22–23; Ex. 2011 ¶¶ 88–101.

¹¹ In IPR2023-01004, Petitioner made similar arguments regarding claims reciting a “voice exchange” between a computer program and user, and moving a SLP of a voice of a computer program during such a “voice exchange,” and we determined that Petitioner had not shown sufficiently that Li teaches the limitations involving a “voice exchange.” *See* Ex. 2017, 17–25; IPR2023-01004, Paper 14 at 2–7 (PTAB Apr. 29, 2024). We reach the same conclusion here based on the full trial record of this proceeding.

Petitioner makes two arguments in its Reply. First, Petitioner argues that “Li expressly contrasts a person’s voice (i.e., from a live exchange) as compared to a pre-recording,” referring to Li’s disclosure that “sound sources” can include “a person’s voice, pre-recorded multiple sound tracks, pre-recorded stereo sound tracks,” and “sources from where sound originates and can be transmitted.” Reply 26 (quoting Ex. 1006, col. 4, ll. 58–66) (emphasis omitted). According to Petitioner, “Li discloses transmitting the sound, not storing the sound.” *Id.*

We are not persuaded. The portion of Li relied upon by Petitioner merely describes various *sources* of sound, not how sound from those sources is processed or used (e.g., in a live voice exchange between parties communicating with each other):

As used herein, the term “sound sources” refers to similar or different sound generating devices or sound emitting devices, for example, musical instruments, loudspeakers, televisions, music systems, home theater systems, theater systems, a person’s voice, pre-recorded multiple sound tracks, pre-recorded stereo sound tracks, etc. The sound sources may also comprise sources from where sound originates and can be transmitted.

Ex. 1006, col. 4, ll. 58–66. Li describes in detail how sound originating from a source, such as a person’s voice, is recorded in “sound tracks”—defined as “an output of an acoustic beam pattern of a microphone element of the microphone array system”—and how the “recorded sound tracks” are used to generate the configurable sound field. *See, e.g., id.* at col. 4, l. 67–col. 5, l. 10, col. 19, ll. 54–56 (“In the studio recording, each sound track represents, for example, one musical instrument or one singer’s voice.”). Dr. Begault also testifies, and we agree, that “when Li refers to ‘recorded,’ it refers to sounds that were recorded and then stored by Li’s system for later playback, as opposed to ‘pre-recorded’ which refers to

sound recorded by a system other than Li's." *See* Ex. 2011 ¶¶ 93–98.

Finally, to the extent Petitioner attempts to tie Li's "transmitted" disclosure to its mention of a "conference call," we note that the two disclosures are separated by 17 columns of text and are not described as such in the reference.

Second, Petitioner contends that "the plain meaning of 'record' covers both live and non-live sounds," as demonstrated by the '090 patent "repeatedly us[ing] the term 'record' in the context of telephone calls" and Dr. Begault confirming that understanding of the '090 patent. Reply 27–28 (citing Ex. 1001, col. 5, ll. 32–36, col. 8, ll. 8–11, col. 33, ll. 42–45; Ex. 1051, 55:6–19). The relevant issue, however, is how a person of ordinary skill in the art would have understood Li's use of the term, not how the '090 patent uses it. As explained above, Li describes in detail the "recording" of sound tracks that can be configured and played back. For example, Li discloses that "sound tracks *recorded* by the microphone array system 902 are *stored* in a memory or a storage device." Ex. 1006, col. 17, ll. 20–22 (emphasis added). Similarly, when describing the "reconstruction" (i.e., play back) of a music concert, Li discloses that the user uses the 3D sound processing application to arrange four musical instruments "to experience the 3D sound *recording* of a regular concert." *Id.* at col. 20, l. 53–col. 21, l. 2 (emphasis added), Fig. 17. Petitioner does not point to—and we do not find—any disclosure in Li itself of using "record" in the context of processing the binaural sound of a speaker and providing that processed sound to a listener as the two parties are communicating with each other. *See* Ex. 2011 ¶¶ 93–98 (Dr. Begault discussing numerous passages from Li supporting his opinion that "Li does not use recorded to mean live exchange of sound in real time to a listener").

Petitioner has not shown sufficiently that Li and Andrea teach performing the actions recited in limitations 1[b]–[d] during a “telephone call.”¹² Accordingly, based on the full trial record, we determine that Petitioner has not proven, by a preponderance of the evidence, that claim 1 would have been obvious based on Li and Andrea under 35 U.S.C. § 103.

3. Claims 3, 6, and 15–17

Independent claim 15 recites (emphasis added) “a second wearable electronic device that a second person wears and that captures a binaural voice of the second person *during an electronic phone call* with the first wearable electronic device that the first person wears” and

a processor that executes . . . instructions to adjust the binaural voice of the second person *during the electronic phone call* in order to position a sound localization point of the binaural voice to a location that is away from and proximate to the first person, wherein the sound localization point represents an origin of the binaural voice of the second person to the first person.

Thus, similar to claim 1 discussed above, claim 15 requires devices capturing binaural voice and then performing an action—adjusting the binaural voice to position a SLP—during voice communication between a first person (wearing a first wearable electronic device) and a second person (wearing a second wearable electronic device). Petitioner refers to its previous arguments regarding claim 1, and the parties argue the independent claims together. *See* Pet. 68–70; PO Resp. 60–62; Reply 26–29; Sur-Reply 26–28. For the reasons explained above, we are not persuaded that Li

¹² Given this determination, we need not address Patent Owner’s other arguments disputing Petitioner’s asserted grounds based on Li. *See* PO Resp. 60–61.

teaches a processor that performs the recited action of limitation 15[d] during an “electronic phone call” as recited in claim 15. *See supra* Sections II.B.1, II.H.2. Claims 3 and 6 depend from claim 1, and claims 16 and 17 depend from claim 15. Accordingly, Petitioner has not proven, by a preponderance of the evidence, that claims 3, 6, and 15–17 would have been obvious based on Li and Andrea under 35 U.S.C. § 103.

*I. Additional Obviousness Grounds Based on Li and Other References
(Claims 2, 8–10, 12, 14, 18, and 19)*

Petitioner contends, under 35 U.S.C. § 103, that claims 2 and 18 are unpatentable over Li, Andrea, and Ballas; claim 19 is unpatentable over Li, Andrea, and Sandgren; and claims 8–10, 12, and 14 are unpatentable over Li and Ballas. Independent claim 8 recites (emphasis added) “commenc[ing] an *electronic call* between a first individual wearing an electronic earphone and a second individual that are remote from each other” and “execut[ing] the *electronic call* such that the origin of the voice of the second individual appears to the first individual to originate from a fixed location that is the sound localization point in empty space while the first individual moves and changes a location and a head orientation with respect to the sound localization point.”

Thus, similar to claims 1 and 15 discussed above, claim 8 requires various actions to be performed with respect to voice communication between a first individual and remote second individual—namely, commencing such communication and executing it such that the origin of the second individual’s voice appears to originate from a SLP in empty space while the first individual moves and changes his or her location and head orientation. Petitioner refers to its previous arguments regarding claim 1,

and the parties argue the independent claims together. *See* Pet. 81–83; PO Resp. 60–62; Reply 26–29; Sur-Reply 26–28. For the reasons explained above regarding claims 1 and 15, we are not persuaded that Li teaches the recited action of limitation 8[c] with respect to an “electronic call” as recited in claim 8. *See supra* Sections II.B.1, II.H. Claims 2, 9, 10, 12, 14, 18, and 19 each depend from independent claim 1, 8, or 15. Accordingly, Petitioner has not proven, by a preponderance of the evidence, that claims 2, 8–10, 12, 14, 18, and 19 would have been obvious based on any of the asserted grounds involving Li under 35 U.S.C. § 103.

J. Petitioner’s Motion to Strike and Motion to Exclude

“Sur-replies should only respond to arguments made in reply briefs, comment on reply declaration testimony, or point to cross-examination testimony,” and “may not be accompanied by new evidence other than deposition transcripts of the cross-examination of any reply witness.” Trial Practice Guide 73–74. “A motion to strike may be appropriate when a party believes the Board should disregard arguments or late-filed evidence in its entirety,” but “striking the entirety or a portion of a party’s brief is an exceptional remedy that the Board expects will be granted rarely.” *Id.* at 80.

Petitioner seeks to strike portions of Patent Owner’s Sur-Reply where Patent Owner argues that Dr. Kyriakakis’s testimony in this proceeding is allegedly inconsistent with that of Dr. Welch and Dr. Roginska, Petitioner’s declarants in other proceedings. Mot. to Strike 1. The deposition transcripts of Dr. Welch and Dr. Roginska were introduced during the cross-examination of Dr. Kyriakakis following his reply declaration in this proceeding and filed as Exhibits 2029 and 2030. According to Petitioner, Patent Owner’s “new theories” amount to “an end run around the Board’s

rules that prohibit new evidence on sur-reply,” are late because they were not raised in the Response, pertain to unrelated patents, and prejudice Petitioner because it has no opportunity to respond to the Sur-Reply. *Id.* at 1–3.

We are not persuaded that the instant circumstances warrant the exceptional remedy of striking sentences in the Sur-Reply. Patent Owner filed the deposition transcripts of Dr. Welch and Dr. Roginska “only for the limited purpose of allowing the Board to understand the context of the cross-examination” and “does not rely on the[] [e]xhibits for any substantive argument in [the] Sur-Reply.” Sur-Reply v–vi. Patent Owner does not cite Exhibits 2029 and 2030 themselves in its Sur-Reply; it only cites Dr. Kyriakakis’s deposition transcript in this proceeding. *Id.* We agree with Patent Owner that its arguments in the Sur-Reply are properly responsive to the Reply because they address Dr. Kyriakakis’s cross-examination testimony where he was questioned about the opinions in his reply declaration (but we do not agree with Patent Owner’s claim interpretation arguments on the merits, for the reasons explained above). *See* Mot. to Strike Opp. 3; *supra* Section II.B.2.e. We also agree, under the particular factual circumstances presented, that filing Exhibits 2029 and 2030 was proper so the Board has the full context in which to evaluate Dr. Kyriakakis’s cross-examination testimony. Petitioner’s Motion to Strike is denied.

Petitioner also moves to exclude Exhibits 2029 and 2030 as containing inadmissible hearsay under Federal Rule of Evidence 802 because Patent Owner allegedly “relied on these exhibits for the truth of the matter” asserted and used them to support an argument that “Dr. Kyriakakis’[s] opinion contradicts the testimony of Petitioner’s other

experts.” Pet. Mot. 1, 4. As Patent Owner points out, however, Petitioner does not move to exclude the deposition transcript of Dr. Kyriakakis itself (Exhibit 2031). PO Opp. 1–2. Thus, even if we were to exclude Exhibits 2029 and 2030, Dr. Kyriakakis’s testimony would still be in the record (but we would lack the full context in which to evaluate it). *See id.*; *Netflix, Inc. v. DivX, LLC*, IPR2020-00558, Paper 50 at 31–32 (PTAB Aug. 23, 2021) (dismissing a motion to exclude as moot in similar circumstances). Also, as with Patent Owner’s Sur-Reply, which does not cite Exhibits 2029 and 2030, we do not cite or rely on Exhibits 2029 and 2030 as evidence allegedly supporting Patent Owner’s arguments; we only address the cross-examination testimony itself. Finally, we do not rely on the exhibits in a manner adverse to Petitioner in this Decision. As explained above, even if the cross-examination testimony pertaining to Exhibits 2029 and 2030 is considered, we are not persuaded by Patent Owner’s claim interpretation arguments regarding whether the claims require HRTF processing. *See supra* Section II.B.2. Accordingly, Petitioner’s Motion to Exclude is dismissed as moot.

K. Patent Owner’s Motion to Exclude

The party moving to exclude evidence bears the burden of proof to establish that it is entitled to the relief requested—namely, that the material sought to be excluded is inadmissible under the Federal Rules of Evidence. *See* 37 C.F.R. §§ 42.20(c), 42.62(a). Patent Owner moves to exclude Exhibits 1047–1050 and 1052–1054, and certain portions of Exhibits 1051 and 1055. PO Mot. 1.

Exhibits 1047–1051, 1053, and 1054: Patent Owner argues that Exhibits 1047–1050 should be excluded (1) under Federal Rules of Evidence

401–403 because Petitioner cites them together “to support a single sentence, without providing a pinpoint citation,” and fails to show their relevance, and (2) under Federal Rule of Evidence 901 because they are unauthenticated. PO Mot. 1–2. In addition, Patent Owner seeks to exclude portions of the transcript of Dr. Begault’s deposition (Exhibit 1051) pertaining to Exhibits 1047–1050. *Id.* at 5. Patent Owner also seeks to exclude Exhibits 1053 and 1054 as containing inadmissible hearsay under Federal Rule of Evidence 802 and as unauthenticated. *Id.* at 2–3. These portions of Patent Owner’s Motion are dismissed as moot, as we do not rely on the disputed exhibits, or Dr. Begault’s related testimony, in rendering our Decision.

Exhibit 1052 (Asahi): Patent Owner moves to exclude Asahi as containing inadmissible hearsay under Federal Rule of Evidence 802 because Petitioner quotes the reference in its Reply and “relies on the purported truth of the matter asserted in the [cited] hearsay statement to conclude that Asahi . . . *in fact* disclosed an out-of-head localized sound reproduction system for headphones.” PO Mot. 2–3 (citing Reply 8); PO Mot. Reply 2. We are not persuaded. Petitioner quotes Asahi to show the content of what was disclosed in the prior art and to explain Dr. Kyriakakis’s testimony, discussed in the immediately preceding sentence. *See* Reply 8; Pet. Opp. 5–6. The exhibit is not being offered to prove the truth of any particular matter discussed in the reference. *See* Fed. R. Evid. 801(c). Even if it were, Asahi is a U.S. patent issued in 1979 and would be admissible under Federal Rule of Evidence 803(16), which provides as an exception to the hearsay rule “[a] statement in a document that was prepared before January 1, 1998, and whose authenticity is established.” Patent Owner’s Motion is denied as to Exhibit 1052.

Exhibit 1055: Patent Owner argues that paragraphs 1–5, 11–17, 21–24, 29, and 42 of Dr. Kyriakakis’s reply declaration (*Exhibit 1055*) should be excluded under Federal Rules of Evidence 401–403 because “they are not cited to or relied upon by any [p]aper” and are irrelevant. PO Mot. 3–4; PO Mot. Reply 3–4. We deny this portion of the Motion because Patent Owner does not explain why the paragraphs warrant the remedy of exclusion. We note, however, that in evaluating Petitioner’s asserted grounds of unpatentability, we only consider substantive arguments made by the parties in their papers during trial (i.e., the Petition, Response, Reply, Sur-Reply, and supplemental briefing). To the extent a document is filed in the record but never discussed in a paper, there is no substantive argument pertaining to that document that can be considered.

Patent Owner also argues that certain paragraphs of the reply declaration should be excluded as “unduly misleading and confusing” or containing inadmissible hearsay, but only specifically addresses paragraphs 8, 35, 52, 55, and 56, which should be excluded “for the reasons discussed [in the Motion] with respect to Exs. 1052–54.” PO Mot. 4. For the reasons explained above, Patent Owner’s Motion is dismissed as moot to the extent it pertains to testimony regarding Exhibits 1053 and 1054, and denied to the extent it pertains to testimony regarding Exhibit 1052.

III. CONCLUSION¹³

Petitioner has demonstrated, by a preponderance of the evidence, that claims 1, 3, 6, 15, 16, and 19 of the '090 patent are unpatentable on the bases set forth in the following table, but has not demonstrated, by a preponderance of the evidence, that claims 2, 8–10, 12, 14, 17, and 18 of the '090 patent are unpatentable.

¹³ Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this Decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. See 84 Fed. Reg. 16,654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. See 37 C.F.R. §§ 42.8(a)(3), 42.8(b)(2).

In summary:

Claim(s)	35 U.S.C. §	Reference(s)/ Basis	Claim(s) Shown Unpatentable	Claim(s) Not Shown Unpatentable
1–3, 6, 15–17	103	Bedingfield, Andrea	1, 3, 6, 15, 16	2, 17
18	103	Bedingfield, Andrea, Ballas		18
19	103	Bedingfield, Andrea, Sandgren	19	
8–10, 12, 14	103	Bedingfield, Ballas		8–10, 12, 14
1, 3, 6, 15–17	103	Li, Andrea		1, 3, 6, 15–17
2, 18	103	Li, Andrea, Ballas		2, 18
19	103	Li, Andrea, Sandgren		19
8–10, 12, 14	103	Li, Ballas		8–10, 12, 14
Overall Outcome			1, 3, 6, 15, 16, 19	2, 8–10, 12, 14, 17, 18

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 1, 3, 6, 15, 16, and 19 of the '090 patent are determined to be unpatentable;

FURTHER ORDERED that claims 2, 8–10, 12, 14, 17, and 18 of the '090 patent are not determined to be unpatentable;

FURTHER ORDERED that Petitioner's Motion to Strike is *denied*;

FURTHER ORDERED that Petitioner's Motion to Exclude is *dismissed*;

FURTHER ORDERED that Patent Owner's Motion to Exclude is *dismissed-in-part* and *denied-in-part*; and

FURTHER ORDERED that, because this is a Final Written 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.

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