

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROSOFT CORPORATION,
Petitioner,

v.

D3D TECHNOLOGIES, INC.,
Patent Owner.

IPR2021-00648
Patent 9,349,183 B1

Before JAMESON LEE, BARBARA A. PARVIS, and SCOTT RAEVSKY,
Administrative Patent Judges.

PARVIS, *Administrative Patent Judge.*

DECISION
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

We instituted an *inter partes* review of claims 1–18 of U.S. Patent No. 9,349,183 B1 (Ex. 1001, “the ’183 patent”) owned by D3D Technologies, Inc. (“Patent Owner”). Paper 10 (“Decision to Institute” or “Inst. Dec.”). We have authority to hear this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision issues pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. We determine that Microsoft Corporation (“Petitioner”) has proved by a preponderance of the evidence that claims 1–18 of the ’183 patent are unpatentable.

A. Background

Petitioner filed a Petition (Paper 2 (“Pet.”)) requesting an *inter partes* review of claims 1–18 of the ’183 patent, along with the supporting Declaration of Michael Zyda, Ph.D. (Ex. 1003). Patent Owner filed a Preliminary Response. Paper 6 (“Prelim. Resp.”). With our authorization, Petitioner filed a Reply to Patent Owner’s Preliminary Response (Paper 8, “Reply”) and Patent Owner filed a Sur-reply (Paper 9, “Sur-reply”).

The Decision to Institute was entered on September 1, 2021. Inst. Dec. 1. Subsequently, Patent Owner filed a Patent Owner Response. Paper 13 (“PO Resp.”). Petitioner filed a Reply (Paper 21 (“Pet. Reply”)), along with the second Declaration of Michael Zyda, Ph.D. (Ex. 1035). Patent Owner filed a Sur-reply. Paper 23 (“PO Sur-reply”). The oral hearing was consolidated with the oral hearing in IPR2021-00647 (Paper 26, 2), and was held on May 31, 2022. A copy of the hearing transcript has been entered into the record as Paper 29 (“Tr.”).¹

¹ Patent Owner has not filed a Declaration with technical opinions in support of its positions in this proceeding.

B. Real Parties-in-Interest

Each party identifies itself as the only real party in interest. Pet. 97; Paper 4, 2.

C. Related Matters

Each party identifies a judicial matter that would affect, or be affected by, a decision in this proceeding. In particular, the parties inform us that the '183 patent is asserted in the following district court case: *D3D Technologies, Inc. v. Microsoft Corporation.*, No. 6:20-cv-01699 (M.D. Fla.) ("parallel district court proceeding"). Pet. 97; Paper 4, 2.

Petitioner also has filed (1) a petition for *inter partes* review of U.S. Patent No. 8,384,771 B1² (IPR2021-00647); (2) a petition for *inter partes* review of U.S. Patent No. 9,473,766 B2 (IPR2021-00703); (3) two petitions for *inter partes* review of U.S. Patent No. 9,980,691 B2 (IPR2021-00877 and IPR2021-00878); and a petition for *inter partes* review of U.S. Patent No. 10,795,457 B2 (IPR2021-01325). We instituted review in each of IPR2021-00647, IPR2021-00648, IPR2021-00703, IPR2021-00878, and IPR2021-01325.

D. The '183 Patent

The '183 patent relates to the field of medical imaging. Ex. 1001, 1:15. The '183 patent describes providing three-dimensional viewing of images by a user. *Id.* at 2:53–54. Figure 1 is a block diagram of a computer system that produces a three-dimensional image to the user and is reproduced below. *Id.* at 4:31–32, 5:48–49.

² We refer to this patent as the '771 patent here.

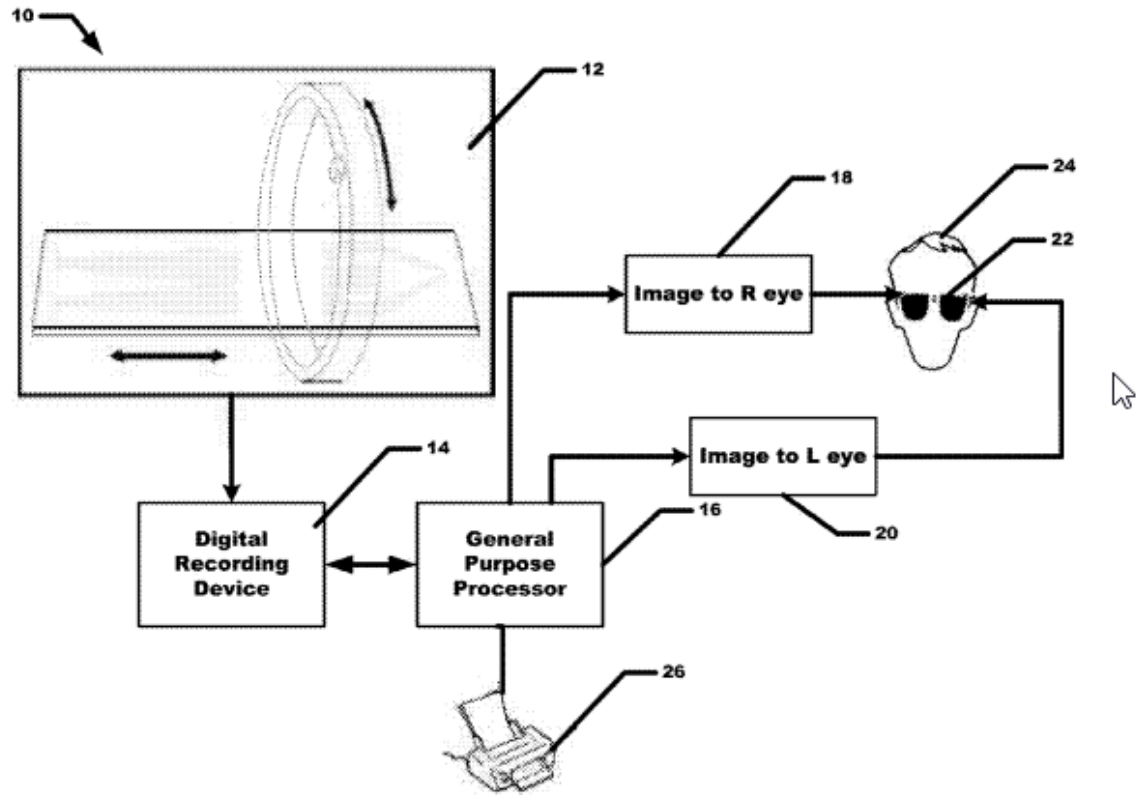


FIGURE 1

Figure 1, above, is a diagram of system 10, which includes imaging device 12, digital recording device 14, general purpose processor (“processor”) 16, and head display unit (HDU) 22, among other components. *Id.* at 5:11–34.

Imaging device 12 communicates with digital recording device 14 to record slices of imagery with metadata. *Id.* at 5:14–19. Processor 16 receives input from user 24 and interacts with digital recording device 14 to generate image for right eye 18 and image for left eye 20. *Id.* at 5:20–26. The images are sent to HDU 22 worn by user 24. *Id.* at 5:33–34.

Figure 8, reproduced below, is a flow diagram of a method for providing three-dimensional images. *Id.* at 4:48–50.

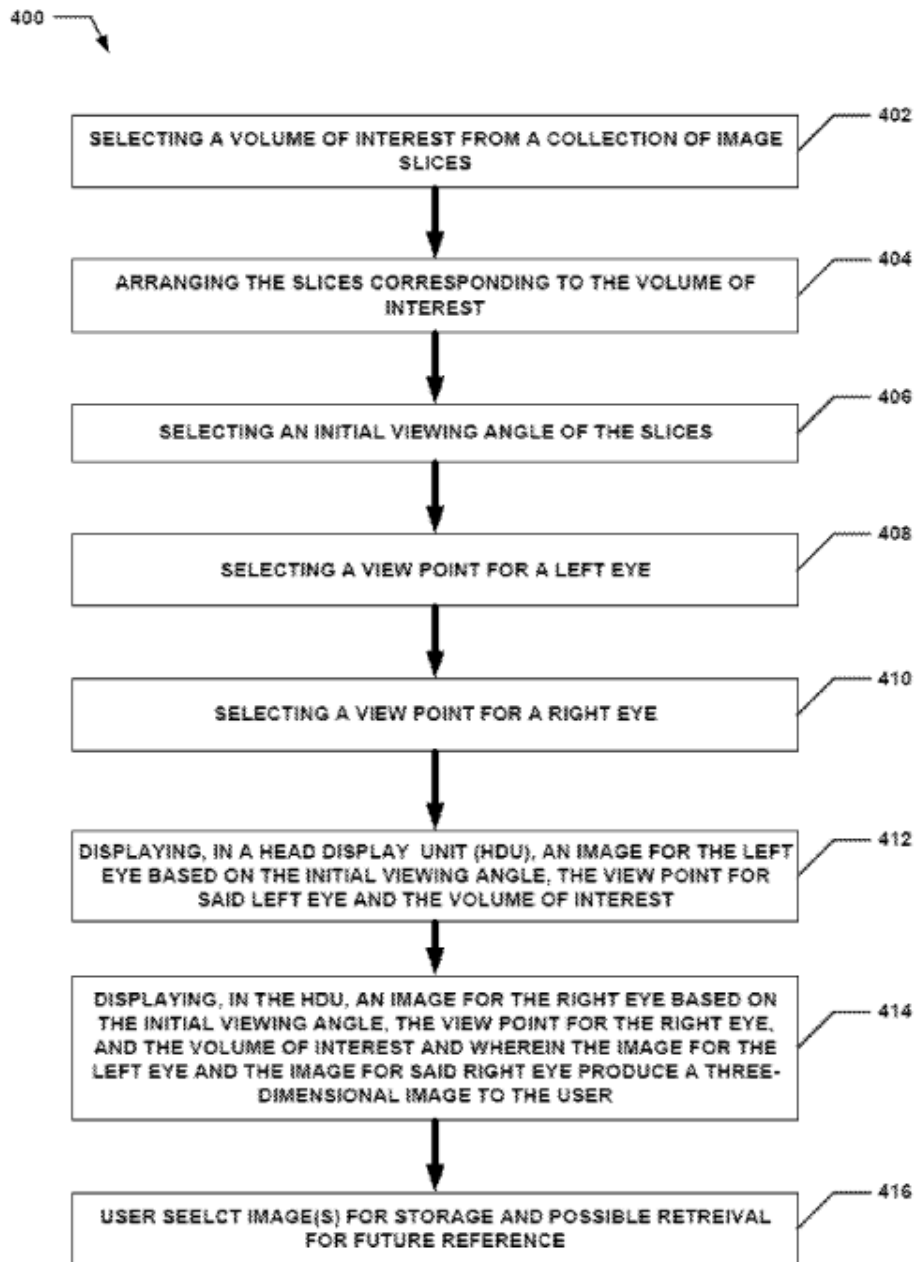


FIGURE 8

Figure 8, above, is a flow diagram of method 400 for providing three-dimensional viewing of images to a user. *Id.*

Method 400 begins with processing block 402, which discloses selecting a volume of interest from a collection of image slices. *Id.* at 8:32–34. The '183 patent states “[t]hrough interaction with the GUI [graphical user interface], the user selects viewing parameter(s) from, for example, a pull down menu.” *Id.* at 8:34–36.

Processing continues with processing blocks 404 through 416. Processing block 404 discloses arranging the slices corresponding to the volume of interest. *Id.* at 8:42–43. The '183 patent describes that in block 404 the software stacks slices corresponding to the area of interest. *Id.* at 8:44–45.

Processing block 406 discloses selecting an initial viewing angle of the slices. *Id.* at 8:56–57. The '183 patent describes that in block 406 the software rotates the volume of interest so that the viewing angle is aligned with that directed by the user. *Id.* at 8:57–59. The user interacts with the GUI to indicate the initial desired viewing angle. *Id.* at 8:59–60.

Processing block 408 discloses selecting a view point for a left eye, and processing block 410 discloses selecting a view point for a right eye. *Id.* at 8:64–66. The '183 patent describes that the software selects initial view points for the left and right eyes, respectively. *Id.* at 8:66–67.

Processing block 412 discloses displaying in a HDU, an image for the left eye based on the initial viewing angle, the view point for the left eye, and the volume of interest. *Id.* at 9:28–31. Processing block 414 discloses displaying, in the HDU, an image for the right eye based on the initial viewing angle, the view point for the right eye, and the volume of interest. *Id.* at 9:31–34. According to the '183 patent, the image for the left eye and the image for the right eye produce a three-dimensional image to the user. *Id.* at 9:34–36.

Processing block 416 discloses selecting images for future reference. *Id.* at 10:4–5. The '183 patent describes that the image slices generated through the imaging process are stored in a sequential file in the digital recording unit together with associated meta data. *Id.* at 10:5–7.

E. Illustrative Claim

Petitioner challenges claims 1–18 of the '183 patent. Pet. 1. Claims 1, 7, and 13 are the independent claims. Claims 2–6 depend directly from claim 1. Claims 8–12 depend directly from claim 7. Claims 14–18 depend directly from claim 13. Independent claim 1, reproduced below, is illustrative of the claimed subject matter.

1. [1 pre]³ A method of three-dimensional viewing of images by a user comprising:
 - [1a] selecting a volume of interest from a collection of image slices;
 - [1b] arranging said slices corresponding to said volume of interest;
 - [1c] selecting an initial viewing angle of said slices;
 - [1d] selecting a viewpoint for a left eye;
 - [1e] selecting a viewpoint for a right eye;
 - [1f] displaying, in a display unit (DU), an image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest;
 - [1g] displaying, in said DU, an image for said right eye based on said initial viewing angle, said view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce a three-dimensional image to said user;

³ Petitioner's designations to reference the elements of claim 1 are set forth in brackets. Pet. v–vi. Herein we refer to the elements of claim 1 using Petitioner's designations.

- [1h] wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user; and
- [1i] selecting an alternate viewing angle, said selecting an alternate viewing angle comprising:
 - [1j] reorienting said volume of interest in accordance with said alternate viewing angle;
 - [1k] displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest; and
 - [1l] displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce an alternate three-dimensional image to said user.

Ex. 1001, 17:23–56.

F. Evidence

Petitioner relies on the patent document references summarized in the table below.

Name	Patent Document	Exhibit
Schoolman	US 5,488,952	1005
Murphy	WO 2007/059477 A2	1010
Jones	EP 1 056 049 A2	1013
Guang	US 2005/0148848 A1	1014

G. Asserted Grounds

Petitioner asserts that the challenged claims of the '183 patent are unpatentable based on the following grounds summarized in the table below:

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
1, 5–7, 11–13, 17, 18	102 ⁴	Jones
1, 5–7, 11–13, 17, 18	103(a)	Jones
2–5, 8–10, 14–16	103(a)	Jones, Schoolman
1–18	103(a)	Murphy, Guang

II. ANALYSIS

A. Legal Standards

To prevail in its challenge to Patent Owner’s claims, Petitioner must demonstrate that the claims are unpatentable and that burden never shifts to the patentee. *Dynamic Drinkware, LLC v. Nat’l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015). To establish anticipation, each and every element in a claim, arranged as recited in the claim, must be found in a single prior art reference. *Therasense, Inc. v. Becton, Dickinson & Co.*, 593 F.3d 1325, 1332 (Fed. Cir. 2010); *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008). The applied reference “need not satisfy an *ipsissimis verbis* test.” *In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009); *In re Bond*, 910 F.2d 831, 832–33 (Fed. Cir. 1990). Even in a non-obviousness setting, it is proper to take into account not only the literal and specific teachings of the reference, but also the inferences which one skilled in the art would reasonably be expected to draw therefrom. *In re Preda*, 401 F.2d 825, 826 (CCPA 1968). For anticipation, the dispositive question is whether one skilled in the art would reasonably understand or infer from a prior art reference that every claim element is disclosed in that reference. *Eli*

⁴ The Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §§ 102 and 103. Because the ’183 Patent has an effective filing date before the effective date of the applicable AIA amendments, we refer to the pre-AIA version of 35 U.S.C. §§ 102 and 103.

Lilly v. Los Angeles Biomedical Res. Inst., 849 F.3d 1073, 1074–75 (Fed. Cir. 2017).

A patent claim is unpatentable under 35 U.S.C. § 103(a) if the differences between the claimed subject matter and the prior art are such that the subject matter, as a whole, would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations including: (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of ordinary skill in the art; and (4) when in evidence, objective evidence of nonobviousness.⁵ *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art the time of the invention would have had “at least a Bachelor’s degree in an academic area emphasizing electrical engineering, computer science, or a similar discipline, and at least two years of experience in the field working with, teaching, or researching stereoscopic and/or virtual/augmented reality (VR/AR) display technologies.” Pet. 4 (citing Ex. 1003 ¶¶ 15–16). Petitioner further contends that “[s]uperior education could compensate for a deficiency in work experience, and vice-versa.” *Id.* At the institution stage in the proceeding, Patent Owner did not dispute Petitioner’s proposal. *See generally* Prelim. Resp.

⁵ Patent Owner does not present objective evidence of nonobviousness at this stage of the proceeding.

In the Decision to Institute, we stated the following:

We find that the phrase “at least” in Petitioner's proposed definition creates a vague, open-ended upper bound for the level of ordinary skill, and we therefore do not adopt that aspect of the proposal. With that exception, considering the subject matter of the '183 patent, the background technical field, and the asserted prior art, we otherwise agree with Petitioner's proposed qualifications for an ordinary level of skill.

Inst. Dec. 17.

In its Patent Owner Response, Patent Owner asserts that it “mostly agrees with [Petitioner's] position, but like the Board believes that the use of the term ‘at least’ is inappropriate inasmuch as it would extend to persons having more than ordinary skill.” PO Resp. 18.

We maintain our finding at the institution stage that the phrase “at least” in Petitioner's proposed definition creates a vague, open-ended upper bound for the level of ordinary skill, and we therefore do not adopt that aspect of the proposal. Inst. Dec. 17. With that exception, considering the subject matter of the '183 patent, the background technical field, and the asserted prior art, we otherwise agree with Petitioner's proposed qualifications for an ordinary level of skill. Petitioner's proposed definition is consistent with the level of skill reflected in the specification of the '183 patent and the asserted prior art references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Accordingly, based on the complete record now before us, we adopt Petitioner's assessment of the level of skill for one of ordinary skill in the art, except without the “at least” phrase.

C. Claim Construction

We construe the challenged claims by applying the standard used in federal courts, in other words, “the same claim construction standard that

would be used to construe the claim in a civil action under 35 U.S.C. [§] 282(b),” which is articulated in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc). 37 C.F.R. § 42.100(b) (2020). Under this standard, the words of a claim generally are given their “ordinary and customary meaning,” which is the meaning the term would have to a person of ordinary skill at the time of the invention, in the context of the entire patent including the specification. *Phillips*, 415 F.3d at 1312–13.

I. “volume” and “volume of interest”

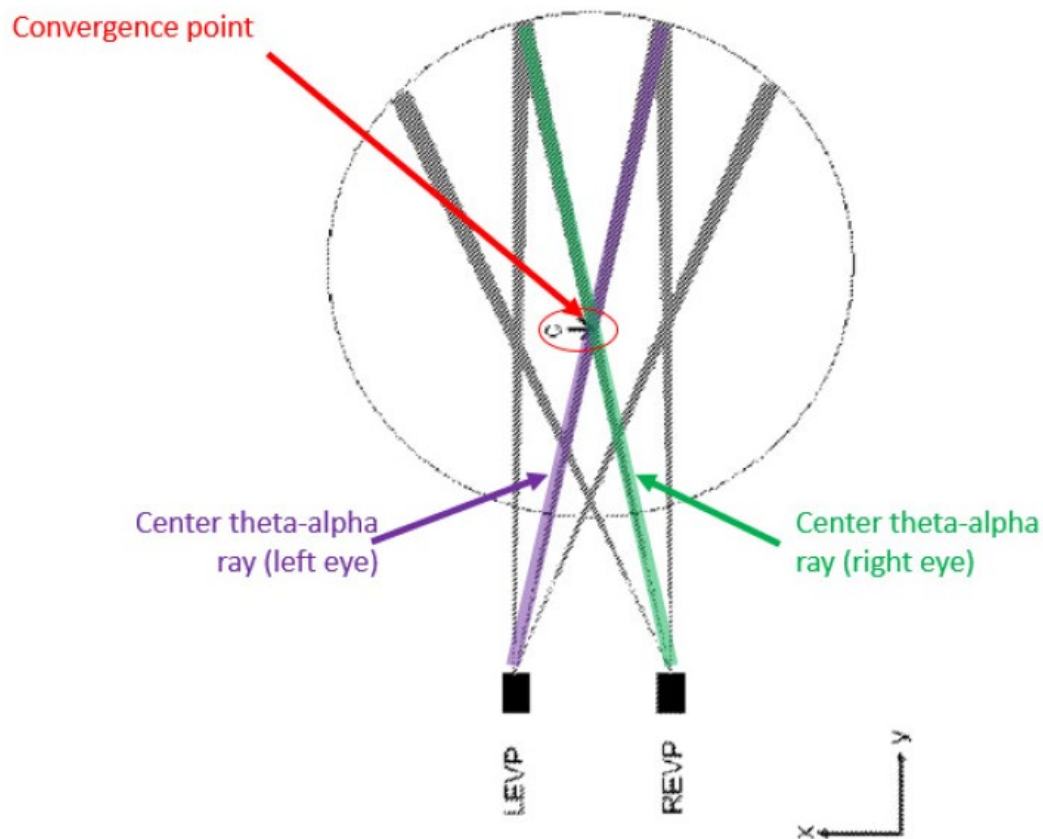
At the institution stage, we adopted agreed-to constructions in the parallel district court proceeding because Petitioner’s showing was sufficient under those constructions. Inst. Dec. 18. In particular, we adopted the following constructions: (1) that a “volume” is made up of three-dimensional pixels; and (2) that “volume of interest” “means one or more three-dimensional pixels selected by an individual or automated process.” *Id.* Patent Owner asserts that our “preliminary construction should now be confirmed.” PO Resp. 19. Petitioner states “Petitioner, likewise, agrees and does not argue for a different construction than the one proffered in the district court.” Pet. Reply 2.

Based on the complete record now before us, we maintain our decision to adopt the agreed-to constructions in the parallel district court proceeding because the parties agree to those constructions in the instant proceeding and Petitioner has established unpatentability under those constructions. *See Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017)), *cert. denied*, 138 S. Ct. 1695 (April 30, 2018) (noting that “we need only construe terms ‘that are in controversy, and only to the extent necessary to resolve the controversy’”)

(citing *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

2. “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user”

Petitioner asserts that “the ’183 patent describes that “[t]he convergence point is where the center theta-alpha ray from each LEVP and REVP intersect.” Pet. 21 (citing Ex. 1001, 6:51–59, Fig. 3B; Ex. 1003 ¶ 67) (alteration in original).⁶ Petitioner provides annotations to Figure 3B of the ’183 patent, reproduced below, illustrating Petitioner’s position.



⁶ Petitioner’s citation to the ’183 patent in this sentence includes the wrong exhibit number. *Id.* at 21. We treat this as harmless error.

Figure 3B of the '183 patent, above, illustrates a user-selectable convergence point (Ex. 1001, 4:38–39) and includes Petitioner's purple highlighting of the center theta-alpha ray for the left eye, green highlighting of the center theta-alpha ray for the right eye, and a red circle indicating the convergence point. Pet. 21.

At the institution stage, we determined that the term “convergence point” is “where the center theta-alpha ray from the left and right eye viewing perspectives intersect.” Inst. Dec. 22. We stated,

[o]ur understanding is that that convergence point, without simulation, is determined by a point on an object a viewer focuses his or her eyes on to look, and that if the object moves and the viewer continues to focus on the same point on the object after the object moved, then the convergence point has changed.

Id. (citing Ex. 1001, 6:52–53, 6:66–7:2). Patent Owner disputes our determination, as discussed below.

With respect to the full phrase i.e., “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user,” we declined to limit the independent claims so as to require convergence adjustment by a user. *Id.* We determined in our Decision to Institute that “we need not provide an express construction for the full phrase at this juncture for purposes of this decision.” *Id.* Subsequent to our Decision to Institute, neither party has disputed our decision to decline to limit the independent claims so as to require convergence adjustment by a user. Based on the complete record now before us, we maintain that determination without further discussion. The parties present additional arguments relating to “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user,” which we discuss below.

a) The Parties' Contentions

Regarding the term “convergence point,” the Petition states “the ’183 patent states that ‘[t]he convergence point is where the center theta-alpha ray from each LEVP and REVP intersect.’” Pet. 5, 21 (citing Ex. 1001, 6:52–53) (alteration in original). Petitioner also states “the ’183 patent mentions that such ‘convergence point may be shifted to any point within (x, y, z) space at the user(s) discretion to give a different perspective of the volumetric data to the user.” *Id.* at 5–6 (citing Ex. 1001, 6:60–62). Petitioner does not provide further contentions relating to claim construction and asserts that “no formal claim constructions are necessary.” *See, e.g., id.* at 3–4.

Regarding the term “convergence point,” in its summary of the ’183 patent, Patent Owner states “[a] convergence point is ‘where the center theta-alpha ray from each LEVP [(left eye viewing perspective)] and REVP [(right eye viewing perspective)] intersect.” PO Resp. 15 (citing Ex. 1001, 6:52–53). Patent Owner, however, also asserts that “a person of ordinary skill in the art would understand that a convergence point is a location (x, y, z) within a volume of interest.” *Id.* at 23. Patent Owner asserts the following:

[The Board’s] construction overlooks the language of claims 6, 12, and 18, which recite, “wherein said convergence point comprises a point where a center theta-alpha ray from said viewpoint of said left eye and a center theta-alpha ray from said viewpoint of said right eye intersect.” Ex. 1001 at 18:39–42; 20:4–7; 22:14–17. The Board’s construction would make these dependent claims redundant or perhaps meaningless. Claim differentiation considerations require that a convergence point means something other than the limitations thereon imposed by the dependent claims. *See e.g., Environmental Designs, Ltd. v. Union Oil Co.*, 713 F.2d 693, 699 (Fed. Cir. 1983) (“It is improper for courts to read into an independent claim a limitation explicitly set forth in another claim.”).

Id.

Regarding the full phrase i.e., “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user,” Patent Owner asserts “a person of ordinary skill in the art would understand that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point.” PO Resp. 31. Patent Owner asserts “[i]n the Institution Decision” we determined the full phrase did not require “convergence adjustment by a user.” *Id.* at 24.

Patent Owner also asserts that “the claims require” that “the left and right eye images . . . remain based on the initial view points.” PO Resp. 56. Patent Owner’s assertion pertains to other recitations in the claim and will be discussed further below. *Id.* at 55–56 (omitting element 1h from the list of recitations analyzed), 59 (asserting “the challenged independent claims require displaying images for a left eye / right eye based on an alternate viewing angle, and an initial view point for said left eye / right eye and the volume of interest” and not mentioning “wherein a convergence point . . . is shifted”). Patent Owner, however, discusses providing a display “in connection with shifting convergence points and displaying from alternate viewing angles” thereby implicating the recitation of “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user.” *Id.* at 59–60.

In its Reply, Petitioner does not dispute our determinations at the institution stage regarding the meaning of the term “convergence point.” *See generally* Pet. Reply. Petitioner disputes Patent Owner’s assertion that “a person of ordinary skill in the art would understand that a shifted

convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point.” *Id.* at 10–11. Petitioner asserts “the claim merely requires ‘a convergence point of said image’ to be shifted and further that ‘a different perspective of the volume of interest’ be presented to the user.” *Id.* at 11 (emphases omitted).

Petitioner also disputes Patent Owner’s assertion that “the claims require” that “the left and right eye images . . . remain based on the initial view points.” PO Resp. 56. Petitioner asserts that “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require “shifting of the convergence point to occur while holding all viewpoints unaltered.” Pet. Reply 21 (citing Ex. 1035 ¶ 30). Petitioner contends “[w]hat may or may not happen to the viewpoints during this convergence point shift is not recited in the claims, and a POSITA would have no reason to think otherwise.” *Id.* (citing Ex. 1035 ¶ 30).

In its Sur-reply, Patent Owner maintains its position that “a person of ordinary skill in the art reading the claim would understand that a shifted convergence point of the left-eye and right-eye images would have a different location, e.g., a different set of (x,y,z) coordinates, within the volume of interest than an original convergence point thereof.” PO Sur-reply 10 (citing PO Resp. 31–32). Patent Owner asserts “[t]his should not be controversial because the specification takes care to actually explain this point: ‘This convergence point may be shifted to any point within (x, y, z) space at the user(s) discretion to give a different perspective of the volumetric data to the user.’” *Id.* (citing Ex. 1001, 6:60–62).

In its Sur-reply, Patent Owner disputes Petitioner's contentions in the Reply. PO Sur-reply 15–16. Patent Owner maintains its position that “the claims require” that “the left and right eye images . . . remain based on the initial view points.” *Id.* at 16 (citing PO Resp. 56).

b) “convergence point”

We begin our analysis of the meaning of the term “convergence point” with the language of the claim. Each of the independent claims recites “a convergence point of said image for said left eye and said image for said right eye.” Ex. 1001, 17:40–41, 18:64–65, 20:34–35. The claim language recites that the “convergence point” is related to “said image for said left eye and said image for said right eye.” *Id.*

The '183 patent Specification describes that the convergence point is “where the center theta-alpha ray from each LEVP [Left Eye Viewing Perspective] and REVP [Right Eye Viewing Perspective] *intersect*.” Ex. 1001, 6:25–32, 6:52–53. Also, Figure 3B illustrates the “convergence point” as an intersection. *Id.* at Fig. 3B. The '183 patent describes the “convergence point” with respect to the viewer by stating that the viewer converges his or her eyes “to focus on an object,” and then the object is moved, resulting in the “eye muscles alter[ing] the convergence angle.” *Id.* at 6:66–7:2.⁷

We turn to Patent Owner's argument that our construction at the institution stage “would make [dependent claims 6, 12, and 18] redundant or

⁷ We note that the portion of the '183 patent Specification describing that the convergence point is “where the center theta-alpha ray from each LEVP [Left Eye Viewing Perspective] and REVP [Right Eye Viewing Perspective] intersect” (Ex. 1001, 6:25–32, 6:52–53) is identified by both parties as describing the “convergence point.” Pet. 5 (citing Ex. 1001, 6:52–53); PO Resp. 15 (citing Ex. 1001, 6:52–53).

perhaps meaningless” and “[c]laim differentiation considerations require that a convergence point means something other than the limitations thereon imposed by the dependent claims.” PO Resp. 23 (citing *Environmental Designs*, 713 F.2d at 699). In *Environmental Designs*, the question was whether reading a phrase, i.e., “prior to contact with an aqueous absorption solution” into the claim was appropriate. *Id.* In contrast, here the ’183 patent Specification states expressly what the “convergence point” is. Ex. 1001, 6:52–53. Also, both parties identify that same sentence as explaining what a convergence point is. Pet. 5; PO Resp. 15.

“[C]laim differentiation is a rebuttable presumption that may be overcome by a contrary construction dictated by the written description or prosecution history.” *Howmedica Osteonics Corp. v. Zimmer, Inc.*, 822 F.3d 1312, 1323 (Fed. Cir. 2016). Here, that presumption has been rebutted. The ’183 patent Specification set forth an express definition as follows: the “convergence point is where the center theta-alpha ray from each LEVP and REVP intersect.” Ex. 1001, 6:52–53.

In contrast to Patent Owner’s proposal that “a person of ordinary skill in the art would understand that a convergence point is a location (x, y, z) within a volume of interest” (PO Resp. 23), the express definition in the ’183 patent Specification does not limit the term “convergence point” to a point within a volume of interest. Ex. 1001, 6:52–53; *cf. Cont’l Circs. LLC v. Intel Corp.*, 915 F.3d 788, 796 (Fed. Cir. 2019) (citing *Phillips*, 415 F.3d at 1316) (“When the patentee acts as its own lexicographer, that definition governs.”). Patent Owner’s proposal is not consistent with other portions of the ’183 patent Specification. For instance, the ’183 patent Specification describes that “[t]he convergence point may be shifted to *any point within (x, y, z) space* at the user(s) discretion.” Ex. 1001, 6:60–61 (emphasis added). Also,

the '183 patent Specification describes “converg[ing] your eyes to focus on an object, such as a pencil in front of you” and moving the pencil “to a different location *in (x, y, z) space*.” *Id.* at 6:66–7:1 (emphasis added). The '183 patent Specification further describes “[t]he eye muscles alter the convergence to view the object at varying locations.” *Id.* at 7:1–3. In addition to being contrary to the '183 patent Specification, Patent Owner does not submit testimony of a declarant to support its proposal and, instead, relies on only attorney argument for its asserted understanding of a person of ordinary skill in the art.

We maintain our determination at the institution stage that the term “convergence point” is where the center theta-alpha ray from the left and right eye viewing perspectives intersect. Our understanding is that this convergence point, without simulation, is determined by a point on an object a viewer focuses his or her eyes on to look, and that if the object moves and the viewer continues to focus on the same point on the object after the object moved, then the convergence point has changed. Ex. 1001, 6:52–53, 6:66–7:2.

We note, however, that Patent Owner’s proposed construction is not germane to the dispute between the parties, except Patent Owner uses its proposed construction to further assert that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point. PO Resp. 31; PO Sur-reply 10. In addition to being based on its incorrect claim construction of “convergence point,” we discuss additional flaws with Patent Owner’s proposed construction for the full phrase below. *See* § II.C.2.c. For the reasons given in our discussion of the prior art, even using Patent Owner’s proposal that “a person of ordinary skill in the art would understand that a

convergence point is a location (x, y, z) within a volume of interest” (PO Resp. 23), Petitioner has shown that the prior art meets the claim limitations. *See infra* §§ II.D.2, II.D.3, II.G.3, II.G.4.

c) Does the phrase “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” require “that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point” (PO Resp. 31; PO Sur-reply 10)?

Patent Owner’s assertion that “a person of ordinary skill in the art would understand that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point” (PO Resp. 31; PO Sur-reply 10) is based on an incorrect characterization of the ’183 patent Specification. Patent Owner asserts that its proposed construction “should not be controversial” because the specification explains that the “convergence point may be shifted to any point within (x, y, z) space at the user(s) discretion to give a different perspective of the volumetric data to the user.” PO Sur-reply 10 (citing Ex. 1001, 6:60–62). Patent Owner, however, points to a portion of the ’183 patent Specification that discusses shifting “within (x, y, z) space,” not shifting within a “volume of interest.” *Id.* Patent Owner’s proposed construction requires that the shifting occur “within the volume of interest,” thereby substituting the term “volume of interest” for the different term “(x, y, z) space” used in the ’183 patent Specification.

The ’183 patent Specification clearly describes that the “volume of interest” is different than “(x, y, z) space.” For instance, the ’183 patent Specification describes that the user views the “volume of interest” from “any viewpoints in (x, y, z) space” including view points that are not within

the volume of interest. Ex. 1001, 10:25–28 (“This step allows the user the flexibility to view the volume of interest from different angles including from any viewpoints in (x, y, z) space.”). In other words, the “volume of interest” is a subset of “(x, y, z) space.” Similarly, Figure 3B illustrates that the viewing perspectives, i.e., the “LEVP” and “REVP” are within (x, y, z) space as shown by the “x” and “y” coordinates, but outside of the “volume of interest,” which is illustrated as a circle. *Id.* at Fig. 3B. The ’183 patent Specification sets forth an example of converging focus on a pencil that is “in front of” the viewer. *Id.* at 6:66–7:3. The ’183 patent describes that the “volume of interest,” i.e., the pencil “is moved to a different location in (x, y, z) space.” *Id.*

Considering the claim language, the recitation “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not exclude viewing from a point in (x, y, z) space that is outside of the volume of interest. That claim language is consistent with the ’183 patent Specification, as discussed above. For instance, in the example set forth in the ’183 patent Specification, the user views the “volume of interest,” the pencil from a point in “(x, y, z) space” that is some distance from the pencil. *Id.* at 6:66–7:3. Also, Figure 3B illustrates a viewer outside the volume of interest. *Id.* at Fig. 3B.

Patent Owner’s requirement that “a person of ordinary skill in the art would understand that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point” (PO Resp. 31; PO Sur-reply 10) is not supported by any testimony of a person of ordinary skill in the art. *See generally* PO Resp.; PO Sur-reply. In contrast, Dr. Zyda testifies in support

of Petitioner's position that "the claim merely requires 'a convergence point of said image' to be shifted and further that 'a different perspective of the volume of interest' be presented to the user." Ex. 1035 ¶ 13.

Patent Owner's assertion is based on an incorrect characterization of the terms "volume of interest" and "(x, y, z) space" as being the same. Contrary to Patent Owner assertion (*see, e.g.*, PO Sur-reply 10), the '183 patent Specification describes "volume of interest" as different from (x, y, z) space. Ex. 1001, 6:66–7:3, 10:25–28, Fig. 3B. For this reason and the other reasons given herein, we decline to adopt Patent Owner's proposed construction.

Patent Owner's assertion that "[i]n the Institution Decision" we determined the full phrase did not require "convergence adjustment by a user" (PO Resp. 24) is based on Patent Owner's proposed construction requiring "that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point" (*id.*), which we decline to adopt for the reasons given herein.

d) Does "wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user" require shifting of the convergence point to occur while holding all view points unaltered?

The phrase "wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user" does not include the term "view point" or "viewpoint." Patent Owner does not point to language recited in "wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user" in support of its position that left eye and

right eye images “remain” based on the initial view points. PO Resp. 55–60; PO Sur-reply 15–18. The recitation “a convergence point of said image for said left eye and said image for said right eye is shifted” is silent with respect to whether subsequent to the shifting images are based on the same view points. Patent Owner does not point to any other evidence, e.g., the ’183 patent Specification or the testimony of a declarant.

To the extent that Patent Owner’s assertion, i.e., that “the claims require” that “the left and right eye images . . . remain based on the initial view points” (PO Resp. 56) is meant to limit the phrase “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user,” we disagree with Patent Owner. We, instead, agree with Petitioner that “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require “shifting of the convergence point to occur while holding all viewpoints unaltered.” Pet. Reply 21 (citing Ex. 1035 ¶ 30). We discuss other flaws in Patent Owner’s position below. *See* § II.C.5.

e) Summary

In summary, we maintain our determination at the institution stage that the term “convergence point” is where the center theta-alpha ray from the left and right eye viewing perspectives intersect. Also, we agree with Petitioner and are not persuaded by Patent Owner’s arguments regarding the meaning and scope of “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user.” In particular, we adopt Petitioner’s position and determine that the phrase “wherein a convergence

point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require “that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point,” contrary to Patent Owner’s contentions. PO Resp. 31; PO Sur-reply 10. Also, we adopt Petitioner’s position and determine that “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require shifting of the convergence point to occur while holding all view points unaltered. Pet. Reply 21.

3. *“selecting an initial viewing angle” and “selecting an alternate viewing angle”*

Petitioner asserts that Jones’s “initial angle at which the 3D volume is presented to the user . . . which may be set by the system or chosen by the user” meets element 1c. Pet. 14 (citing Ex. 1003 ¶ 57). Petitioner similarly asserts that Jones’s disclosure of “rotating the dataset to provide [a] particular viewing angle, which may be set by the system or chosen by the user” meets element 1i. *Id.* at 25 (citing Ex. 1003 ¶ 73). In our discussion of the element-by-element analysis of anticipation of claim 1 by Jones, we do not make a determination as to whether Jones discloses the user performing the selecting because we determine that the claims are not limited to require user selection.⁸

⁸ With respect to obviousness over Murphy and Guang, we find that Petitioner has shown that the asserted prior art teaches the user selecting the initial and alternate viewing angles, although the claims are not limited to user selection. *See infra* §§ II.G.3.e.

At the institution stage, we noted that the '183 patent Specification describes that “selecting an initial viewing angle” and “selecting an alternate viewing angle” are performed by a user. Ex. 1001, 8:59–60 (describing with respect to processing block 406 in Figure 8 that the “user interacts with the GUI to indicate the initial desired viewing angle”), 10:24–25 (describing that processing block 452 in Figure 9 “discloses the user selecting an alternative viewing angle”). We also noted that the claim recitations are not limited to a user performing the selecting. In our preliminary analysis of elements 1c and 1i, we indicated that we preliminarily declined to construe “selecting an initial viewing angle” and “selecting an alternate viewing angle” so as to require that a user perform the selecting. Inst. Dec. 28, 37.

At this final stage of the proceeding, neither party proposes that “selecting an initial viewing angle” and “selecting an alternate viewing angle” should be limited to selection by a user. Based on the complete record now before us, we maintain our determination at the institution stage and we decline to construe “selecting an initial viewing angle” and “selecting an alternate viewing angle” so as to require that a user perform the selecting.

No further analysis of claim construction is needed for our determinations herein.

4. “*subtracted*”

We did not construe this term at the institution stage because a construction was not needed at that stage to resolve a dispute between the parties. Subsequent to institution, Patent Owner provides a proposed construction for the term “subtracted.” PO Resp. 21.

In a related proceeding, i.e., IPR2021-00647, the parties’ dispute the construction of “subtracted,” and the Final Decision sets forth a construction

for the term, i.e., that “subtracted” means “withdrawn or taken away, as a part from a whole.” To resolve the disputes between the parties in the instant proceeding, we need only determine whether the term is limited to requiring an “actual elimination of data (voxels) from the underlying three-dimensional model from which the images are created” (PO Resp. 21), as proposed by Patent Owner, or “should be viewed ‘more expansively’” so as to encompass the ’183 patent’s embodiments of “filtering,” “ignoring,” and “eliminat[ing] [tissue] from the observed volume” (Pet. Reply 3–4), as proposed by Petitioner.

We are mindful that “the same claim term in the same patent or related patents carries the same construed meaning.” *Omega Engineering, Inc. v. Raytek Corp.*, 334 F.3d 1314, 1334 (Fed. Cir. 2003). The ’771 patent challenged in IPR2021-00647 is related to the ’183 patent challenged here. Our construction analysis here is consistent with that in the IPR2021-00647 proceeding and our determinations are for the most part the same, with the exception that we do not rely on the dictionary definition that is not part of the record in this proceeding. We note, however, that our analysis, findings, and conclusions in the instant proceeding would not change even if we were to adopt the precise definition set forth in the IPR2021-00647 Final Decision, i.e., that “subtracted” means “withdrawn or taken away, as a part from a whole.”

a) The Parties’ Contentions

Patent Owner contends that “subtracted” means “eliminated from the volume of interest.” PO Resp. 21 (citing Ex. 1001, 10:65–67). Patent Owner contends “[b]ut more than just removal of an item in a displayed image, the ’183 patent proposes subtraction as actual elimination of data (voxels) from the underlying three-dimensional model from which the images are created.”

Id. Patent Owner relies on the following statement from the Specification: “Software reviews each element of tissue throughout the volume, selects tissue to be filtered and eliminates the selected tissue from the volume of interest.” *Id.* at 21–22 (citing Ex. 1001, 10:65–67).

Patent Owner points to other portions of the ’183 patent Specification that Patent Owner contends support its proposals. In particular, Patent Owner contends, in the Specification’s “so-called histogram method of filtering, ‘the user [can] select which tissues to be eliminate from the observed volume.’” *Id.* at 22 (citing Ex. 1001, 15:24–25; Ex. 2019, 25:8–31:1). Patent Owner also asserts that

in a Geometric Boundary method, “[c]omplex boundaries [can] be created to eliminate particular shapes at direction of the user [and f]or multiple voxels with the same theta and alpha, [] this technique [is used] to determine which voxel and its associated H. unit to place in the HDU.”

Id. at 22 (citing Ex. 1001, 14:18–26; Ex. 2019, 31:2–22).

Petitioner disputes Patent Owner’s construction for the term “subtracted” and, instead, “agrees with the Board’s finding in the related IPR2021-00647 proceeding” for the ’771 patent that the term “should be viewed ‘more expansively’” so as to encompass the ’183 patent’s embodiments of “‘filtering’ an image, ‘eliminating’ selected tissue, and ‘ignoring’ certain voxels.” Pet. Reply 3–4 (Ex. 1001, 9:60–67, 10:9–11, 13:15–18).

Petitioner disagrees that “subtracted” requires elimination of underlying data because the plain claim language requires selected items to be “subtracted *from said image to produce a filtered image*,” and thus, subtraction is “applied *to the image*.” *Id.* at 4 (citing Ex. 1035 ¶ 8). In addition, Petitioner views Patent Owner’s position to be “inconsistent with

its own specification” because “[w]ere the underlying data deleted, . . . there would be nothing left to be ‘ignored’ or ‘filtered.’” *Id.* (citing Ex. 1035 ¶ 7). Finally, Petitioner asserts that during prosecution, “Patent Owner clarified that subtraction requires ‘selecting items of an image to be filtered by subtracting them from an image.’” *Id.* at 5 (citing Ex. 1036, 236).

In the Sur-reply, Patent Owner asserts that its construction is “well-grounded in the specification” because the ’183 patent explains that “subtraction” is “actual elimination of data (voxels) from the underlying three-dimensional model from which images are created.” PO Sur-reply 5 (citing Ex. 1001, 10:65–67, 15:24–25). Patent Owner further asserts that Petitioner’s interpretation of “subtracted” relies on an incorrect view that the claimed three-dimensional image is an image displayed on a display. *Id.* at 6–7. The three-dimensional image does not occur on a display, Patent Owner argues, but rather only in the viewer’s mind. *Id.* at 7 (citing Ex. 1001, 6:20–23). Patent Owner argues that the Specification supports this view by teaching, “Each eye will see the image from a different angle. The brain will interpret the left eye viewing angle’s image and the right eyes’ viewing angle image together to give depth perception. Thus, a three-dimensional image will be seen.” *Id.* (citing Ex. 1001, 6:20–23). Moreover, Patent Owner argues, the Specification explains that “it is the ‘volume of interest’ from which selected items are removed.” *Id.* at 7–8 (citing Ex. 1001, 11:1–6 (“After viewing the volume of interest with the tissue selected having been removed”))).

b) Our Analysis

We begin with the claim language. *See Allergan Sales, LLC v. Sandoz, Inc.*, 935 F.3d 1370, 1373 (Fed. Cir. 2019) (“[C]laim construction must begin with the words of the claims themselves.”) (quoting *Amgen Inc.*

v. Hoechst Marion Roussel, Inc., 457 F.3d 1293, 1301 (Fed. Cir. 2006)).

Claim 2 recites in part:

selecting items of said image to be filtered, said selecting
items of said image to be filtered comprising:

selecting items of said image to be subtracted from said
image to produce a filtered image[.]

Ex. 1001, 17:58–61. Claims 8 and 14 include similar recitations. As Petitioner correctly points out, the claims require selecting items to be “subtracted *from said image to produce a filtered image*,” or in other words, “the subtraction is being applied *to the image*.” Reply 4 (citing Ex. 1035 ¶ 8). Nothing in the claim explicitly requires “actual elimination of data (voxels) from the underlying three-dimensional model from which the images are created,” as Patent Owner urges. *See* PO Resp. 21. To the contrary, the plain claim language states that it is the *image* that is filtered. Thus, absent some definition or disclaimer in the intrinsic record (whether explicit or implicit), the claims do not require eliminating underlying data. *See Trustees of Columbia University v. Symantec*, 811 F.3d 1359, 1363–64 (Fed. Cir. 2016).

The ’183 patent Specification does not include any such definition or disclaimer. Rather, Patent Owner relies only on embodiments and examples in the Specification to support its construction. For instance, the Patent Owner relies on the statement that “Software reviews each element of tissue throughout the volume, selects tissue to be filtered and eliminates the selected tissue from the volume of interest.” PO Resp. 21–22 (citing Ex. 1001, 10:65–67). But this statement occurs in a section of the ’183 patent describing “a particular embodiment of a method 500 for filtering an image.” Ex. 1001, 10:49–50, 10:65–67. Patent Owner also relies on the Specification’s “histogram method” and “Geometric Boundary method,” but

the '183 patent describes these as “two example methods.” PO Resp. 21–22; Ex. 1001, 15:7–31.

It is axiomatic that we must not “import into a claim limitations that are not a part of the claim.” *See SuperGuide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004); *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1346–47 (Fed. Cir. 2015) (“This court has repeatedly cautioned against limiting the claimed invention to preferred embodiments or specific examples in the specification.” (internal quotation omitted)). Thus, “a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.” *SuperGuide*, 358 F.3d at 875.

Patent Owner does not explain why these embodiments and examples should be limiting, only saying that they are so. *See* PO Resp. 21–23. Not only that, but closer inspection of the Specification language Patent Owner relies on undermines Patent Owner’s argument. One statement upon which Patent Owner relies is, “Software reviews each element of tissue throughout the volume, selects tissue to be filtered and eliminates the selected tissue from the volume of interest.” *Id.* at 21 (citing Ex. 1001, 10:65–67). Another statement that Patent Owner draws to our attention is, “the user could select which tissues to eliminate from the observed volume.” Ex. 1001, 15:24–25. Neither of these statements mentions deleting underlying data. Rather, each statement refers to eliminating displayed “*tissue*.” It takes a logical leap to suggest that eliminating displayed tissue means eliminating the data underlying the displayed tissue. This is particularly evident because the preceding Specification passage refers to eliminating tissues from the “observed” volume, i.e., from an image. *Id.* Thus, even if the statements

Patent Owner relies on were somehow not merely describing a preferred embodiment, they do not convey the meaning Patent Owner reads into them.

The Specification also includes contrary examples that suggest a broader interpretation of “subtracted.” For instance, when describing “filtering an image” by “selecting items of the image to be subtracted,” the Specification broadly contemplates that “[s]everal filtering processes are possible.” *Id.* at 10:53–54. These processes “includ[e] by composition (e.g. Hounsfield unit or signal intensity) or position (x, y, z) of the tissue.” *Id.* at 10:54–56. Elsewhere, the Specification refers to an example of ignoring, not deleting, data: “In order to display only the bones, one method would be to *ignore* all voxels with H. units less than 500 and display all voxels with H. unit of greater than 500.” *Id.* at 14:23–26 (emphasis added). Similarly, the Specification describes a Geometric boundary method (upon which Patent Owner relies), that creates a “surface representation” that changes grayscale values, rather than deleting data. *Id.* at 15:29–42; *see also id.* at 15:42–46 (“If only the bones were chosen to be displayed, the grayscale used could be either black or white (i.e., for Hounsfield unit<500, use 0 (black) and for H. unit>500 use 1 (white)).”). Thus, even if “eliminates the selected tissue from the volume of interest” means deleting underlying data (which it does not), because the ’183 patent discloses multiple filtering processes, we cannot limit the claimed “subtracted” to deletion of underlying data.

We do not agree with Patent Owner’s assertion that the claimed three-dimensional image does not occur on a display but only in the viewer’s mind. *See* PO Sur-reply 6–8 (citing Ex. 1001, 6:20–23). The assertion that the underlying data must be deleted does not follow from the ’183 patent’s disclosure that the brain will interpret the left and right eye images to give depth perception. *See* Ex. 1001, 6:20–23. Patent Owner does not explain

why the brain’s perception of three-dimensional images has anything to do with how the filtering operation takes place, and we can find no explanation in the intrinsic evidence that supports Patent Owner’s position. *See* PO Sur-reply 6–8.

Turning to the extrinsic evidence, we agree with Dr. Zyda’s testimony that “if the underlying data had to be deleted each time, as Patent Owner suggests, there would be no need to ‘ignore’ voxels or ‘filter’ the image” as per the ’183 patent and “thus, Patent Owner’s proposed construction is inconsistent with the actual specification of the ’771 patent (which is shared with the ’183 patent).” Ex. 1035 ¶ 7. As we explained above, the ’183 patent discloses a method that “ignore[s]” voxels as an embodiment that Patent Owner does not persuasively account for. *See* Ex. 1001, 14:23–26. We also agree with Dr. Zyda, for reasons discussed in detail above, that “the claims make it clear that the subtraction process is being applied *to the image* in order to produce a *filtered image*.” Ex. 1035 ¶ 8. We further find persuasive and credit Dr. Zyda’s opinion that “[n]ot only would such ‘subtraction’ be inconsistent with the claim language, it would be inconsistent with a POSITA’s desire to quickly and efficiently manipulate 3D images in real time by, for instance, repeatedly removing and re-adding different tissue sections.” *Id.* (citing Ex. 1001⁹, 10:12–17).

c) Summary

Accordingly, we agree with Petitioner and are not persuaded by Patent Owner’s arguments regarding the meaning of the term “subtracted.” We determine that the term “subtracted” is not limited to requiring an “actual

⁹ Dr. Zyda omits “1001” here as a typo, but he is plainly referring to Ex. 1001.

elimination of data (voxels) from the underlying three-dimensional model from which the images are created” (PO Resp. 21), as proposed by Patent Owner and, instead, “should be viewed ‘more expansively’” so as to encompass the ’183 patent’s embodiments of “filtering,” “ignoring,” and “eliminat[ing] [tissue] from the observed volume” (Pet. Reply 3–4), as proposed by Petitioner.

As explained above, we are mindful that “the same claim term in the same patent or related patents carries the same construed meaning” (*Omega*, 334 F.3d at 1334) and the Final Decision for a related patent states that “subtracted” means “withdrawn or taken away, as a part from a whole.” Our analysis, findings, and conclusions in the instant proceeding do not change even if we adopt the precise definition set forth in the IPR2021-00647 Final Decision, i.e., that “subtracted” means “withdrawn or taken away, as a part from a whole.”

5. Do the claim recitations “displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest” and “displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest” impose a requirement that the shifting of the convergence point occurs while holding all viewpoints unaltered?

a) The Parties’ Contentions

In the Patent Owner Response, Patent Owner asserts that “the claims require” that “the left and right eye images . . . remain based on the initial view points.” PO Resp. 56; *see also id.* at 59 (asserting “[a]s noted, the challenged independent claims require displaying images for a left eye / right eye based on an alternate viewing angle, and an initial view point for said left eye / right eye and the volume of interest.”). Patent Owner also

discusses providing a display “in connection with shifting convergence points and displaying from alternate viewing angles.” *Id.* at 59–60.

In its Reply, Petitioner responds, “nothing in the claim language requires the shifting of the convergence point to occur while holding all viewpoints unaltered.” Pet. Reply 21 (citing Ex. 1035 ¶ 30). Petitioner contends “[w]hat may or may not happen to the viewpoints during this convergence point shift is not recited in the claims, and a POSITA would have no reason to think otherwise.” *Id.* (citing Ex. 1035 ¶ 30).

In its Sur-reply, Patent Owner disputes Petitioner’s response as follows:

Microsoft’s Reply asserts, “nothing in the claim language requires the shifting of the convergence point to occur while holding all viewpoints unaltered.” Reply at 21. Not true. Independent claims 1, 7, and 13 each recite “displaying, in said DU, an image for said left eye based on said alternate viewing angle, **said view point for said left eye** and said volume of interest,” and “displaying, in said DU, an image for said right eye based on said alternate viewing angle, **said view point for said right eye**, and said volume of interest.” Ex. 1001 at 17:48-56 (claim 1); 19:5-10 (claim 7); 20:42-47 (claim 13). The recited “said view point” for each of the left-eye and right-eye images is **the same** left eye/right eye viewpoint that is initially selected, as recited in each claim. Ex. 2022 at 10:13 – 12:18.

PO Sur-reply 15.

Patent Owner also refers to Dr. Zyda’s testimony that “the claim doesn’t dictate what may or may not happen to the viewpoints during this shifting of the convergence point.” *Id.* (citing Ex. 1035 ¶ 30). Patent Owner asserts, “[b]ut the claims do in fact specify selecting an alternate view angle” and that, during his deposition, Dr. Zyda agreed that “when displaying images for the left eye and right eye based on the alternate viewing angle,

those left-eye and right-eye images are also based on the initially selected viewpoints for each eye.” *Id.* at 15–16 (citing Ex. 2022, 10:13–12:18).

b) Our Analysis

Patent Owner’s assertion that “although the viewing angle is altered and the volume of interest is reoriented, the left eye and right eye images that are displayed *remain* based on the initial view points” (PO Resp. 56 (emphasis added)) is flawed. The claims do not require the displayed images to “remain.”

Patent Owner’s discussion of providing a display “in connection with shifting convergence points and displaying from alternate viewing angles” implicating the recitation of “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” (PO Resp. 59–60) is misplaced. The claims recite the shifting only of “a convergence point,” not “convergence points” as asserted by Patent Owner. *Id.* Also, the shifting of the “convergence point” occurs after the initial displaying steps, i.e., elements 1f and 1g, but before the step of “selecting an alternate viewing angle” i.e., element 1i.¹⁰ In elements 1k and 1l, the displaying is not “in connection with shifting convergence points,” contrary to Patent Owner’s contentions. PO Resp. 59–60.

Importantly, each of independent claims 1, 7, and 13 uses the term “comprising.” “Comprising” is a term of art used in claim language, which means that the named elements are essential, but other elements also may be

¹⁰ In our analysis of the parties’ contentions, we refer to elements recited in illustrative claim 1 to simplify the discussion. Independent claims 7 and 13 include similar recitations.

included to constitute additional components within the scope of the claim. *Genentech, Inc. v. Chiron Corp.*, 112 F.3d 495, 501 (Fed. Cir. 1997).

Like elements 1f and 1g that produced the initial “three-dimensional image” to the user, elements 1k and 1l recite “displaying, in said DU, an image for” said left eye and said right eye based on “said view point” for said left eye and said right eye, respectively. The claims, however, are silent with respect to further details as to how that displaying occurs. The claim language including the term “comprising” encompasses performance of unrecited steps that result in displaying “said view point for said left eye” and “said view point for said right eye.” For instance, the claims do not exclude repeating the “selecting” steps recited in 1d and 1e, moving the image so as to return to the initial view points, zooming towards or away from the image after shifting the convergence point, or taking other steps to obtain the initial view points. The claims also do not exclude storing the user’s selections for initial view points for later retrieval after view points have changed.

The claims do not require that “said view point for said left eye” and “said view point for said right eye” be the same as any view point associated with “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user.” For the reasons we discuss above (*see* Section II.C.2), we agree with Petitioner’s contentions regarding the phrase “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user,” including that the claims do not require “shifting of the convergence point to occur while holding all viewpoints unaltered.” Pet. Reply 21 (citing Ex. 1035 ¶ 30).

Patent Owner's assertion that images "remain" is not consistent with the claim language. Patent Owner does not point to intrinsic evidence other than the language of the claims. PO Resp. 55–60; PO Sur-reply 15–18. Patent Owner also does not present extrinsic evidence or declarant testimony regarding the understanding of a person of ordinary skill in the art. *See generally* PO Resp.; PO Sur-reply.

Accordingly, we agree with Petitioner and are not persuaded by Patent Owner's arguments regarding "displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest" and "displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest." We are not persuaded that "said view point" in those recitations pertains to the earlier recitation "wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user." We determine that the phrases "displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest" and "displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest" do not impose a requirement that the shifting of the convergence point occur while holding all viewpoints unaltered.

6. “*zooming in on a portion of said image*” comprising “*selecting a new viewpoint for a left eye*” and “*selecting a new viewpoint for a right eye*”

a) The Parties’ Contentions

Patent Owner contends that the ’183 patent “provides that magnification, of the kind where pixels are replicated in orthogonal dimensions is different than the zooming through the altering of viewpoints being claimed.” PO Resp. 52 (citing Ex. 1001, 12:9–27). Patent Owner contends, “[w]ith magnification, ‘pixels are replicated in both the x and y directions’” such that “[n]ew information content is not available to the user.” *Id.* (citing Ex. 1001, 12:11–16). Patent Owner asserts “[i]n contrast, in the claimed approach of the ’183 patent, ‘the viewpoints [are moved] closer to the volume of interest, thus reducing the totality of the volume observed, but enlarging the area that is actually being observed.’” *Id.* (citing Ex. 1001, 12:21–24).

Petitioner contends that Patent Owner’s contentions “lack[] merit.” Pet. Reply 18. Petitioner points to a sentence in the ’183 patent Specification that states “[a]nother type of zoom would be associated with providing greater resolution.” *Id.* at 18–19 (citing Ex. 1001, 12:16–18).

b) Our analysis

We find that Patent Owner mischaracterizes the ’183 patent Specification. The portions of the ’183 patent Specification relied on by Patent Owner do not use the term “magnification.” In particular, the ’183 patent Specification describes “[t]here are multiple ways in which the zoom function can be accomplished.” Ex. 1001, 12:9–10. The ’183 patent Specification describes “a straightforward electronic zoom” that does not make new information content available to a user. *Id.* at 12:10–15. The ’183

patent Specification also describes “[a]nother type of zoom would be associated with providing greater resolution surrounding the identified zone of interest.” *Id.* at 12:16–18. The ’183 patent Specification also describes that a “way to zoom would be to move the viewpoints closer to the volume of interest.” *Id.* at 12:21–22. In contrast to Patent Owner’s contentions, the ’183 patent Specification does not describe “magnification” in connection with any types of zooming operations described or recognize a distinction between magnification and zooming.

Also, the claims do not recite “providing greater resolution surrounding the identified zone of interest,” as is described in the ’183 patent Specification. *Id.* at 12:16–18. We decline to import any requirement for “greater resolution” from the ’183 patent Specification into the claims. *See SuperGuide*, 358 F.3d at 875 (stating “a particular embodiment appearing in the written description may not be read into a claim when the claim language is broader than the embodiment.”); *Williamson*, 792 F.3d at 1346–47 (“This court has repeatedly cautioned against limiting the claimed invention to preferred embodiments or specific examples in the specification.” (internal quotation omitted)).

In summary, we disagree with Patent Owner that the ’183 patent Specification distinguishes between magnification and zooming. Also, we decline to read into the claim a requirement of “providing greater resolution surrounding the identified zone of interest.” No further determinations are needed regarding the meaning of “zooming in on a portion of said image” comprising “selecting a new viewpoint for a left eye” and “selecting a new viewpoint for a right eye” to resolve a dispute in this proceeding.

D. Unpatentability of Claims 1, 5–7, 11–13, 17, and 18 under 35 U.S.C. § 102 as Anticipated by Jones

Petitioner asserts that claims 1, 5–7, 11–13, 17, and 18 are unpatentable as anticipated by or obvious over Jones. Pet. 1. Patent Owner counters that the asserted prior art does not disclose element 1h, i.e., “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” recited in each of independent claims 1, 7, and 13. PO Resp. 28–37. Patent Owner disputes only Petitioner’s showing with respect to element 1h recited in claim 1 and similar recitations in independent claims 7 and 13.

Patent Owner does not dispute Petitioner’s contentions for other elements recited in the independent claims or Petitioner’s contentions for dependent claims 5, 6, 11, 12, 17, and 18. Petitioner supports its arguments with specific citations to Jones and Dr. Zyda’s declaration. Pet. 7–36 (citing, e.g., Ex. 1013 ¶¶ 40–43, 51–115). Based on our review of the entire record, including the arguments and evidence presented by both parties, we agree with Petitioner that Jones discloses all recitations in the independent claims and dependent claims 5, 6, 11, 12, 17, and 18.

We need not provide further analysis relating to the undisputed arguments and evidence, including the undisputed recitations in the independent and dependent claims. *LG Elecs., Inc. v. Conversant Wireless Licensing S.A.R.L.*, 759 F. App’x 917, 925 (Fed. Cir. 2019) (nonprecedential) (“The Board is not required to address undisputed matters or arguments about limitations with which it was never presented.”) (internal quotation omitted). To provide a more explanation, however, we provide

highlights of our analysis of certain of Petitioner's undisputed contentions and we address the parties' dispute.

We begin with an overview of Jones. We then turn to the parties' contentions.

1. Jones

Jones describes a method and apparatus for displaying volumetric data. Ex. 1013 ¶ 1. Figure 5 illustrates an apparatus for performing observer eye tracking. *Id.* ¶ 41.

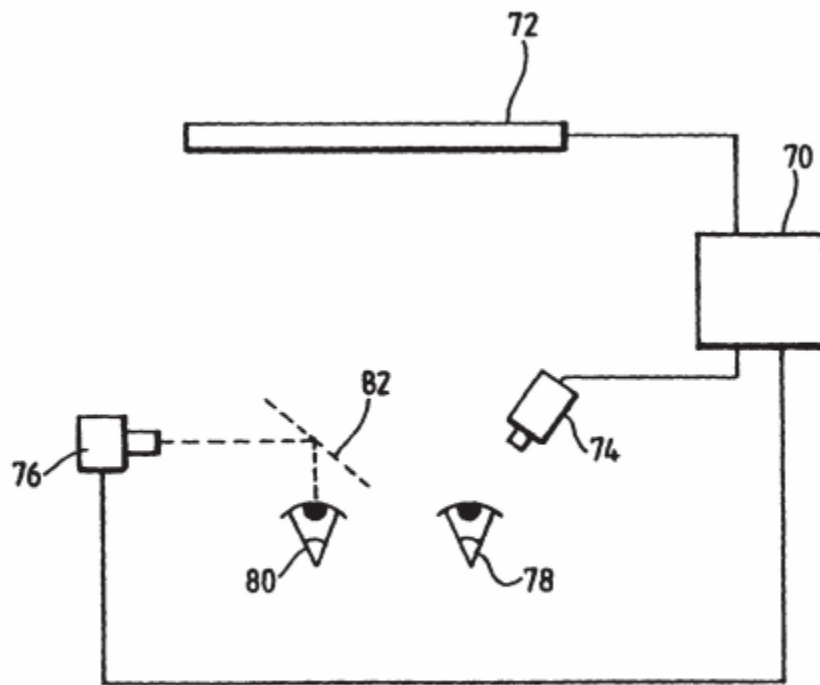


Fig.5.

Figure 5, above, schematically illustrates an apparatus for observer eye tracking, which includes data processor 70 connected to display 72, among other things. *Id.* ¶ 41.

Data processor 70 generates a plurality of views, which are displayed on display 72. *Id.* Cameras 74 and 76 are arranged to view eyes 78 and 80 of an observer. *Id.* Data processor 70 receives information from cameras 74 and

76 to perform visual tracking to determine the observer's fixation point in three-dimensions. *Id.*

Figure 7b, reproduced below, illustrates applying fixation point tracking techniques when a dataset rotates with respect to the observer. *Id.* ¶ 43.

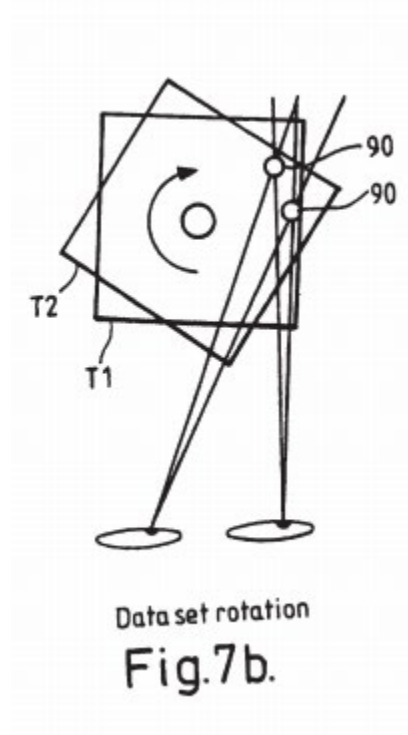


Figure 7b, above, illustrates applying fixation point tracking techniques when a dataset rotates with respect to the observer. *Id.* ¶ 43.

As shown in Figure 7b, region of interest 90 moves from a first position at time T1 to a second position at time T2 with respect to the observer. *Id.* Jones describes that at each of positions T1 and T2, eye direction data may be used to calculate a region of intersection. *Id.*

2. *Independent Claim 1*

a) *The Preamble*

The preamble of claim 1 is a “method of three-dimensional viewing of images by a user.” Ex. 1001, 17:23–24.¹¹ Petitioner contends that Jones discloses the preamble, based on Jones’s disclosure that it relates to “a method of and apparatus for displaying volumetric data.” Pet. 10 (quoting Ex. 1013 ¶ 1); *see also id.* (quoting Claim 1 (“A method of displaying data, wherein the data represents structure within at least a three dimensional space . . .”)). Petitioner also contends that Jones illustrates a viewing of a three-dimensional space. *Id.* (citing Ex. 1013 ¶ 29, Fig. 1). Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* (citing Ex. 1003 ¶ 52).

Patent Owner does not address Petitioner’s arguments or evidence regarding the preamble. Petitioner’s assertions and Dr. Zyda’s testimony are supported by the cited portions of Jones, including the quoted portions reproduced above. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses the preamble of claim 1.

b) *Element 1a: “selecting a volume of interest from a collection of image slices”*

Petitioner contends that Jones discloses “selecting a volume of interest” based on Jones’s disclosure of a user “select[ing] a volume of space encompassing the right eye,” where the right eye corresponds to the “volume of interest” recited in claim 1. Pet. 11 (quoting Ex. 1013 ¶ 32). Petitioner also points to Jones’s disclosure of displaying “data representing a head 12.” *Id.* at 12 (quoting Ex. 1013 ¶ 31; citing Ex. 1003 ¶ 54). Petitioner contends

¹¹ We treat the preamble as limiting without deciding, because Petitioner shows Jones discloses the preamble.

that Jones discloses that the volume of interest is from “a collection of image slices” based on Jones’s disclosure of cubic data volume 2 defined by orthogonal X, Y and Z axes, where a plurality of slices are stacked along the Z direction. *Id.* at 11 (citing Ex. 1013 ¶¶ 2, 9, 30, Fig. 1 Ex. 1003 ¶¶ 53–54); Ex. 1013 ¶ 30. Jones discloses that “[t]ypically such a dataset may comprise 256 x 256 pixels in the X and Y directions and 128 planes 4 in the Z direction.” Ex. 1013 ¶ 30. Petitioner cites Dr. Zyda’s testimony as further supporting evidence. Pet. 11–12 (citing Ex. 1003 ¶¶ 53–54).

As discussed above with respect to claim construction (*see* § II.C.1), we adopt the agreed-to construction in the parallel district court proceeding because Petitioner has shown Jones discloses element 1a using that construction. In particular, we adopt that “‘volume’ [is] made up of three-dimensional pixels” and that “‘volume of interest’” “means one or more three-dimensional pixels selected by an individual or automated process.” *See id.* (citing Ex. 2002, 1, 6; Ex. 2005). Jones discloses that “[a] typical volumetric data set is made up of a plurality of voxels,” and a “typical image dataset may contain 256 x 256 x 128 voxels.” Ex. 1013 ¶ 3; *see also id.* ¶ 30 (“Typically such a dataset may comprise 256 x 256 pixels in the X and Y directions and 128 planes in the Z direction”).

Patent Owner does not address Petitioner’s arguments or evidence regarding element 1a. Petitioner’s assertions and Dr. Zyda’s testimony are supported by cited portions of Jones, including the portions of Jones reproduced above. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses element 1a of claim 1.

c) Element 1b: “arranging said slices corresponding to said volume of interest”

Petitioner contends that Jones discloses element 1b based on Jones’s disclosure that “‘a plurality of slices are stacked along the Z direction’ to show ‘features within the dataset [that] represent an object, such as a part or whole of a persons body[.]’” Pet. 12 (quoting Ex. 1013 ¶ 30); *see also id.* (citing Ex. 1013 ¶ 31 (describing that “the display of data representing a head 12” includes steps in which “various layers . . . of the data set are stacked and displayed”)). Relying on the testimony of Dr. Zyda, Petitioner contends “the selected slices that correspond to the user’s selected volume of interest, such as head or eye for instance, are stacked (arranged) to form a corresponding 3D model” and that “only those slices that correspond to the selected volume of interest” are “arranged/stacked and displayed.” *Id.* at 12–13 (citing Ex. 1003 ¶¶ 55–56; Ex. 1013 ¶¶ 2, 30, 31, Fig. 1).

Patent Owner does not address Petitioner’s arguments or evidence regarding element 1b. Petitioner’s assertions and Dr. Zyda’s testimony are supported by the cited portions of Jones, including the portions of Jones reproduced above. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses element 1b of claim 1.

d) Element 1c: “selecting an initial viewing angle of said slices”

Petitioner contends that Jones discloses element 1c based on Jones’s disclosure that “the dataset is displayed” and “the dataset may also be rotated in space in order to present the observer with a plurality of views of the data.” Pet. 13–14 (quoting Ex. 1013 ¶ 9; citing *id.* ¶ 22). Petitioner contends that “[a]n initial angle at which the 3D volume is presented to the user (initial viewing angle), which may be set by the system or chosen by the user, corresponds to selection of an initial viewing angle from which further

rotation is performed.” *Id.* at 14 (citing Ex. 1003 ¶ 57). Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* at 14–15 (citing Ex. 1003 ¶¶ 58–59).

Patent Owner does not address Petitioner’s arguments or evidence regarding element 1c. As we explained above with respect to claim construction (*see* § II.C.3), we decline to construe “selecting an initial viewing angle” and “selecting an alternate viewing angle” so as to require that a user perform the selecting. Setting by the system an initial angle at the start of the rotation, therefore, meets the “selecting” requirement recited in element 1c.

For the reasons given, we determine that Petitioner’s assertions and Dr. Zyda’s testimony are supported by the cited portions of Jones. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses element 1c of claim 1.

*e) Element 1d: “selecting a viewpoint for a left eye” and
Element 1e: “selecting a viewpoint for a right eye”*

Petitioner contends that Jones discloses elements 1d and 1e based on Jones’s disclosure of displaying the three-dimensional volume “in a stereoscopic form, with different view points being presented to the observer’s left and right eyes, respectively.” Pet. 16–17 (quoting Ex. 1013 ¶ 9). Petitioner also points to Jones’s disclosure that “[f]or a stereoscopic display, different projection images must be calculated for each of the left and right eye view points.” *Id.* at 17 (quoting Ex. 1013 ¶ 33).

Petitioner contends that “a particular viewing point (e.g., viewpoint for a left eye) is selected and presented to the user’s left eye for stereoscopic viewing of the 3D volume.” *Id.* at 16 (citing Ex. 1003 ¶ 60; Ex. 1013 ¶ 46, Fig. 7a). Petitioner also contends “a particular viewing point (e.g., viewpoint

for a right eye) is selected and presented to the user's right eye for stereoscopic viewing of the 3D volume." *Id.* at 17 (citing Ex. 1003 ¶ 61; Ex. 1013 ¶ 46). Petitioner cites Dr. Zyda's testimony as further supporting evidence. *Id.* at 15–18 (citing Ex. 1003 ¶¶ 60–61).

Patent Owner does not address Petitioner's arguments or evidence regarding elements 1d and 1e. Petitioner's assertions and Dr. Zyda's testimony are supported by the cited portions of Jones, including the quoted portions above. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses elements 1d and 1e of claim 1.

f) Elements 1f and 1g

Elements 1f and 1g are reproduced below.

[1f] displaying, in a display unit (DU), an image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest;

[1g] displaying, in said DU, an image for said right eye based on said initial viewing angle, said view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce a three-dimensional image to said user;

Ex. 1001, 17:32–39.

Petitioner contends that Jones discloses elements 1f and 1g based on Jones's disclosure that "a plurality of views . . . are displayed on a display 72." Pet. 18–19 (quoting Ex. 1013 ¶ 41) (alteration in original). Relying on the testimony of Dr. Zyda, Petitioner also provides an annotation to Figure 5 of Jones pointing to display 72 for meeting the recitation of "display unit (DU)" in claim 1. *Id.* at 19–20 (citing Fig. 5; Ex. 1003 ¶¶ 62, 64).

Petitioner further points to Jones's disclosure regarding computing views of data in a first contextual form and a second enhanced contextual

form, which includes processing so that the three-dimensional data volume can be displayed on a two-dimensional display. *Id.* (citing Ex. 1013 ¶ 33). Petitioner contends that Jones’s disclosure in this regard states that “different projection images must be calculated for each of the left and right eye view points.” *Id.* (quoting Ex. 1013 ¶ 33). Petitioner also points to Jones’s disclosure that “[e]xisting display technologies can be used to separate the left eye and right eye images,” which Petitioner contends results in a different image being provided to each of the left and right eyes. *Id.* (citing Ex. 1013 ¶ 9) (alteration in original). Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* at 18–21 (citing Ex. 1003 ¶¶ 62–65).

With respect to the claim recitation “based on said initial viewing angle, said view point for said [left/right] eye and said volume of interest” recited in elements 1f and 1g of claim 1, Petitioner refers to its contentions for elements 1a, 1c, and 1d. *Id.* at 18–19.

Patent Owner does not address Petitioner’s arguments or evidence regarding elements 1f and 1g. Petitioner’s assertions and Dr. Zyda’s testimony are supported by the cited portions of Jones. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses elements 1f and 1g of claim 1.

g) *Element 1h: “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user”*

i. The Parties’ Contentions

Petitioner contends that Jones discloses element 1h based on Jones’s disclosure relating to fixation point tracking. Pet. 21–25 (citing, *e.g.*, Ex. 1013 ¶¶ 42–43, Figs. 7a–7c). Petitioner contends that “point of intersection 90” described with respect to Figure 7A and “region of interest

90” described with respect to Figure 7b correspond to the claimed convergence point. *Id.* (citing, e.g., Ex. 1013 ¶¶ 42–43, Figs. 7a, 7b; Ex. 1013 ¶ 42). Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* (citing Ex. 1003 ¶¶ 67–72).

Relying on the testimony of Dr. Zyda (Ex. 1003 ¶¶ 69–70), Petitioner provides an annotated version of Figure 7b to illustrate Petitioner’s contentions regarding shifting of the convergence point. Pet. 23.

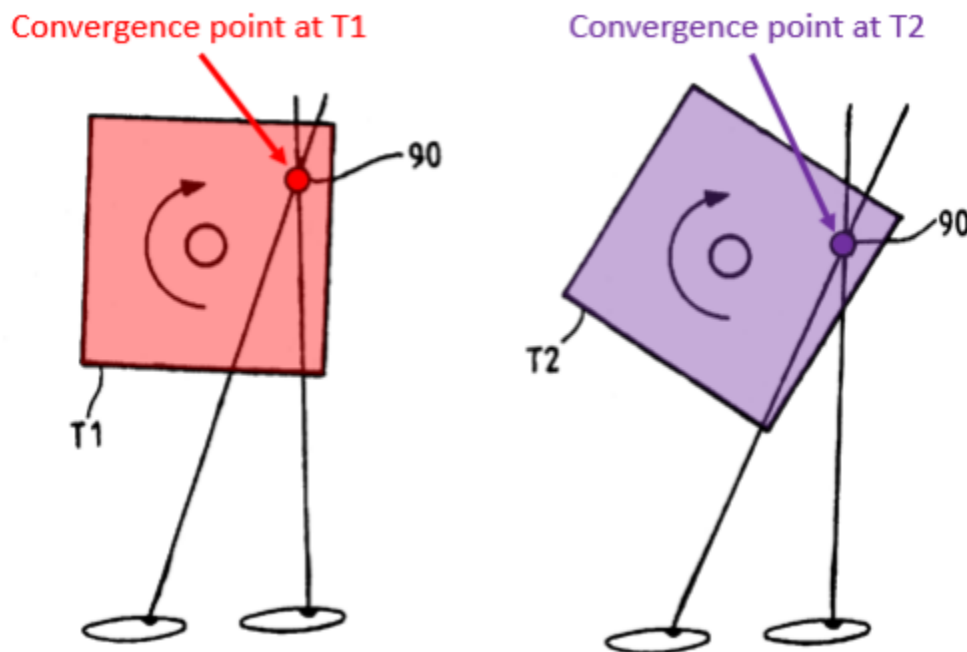


Figure 7b of Jones, above, illustrates observer eye tracking with a rotating dataset and has been modified by Petitioner (1) to separate the representation of the dataset at T1 from the representation at T2, (2) to include red annotations of the dataset and point 90 at T1, and (3) to include purple annotations of the dataset and point 90 at T2.

Patent Owner contends that Jones does not disclose a shifting convergence point because “a person having ordinary skill in the art would understand that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an

original convergence point.” PO Resp. 31. To illustrate its argument, Patent Owner provides a further annotated Figure 7b, which is reproduced below in part. *Id.* at 32.

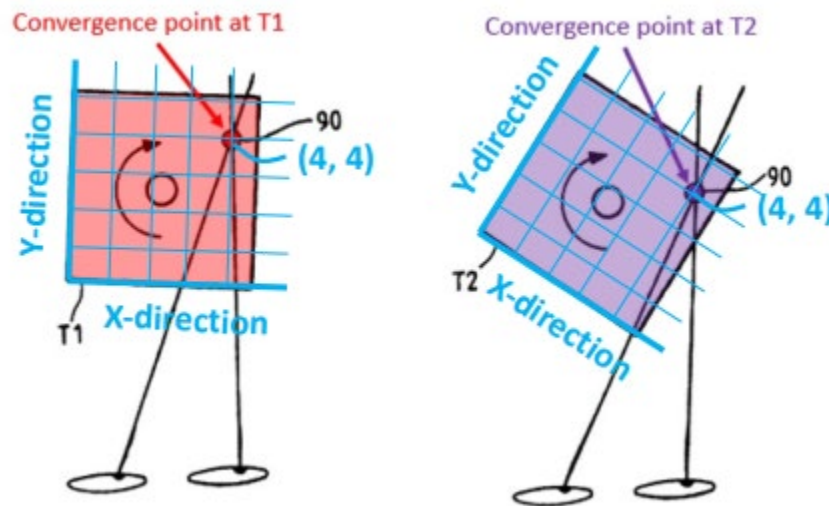


Figure 7b of Jones, above, illustrates observer eye tracking with a rotating dataset that has been modified by Petitioner as set forth immediately above and has been further modified by Patent Owner with (1) a blue text label of “X-direction” on the bottom line of each of the red and purple datasets, (2) the blue text label of “Y-direction” on the left line of each of the red and purple datasets, and (3) the blue text label (4, 4) on point 90 in each of the red and purple datasets.

Although not reproduced above, Patent Owner further annotates Figure 7b above to include (1) blue text stating “Convergence point would be located at the (4, 4) coordinate within the volume at T1” under the red dataset, and (2) blue text stating “Convergence point would still be located at the (4, 4) coordinate within the volume at T2 [and, t]herefore, the convergence point ***does not shift within the volume*** of interest, as required by the claim[]” under the purple dataset. *Id.*

Patent Owner contends that Jones teaches the following:

As the dataset rotates, the viewer’s eye movement is tracked, but the focus of the viewer’s gaze does not change. The viewer continues to look at the same point within the dataset while the

dataset rotates. One can imagine a similar result if a parent watches his or her child as the child goes around a merry-go-round.

Id. at 34.

Patent Owner also contends “Jones never teaches or suggests shifting a convergence point.” *Id.* at 35. Patent Owner contends “Jones uses Figures 7a–7c to illustrate why it is not necessary to be concerned with convergence points at all and instead one need only track the movement of a viewer’s gaze.” *Id.* Patent Owner contends “[b]ecause rotation of an image with respect to an observer (Jones’ Fig. 7b) is equivalent to rotation of the observer with respect to the image (Jones’ Fig. 7c), ‘only one eye needs to be subjected to tracking.’” *Id.* at 35–36 (citing Ex. 1013 ¶ 43).

ii. Our Analysis

As we explained with respect to claim construction, we maintain our determination at the institution stage that the term “convergence point” is where the center theta-alpha ray from the left and right eye viewing perspectives intersect. *See* § II.C.2. Petitioner has shown that Jones discloses claim element 1h. For instance, Jones describes that “both eyes are tracked” and that “the point of intersection 90” is calculated with respect to a stationary three-dimensional object illustrated in Figure 7a. Ex. 1013 ¶ 42. Jones’s “point of intersection 90” meets the recitation of “convergence point.” Jones illustrates this same point 90 with respect to Figures 7b and 7c, as is discussed further below.

As we explained in the Decision to Institute (Inst. Dec. 35), Jones uses different terms to refer to the same thing. In particular, in its discussion of performing eye tracking, Jones uses the terms “fixation point,” “point of intersection,” “point of interest,” and “region of intersection” in a manner

such that Jones's disclosure as understood by a person having ordinary skill in the art meets the "convergence point" requirement recited in claim 1. For instance, with respect to "fixation point," Jones describes "the observer's fixation point," which is determined using camera information in one embodiment obtained from both eyes of the observer. Ex. 1013 ¶ 41. Jones's "point of intersection" is described as being calculated using measurements of "the direction of the view of each eye." *Id.* ¶ 42. Also, Jones's "region of interest 90" and "region of intersection" are described with respect to performance of motion tracking "with both eyes." *Id.* ¶ 43. In the Decision to Institute (Inst. 35), we stated that we find that a person having ordinary skill in the art would have understood Figure 7b's "region of interest 90" to be much like "point of intersection 90" shown in Figure 7a, except in Figure 7b the dataset rotates and the viewer continues to focus on the same point on the object. Ex. 1013, Figs. 7a, 7b, ¶¶ 9, 42–43; Ex. 1003 ¶¶ 67–72. Neither party disputes our findings in the Decision to Institute (Inst. Dec. 35) relating to Jones using different terms to refer to the same thing. Based on the complete record now before us, we maintain those findings.

As discussed with respect to claim construction (*see* Section II.C.2), Patent Owner's proposed construction is not germane to the dispute between the parties, except Patent Owner uses its proposed construction to further assert that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point. PO Resp. 31; PO Sur-reply 10. Even using Patent Owner's proposal that "a person of ordinary skill in the art would understand that a convergence point is a location (x, y, z) within a volume of interest" (PO Resp. 23), Petitioner has shown that the prior art meets the claim element 1h. For instance, we are persuaded that each of Figure 7a's

“point of intersection 90,” Figure 7b’s “region of interest 90,” and point 90 illustrated in Figure 7c illustrates a convergence point that is a location (x, y, z) within a volume of interest, i.e., the dataset. Ex. 1013, Figs. 7a–7c, ¶¶ 42–43.

As we also explained with respect to claim construction, we adopt Petitioner’s position and determine that the phrase “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require that “that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point,” contrary to Patent Owner’s contentions. *See* § II.C.2 (citing PO Resp. 31; PO Sur-reply 10). We find that Jones also discloses element 1h using the correct construction.

For instance, as we indicate above, “point of intersection 90” in Jones meets the recitation of “convergence point.” Figure 7a, however, pertains to a stationary object, and each of the claims requires that “a convergence point . . . is shifted.” Jones also describes that Figures 7b and 7c illustrate applying “fixation point” tracking techniques “when the dataset *rotates*.” Ex. 1013 ¶ 43. Jones further describes the following:

In Figure 7b, motion tracking is performed with both eyes as the region of interest 90 moves from the first position at time T1 to a second position at time T2 with respect to the observer. At each of these positions, and at intermediate ones, eye direction data may[]be used to calculate a region of intersection.

Id.

Jones describes calculating the “region of intersection” “when the dataset rotates,” i.e., when that region “moves from the first position at time T1 to a second position at time T2.” *Id.* Jones also describes that the

calculation may be performed “[a]t each of these positions, and at intermediate ones.” *Id.* We find that the recitation of “a convergence point . . . is shifted” is met by Jones’s disclosure of “region of interest 90” used interchangeably with “region of intersection” moving “from the first position at time T1 to a second position at time T2” and having “intermediate” positions. *Id.*

We also find that Jones discloses rotating or altering the image to provide a different perspective of the image to the user. *See, e.g.,* Ex. 1013 ¶ 9 (“[T]he dataset may also be *rotated in space in order to present the observer with a plurality of views of the data.*”) (emphasis added), ¶ 22 (describing imaging systems “in which the dataset is *moved (such movement is often rotational)*”) (emphasis added), ¶ 36 (“The view point may be fixed or may be changed depending on whether the pre-processing of the base image was performed only for a single view point or for *a smoothly changing set of view points thereby giving the impression that the data space is rotating on the screen.*”) (emphasis added), ¶ 43 (“In Figure 7b, motion tracking is performed with both eyes as the region of interest 90, *moves from the first position at time T1 to a second position at time T2* with respect to the observer.”) (emphasis added).

Patent Owner’s contention that Jones does not disclose a shifting convergence point because “a person having ordinary skill in the art would understand that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point” (PO Resp. 31) is premised on Patent Owner’s construction, which we did not adopt for the reasons given above. *See* § II.C.2. Patent Owner’s further annotated Figure 7b (PO Resp. 32), which is reproduced above, does not undermine Petitioner’s illustration that the

convergence point does indeed move from the perspective of the viewer (depicted as eyes in Figure 7b) and in (x, y, z) space. As illustrated, point 90 is slightly lower and further to the right. Ex. 1013, Fig. 7b; Pet. 23.

Counsel for Patent Owner acknowledged at oral hearing that Jones discloses shifting in (x, y, z) space assuming that space includes the user.

JUDGE PARVIS: So I've got a carousel. And I'm looking at your Slide 5,¹² and the red shaded volume of 2 interest is the carousel, and 4, 4 is the horse. Now, I'm taking 4, 4 and I'm shifting it 180 degrees. You can see the user's eyes here in Figure 3B¹³ of Jones are to the right. In your other one, they go a little further to the right, but if we move it 180 degrees, those eyes are going to shift to the left; is that correct?

MR. FAHMI: Yeah. I think I see what you're saying, Your Honor. Yes.

JUDGE PARVIS: So isn't that a shift in convergence point?

MR. FAHMI: Depends what the volume of interest is, Your Honor. So if -- if it's just the carousel and the horses, then the situation is as illustrated in Jones, and the convergence point doesn't change. The same -- it would be at the same grid reference. If you're talking about the entirety of the volume within which the user is standing, like the pencil example, the convergence point would shift.

JUDGE PARVIS: So in X, Y, Z space, the convergence point shifts; is that correct?

MR. FAHMI: If that space includes the viewer, yes.
Tr. 66:26–67:23.

We turn to Patent Owner's additional contentions as follows:

¹² Patent Owner's Slide 5 depicts the same annotated Figure 7b provided in Patent Owner's Response. PO Resp. 32–33.

¹³ This reference is to Patent Owner's annotated Figure 7b. We treat this as a harmless error typographical in nature.

As the dataset rotates, the viewer's eye movement is tracked, but the focus of the viewer's gaze does not change. The viewer continues to look at the same point within the dataset while the dataset rotates. One can imagine a similar result if a parent watches his or her child as the child goes around a merry-go-round.

PO Resp. 34.

Patent Owner's additional contentions are unavailing for the same reasons given above. Contrary to Patent Owner's argument, Jones illustrates that the viewer's gaze changes because a second set of indicator lines illustrating the view of the eyes are a little to the right of a first set of indicator lines illustrating the view prior to the shift. Ex. 1013, Fig. 7b. Although the viewer continues to look at the same point, because Jones's dataset rotates and the viewer views the dataset from a point external to the volume of interest, but within (x, y, z) space, the rotation of the dataset causes the point to shift, from the perspective of the viewer. *Id.*

We turn to Patent Owner's contention that "Jones never teaches or suggests shifting a convergence point" and, instead, "Jones uses Figures 7a–7c to illustrate why it is not necessary to be concerned with convergence points at all and instead one need only track the movement of a viewer's gaze." PO Resp. 35. Patent Owner provides further argument contending "[b]ecause rotation of an image with respect to an observer (Jones' Fig. 7b) is equivalent to rotation of the observer with respect to the image (Jones' Fig. 7c), 'only one eye needs to be subjected to tracking.'" *Id.* at 35–36 (citing Ex. 1013 ¶ 43).

Patent Owner improperly suggests that Jones describes the observer viewing the image with a single eye because Jones describes tracking the movement of a single eye, but viewing and tracking are not synonymous,

and Jones describes viewing with both eyes. *See, e.g.*, Ex. 1013, Fig. 5, ¶ 41 (“One or more cameras 74 and 76 are arranged to view the *eyes 78 and 80 of an observer.*”) (emphasis added). Indeed, although the claims require view points for the left and right eyes, the claims do not require tracking, measuring, or calculating with respect to those view points. Tracking, measuring, and calculating are additional features discussed in Jones that are not required by the claims. Independent claim 1 uses the term “comprising,” which means that the named elements are essential, but other elements also may be included to constitute additional components within the scope of the claim. *Genentech*, 112 F.3d at 501. Nonetheless, with respect to Figure 7b, Jones describes that “motion tracking is performed with *both eyes.*” Ex. 1013 ¶ 43 (emphasis added). Further, Patent Owner does not contend that by tracking the motion of a single eye, Jones cannot determine the point at which the viewer looks to provide an appropriate image for the other eye.

Even to the extent that Jones describes tracking one eye as advantageous, that does not negate anticipation. Un-preferred—even disfavored—embodiments may still anticipate a claim. *Celeritas Techs. Ltd. v. Rockwell Int’l Corp.*, 150 F.3d 1354, 1361 (Fed. Cir. 1998) (“A reference is no less anticipatory if, after disclosing the invention, the reference then disparages it.”). With respect to Figure 7b, Jones describes that “motion tracking is performed with *both eyes.*” Ex. 1013 ¶ 43 (emphasis added).

As we also explained with respect to claim construction, we adopt Petitioner’s position and determine that “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require shifting of the convergence point to occur while holding all view points unaltered. *See* § II.C.2 (citing Pet. Reply 21). Furthermore, we stated

that we determine that the phrases “displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest” and “displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest” do not impose a requirement that the shifting of the convergence point occur while holding all viewpoints unaltered. *See* § II.C.5. Patent Owner’s contentions in that regard pertain to only the ground based on the combination of Murphy and Guang. PO Resp. 53–60; PO Sur-reply 15–18. Patent Owner does not make similar arguments with respect to the grounds based on Jones. *See, e.g.*, PO Resp. 25–37; PO Sur-reply 1–2, 9–12.

Based on the complete record now before us, we find that Petitioner has shown that Jones discloses element 1h of claim 1. We find that Patent Owner’s arguments and evidence do not undermine Petitioner’s showing.

h) Element 1i: “selecting an alternate viewing angle, said selecting an alternate viewing angle comprising”

Petitioner contends that Jones discloses element 1i based on Jones’s disclosure of that “the dataset may also be rotated in space in order to present the observer with a plurality of views of the data.” Pet. 25 (citing Ex. 1013 ¶ 9). Petitioner contends that “rotating the dataset to a particular viewing angle, which may be set by the system or chosen by the user, corresponds to *selection of an alternate viewing angle*.” *Id.* (citing Ex. 1003 ¶ 73). Petitioner also refers to its contentions for element 1h and contends “an alternate viewing angle is presented to the user by rotating the 3D model from an initial viewing angle at T1 to an alternate viewing angle at T2.” *Id.* Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* at 25–26 (citing Ex. 1003 ¶¶ 73–74).

Patent Owner does not address Petitioner's arguments or evidence regarding element 1i. As we explained above with respect to claim construction (*see* § II.C.3), we decline to construe "selecting an initial viewing angle" and "selecting an alternate viewing angle" so as to require that a user perform the selecting. The system setting an alternate viewing angle after the start of the rotation, therefore, meets the "selecting" requirement recited in element 1i based on the entire record.

We find that Petitioner's assertions and Dr. Zyda's testimony are supported by the cited portions of Jones. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses element 1i of claim 1.

i) Element 1j: "reorienting said volume of interest in accordance with said alternate viewing angle"

Petitioner contends that Jones discloses element 1j, based on Jones's disclosure of "changing the viewpoint of the 3D volume such that an alternate viewing angle is presented to the user." Pet. 26 (citing Ex. 1003 ¶ 75; Ex. 1013 ¶¶ 9, 36, 43). Petitioner contends "[t]hat is, once an alternate viewing angle is selected, either by the system or by the user, as described in [1i], the selected data space (volume of interest) is reoriented by being rotated." *Id.* (citing Ex. 1003 ¶ 75; Ex. 1013 ¶¶ 9, 36, 43). Petitioner cites Dr. Zyda's testimony as further supporting evidence. *Id.* (citing Ex. 1003 ¶ 75).

Patent Owner does not address Petitioner's arguments or evidence regarding element 1j. Petitioner's assertions and Dr. Zyda's testimony are supported by the cited portions of Jones. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses element 1j of claim 1.

j) Elements 1k and 1l

Elements 1k and 1l are reproduced below.

displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest; and
displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce an alternate three-dimensional image to said user.

Ex. 1001, 17:48–56.

Petitioner refers to its contentions and evidence for other elements recited in claim 1. Pet. 26–27 (referring to contentions and evidence presented for elements 1a, 1d, 1e, 1f, 1g, and 1) (citing Ex. 1013 ¶ 33). As we indicated above (*see* Section II.D.2.f), Jones describes with respect to Figure 5, “[a] data processor 70 generates a plurality of views which are displayed on display 72.” Ex. 1013 ¶ 41.

Petitioner also contends that Jones discloses elements 1k and 1l based on Jones’s disclosure that “the dataset is displayed in a stereoscopic form, with different view points being presented to the observer's left and right eyes, respectively.” Pet. 27–28 (quoting Ex. 1013 ¶ 9; citing Ex. 1003 ¶ 77). Petitioner contends Jones’s different view points are based on the alternate viewing angle and, therefore, an alternate three-dimensional image is presented to the user. *Id.* Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* at 26–27 (citing Ex. 1003 ¶¶ 76–77).

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Jones. In addition to the quoted portions of Jones reproduced above, Jones

describes that “[t]he dataset may also be *rotated* in space in order to present the observer with a plurality of views of the data” and that “[t]he *enhanced* image,” e.g., rotated image may be produced using “perspective projection” such that stereoscopic images are generated. Ex. 1013 ¶ 9 (emphases added). Jones describes computing views of the data in “its first contextual form and in its second *enhanced* form.” *Id.* ¶ 33 (emphasis added).

Patent Owner does not address Petitioner’s arguments or evidence regarding element 1k and 1l. Petitioner’s assertions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Jones, including the portions reproduced above. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses elements 1k and 1l of claim 1.

k) Conclusion

Based on the complete record now before us, we find that Petitioner has shown that Jones discloses each recitation of claim 1. Accordingly, we determine that Petitioner has proved, by a preponderance of the evidence, that claim 1 is unpatentable under 35 U.S.C. § 102 as anticipated by Jones.

3. Independent Claims 7 and 13

Independent claims 7 and 13 are similar to independent claim 1. Petitioner’s analysis of these claims for this challenge largely relies on Petitioner’s analysis of claim 1. Pet. 30–36. Petitioner accounts for all differences between the claims. For instance, in contrast to claim 1, which recites a method, the preamble of claim 7 recites a “non-transitory computer readable medium having computer readable code thereon” and claim 13 recites a “computer system” comprising “a memory,” “a processor,” “a communications interface,” and “an interconnection mechanism coupling

the memory, the processor and the communications interface.” Ex. 1001, 18:43–44, 20:8–15.

Petitioner contends “[t]o the extent the preamble is limiting,” Jones discloses the preamble of claim 7. Pet. 30. Petitioner contends that Jones discloses “non-transitory computer readable medium having computer readable code thereon” recited in the preamble of claim 7 based on Jones’s disclosure of “a computer program product stored on a computer readable medium.” *Id.* (quoting Ex. 1013 ¶ 28). Petitioner also points to Jones’s disclosure that the “computer program product” causes “a computer to perform [a] method” of an aspect of the Jones invention. *Id.* (quoting Ex. 1013 ¶ 27).

Petitioner contends that “[t]o the extent the preamble is limiting,” Jones discloses the preamble of claim 13. Pet. 32. Petitioner contends that Jones discloses “computer system” recited in claim 13 based on Jones’s disclosure that a “computer” is used to perform methods described in Jones. *Id.* (quoting Ex. 1013 ¶¶ 27, 28).

Petitioner contends Jones discloses that the “computer system” comprises “a memory” based on the same disclosures relied on for claim 7 relating to “a computer program product stored on computer readable medium.” *See, e.g., id.* at 33 (quoting Ex. 1013 ¶ 28). Petitioner asserts that “[t]he ‘computer readable medium’ is one implementation of a memory.” *Id.* (citing Ex. 1003 ¶ 97).

Petitioner contends Jones discloses that the “computer system” comprises “a processor” based on Jones’s disclosure of “data processor (70).” *Id.* (citing, *e.g.*, Fig. 5). Petitioner contends Jones discloses that the “computer system” comprises “a communications interface” based on Jones’s disclosure of “a pointer, such as a mouse.” *Id.* at 34 (quoting

Ex. 1013 ¶ 38). Petitioner contends Jones discloses that the “computer system” comprises “an interconnection mechanism coupling the memory, the processor and the communications interface.” based on Jones’s disclosure that the recited elements operate together. *Id.* Petitioner asserts a person having ordinary skill in the art would have recognized that Jones’s disclosure is of interconnected elements that operated together. *Id.*

Patent Owner does not argue claims 7 and 13 separately from claim 1. *See generally* PO Resp. Petitioner’s assertions regarding claims 7 and 13 are supported by the cited portions of Jones. For the reasons given in our discussion of claim 1, as well as immediately above with respect to claims 7 and 13, Petitioner has proved, by a preponderance of the evidence, that claims 7 and 13 are unpatentable under 35 U.S.C. § 102 as anticipated by Jones.

4. *Dependent Claims 5, 11, and 17*

Claim 5 depends directly from claim 1 and further recites “wherein said DU is selected from the group consisting of a display unit incorporating polarized lenses, a display unit wherein multiplexed images are viewed via shuttered lenses, virtual reality displays having a display unit with unique left and right eye pixel displays, and other types of three-dimensional (3D) displays.” Claims 11 and 17 depend directly from independent claims 7 and 13, respectively, and recite the same further recitation.

Petitioner asserts that the further recitation in each of claim 5, 11, and 17 is disclosed by Jones based on Jones’s description that that “a plurality of views . . . are displayed on a display 72” and that “the dataset is displayed in a stereoscopic form, with different view points being presented to the observer’s left and right eyes, respectively.” Pet. 27–28 (quoting Ex. 1013 ¶¶ 41, 9; citing *id.* at Fig. 5; Ex. 1003 ¶ 78); *see also id.* at 32 (asserting

claim 11 met based on contentions for claim 5), 36 (asserting claim 17 met based on contentions for claim 5). Petitioner also points to (*id.* at 28) Jones’s statement that “[e]xisting display technologies can be used to separate the left eye and right eye images.” Ex. 1013 ¶ 9. Petitioner cites Dr. Zyda’s testimony as further supporting evidence. Pet. 27–28 (citing Ex. 1003 ¶¶ 78–79).

Dr. Zyda testifies that “because the stereoscopic image in Jones provides a 3D image using a stereoscopic display system, Jones provides at least ‘other types of three-dimensional (3D) displays’ as required by Claim 5.” Ex. 1003 ¶ 79 (citing Ex. 1013 ¶ 46). Consistent with Dr. Zyda’s testimony, Jones describes “[u]sing the conventional left-right eye based 3D tracking method requires the use of a stereoscopic display.” Ex. 1013 ¶ 46.

Patent Owner does not address separately Petitioner’s arguments or evidence regarding the further element of claims 5, 11, and 17. Petitioner’s assertions and Dr. Zyda’s testimony are supported by the cited portions of Jones. Based on the complete record now before us, we find that Petitioner has shown that Jones discloses the further recitations in claims 5, 11, and 17.

For these reasons, in addition to the reasons explained above addressing independent claims 1, 7, and 13, based on the entire record, Petitioner has established by a preponderance of the evidence that dependent claims 5, 11, and 17 are unpatentable under 35 U.S.C. § 102 as anticipated by Jones.

5. *Dependent Claims 6, 12, and 18*

Claim 6 depends directly from claim 1 and further recites “wherein said convergence point comprises a point where a center theta-alpha ray from said viewpoint of said left eye and a center theta-alpha ray from said viewpoint of said right eye intersect.” Claims 12 and 18 depend directly

from independent claims 7 and 13, respectively, and recite the same further recitation.

Patent Owner does not address separately Petitioner's arguments or evidence regarding the further element of claims 6, 12, and 18. For reasons explained above addressing independent claims 1, 7, and 13, and further based on Petitioner's assertions for these dependent claims, which are supported by the cited evidence, Petitioner has established by a preponderance of the evidence that dependent claims 6, 12, and 18 are unpatentable under 35 U.S.C. § 102 as anticipated by Jones.

E. Unpatentability of Claims 1, 5–7, 11–13, 17, and 18 under 35 U.S.C. § 103(a) over Jones

Petitioner asserts an additional position that claims 1, 5–7, 11–13, 17, and 18 are unpatentable as obvious over Jones. Pet. 1. For its additional position of obviousness, Petitioner contends that “selecting an alternate viewing angle, said selecting an alternate viewing angle comprising” recited in claims 1, 7, and 13 would have been obvious over Jones's disclosure of rotating a dataset. Pet. 25 (citing Ex. 1003 ¶ 73). Petitioner also contends that the “computer system” comprises “an interconnection mechanism coupling the memory, the processor and the communications interface” recited in claim 13 would have been obvious over Jones's disclosure that the recited elements operate together. *Id.* at 34 (citing Ex. 1003 ¶ 100). Regarding the additional position, Dr. Zyda testifies that claims 1, 7, and 13 are obvious over the explicit disclosure of Jones combined with the common sense of a person having ordinary skill in the art. Ex. 1003 ¶ 51.

For the reasons given, we are persuaded that Petitioner establishes that Jones discloses all of the limitations recited in claims 1, 5–7, 11–13, 17, and 18. A disclosure that anticipates under 35 U.S.C. § 102 also renders the

claim unpatentable under 35 U.S.C. § 103(a), because anticipation is the epitome of obviousness. *See In re McDaniel*, 293 F.3d 1379, 1385 (Fed. Cir. 2002) (“It is well settled that ‘anticipation is the epitome of obviousness.’”) (quoting *Connell v. Sears, Roebuck & Co.*, 722 F.2d 1542, 1548 (Fed. Cir. 1983)).

Furthermore, we agree with Petitioner’s additional assertions regarding obviousness over Jones alone. We find those assertions provide additional support that the independent claims would have been obvious over Jones alone. Although Petitioner does not set forth separate obviousness contentions for claims 5, 6, 11, 12, 17, and 18, each of those claims depends directly from independent claim 1, 7, or 13, so the Petitioner’s obviousness contentions also provide additional support that claims 5, 6, 11, 12, 17, and 18 would have been obvious over Jones alone.

Accordingly, Petitioner has proved, by a preponderance of the evidence, that claims 1, 5–7, 11–13, 17, and 18 are unpatentable under 35 U.S.C. § 103(a) over Jones.

F. Unpatentability of Claims 2–5, 8–10, and 14–16 under 35 U.S.C. § 103(a) over Jones and Schoolman

Petitioner asserts that dependent claims 2–5, 8–10, and 14–16 are unpatentable as obvious over the combination of Jones and Schoolman. Pet. 1, 36–54. Patent Owner disputes this. PO Resp. 37–53; PO Sur-reply 12–15.

We begin with an overview of Schoolman. We then turn to Petitioner’s contentions.

1. Schoolman

Schoolman relates to methods and apparatus for three-dimensional imaging of anatomical structures and stereoscopically displaying image data

derived thereby. Ex. 1005, 1:32–36. Figure 4, reproduced below, illustrates stereoscopic three-dimensional imaging system 6. *Id.* at 9:33–34.

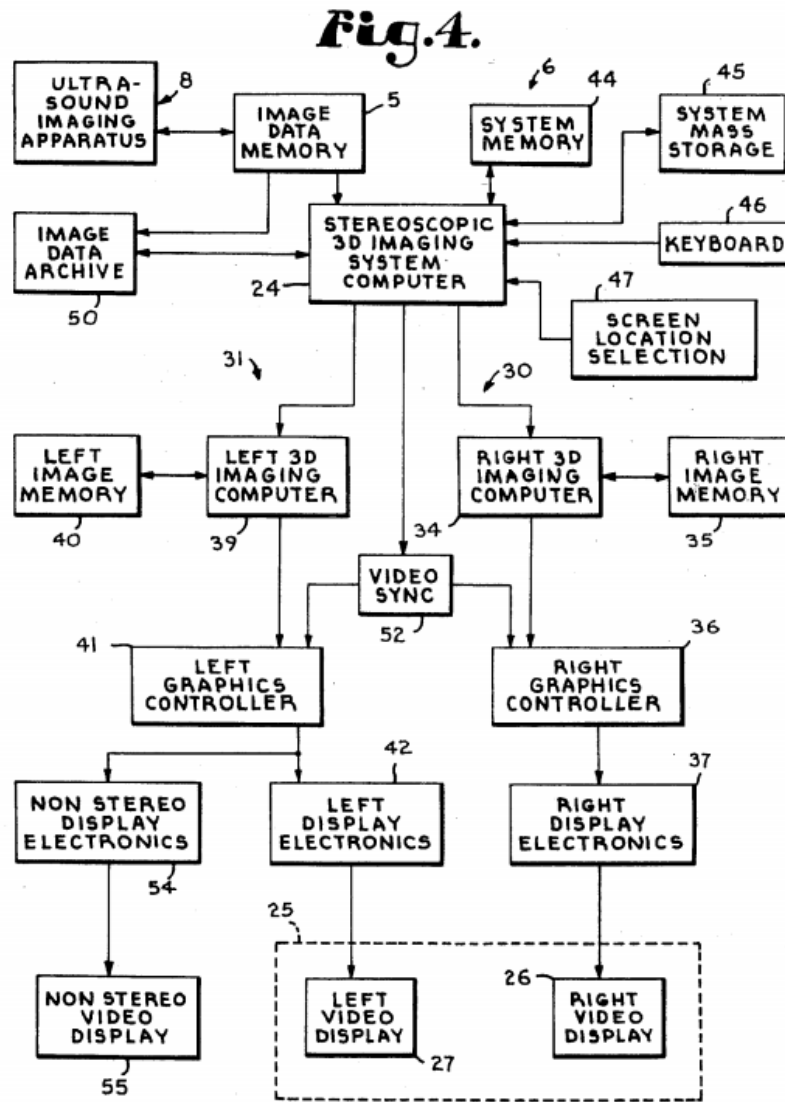


Figure 4, above, illustrates functional blocks of stereoscopic three-dimensional imaging system 6 including computer 24 interfaced between ultrasound imaging apparatus 8 and stereoscopic viewing unit 25. *Id.* at 9:33–41.

Stereoscopic three-dimensional imaging system 6 receives image data from ultrasound imaging apparatus 8, reconstructs the image data into a three-dimensional model, generates right and left stereoscopic three-

dimensional components of the model, and displays the stereoscopic components on right and left video display devices 30 and 31 of viewing unit 25 for viewing. *Id.* at 9:41–48. Computer 24 includes CPU 43, system memory 44, and system mass storage devices 45, among other things. Mass storage devices 45 store operating system and application programs for computer 24, routines for manipulating the images displayed on viewing unit 25 and for communicating with imaging apparatus 8, and software for operating three-dimensional display processors 34 and 39. *Id.* at 9:56–65.

Figure 9 of Schoolman, reproduced below, illustrates stereoscopic viewing unit 116. *Id.* at 12:39–40.

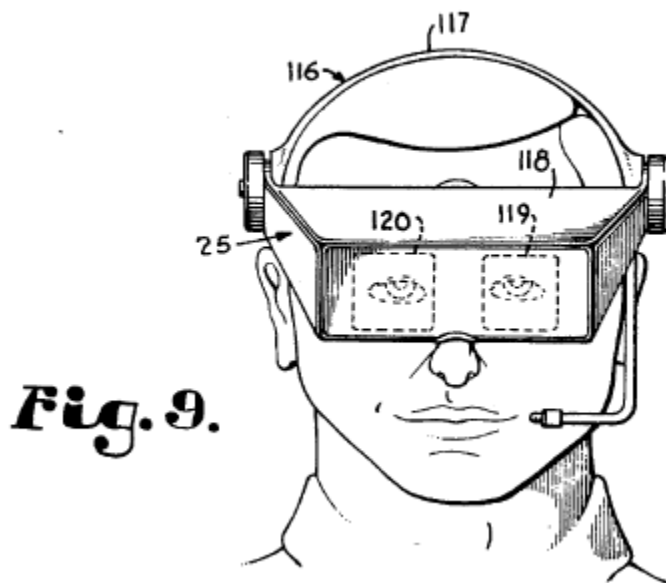


Figure 9, above, illustrates stereoscopic viewing unit 116 including harness 117 connected to visor 118 having left and right video display devices 119 and 120 positioned therein. *Id.* at 12:39–43.

Harness 117 is adjustable and worn on the head of a medical practitioner for viewing the generated images. *Id.* at 12:43–46. Visor 118 has left and right video liquid crystal displays (LCDs) 119 and 120. *Id.* at 12:39–

43, 12:51–53. LCDs 119 and 120 are mounted directly in line of sight of the eyes of the viewer. *Id.* at 12:57–59.

2. *Dependent Claims 2–5, 8–10, and 14–16*

Dependent claims 2–4, 8–10, and 14–16 are directed to techniques for manipulating the image display including a feature of selecting items of an image to be subtracted and displaying the filtered image recited in claims 2, 8, and 14; applying colors to groups of voxels recited in claims 3, 9, and 15; and zooming in on a portion of the image recited in claims 4, 10, and 16. Petitioner relies on Schoolman for teaching the techniques for manipulating the image display claimed. *See, e.g.*, Pet. 39–50, 52–54 (citing, *e.g.*, Ex. 1005, 1:60–2:4, 4:53–59, 6:27–57, 11:15–19, 11:22–27).

Dependent claim 5 recites that the display unit is selected from a group consisting of various display units. Petitioner addresses the further recitations of claim 5 and the reasoning to combine separately for that claim. We discuss Petitioner’s contentions, which are not disputed by Patent Owner, below.

We start with Petitioner’s reasoning to combine for claims 2–4, 8–10, and 14–16.¹⁴ We then turn to the element-by-element analysis for each of claims 2–4, 8–10, and 14–16. Then we turn to claim 5.

a) *Reasoning to Combine— Claims 2–4, 8–10, and 14–16*

Petitioner provides contentions regarding reasoning to combine the teachings of Jones and Schoolman in the manner claimed. Pet. 39–42. For

¹⁴ Petitioner addresses reasoning to combine for dependent claim 5 separately. Pet. 50–51. Patent Owner does not dispute Petitioner’s contentions regarding reasoning to combine for dependent claim 5, which we discuss further below. *See generally* PO Resp.

instance, Petitioner contends that Jones describes viewing an “entire structure,” such that features of the head are “viewable simultaneously.” *Id.* at 40 (citing Ex. 1013 ¶ 31). Petitioner contends “while this simultaneous view provides benefits such as a recognition of the ‘spatial relationship of each feature with respect to every other feature,’” Jones recognizes “downsides” including that the features may be partially obscured. Petitioner contends the following:

To this end, Jones suggests various ways of making the desired parts “more clearly visible” to the user, for instance by adjusting “*the degree of transparency*, local blurring, or *some other method for controlling each region's importance*.” *Id.*, [0006], [0011], [0012]. Thus, Jones expressly contemplates making certain areas of the 3D volume more visible while making other areas less visible in order to provide a more clear view to the user. *Id.*; MS-1003, ¶117.

Pet. 40.

Petitioner also contends the following:

A POSITA in possession of both Jones and Schoolman would have recognized that Schoolman’s filtering techniques (including complete removal of certain parts from user’s view) for improved clarity are common 3D image manipulation techniques that would provide similar benefits for Jones in terms of “making [the desired parts] clearly visible to the user.”

Id. at 41 (citing Ex. 1013 ¶ 11; Ex. 1003 ¶ 119) (alteration in original).

Petitioner also asserts “[i]ndeed, by completely filtering out and/or removing parts of less interest in Jones based on the teachings of Schoolman, a similar but even more pronounced highlighting effect would be achieved compared to what Jones already teaches regarding changing the translucence/transparency.” *Id.* at 41–43 (citing Ex. 1013 ¶¶ 6, 12; Ex. 1003 ¶ 119); *see also id.* at 41 (citing Ex. 1005, 6:27–57, 11:22–27) (describing removal of parts of images).

Petitioner provides further reasoning to combine with respect to claims 4, 10, and 16. For instance, Petitioner contends a person having ordinary skill in the art “would have found it obvious to implement a common image manipulation feature, as in Schoolman, where regions of interest can be magnified.” *Id.* at 47–48. Petitioner asserts a person having ordinary skill in the art would have been motivated to make such a modification to, for instance, provide clearer views of the enhanced volumes of interest to the user.” *Id.* at 48 (citing Ex. 1003 ¶¶ 134–135).

Patent Owner disputes certain of Petitioner’s reasoning to combine. PO Resp. 43–30. In particular, Patent Owner asserts that in Schoolman each image channel includes a display processor to display structures represented by an ultrasound image data by deriving polygon lists from ultrasound image data and forwarding the polygon lists to the right and left image channels. *Id.* at 39, 43–44 (citing Ex. 1005, 5:27–48). Patent Owner asserts that Jones’s volume rendering is different from “rendering of surface characteristics as is found in Schoolman’s use of polygons.” *Id.* at 45. Patent Owner further asserts that Petitioner’s reasoning to combine does not account for “the fact that [Schoolman’s] image manipulation techniques are prescribed in a regime in which polygons are used to construct the very views being manipulated.” *Id.* (citing Ex. 1005, 5:56–6:3, 10:35–54).

In its Reply, Petitioner responds that Patent Owner’s view characterizes Schoolman too narrowly. Pet. Reply 13. Petitioner asserts, “as Dr. Zyda explains based on a more complete reading of Schoolman, ‘a POSITA would have clearly recognized and/or found it to be obvious that Schoolman contemplates voxel-based displaying of 3D data.’” *Id.* (citing Ex. 1035 ¶ 16). Petitioner asserts that “the use of a polygon generator in Schoolman is, at most, optional.” *Id.*

Petitioner also responds that the noted improvement “is applicable to both Jones and Schoolman.” *Id.* Petitioner contends that Patent Owner “relies on mischaracterizing the prior art combinations and Dr. Zyda’s testimony, and ignores the ‘inferences and creative steps’ that a POSITA would have taken when modifying Jones to achieve the benefits taught [by] Schoolman.” *Id.* at 15 (citing Ex. 1003 ¶¶ 116–120; *KSR*, 550 U.S. at 418; Ex. 1035 ¶ 19).

In its Sur-reply, Patent Owner states that it “maintains its position that a person of ordinary skill in the art would not make the Jones-Schoolman combination proposed in the petition, at least for the reasons set forth in Patent Owner’s Response.” PO Sur-reply 13. Patent Owner does not provide further arguments in support of its position. *Id.*

We need not decide whether Petitioner’s contentions in its Reply regarding Schoolman’s disclosure of voxel-based displaying are timely for all dependent claims 2–4, 8–10, and 14–16, because we agree with Petitioner’s other contentions, assuming that Patent Owner is correct that Schoolman operates differently than Jones. For instance, we agree with Petitioner’s contentions that the skilled artisan would have recognized that the improved clarity from using Schoolman’s teachings relating to common techniques would have provided similar benefits when used in Jones’s system. Pet. 41 (citing Ex. 1013 ¶ 11; Ex. 1003 ¶ 119). The improvement is in the observer’s perceived clarity of the display, which applies to both systems. We also are persuaded by Petitioner’s contentions that the techniques recited in dependent claims 2–4, 8–10, and 14–16 are common (*id.*), which Patent Owner does not dispute.

As an additional reason for our determination, Petitioner’s contentions in its Reply are timely for claims 3, 9, and 15. In particular for those claims,

Petitioner relies on Schoolman’s disclosure in its “Background of the Invention” of a reconstruction procedure that produces “an array of numbers (known as picture elements or pixels in 2D and volume element or voxels in 3D)” as well as Schoolman’s disclosure of “information associated with each voxel” in magnetic resonance imaging MRI. Ex. 1005, 1:66–2:4, 2:14–18 (cited in Pet. 45–47). Also, we find Petitioner’s Reply contentions persuasive, and we credit Dr. Zyda’s testimony in his Reply Declaration for claims 3, 9, and 15, as Petitioner’s contentions and Dr. Zyda’s testimony are consistent with the cited prior art. Pet. Reply 13–14; Ex. 1035 ¶¶ 16–17.

Patent Owner also contends that Jones already teaches use of increased resolution to provide detail regarding certain parts of an image. PO Resp. 46 (citing Ex. 1013 ¶ 34). Petitioner, however, relies on Schoolman for providing further teachings regarding techniques for manipulating the image display to improve clarity. *See, e.g.*, Pet. 39–50, 52–54 (citing, *e.g.*, Ex. 1005, 1:60–2:4, 4:53–59, 6:27–57, 11:15–19, 11:22–27). We find that Schoolman’s teachings are not merely duplicative of Jones’s teachings and that Schoolman provides further evidence supporting Petitioner’s contentions that dependent claims 2–4, 8–10, and 14–16 would have been obvious.

For all dependent claims 2–4, 8–10, and 14–16, we are persuaded by Petitioner’s contentions that a person having ordinary skill in the art would have made the proposed combinations to provide a clearer view to the user. Pet. 40–50; Ex. 1003 ¶¶ 117–141. We agree with Petitioner that Jones suggests “making the desired parts ‘more clearly visible’ to the user,” for example by “controlling each region’s importance.” Pet. 40 (citing Ex. 1013 ¶¶ 6, 11, 12).

We also are persuaded by Petitioner’s further reasoning to combine for claims 4, 10, and 16, and we credit Dr. Zyda’s supporting testimony, that a person having ordinary skill in the art would have been motivated to modify Jones to implement Schoolman’s magnification feature, as such feature was common and would have provided clearer views of the enhanced volumes of interest to the user. Pet. 48; Ex. 1003 ¶¶ 134–135. Patent Owner does not dispute Petitioner’s reasoning to combine for claims 4, 10, and 16. Pet. 50–53.¹⁵

Based on the complete record now before us, we are persuaded that Petitioner has articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Jones and Schoolman in the manner recited in claims 2–4, 8–10, and 14–16.

b) Dependent Claims 2, 8, and 14

Petitioner asserts that claims 2, 8, and 14 are unpatentable as obvious over the combination of Jones and Schoolman. Pet. 43–44. With respect to the limitations of claims 2, 8, and 14, Patent Owner disputes that the combination teaches “subtracted.” See PO Resp. 46–47. We start with the parties’ contentions pertaining to claim 2.

Claim 2 is reproduced below.

[2a] The method of claim 1 further comprising selecting items of said image to be filtered, said selecting items of said image to be filtered comprising:

[2b] selecting items of said image to be subtracted from said image to produce a filtered image;

¹⁵ As noted above, Petitioner addresses reasoning to combine for dependent claim 5 separately. Pet. 50–51. Patent Owner does not dispute Petitioner’s contentions regarding reasoning to combine for dependent claim 5, which we discuss further below. See *generally* PO Resp.

- [2c] displaying, in said DU, a filtered image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest; and
- [2d] displaying, in said DU, a filtered image for said right eye based on said initial viewing angle, said view point for said right eye, and said volume of interest and wherein said filtered image for said left eye and said filtered image for said right eye produce a filtered three-dimensional image to said user.

Ex. 1001, 17:57–18:3.

With respect to the “selecting” recited in elements 2a and 2b, Petitioner points to (Pet. 43) Jones’s disclosure that a “user may select the enhanced region by using a pointer, such as a mouse.” Ex. 1013 ¶ 38. Petitioner points to (Pet. 43) Jones’s disclosure of displaying data “in the enhanced region” to make “it clearly visible to the user.” Ex. 1013 ¶ 11. Petitioner asserts Jones teaches selecting the “enhanced region (and by extension areas that are not enhanced regions).” Pet. 43. With respect to filtering, Petitioner points to (*id.*) Jones’s teachings of changing “the degree of transparency.” Ex. 1013 ¶ 12.

Petitioner contends “to the extent Jones by itself” does not disclose element 2a, “by completely filtering out and/or removing parts of less interest in Jones based on the teachings of Schoolman, a similar but even more pronounced highlighting effect can be achieved.” Pet. 43 (citing, *e.g.*, Ex. 1003 ¶ 122). For element 2b, Petitioner asserts the combination of Jones and Schoolman “renders obvious complete removal (subtracted) of selected items of the image.” *Id.* at 44. For both elements 2a and 2b, Petitioner refers back to its contentions for reasoning to combine. Pet. 43–44. For elements 2c and 2d, Petitioner refers back to its contentions for claim 1. *Id.* at 44.

With respect to the limitations of claim 2, Patent Owner contends “even if a person of ordinary skill in the art did consider the combination of Jones and Schoolman, that combination does not teach or suggest ‘subtraction’ as claimed.” PO Resp. 46. Patent Owner contends “at best the combination of Jones and Schoolman may suggest to a person of ordinary skill in the art” adjusting “to inhibit display of a data item or perhaps elimination of data points on one side of a selected clip plane.” *Id.* Patent Owner contends that in Schoolman, “display processors . . . perform ‘removal’ of parts of images.” *Id.* at 47. Patent Owner contends that because “data processors operate” on supplied data, the data processors “do not eliminate anything from any underlying dataset.” *Id.*

Patent Owner further contends “[i]n contrast, the ‘subtraction’ recited in the challenged claims means ‘elimination from the volume of interest.’” *Id.* Patent Owner contends Schoolman’s display processors do not eliminate from “the underlying data model.” *Id.*

Patent Owner’s contentions are premised on Patent Owner’s proposed claim construction, which we decline to adopt. *See* § II.C.4. We have reviewed Petitioner’s contentions and cited supporting evidence addressing how the combination of Jones and Schoolman teaches claim 2 using the correct claim construction. *See, e.g.,* Pet. 43–44 (citing, *e.g.,* Ex. 1003 ¶¶ 121–125). As explained above (*see* Section II.C.4), we determine that the term “subtracted” is not limited to requiring an “actual elimination of data (voxels) from the underlying three-dimensional model from which the images are created” (PO Resp. 21), as proposed by Patent Owner. We determined, instead, the term “should be viewed ‘more expansively’” so as to encompass the ’183 patent’s embodiments of “filtering,” “ignoring,” and “eliminat[ing] [tissue] from the observed volume” (Pet. Reply 3–4), as

proposed by Petitioner. As also explained above (*see* Section II.C.4), our analysis, findings, and conclusions in the instant proceeding do not change even if we adopt the precise definition set forth in the IPR2021-00647 Final Decision, i.e., that “subtracted” means “withdrawn or taken away, as a part from a whole.”

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda over Patent Owner’s contentions and evidence because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Jones and Schoolman. For instance, Schoolman describes that “[t]he principal objects of the present invention” include providing “an improved medical imaging system” and providing “such a system with image manipulating capabilities such as rotations about selected axes, removal of selected parts of images, and the like.” Ex. 1005, 6:27–57. Consistent with Petitioner’s contentions and Dr. Zyda’s testimony, we find that Schoolman’s disclosure of image manipulating capabilities is further evidence in addition to Jones of the “selecting” recited in elements 2a and 2b. Also, Schoolman’s “removal of selected parts of images” teaches that the “selecting” is of “items of said image to be subtracted from said image to produce a filtered image” recited in element 2b. That the subtraction is from “said image” is consistent with our construction that encompasses the ’183 patent Specification’s embodiment of eliminating “from the observed volume.” *See* § II.C.4. Also, like Jones, Schoolman’s system is envisioned for medical imaging (Ex. 1005, 6:27–57), which is further evidence supporting Petitioner’s reasoning to combine.

Schoolman also describes “conventional monoscopic 3D display processors” that are “usually provided with software routines to allow

manipulation of the images, such as rotation of the displayed image, removal of portions of the displayed anatomical structures to reveal other details, removal of superfluous details or portions, magnification of a selected portion of the structures, and the like.” *Id.* at 11:20–27. Consistent with Petitioner’s contentions and Dr. Zyda’s testimony, we find Schoolman’s disclosure (*id.*) to be further evidence that Schoolman’s “selecting” is of “items of said image to be subtracted from said image to produce a filtered image.”

Claims 8 and 14 are similar to claim 2. Petitioner’s analysis of these claims for this challenge relies on Petitioner’s analysis of claim 2. Pet. 52–53. Patent Owner does not argue claims 8 and 14 separately from claim 2. *See generally* PO Resp.

Upon consideration, we agree with Petitioner’s assertions for dependent claims 2, 8, and 14 and obviousness over Jones and Schoolman, except to the extent noted above in Section II.F.2.a with respect to whether certain Reply arguments are timely. We find Petitioner’s showing is not undermined by Patent Owner’s contentions.

Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claims 2, 8, and 14 are unpatentable under 35 U.S.C. § 103(a) over the combination of Jones and Schoolman.

c) Dependent Claims 3, 9, and 15

Petitioner asserts that claims 3, 9, and 15 are unpatentable as obvious over the combination of Jones and Schoolman. Pet. 44–47. Patent Owner disputes Petitioner’s showing that the asserted art teaches the limitations of claims 3, 9, and 15. *See* PO Resp. 48–50. We start with the parties’ contentions pertaining to claim 3.

Claim 3 is reproduced below.

[3a] The method of claim 1 further comprising selecting items of said image to be colored, said selecting items of said image to be colored comprising:

[3b] sorting voxels of said items by a property of said voxel;

[3c] applying colors to groups of sorted voxels to obtain a colored image;

[3d] displaying, in said DU, a colored image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest; and

[3e] displaying, in said DU, a colored image for said right eye based on said initial viewing angle, said view point for said right eye, and said volume of interest and wherein said colored image for said left eye and said colored image for said right eye produce a colored three-dimensional image to said user.

Ex. 1001, 18:4–19.

Petitioner points to Jones for “selecting items of said image to be colored” recited in element 3a. Pet. 44–45 (citing Ex. 1013 ¶¶ 32, 38; Ex. 1003 ¶ 126). In particular, Petitioner points to Jones’s disclosure that “if the user so selects . . . false colour may be applied to structures highlighted within the enhancement region.” Ex. 1013 ¶ 32. Petitioner also points to (Pet. 45) Jones’s disclosure that “the user may select the enhanced data region by using a pointer, such as a mouse.” Ex. 1013 ¶ 38.

Patent Owner disputes Petitioner’s contentions for “selecting” on the bases that Petitioner relies on Schoolman for that feature and Schoolman uses polygon lists in its process. PO Resp. 48–49. Petitioner, however, relies on exclusively Jones’s teachings for element 3a. Pet. 44–45 (citing Ex. 1013 ¶¶ 32, 38; Ex. 1003 ¶ 126).

We find Petitioner’s contentions for element 3a persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr.

Zyda's testimony are consistent with and supported by the cited portions of Jones, including the express disclosure in Jones of applying color to structures if the user so selects. Ex. 1013 ¶ 32. With respect to Patent Owner's contentions regarding Schoolman's polygon lists, in addition to not relying on Schoolman, Petitioner points to (Pet. 45) Jones's disclosure that "[a] typical volumetric data set is made up of a plurality of voxels." Ex. 1013 ¶ 3.

For element 3b, Petitioner points to the same disclosure in Jones of applying color to selected structures. Pet. 45 (citing Ex. 1013 ¶ 32). As discussed with respect to element 3a, Petitioner also points to (*id.*) Jones's disclosure that "[a] typical volumetric data set is made up of a plurality of voxels." Ex. 1013 ¶ 3. With respect to "sorting voxels of said items by a property of said voxel" recited in element 3b, relying on the testimony of Dr. Zyda, Petitioner contends "Schoolman discloses ***sorting***, or classifying, the ***voxels according to their properties*** in order to assign them the proper color." Pet. 46 (citing Ex. 1005, 1:60–2:4, 2:12–18, 4:53–59, 11:15–19, 13:19–31 (claim 1), 13:67–14:9 (claim 4); Ex. 1003 ¶¶ 128–129).

Patent Owner contends in claim 3, "sorting[] and coloring are performed after an image is displayed" and "[i]n Schoolman, by the time the image is displayed, the polygon list information has been generated and loaded into the display processors." PO Resp. 49. Patent Owner contends Schoolman's "display processors apply coloring on the basis of this polygon list information," so "no voxels" are sorted by property. *Id.* (citing Ex. 1005, 5:37–39; 5:60–63, 11:11–18, 11:48–55).

In its Reply, Petitioner refers to its Reply contentions discussed above with respect to Petitioner's reasoning to combine. Pet. Reply 17. Contrary to Patent Owner's contentions, as we discuss above, for claims 3, 9, and 15,

Petitioner relies on Schoolman's disclosures of voxels. Pet. 46 (citing Ex. 1005, 1:60–2:4, 2:12–18). For instance, Schoolman discloses “[t]he output of the reconstruction procedure is an array of numbers (known as picture elements or pixels in 2D and *volume element or voxels in 3D*) representing the radiological density (x-ray attenuation) at points within the slice.” Ex. 1005, 1:60–2:4 (emphasis added). Schoolman also discloses “[i]n MRI, the information associated with each *voxel* is a composite of proton density (essentially, the amount of water present) and so called T1 and T2 relaxation times, which are functions of physical and chemical structure.” *Id.* at 2:12–18.

In its Sur-reply, Patent Owner maintains its position that Schoolman's teachings apply to only polygon list information because “by the time an image is displayed, the polygon list information has been generated and the display processors apply coloring on the basis of this polygon list information.” PO Sur-reply 14 (citing Ex. 1005, 5:37–39; 5:60–63, 11:11–18, 11:48–55). Patent Owner also argues the Petitioner's Reply raises new arguments relating to claim 4 and that claim 4 “says nothing about applying colors to groups of voxels.” *Id.* (citing Ex. 1005, 14:1–9).

Petitioner has the better argument. We do not agree with Patent Owner that Schoolman's disclosures are limited to relating to only polygon list information. Patent Owner does not address (*see generally* PO Resp.; PO Sur-reply) Schoolman's disclosures of voxels and properties of voxels relied on in the Petition. Pet. 46 (citing Ex. 1005, 1:60–2:4, 2:12–18, 4:53–59, 11:15–19, 13:19–31 (claim 1), 13:67–14:9 (claim 4)). A prior art reference must be considered for everything it teaches by way of technology and is not limited to the particular example it is describing. *EWP Corp. v. Reliance Universal Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985). Furthermore, in an

obviousness analysis, we must consider the combination of references, as a whole, in light of the general knowledge of an ordinarily skilled artisan. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986).

Also, Patent Owner's argument that Petitioner raised new arguments in its Reply (PO Sur-reply 14) is conclusory and does not address that Petitioner discussed claim 4 of Schoolman in the Petition. Pet. 46. Petitioner's Reply arguments and Dr. Zyda's Reply Declaration do no more than fairly and directly respond to Patent Owner's Response. *See* 37 C.F.R. § 42.23(b); *see also Belden Inc. v. Berk-Tek LLC*, 805 F.3d 1064, 1078–80 (Fed. Cir. 2015) (holding that the Board may rely on new evidence submitted with a reply because the evidence was legitimately responsive to patent owner's arguments and not needed for a *prima facie* case of obviousness). Petitioner does not raise improper new arguments in its Reply.

We have reviewed Petitioner's contentions and cited supporting evidence addressing how the combination of Jones and Schoolman teaches element 3b. Pet. 45–47 (citing Ex. 1013 ¶¶ 3, 32; Ex. 1005, 1:60–2:4, 2:12–18, 4:53–59, 11:15–19, 13:19–31 (claim 1), 13:67–14:9 (claim 4); Ex. 1003 ¶¶ 128–129). In addition to Schoolman's disclosures of voxels discussed above (Pet. 46 (citing Ex. 1005, 1:60–2:4, 2:12–18)), we have considered Petitioner's other evidence including the testimony of Dr. Zyda. For instance, Dr. Zyda testifies that the aforementioned disclosures in Schoolman describe “that each voxel in a 3D volume obtained through a medical imaging technique, such as ultrasound, CT, MRI, etc., has a property that corresponds to the measured data.” Ex. 1003 ¶ 128 (citing Ex. 1005, 1:60–2:4, 2:12–18). Dr. Zyda testifies that the “information that is associated with each voxel in Schoolman's 3D volume corresponds to the type of anatomical structure in the particular location of the scanned

anatomy. *Id.* (citing Ex. 1005, 4:53–59). Dr. Zyda further testifies that a person having ordinary skill in the art “would have recognized that the coloring process in Jones ‘to aid interpretation of the volumetric data’” would have been implemented “by assigning specific colors to the voxels according to their properties.” *Id.*

Dr. Zyda’s testimony identifies other disclosures in Schoolman that describe correlating color to parameters of anatomical structures and assigning color based on value ranges or known colors of organs or anatomical structures. *Id.* ¶ 129 (citing Ex. 1005, 11:15–19, 13:67–14:9 (claim 4)). Dr. Zyda testifies that in Schoolman, the “voxel information, is used for sorting, or classifying, the voxels according to their properties in order to assign them the proper color.” *Id.*

Patent Owner relies on attorney argument and does not provide the testimony of a declarant regarding the understanding of a person of ordinary skill in the art of Schoolman’s disclosures and whether they teach element 3b. *See generally* PO Resp. Patent Owner’s arguments are not supported by objective evidence. Argument of counsel cannot take the place of evidence lacking in the record. *Meitzner v. Mindick*, 549 F.2d 775, 782 (CCPA 1977). Upon consideration, we find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda over Patent Owner’s contentions because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Jones and Schoolman, including the portions of Jones and Schoolman reproduced above.

Claims 9 and 15 are similar to claim 3. Petitioner’s analysis of these claims for this challenge relies on Petitioner’s analysis of claim 3. Pet. 52–54. Patent Owner does not argue claims 9 and 15 separately from claim 3.

Upon consideration, we agree with Petitioner's assertions for dependent claims 3, 9, and 15 and obviousness over Jones and Schoolman. We find Petitioner's showing is not undermined by Patent Owner's contentions.

Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claims 3, 9 and 15 are unpatentable under 35 U.S.C. § 103(a) over the combination of Jones and Schoolman.

d) Dependent Claims 4, 10, and 16

Petitioner asserts that claims 4, 10, and 16 are unpatentable as obvious over the combination of Jones and Schoolman. Pet. 47–50. With respect to the limitations of claims 4, 10, and 16, Patent Owner disputes that Schoolman's magnification teaches "zooming in on a portion" of an image recited in dependent claims 4, 10, and 16. PO Resp. 50–53. We start with the parties' contentions pertaining to claim 4.

Claim 4 is reproduced below.

[4a] The method of claim 1 further comprising zooming in on a portion of said image, said zooming in on a portion of said image comprising:

[4b] selecting a new viewpoint for a left eye;

[4c] selecting a new viewpoint for a right eye;

[4d] displaying, in said DU, an image for said left eye based on said initial viewing angle, said new view point for said left eye and said volume of interest; and

[4e] displaying, in said DU, an image for said right eye based on said initial viewing angle, said new view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce a three-dimensional image to said user.

Ex. 1001, 18:20–32.

Petitioner contends that Schoolman teaches magnifying regions of interest. Pet. 47–50 (Ex. 1005, 3:10–18, 5:60–62, 11:20–27). Petitioner provides Dr. Zyda’s testimony that a person having ordinary skill in the art would have recognized that zooming in on a portion results in selecting new viewpoints. *Id.* at 48–50 (Ex. 1003 ¶¶ 136–138). Petitioner refers back to its contentions for claim 1 for elements 4c, 4d, and 4e. *Id.* at 50.

Dr. Zyda testifies a person having ordinary skill in the art “would have recognized that zooming in on a portion of the image in the Jones-Schoolman stereoscopic viewing system results in selecting new viewpoints at a closer distance.” Ex. 1003 ¶ 136. Dr. Zyda’s testimony includes evidence of the understanding of a person having ordinary skill in the art in support of his testimony. *Id.* (citing Ex. 1006 ¶ 186; Ex. 1009, 6:10–14, Fig. 12). Dr. Zyda further testifies as follows:

Additionally, a POSITA would have further recognized that freely moving the 3D image as in Schoolman (as well as in Jones) includes moving toward or away from a volume of interest, in other words decreasing or increasing, respectively, the distance between the 3D volume and the user’s viewpoint. As illustrated below in Fukui, a POSITA would have understood that decreasing the distance between the 3D volume and the user’s viewpoint corresponds to a selection of new viewpoints for each of the user’s eyes in which the image is enlarged as viewed by the user.

Ex. 1003 ¶ 137 (citing Ex. 1009, 4:56–5:29, Figs. 6A, 6C).

As discussed above with respect to reasoning to combine, Petitioner contends a person having ordinary skill in the art “would have found it obvious to implement a common image manipulation feature, as in Schoolman, where regions of interest can be magnified.” Pet. 47–48. Petitioner asserts a person having ordinary skill in the art would have been motivated to make such a modification to, for instance, provide clearer

views of the enhanced volumes of interest to the user.” *Id.* at 48 (citing Ex. 1003 ¶¶ 134–135). Petitioner asserts its reasoning to combine is consistent with Jones’s teachings of making three-dimensional data “more clearly visible” to the user and allowing highlighting of “volumes of interest.” Pet. 47 (quoting Ex. 1013 ¶¶ 6, 11, 12). Patent Owner does not make arguments regarding Petitioner’s reasoning to combine for claims 4, 10, and 16. PO Resp. 50–53.

Patent Owner disputes that Schoolman’s magnification teaches “zooming in on a portion” of an image recited in dependent claims 4, 10, and 16. PO Resp. 50–53. Patent Owner contends that Schoolman’s “[m]agnification is not the zooming recited in the claims.” *Id.* at 51. Patent Owner contends that ’183 patent “provides that magnification, of the kind where pixels are replicated in orthogonal dimensions is different than the zooming through the altering of viewpoints being claimed.” *Id.* at 52 (citing Ex. 1001, 12:9–27). Patent Owner contends “[w]ith magnification, ‘pixels are replicated in both the x and y directions’” such that “[n]ew information content is not available to the user.” *Id.* (citing Ex. 1001, 12:11–16). Patent Owner further contends “Schoolman makes clear that [magnification] is an operation performed on an image.” *Id.* at 51 (citing Ex. 1005, 11:20–27).

Petitioner responds that Schoolman is directed to zooming that gives greater information. Pet. Reply 19 (citing Ex. 1003 ¶ 134; Ex. 1035 ¶ 26; Ex. 1005, 3:31–34). Petitioner also contends “Patent Owner further ignores and fails to rebut Dr. Zyda’s explanation” that Schoolman teaches “moving toward (or away from) a volume of interest, namely decreasing (or increasing) the distance between the 3D volume and the user’s viewpoint.” *Id.* (citing Ex. 1003 ¶¶ 135–138; Ex. 1035 ¶ 27).

Upon consideration of the contentions and evidence of both parties, we find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda over Patent Owner’s contentions and evidence because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Jones and Schoolman. Patent Owner’s arguments are premised on Patent Owner’s contentions relating to claim construction, which we do not agree with and decline to adopt. *See* § II.C.6. As we discussed with respect to claim construction (*id.*), we disagree with Patent Owner that the ’183 patent Specification distinguishes between magnification and zooming. Also, we decline to read into the claim a requirement of “providing greater resolution surrounding the identified zone of interest.”

Consistent with Petitioner’s contentions and Dr. Zyda’s testimony, Schoolman describes “software routines” that allow “manipulation of the images, such as . . . magnification of a selection portion of the structures.” Ex. 1005, 11:20–27. Schoolman also describes performing routines “such as rotation [and] magnification.” *Id.* at 5:60–62.

Dr. Zyda’s testimony cites evidence documenting the knowledge of a person having ordinary skill in the art. The Federal Circuit has recognized that non-prior art evidence “can be relied on for their proper supporting roles, e.g., indicating the level of ordinary skill in the art . . . and how one with ordinary skill in the art would have understood a prior art disclosure.” *Yeda Research v. Mylan Pharm. Inc.*, 906 F.3d 1031, 1041 (Fed. Cir. 2018) (citing *Dominion Dealer Sols., LLC v. AutoAlert, Inc.*, IPR2014-00684, 2014 WL 5035359, at *5 (PTAB Oct. 6, 2014)). Indeed, “evidence of the background understanding of skilled artisans” is admissible in an *inter partes* review, and references “can legitimately serve to document the

knowledge that skilled artisans would bring to bear in reading the prior art identified as producing obviousness.” *Ariosa Diagnostics v. Verinata Health, Inc.*, 805 F.3d 1359, 1365 (Fed. Cir. 2015) (citing *Randall Mfg. v. Rea*, 733 F.3d, 1355, 1362–63 (Fed. Cir. 2013)). We credit Dr. Zyda’s testimony as it is consistent with the cited evidence documenting the knowledge of a person having ordinary skill in the art.

Claims 10 and 16 are similar to claim 4. Petitioner’s analysis of these claims for this challenge relies on Petitioner’s analysis of claim 4. Pet. 52–54. Patent Owner does not argue claims 10 and 16 separately from claim 4. *See generally* PO Resp.

Upon consideration, we agree with Petitioner’s assertions for dependent claims 4, 10 and 16 and obviousness over Jones and Schoolman. We find Petitioner’s showing is not undermined by Patent Owner’s contentions. Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claims 4, 10, and 16 are unpatentable under 35 U.S.C. § 103(a) over the combination of Jones and Schoolman.

e) Dependent Claim 5

Claim 5 depends directly from claim 1 and further recites “wherein said DU is selected from the group consisting of a display unit incorporating polarized lenses, a display unit wherein multiplexed images are viewed via shuttered lenses, virtual reality displays having a display unit with unique left and right eye pixel displays, and other types of three-dimensional (3D) displays.” As discussed above (*see* §§ II.D.4, II.E), we determine Petitioner has shown that claim 5 is anticipated by and obvious over Jones alone.

Petitioner contends that Schoolman provides further descriptions of display units. Pet. 50–51. In particular, Petitioner points to (*id.*) Schoolman’s

disclosure of stereoscopic viewing unit 116 having “right and left video display devices 119 and 120,” which are “color dot matrix type liquid crystal displays (LCD’s).” Ex. 1005, 12:39–61.

For reasoning to combine, Petitioner points to (Pet. 50) Jones’s disclosure that “[e]xisting display technologies can be used to separate the left eye and right eye images.” Ex. 1013 ¶ 9. Petitioner asserts that a person having ordinary skill in the art “would have found it obvious to incorporate 3D display technologies existing at that time (e.g., Schoolman) that can provide separate left/right eye images to the user for stereoscopic imaging as in Jones. Pet. 50–51 (citing Ex. 1003 ¶ 143). Petitioner assertions that a person having ordinary skill in the art would have made the proposed combination because “incorporating a head-worn display unit as in Schoolman into Jones would allow the user to view 3D stereoscopic images in any environment in a more convenient manner without having to carry around a bulky free-standing display.” *Id.* at 51 (citing Ex. 1003 ¶ 143).

Patent Owner does not dispute Petitioner’s contentions regarding dependent claim 5 and obviousness over Jones and Schoolman, including that Patent Owner does not dispute Petitioner’s contentions reasoning to combine for dependent claim 5. *See generally* PO Resp. Upon consideration, we agree with Petitioner’s assertions for dependent claim 5 and obviousness over Jones and Schoolman.

Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claim 5 is unpatentable under 35 U.S.C. § 103(a) over the combination of Jones and Schoolman.

*G. Unpatentability of Claims 1–18 under 35 U.S.C. § 103(a) over
Murphy and Guang*

Petitioner asserts that claims 1–18 are unpatentable as obvious over the combination of Murphy and Guang. Patent Owner counters that “although the viewing angle is altered and the volume of interest reoriented, the left eye and right eye images that are displayed remain based on the initial view points” and “[s]uch a feature would not exist in a Murphy-Guang combination.” PO Resp. 56. Patent Owner disputes only Petitioner’s showing with respect to elements 1k and 1l recited in claim 1 and similar recitations in independent claims 7 and 13.

Patent Owner does not dispute Petitioner’s contentions for other elements recited in the independent claims, Petitioner’s reasoning to combine, or Petitioner’s contentions for the dependent claims. Petitioner supports its arguments with specific citations to Murphy and Guang and Dr. Zyda’s declaration. Pet. 54–92 (citing, *e.g.*, Ex. 1003 ¶¶ 48–50, 172–279). Based on our review of the entire record, including the arguments and evidence presented by both parties, we agree with Petitioner that the combination of Murphy and Guang teaches all recitations in the independent and dependent claims.¹⁶ We also agree with Petitioner’s arguments and

¹⁶ Patent Owner has presented argument and evidence, including the testimony of a declarant, for a related patent challenged in IPR2021-00647 having claims with recitations similar to the recitations of certain dependent claims of the ’183 patent. Tr. 55:8–12. Patent Owner, however, has not presented the same argument and evidence in the instant proceeding. Patent Owner has acknowledged that some arguments relate to only the challenged patent in IPR2021-00647. Tr. 51:22–52:7. Regardless of whether Patent Owner has provided an acknowledgement, any arguments not presented in the instant proceeding have been waived. Paper 11, 8 (“Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.”)

evidence articulating reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Murphy and Guang in the manner recited in the claims

We need not provide further analysis relating to the undisputed arguments and evidence, including the undisputed recitations in the independent claims and dependent claims. *LG Elecs.*, 759 F. App'x at 925 (“The Board is not required to address undisputed matters or arguments about limitations with which it was never presented.”) (internal quotation omitted). To provide more explanation, however, we provide highlights of our analysis of certain of Petitioner’s undisputed contentions and we address the parties’ dispute.

We begin with an overview of Murphy and Guang. We then turn to the parties’ contentions.

1. Murphy

Murphy describes “a stereoscopic display system” that displays “data representing human anatomy.” Ex. 1010 ¶ 15. Murphy’s system can “create complete, anatomically detailed, three-dimensional representations of the normal male and female human bodies” based on data obtained from medical imaging. *Id.* ¶ 33. A displayed user interface can allow rotation, translation, and alterations to the displayed virtual patient. *Id.* ¶ 41. For example, a user can select a part of a virtual patient to display by selecting any part or sub-part of the virtual patient. *Id.*

2. Guang

Guang describes a system and methods for improved visualization and stereographic display of three-dimensional data sets of tube-like anatomical structures. Ex. 1014 ¶ 2. Guang describes that the convergence point is

“where the two eyes’ viewing direction cross, thus setting the directions of the two eyes.” *Id.* ¶ 100. Guang describes that “the convergence point can be varied as necessary” and can be “dynamically set.” *Id.* ¶ 105.

3. *Independent Claim 1*

a) *Reasoning to Combine*

Petitioner contends that a person having ordinary skill in the art “would have been motivated to modify 3D stereoscopic viewing system of Murphy to include ‘dynamic adjustment of an eye convergence point for stereo display’ to allow the user to, for instance, view stereoscopic images ‘clearly and most comfortably’ as described in Guang.” Pet. 57 (citing Ex. 1014, code (57), ¶ 87; Ex. 1003 ¶ 172). Relying on the testimony of Dr. Zyda, Petitioner explains why and how a person having ordinary skill in the art would have made the proposed combination. *Id.* at 57–60 (citing, *e.g.*, Ex. 1003 ¶¶ 172–177).

Dr. Zyda testifies as follows:

Briefly regarding the concept of convergence point as mentioned in the ’183 patent, I note that Guang mentions that “when people are looking at a certain object, their two eyes are focusing on the object, which means the two eyes’ respective viewing directions cross at that point.” Ex. 1014, [0087]. Guang further says that “[t]his is the point at which people can see things clearly and most comfortably, and is known as the convergence point.” *Id.*

Ex. 1003 ¶ 173.

Dr. Zyda testifies that in Murphy a surgeon’s eyes “become focused on a particular convergence point” associated with a region they want to see clearly. *Id.* (citing Ex. 1010 ¶ 20). Dr. Zyda testifies “[w]hile Murphy does not explain how the 3D model being display should be modified in view of [an] altered gaze to increase its clarity to the user, Guang describes that ‘it is

desirable to dynamically adjust the convergence point of the stereo images to be at or near the object a user is currently inspecting.” Ex. 1003 ¶ 174 (quoting Ex. 1014 ¶ 108).¹⁷

Dr. Zyda also testifies that the combination of Murphy and Guang “is particularly obvious because Murphy already contemplates incorporating eye-tracking techniques,” but “Murphy does not expressly describe how such an eye tracking process would be implemented, instead leaving such implementation details to the knowledge of a POSITA.” Ex. 1003 ¶ 172 (citing Ex. 1010 ¶ 20). Dr. Zyda further testifies as follows:

In view of Murphy’s disclosure that eye-tracking can be used to detect where the user is looking in order to enhance that area of focus (by re-rendering the image to have a new convergence point), a POSITA would have found it obvious to incorporate Guang’s teachings into Murphy such that the system updates the rendering appropriately to shift the convergence point provided to the user for a clearer and more comfortable viewing experience. By ensuring that [a] convergence point of the rendered 3D image coincides with the area of interest (focus point) among the 3D volume that the user is looking at, the resulting Murphy-Guang system would allow the user to get a clearer view of the particular anatomy of interest.

Ex. 1003 ¶ 175.

Patent Owner does not dispute Petitioner’s arguments or evidence regarding Petitioner’s reasoning to combine the teachings of Murphy and Guang. *See generally* PO Resp; PO Sur-reply.¹⁸ Based on the complete

¹⁷ Dr. Zyda cites to paragraph 102 of Guang, but the quote appears instead in paragraph 108 of Guang. Ex. 1014 ¶¶ 102, 108. We treat this as harmless error.

¹⁸ Patent Owner characterizes Petitioner’s contentions including that Patent Owner asserts that the Petition proposes “bodily incorporation.” PO Sur-reply 17. Patent Owner’s characterization, for the first time in its Sur-reply, is conclusory. To the extent Patent Owner’s arguments are meant to

record now before us, we are persuaded that Petitioner has articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Murphy and Guang in the manner recited in claim 1.

b) The Preamble

The preamble of claim 1 is a “method of three-dimensional viewing of images by a user.” Ex. 1001, 17:23–24.¹⁹ Petitioner contends that Murphy teaches the preamble based on Murphy’s description of software that is designed for “generation of 3D stereo display of the data.” (Pet. 61 (quoting Ex. 1010 ¶ 32). Petitioner cites additional portions of Murphy and Dr. Zyda’s testimony as further supporting evidence. *Id.* (citing Ex. 1010 ¶¶ 20, 33, 62; Ex. 1003 ¶ 178).

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy, including the quoted portions reproduced above. Also, Murphy describes that “[s]oftware in the system can perform various functions including reading data from a Visible Human dataset, *generation of 3D stereo display of the data*, and segmentation algorithms to differentiate skin, bones, and several other major anatomical features.” Ex. 1010 ¶ 32 (emphasis added). Murphy also describes “[t]he system can use data from the Visible Human Project® to create complete, anatomically detailed, *three-dimensional*

implicitly dispute Petitioner’s reasoning to combine, we find Patent Owner’s arguments are not set forth with sufficient clarity and, nonetheless, do not undermine Petitioner’s showing.

¹⁹ We treat the preamble as limiting without deciding, because Petitioner shows that Murphy teaches the preamble.

presentations of the normal male and female bodies.” *Id.* ¶ 33 (emphasis added).

Patent Owner does not dispute Petitioner’s arguments or evidence regarding the preamble. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches the preamble of claim 1.

c) Element 1a: “selecting a volume of interest from a collection of image slices”

Petitioner contends that Murphy teaches element 1a based on Murphy’s description that a user can “select a part of a virtual patient to display by selecting a geometry of the virtual patient,” including “any part or sub-part of the virtual patient available in the medical image data.” Pet. 61 (quoting Ex. 1010 ¶ 41). Petitioner also points to step 401 in Figure 4 (*id.* at 61–62), which states “Receive Geometry Selection.” Ex. 1010, Fig. 4. Petitioner also points to Murphy’s user interface for selecting the volume of interest. Pet. 62–63 (citing Ex. 1010, Fig. 1). Petitioner further asserts that Murphy teaches that “the ‘virtual patient available in the medical image data’ . . . includes various ‘slices of images’ obtained from ‘CT or MRI’ that can subsequently be stacked to form 3D images.” *Id.* at 63 (citing Ex. 1010 ¶¶ 33, 46).

Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* at 61–63 (citing Ex. 1003 ¶¶ 179–181). Dr. Zyda testifies that “any part or sub-part of the virtual patient” described in Murphy corresponds to the “volume of interest” recited in element 1a. Ex. 1003 ¶ 179. Dr. Zyda testifies that Murphy’s “virtual patient available in the medical image data” corresponds to the “collection of image slices” recited in element 1a. *Id.* ¶ 181.

We find Petitioner's contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner's contentions and Dr. Zyda's testimony are consistent with and supported by the cited portions of Murphy. For instance, Murphy describes that "*a user can select a part of a virtual patient to display* by selecting a geometry of the virtual patient." Ex. 1010 ¶ 41 (emphasis added). Murphy describes that "[a] geometry of the virtual patient includes *any part or sub-part of the virtual patient* available in the medical image data." *Id.* (emphasis added). Also, step 401 in Figure 4 states "Receive Geometry Selection." *Id.* at Fig. 4. Murphy describes that "[d]ata from the Visible Human Project® can exemplarily include transverse CT, MR and cryosection images of male and female patients. The male was *sectioned* at one millimeter intervals, the female at one-third of a millimeter interval." *Id.* ¶ 33 (emphasis added).

Murphy further describes the following:

Volume rendering offers a better representation for displaying weak or fuzzy surfaces. This is a major approach in rendering medical images, where volume data is available from various imaging modalities, such as the X-ray based Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) scanners. These *scanners produce three-dimensional stacks of parallel plane images with distance between each slice being less than 1mm to about 8mm.*

Id. ¶ 46 (emphasis added).

Patent Owner does not dispute Petitioner's arguments or evidence regarding element 1a. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches element 1a of claim 1.

d) Element 1b: “arranging said slices corresponding to said volume of interest”

Petitioner contends that Murphy teaches element 1b based on Murphy’s description of receiving medical image data (step 402 in Figure 4) and performing volume rendering (step 409 in Figure 4). Pet. 63–64 (citing, *e.g.*, Ex. 1010 ¶¶ 41, 44, Fig. 4). Petitioner also points to Murphy’s description that volume rendering involves production of “three-dimensional stacks of parallel plane images.” *Id.* at 64 (citing Ex. 1010 ¶ 46). Petitioner points to Murphy’s further description of volume rendering and, relying on Dr. Zyda’s testimony, asserts “because the data is received in 2D/slice form, forming the corresponding RGBA [red, green, blue, and alpha (opacity)] volume *in 3D* includes arranging (or stacking) the 2D slices according to the selected volume of interest in order to subsequently reconstruct the data into a high-quality solid object.” *Id.* at 65–66 (citing Ex. 1010 ¶¶ 45–49; Ex. 1003 ¶ 184).

Petitioner also submits the testimony of Dr. Zyda that a person having ordinary skill in the art “would have understood that that presenting 2D slices in 3D volumetric form requires taking the 2D slices and subsequently stacking/arranging them in an order similar to that in which they were generated when originally created by the imaging device.” Ex. 1003 ¶ 184 (citing Ex. 1010 ¶ 46). Dr. Zyda testifies “[b]ecause the data is received in 2D/slice form, forming the corresponding RGBA volume in 3D would necessarily include arranging (or stacking) the 2D slices according to the selected volume of interest in order to reconstruct data into a solid 3D object.” Ex. 1003 ¶ 184 (citing Ex. 1010 ¶¶ 45–49).

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s

testimony are consistent with and supported by the cited portions of Murphy. For instance, Murphy describes that “[a]t block 402, the system can receive medical image data associated with the selected geometry, such as processed data.” Ex. 1010 ¶ 41. Murphy describes that the scanners “produce three-dimensional stacks of parallel plane images.” *Id.* ¶ 46.

Murphy also describes “at block 409, the system can perform volume rendering on the segmented image data,” which is described as “a technique for directly displaying a sampled 3D scalar field.” *Id.* ¶ 44. Murphy describes “[t]he term volume rendering is used to describe the technique for the visualization of a three-dimensional volumetric data.” *Id.* ¶ 45. Murphy describes “[e]xemplary volume rendering involves several steps: (a) the forming of an RGBA volume from the data, (b) reconstruction of a continuous function from this discrete data set, and projecting it onto the 2D viewing plane from the user-defined point of view.” *Id.* ¶ 45. Petitioner’s contentions and Dr. Zyda’s testimony (Ex. 1003 ¶ 184) are consistent with Murphy’s disclosures above include the disclosures of receiving medical image data (Ex. 1010 ¶ 41) that includes “three-dimensional stacks of parallel plane images” (*id.* ¶ 46) and performing “volume rendering on the *segmented* data” (*id.* ¶ 44 (emphasis added)) including “forming an RGBA volume from the data” (*id.* ¶ 45).

Patent Owner does not dispute Petitioner’s arguments or evidence regarding element 1b. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches element 1b of claim 1.

e) Element 1c: “selecting an initial viewing angle of said slices”

Petitioner contends that Murphy teaches element 1c based on Murphy’s description that a user “can select pre-defined views” and “can move and rotate the Virtual Patient in any direction or angle.” Pet. 66, 87

(quoting Ex. 1010 ¶ 57); *see also id.* (citing Ex. 1010 ¶ 55 (describing that “the user can control the system,” including for example that “the user can manipulate the scenario such as by selecting a pre-defined view of the image, moving the image, [and] rotating the image.”)). Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* (citing Ex. 1003 ¶ 185).

Dr. Zyda testifies “a predefined ‘view’ includes a pre-defined “‘viewing angle’ because the angle at which the stacked/rendered 3D object is viewed dictates what the viewer sees.” Ex. 1003 ¶ 185. Dr. Zyda also testifies “because the 3D volume in Murphy can be viewed at multiple angles by being rotated from some initial position, a POSITA would have understood that the predefined view that is selected and displayed in Murphy corresponds to selection of an initial viewing angle from which further rotations and other manipulations can then be performed.” *Id.*

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy. For instance, Murphy describes that “the user can control the system, at block 417, through an input device and the user interface,” including that the user “can manipulate the scenario such as by selecting a pre-defined view of the image, moving the image, rotating the image, [and] zooming in on the image.” Ex. 1010 ¶ 55. Murphy also describes “[i]nteraction with the Virtual Patient takes many forms.” *Id.* ¶ 57. Murphy describes “[i]t is contemplated that, the viewers can select pre-defined views [and] they can move and rotate the Virtual Patient in any direction or angle.” *Id.*

We find that Murphy’s predefined “view” would have been viewed at viewing angle. *Id.* ¶¶ 55, 57. We further find that Murphy’s description of a user controlling the system through the user interface and “selecting a

predefined view of the image” teaches “selecting an initial viewing angle of said slices.” *See, e.g., id.*

Patent Owner does not dispute Petitioner’s arguments or evidence regarding element 1c. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches element 1c of claim 1.

*f) Element 1d: “selecting a viewpoint for a left eye” and
Element 1e: “selecting a viewpoint for a right eye”*

Petitioner contends that Murphy teaches elements 1d and 1e based on Murphy’s description of a “stereoscopic display” in which the image to be viewed is rendered with “two slightly different view transformations, reflecting the different locations of the ideal viewer’s two eyes.” *See, e.g.,* Pet. 67 (quoting Ex. 1010 ¶ 50). Petitioner contends that one image representing the left eye’s viewpoint is “rendered for the left eye’s position” and another image representing the right eye’s viewpoint is “rendered for the right eye’s position.” *Id.* (quoting Ex. 1010 ¶ 50). Petitioner cites other portions of Murphy and Dr. Zyda’s testimony as further supporting evidence. *Id.* at 67–68 (citing Ex. 1010 ¶¶ 20, 58, Figs. 3, 4; Ex. 1003 ¶¶ 186–188).

Dr. Zyda testifies that a person having ordinary skill in the art would have understood “that left and right eye viewpoints in Murphy are different to achieve the desired stereoscopic effect.” Ex. 1003 ¶ 188 (citing Ex. 1010 ¶ 20). Dr. Zyda also testifies “Murphy discloses a stereoscopic system for viewing 3D images, and in particular one in which each eye sees a different viewpoint of the image rendered from a different angle corresponding to each eye.” *Id.*

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s

testimony are consistent with and supported by the cited portions of Murphy. For instance, “[t]he image to be viewed can be rendered with two slightly different view transformations, reflecting the different locations of the ideal viewer’s eyes.” Ex. 1010 ¶ 50. Murphy describes rendering “for the left eye’s position” and “for the right eye’s position.” *Id.* Murphy also describes “[i]n operation, the glasses restrict the light so that the left eye sees only the image rendered for it, and the right eye sees only the image rendered for it.” *Id.* Murphy also describes displaying “for each eye.” *Id.* ¶ 20.

Also, as we discussed with respect to element 1c (*see* § II.G.3.e), the user controls viewing through a user interface and makes selections. In particular, Murphy describes the user controlling the system through a user interface, including that the user “can manipulate the scenario such as by selecting a pre-defined view of the image, moving the image, rotating the image, [and] zooming in on the image.” Ex. 1010 ¶ 55; *see also id.* ¶ 57 (describing “[i]t is contemplated that, the viewers can select pre-defined views [and] they can move and rotate the Virtual Patient in any direction or angle.”).

Patent Owner does not dispute Petitioner’s arguments or evidence regarding elements 1d and 1e. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches elements 1d and 1e of claim 1.

g) Elements 1f and 1g

Elements 1f and 1g are reproduced below.

displaying, in a display unit (DU), an image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest;
displaying, in said DU, an image for said right eye based on said initial viewing angle, said view point for

said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce a three-dimensional image to said user;

Ex. 1001, 17:32–39.

Petitioner contends that Murphy teaches elements 1f and 1g based on Murphy’s description that its system “display[s] the resulting image” using “a stereoscopic display, or any other virtual reality display system.” Pet. 68 (quoting Ex. 1010 ¶ 50) (alteration in original). Petitioner also contends that Murphy describes that output devices for its system include “head mounted displays (HMD) in the form of glasses or goggles, which allow a user to wear a display system on their head.” *Id.* at 68, 70 (quoting Ex. 1010 ¶ 20). Petitioner further contends that Murphy describes that different images are presented to the left and right eyes. *Id.* at 70 (citing Ex. 1010 ¶¶ 20, 50; Pet. 67–68). Petitioner cites other portions of Murphy and Dr. Zyda’s testimony as further supporting evidence. *Id.* at 68–69 (citing Ex. 1010 ¶ 17, Fig. 4; Ex. 1003 ¶¶ 189–191).

Dr. Zyda testifies “[a]s further illustrated in the data flow diagram [in Figure 4], the image that is displayed for the left eye at block 410 is generated based on, among other things, [the] volume of interest selected at block 401 as well as viewpoint and viewing angle selected at block 409.” Ex. 1003 ¶ 190 (citing Ex. 1010 ¶ 50, Fig. 4). Dr. Zyda also testifies “[a]s I discussed above for element [1f], Murphy discloses displaying the rendered 3D image—in this instance an image for the right eye—based on initial viewing angle, right eye viewpoint, and volume of interest using a display unit.” *Id.* ¶ 191 (citing Ex. 1010 ¶¶ 17, 20, 50, Fig. 4).

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s

testimony are consistent with and supported by the cited portions of Murphy. For instance, Murphy describes that “an example of an output device that can be used in the present system” includes “head mounted displays (HMD) in the form of glasses or goggles, which allow a user to wear a display system on their head.” Ex. 1010 ¶ 20; *see also id.* ¶ 17 (describing an immersive virtual reality that is accomplished “through the use of such devices as Head Mounted Displays (HMD’s), earphones, and input devices such as gloves or wands.”) Murphy describes displaying the image using “a stereoscopic display, or any other virtual reality display system.” *Id.* ¶ 50. Murphy describes that the “stereoscopic display can comprise at least two display projectors.” *Id.* Murphy describes that “[o]ne projector displays the image rendered for the left eye’s position, and the other projector displays the image rendered for the right eye’s position.” *Id.*

As is shown in Figure 4, block 410, i.e., “Display Image” follows block 401 “Receive Geometry Selection,” referred to with respect to element 1a (*see* Section II.G.3.c), block 409 “Volume Rendering,” and block 417 “Receive User Manipulation,” in which a user controls the system through a user interface. Ex. 1010 ¶¶ 41, 44, 50, 55, 57, Fig. 4. Murphy describes “[a]t block 410, the system can display the resulting image.” *Id.* ¶ 50.

Patent Owner does not dispute Petitioner’s arguments or evidence regarding elements 1f and 1g. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches elements 1f and 1g of claim 1.

- h) Element 1h: “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user”*

Relying on the testimony of Dr. Zyda, Petitioner contends that the combination of Murphy and Guang teaches element 1h because “[a]s explained above in Section III.C.3 [Pet. 57–60 regarding reasoning to combine], incorporated herein, the Murphy-Guang combination provides a stereoscopic viewing system with dynamic convergence point capabilities (i.e., shifted convergence point).” Pet. 70–71 (citing, *e.g.*, Ex. 1014, code (57), ¶¶ 87, 102, 104, Fig. 19; Ex. 1003 ¶ 193). In its contentions regarding reasoning to combine, Petitioner asserts “Guang recognizes that ‘when people are looking at a certain object, their two eyes are focusing on the object, which means the two eyes’ respective viewing directions cross at that point.’” *Id.* at 57 (citing Ex. 1014 ¶ 87). Petitioner also asserts “[i]ndeed, “[t]his is the point at which people can see things clearly and most comfortably, and is known as the convergence point.”” *Id.* at 57–58 (citing Ex. 1003 ¶ 173).

As discussed with respect to reasoning to combine (*see* Section II.G.a), Dr. Zyda testifies as follows:

Briefly regarding the concept of convergence point as mentioned in the ’183 patent, I note that Guang mentions that “when people are looking at a certain object, their two eyes are focusing on the object, which means the two eyes’ respective viewing directions cross at that point.” Ex. 1014, [0087]. Guang further says that “[t]his is the point at which people can see things clearly and most comfortably, and is known as the convergence point.” *Id.* Ex. 1003 ¶ 173.

Dr. Zyda also testifies “shifting the convergence point in Guang is accompanied by a corresponding shifting of the perspective of the volume of

interest that is provided to the user.” Ex. 1003 ¶ 193. Dr. Zyda’s testimony includes an annotated version of Figure 19 of Guang, which is reproduced below.

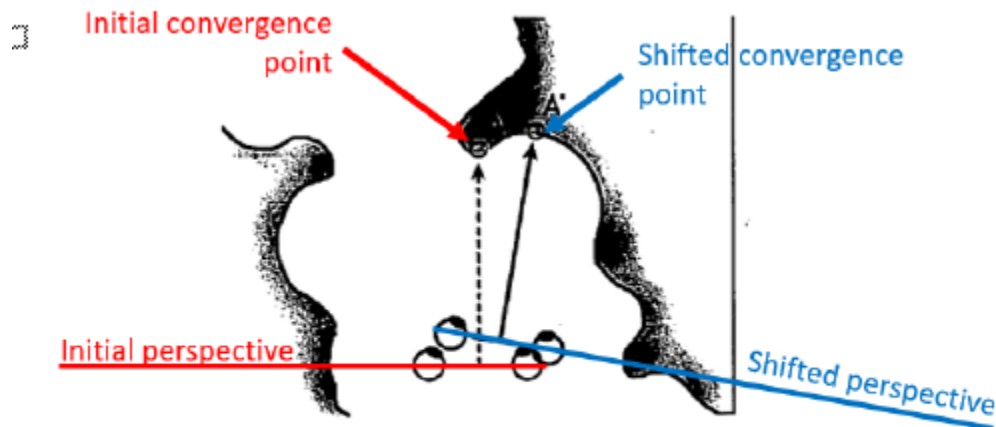


Fig. 19 - Determine Convergence Points

Ex. 1014, FIG. 19.

Figure 19 in Dr. Zyda’s Declaration, above, illustrates determining convergence points and includes Dr. Zyda’s annotations as follows: (a) a red indicator line to the lower set of eyes with red text labeling those eyes “initial perspective”; (2) a red arrow with the head at the same point as the head of the arrow with the dotted line and red text labeling that point “initial convergence point”; (3) a blue indicator line to the upper set of eyes with blue text labeling those eyes “shifted perspective”; and (4) a blue arrow with the head at the same point as the head of the arrow with the solid line and blue text labeling that point “shifted convergence point.” Ex. 1003 ¶ 193.

Patent Owner offered contentions in its Preliminary Response that Patent Owner does not maintain in its Patent Owner Response. *Compare* PO Resp. 55–60, *with* Prelim. Resp. 32–34. Although not necessary for our determinations herein, upon consideration of the arguments and evidence based on the complete record now before us, we maintain our determinations at the institution stage regarding Patent Owner’s Preliminary Response arguments.

i. The Parties' Contentions After Institution

In its Patent Owner Response, Patent Owner asserts “the claims specifically require that although the viewing angle is altered and the volume of interest reoriented, the left eye and right eye images that are displayed remain based on the initial view points.” PO Resp. 56. Patent Owner asserts “[s]uch a feature would not exist in a Murphy-Guang combination.” *Id.* Patent Owner asserts “Guang teaches changing a convergence point of left eye and right eye views when a viewer is moving through a series of images” and “Guang also teaches changing from an initial viewing angle to an alternate viewing angle.” *Id.* Patent Owner also asserts “in such alterations, Guang correspondingly moves the view point for the left eye /right eye to new (x, y, z) coordinates.” *Id.* at 56–57 (citing Ex. 1014 ¶ 110, Fig. 19). Patent Owner asserts the “petition relies on Guang’s teachings concerning dynamic adjustment of convergence points for stereo display to meet the requirements of the claims.” *Id.* at 58 (citing Pet. 57).

Patent Owner asserts “any person of ordinary skill in the art seeking to modify Murphy by the teachings of Guang concerning dynamic adjustment of convergence points would necessarily also include Guang’s teachings of correspondingly moving a view point for the left eye / right eye when performing those operations.” Pet. 58. Patent Owner asserts a “Murphy-Guang combination” would “in connection with shifting convergence points and displaying from alternate viewing angles, provide such a display using new view points for the left eye / right eye.” *Id.* at 59–60.

Petitioner responds (1) that the claims are not limited as asserted by Patent Owner; and (2) that even if the claims are so limited, Petitioner has shown the asserted prior art meets the claim limitations. Petitioner’s

contentions that the claims are not limited as asserted by Patent Owner are discussed above with respect to claim construction. *See* §§ II.C.2.d, II.C.5.

As to the second responsive argument, Petitioner asserts “even if the convergence point shifting in Guang were accompanied by a changed viewpoint of the left/right eye—which Petitioner does not concede is true or otherwise departs from the requirements of the claim language—a POSITA would have understood that bodily incorporation of Guang into Murphy is not required to demonstrate obviousness.” Pet. Reply 21 (citing *In re Mouttet*, 686 F.3d 1322, 1332 (Fed. Cir. 2012)). Petitioner quotes Dr. Zyda’s testimony that in “updating the rendering to reflect a new convergence point as in Guang” a person having ordinary skill in the art would have ensured that the “convergence point of the rendered 3D image coincides with the area of interest (focus point) among the 3D volume that the user is looking at” and that Murphy “expressly mentioned the importance of tracking the user’s eyes to make sure that the user has a clear view of the area of interest.” *Id.* at 21–22 (quoting Ex. 1003 ¶ 176). Petitioner asserts that a person having ordinary skill in the art “would have been able to achieve such combination without ‘chang[ing] the hall mark aspects’ of Murphy.” *Id.* at 22 (citing Ex. 1003 ¶ 117; Ex. 1035 ¶ 31).

Petitioner asserts that Patent Owner ignores “the ‘inferences and creative steps’ that a POSITA would have taken when modifying Murphy to achieve the benefits taught by Guang.” *Id.*; *KSR*, 550 U.S. at 418; Ex. 1035 ¶ 31). Petitioner also asserts Patent Owner’s arguments “disregard well-established principles of obviousness analysis in patent law” including “that ‘[a] person of ordinary skill is also a person of ordinary creativity, not an automaton,’ and that ‘[t]he test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the

primary reference,’ but is instead ‘what the combined teachings of those references would have suggested to those of ordinary skill in the art.’” Pet. Reply 22–23 (citing *In re Keller*, 642 F.2d 413, 425 (CCPA 1981); *Facebook Inc. v. Windy City Innovations, LLC*, 953 F.3d 1313, 1333 (Fed. Cir. 2020); *KSR*, 550 U.S. at 418; Ex. 1035 ¶ 31).

Patent Owner responds by contending that Petitioner’s “new argument that ‘bodily incorporation of Guang into Murphy is not required to demonstrate obviousness’ is both too late and contrary to the position” Petitioner took in its petition. PO Sur-reply 16. Patent Owner asserts that in the Petition, Petitioner contends that “‘A POSITA would have been motivated to modify 3D stereoscopic viewing system of Murphy to include “dynamic adjustment of an eye convergence point for stereo display” to allow the user to, for instance, view stereoscopic images “clearly and most comfortably” *as described in Guang*.”” *Id.* at 16–17 (citing Pet. 57). Patent Owner asserts “[t]hat is, the petition itself proposed the ‘bodily incorporation’ of Guang that the reply now says is unnecessary.” *Id.* at 17.

Patent Owner also asserts “Patent Owner has explained how Guang teaches changing a convergence point of left eye and right eye views when a viewer is moving through a series of images by correspondingly moving the view points for the left eye and the right eye.” *Id.* at 17 (citing PO Resp. 56–58; Ex. 1014 ¶ 110). Patent Owner asserts “nothing in Guang . . . adopts a different strategy for changing a convergence point by maintaining the left eye / right-eye viewpoints fixed.” *Id.* Patent Owner asserts “[t]o the extent Petitioner is now proposing to supplement the teachings of Guang with some hypothetical creativity of a person of ordinary skill in the art to arrive at an obviousness determination, Reply at 21-22, that too is impermissible.” *Id.* at 17–18 (citing *Intelligent Bio-Systems, Inc. v. Illumina Cambridge Ltd.*, 821

F.3d 1359, 1369 (Fed. Cir. 2016); 35 U.S.C. § 312(a)(3); Consolidated Trial Practice Guide (“Consolidated Practice Guide”)²⁰ at 74–75; *see also* 84 Fed. Reg. 64,280 (Nov. 21, 2019) (stating that a consolidated Office Patent Trial Practice Guide is being issued and providing the website for viewing or downloading).

ii. Our Analysis

As we explained with respect to claim construction, we maintain our determination at the institution stage that the term “convergence point” is where the center theta-alpha ray from the left and right eye viewing perspectives intersect. *See* § II.C.2. We credit and agree with Dr. Zyda’s testimony that Guang teaches the “convergence point” recited in claim 1. *See, e.g.*, Ex. 1003 ¶ 173 (citing Ex. 1014 ¶ 87). Consistent with Dr. Zyda’s testimony, Guang describes maintaining “optimum convergence of a stereoscopically displayed tube-like structure.” Ex. 1014 ¶ 87. Guang also describes “when human eyes are focused on a certain point of interest (such as, for example, the highlighted spot on the ball’s surface in FIGS. 17(a) and (b)), their respective lines of sight cross at that point, i.e., the convergence point.” Ex. 1014 ¶ 102.²¹

As we also explained with respect to claim construction, we adopt Petitioner’s position and determine that the phrase “wherein a convergence

²⁰ Available at <https://www.uspto.gov/TrialPracticeGuideConsolidated>.

²¹ Although not necessary for our determination, we find that Guang teaches the convergence point even using Patent Owner’s proposed construction. For instance, the convergence point, i.e., the highlighted spot is in the volume of interest, i.e., the ball. Ex. 1014 ¶ 102. Also, Guang teaches “it is desirable to dynamically adjust the convergence point of the stereo images to be at or near the object [volume of interest] a user is currently inspecting.” *Id.* ¶ 108. Nonetheless, Patent Owner’s dispute pertains to only the Jones grounds. PO Resp. 53–60; PO Sur-reply 15–18.

point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require that “that a shifted convergence point has a different location, e.g., a different set of (x, y, z) coordinates, within the volume of interest than an original convergence point,” contrary to Patent Owner’s contentions. *See* § II.C.2 (citing PO Resp. 31; PO Sur-reply 10). Patent Owner’s contentions in that regard pertain to only the grounds based on Jones. PO Resp. 25–37; PO Sur-reply 1–2, 9–12. Patent Owner does not make similar arguments with respect to the combination of Murphy and Guang. *See, e.g.*, PO Resp. 53–60; PO Sur-reply 15–18.

As we also explained with respect to claim construction, we adopt Petitioner’s position and determine that “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user” does not require shifting of the convergence point to occur while holding all view points unaltered. *See* § II.C.2 (citing Pet. Reply 21). Furthermore, we stated that we determine that the phrases “displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest” and “displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest” do not impose a requirement that the shifting of the convergence point occur while holding all viewpoints unaltered. *See* § II.C.5.

We turn to Petitioner’s contentions, relying on the testimony of Dr. Zyda, that the combination of Murphy and Guang teaches element 1h because “[a]s explained above in Section III.C.3 [Pet. 57–60 regarding reasoning to combine], incorporated herein, the Murphy-Guang combination

provides a stereoscopic viewing system with dynamic convergence point capabilities (i.e., shifted convergence point).” Pet. 70–71 (citing, *e.g.*, Ex. 1014, code (57), ¶¶ 87, 102, 104, Fig. 19; Ex. 1003 ¶ 193); *see also id.* at 57–60 (citing, *e.g.*, Ex. 1010 ¶ 20; Ex. 1014, code (57), ¶¶ 87, 102, 105, Fig. 19; Ex. 1003 ¶¶ 172–177). We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy and Guang. For instance, Murphy describes that “[e]ye-tracking can be combined with HMDs” and “[t]his can allow, for example, surgeons to move [their] eyes to the part of the image they want to enhance.” Ex. 1010 ¶ 20. We find Petitioner’s description of Murphy’s teachings of modifying a display “in view of the altered gaze” (Pet. 58) to be consistent with Murphy’s teachings.²²

We also find Petitioner’s description of Guang’s teachings and Dr. Zyda’s testimony relating to Guang to be consistent with the teachings of Guang. For instance, Guang teaches shifting the convergence point by describing “dynamic *adjustment of an eye convergence point* for stereo display.” Ex. 1014, code (57) (emphasis added). Guang describes “it is important to make sure that the convergence point is correctly calculated and therefore the stereographic images are correctly displayed on the screen.” *Id.*

²² Although not needed for our determination herein, with respect to our analysis using Patent Owner’s proposed construction below, we note that Patent Owner has not disputed Murphy’s teachings with respect to element 1h and has not argued that Murphy alone teaches altering view points. PO Resp. 53–60; PO Sur-reply 15–18. We do not find Murphy’s description of a surgeon’s eye movement (Ex. 1010 ¶ 20) to be a teaching of altering view points as Murphy’s eye movement encompasses eye muscles altering the convergence angle, consistent with the exemplary description of shifting the convergence point in the ’183 patent Specification. Ex. 1001, 7:1–3.

¶ 104. Guang describes in some embodiments, “it can be assumed, for example, that the center of the image is the most important part and that a user will always be focused on that point.” *Id.* ¶ 105. Guang describes in those embodiments “the center of the screen can be presented as the point of stereo convergence.” *Id.* Guang also describes that in other embodiments “*the convergence point can be varied as necessary*, and can be, for example, dynamically set where a user is conceivably focusing his view.” *Id.* (emphasis added). Additionally, we find that Figure 19 of Guang illustrates a shift in convergence point. *Id.* at Fig. 19.

Also, we credit Dr. Zyda’s testimony that Guang teaches shifting the convergence point and “shifting the convergence point in Guang is accompanied by a corresponding shifting of the perspective of the volume of interest that is provided to the user” (Ex. 1003 ¶ 193 (citing Ex. 1014 ¶ 95, Fig. 19)) because Dr. Zyda’s testimony is consistent with Guang’s teachings. For example, Figure 19 illustrates a shift in convergence point from A to A', which is slightly lower and to the right of A. Ex. 1014, Fig. 19. Also, Guang describes updating to a “new focus point” when a viewer is “focusing on another object.” Ex. 1014 ¶ 95.

Furthermore, although we determine the claims are not limited in the manner proposed by Patent Owner (*see* Sections II.C.2.d, II.C.5), even assuming the claims are so limited, we are persuaded by Petitioner’s contentions that the prior art meets the claim recitations. Petitioner’s contentions in its Reply quoting Dr. Zyda’s testimony that in “updating the rendering to reflect a new convergence point as in Guang” a person having ordinary skill in the art would have ensured that the “convergence point of the rendered 3D image coincides with the area of interest (focus point) among the 3D volume that the user is looking at” and that Murphy

“expressly mention[ed] the importance of tracking the user’s eyes to make sure that the user has a clear view of the area of interest” (Pet. Reply 21–22 (quoting Ex. 1003 ¶ 176)) are consistent with the portions of Murphy and Guang discussed immediately above. Petitioner also asserts that a person having ordinary skill in the art “would have been able to achieve such combination without ‘chang[ing] the hall mark aspects’ of Murphy.” *Id.* at 22 (citing Ex. 1003 ¶ 117; Ex. 1035 ¶ 31).

Patent Owner does not argue that Murphy has any deficiency. PO Resp. 53–60; PO Sur-reply 15–18. As we have explained above, Murphy describes that “[e]ye-tracking can be combined with HMDs” and “[t]his can allow, for example, surgeons to move [their] eyes to the part of the image they want to enhance.” Ex. 1010 ¶ 20. We find Petitioner’s description of Murphy’s teachings of modifying a display “in view of the altered gaze” (Pet. 58) to be consistent with Murphy’s teachings. Ex. 1010 ¶ 20.

Petitioner asserts that a person having ordinary skill in the art would have understood that bodily incorporation of Guang into Murphy is not required to demonstrate obviousness. Pet. Reply 21–23. We find that Figure 19 relied on by Petitioner to show a shift in convergence point illustrates two sets of eyes that are very close. Ex. 1014, Fig. 19. The second left eye position after the shifting is almost touching the top of the first left eye position prior to the shifting. *Id.* The right eye positions before and after shifting overlap somewhat. *Id.*

Patent Owner’s arguments in its Sur-reply that the Petition proposes the bodily incorporation that Petitioner’s Reply says is unnecessary (PO Sur-reply 16–17) are misplaced. Patent Owner argues that it “has explained how Guang teaches changing a convergence point of left eye and right eye views when a viewer is *moving* through a series of images by correspondingly

moving the view points for the left eye and the right eye.” *Id.* at 17 (citing PO Resp. 56–58; Ex. 1014 ¶ 110). Paragraph 110 of Guang is relied on by Patent Owner in both its Patent Owner Response and Sur-reply. PO Resp. 56–58 (citing Ex. 1014 ¶ 110); PO Sur-reply 17 (citing Ex. 1014 ¶ 110). Although paragraph 110 describes Figure 19, Petitioner does not rely on paragraph 110 of Guang. Pet. 57–60, 70–71. Furthermore, even paragraph 110 of Guang describes only that the “eyes have moved *slightly*.” Ex. 1014 ¶ 110 (emphasis added). Importantly, Patent Owner does not address the full teachings of Murphy and Guang relied on by Petitioner and instead relies on only an uncited portion of Guang. PO Resp. 56–58; PO Sur-reply 15–18. We disagree that the Petition proposes the bodily incorporation Patent Owner refers to in light of the actual and complete contentions set forth in the Petition.

Patent Owner’s argument that to the extent Petitioner proposes to supplement the teachings of Guang with the creativity of a person of ordinary skill in the art, Petitioner’s argument is an impermissible new argument in its Reply (PO Sur-reply 17–18) is unavailing. Patent Owner’s reliance on *Intelligent Bio-Systems* is misplaced because, in contrast, here Petitioner presents no new grounds of invalidity and no new theories as to why a person having ordinary skill in the art would have made the proposed combination. *Intelligent Bio-Systems*, 821 F.3d at 1369. We find Petitioner’s arguments in its Reply and Dr. Zyda’s Reply Declaration (Ex. 1035) simply provide further details to support that the arguments in the Petition and testimony Dr. Zyda’s initial Declaration (Ex. 1003) are correct regarding the knowledge of the skilled artisan and the prior art’s disclosures. The Petition and Dr. Zyda’s testimony in his first Declaration (Ex. 1003) set forth the disclosures of Murphy and Guang that Petitioner relies on in full and include

a detailed element-by-element analysis identifying the portions of Murphy and Guang that teach the elements of claim 1. Petitioner's Reply and Dr. Zyda's Reply Declaration testimony do no more than fairly and directly respond to Patent Owner's Response. *See* 37 C.F.R. § 42.23(b); *see also Belden*, 805 F.3d at 1078–80 (holding that the Board may rely on new evidence submitted with a reply because the evidence was legitimately responsive to patent owner's arguments and not needed for a prima facie case of obviousness).

We agree with Dr. Zyda's testimony that a person of ordinary skill in the art "looking to improve Murphy in view of Guang to help improve clarity under an altered gaze through dynamic adjustment of the convergence point would have been able to do so without adopting every feature of Guang" (Ex. 1035 ¶ 31), such as the feature of the slight change in eye positions illustrated in Figure 19 of Guang. Instead, surgeons may simply move their eye muscles or alter their gaze without altering view points, consistent with Murphy's teachings. Ex. 1010 ¶ 20. We agree with Petitioner (Pet. Reply 22–23) that "[a] person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR*, 550 U.S. at 421.

Based on the complete record now before us, we find that Petitioner has shown that the combination of Murphy and Guang teaches element 1h of claim 1. Also, as we discussed above, we are persuaded that Petitioner has articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Murphy and Guang in the manner proposed by Petitioner. *See* § III.G.3.a.

- i) *Element 1i: “selecting an alternate viewing angle, said selecting an alternate viewing angle comprising”*

Petitioner contends that the combination of Murphy and Guang teaches element 1i based on Murphy’s description of rotating the three-dimensional model including, for example, Murphy’s description of “mov[ing] and rotat[ing] the Virtual Patient in any direction or angle.” Pet. 71 (quoting Ex. 1010 ¶ 57); *see also id.* (citing Ex. 1010 ¶¶ 32, 55; Ex. 1003 ¶ 194). Dr. Zyda testifies “Murphy discloses selecting a viewing angle by rotating the 3D model.” Ex. 1003 ¶ 194. Dr. Zyda also testifies “[b]ecause different viewing angles can be selected by the user in Murphy, the selection of a new angle with respect to an initially selected one represents an ‘alternative’ viewing angle that allows the user to view the desired 3D image from an alternative angle.” *Id.*

We find Petitioner’s contentions persuasive, and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy. For instance, Murphy describes “[i]t is contemplated that, the viewers can select pre-defined views [and] they can move and *rotate* the Virtual Patient in any direction or angle.” Ex. 1010 ¶ 57 (emphasis added). Murphy describes that the user can control the system through the user interface and can, for example, “manipulate the scenario, such as by selecting a pre-defined view of the image, moving the image, [and] *rotating* the image.” *Id.* ¶ 55. Murphy also describes that software in the system “can perform various functions” including providing “the ability for the user to manipulate the image with zoom, pan, and *rotation control*.” *Id.* ¶ 32 (emphasis added).

Patent Owner does not dispute Petitioner's arguments or evidence regarding element 1i. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches element 1i of claim 1.

j) *Element 1j: "reorienting said volume of interest in accordance with said alternate viewing angle"*

Petitioner contends that the combination of Murphy and Guang teaches element 1j based on Murphy's description that an alternate viewing angle is presented to the user and Dr. Zyda's testimony that "once an alternate viewing angle is selected either by the system or by the user, the selected data space (volume of interest) is reoriented by being rotated." Pet. 72 (citing Ex. 1010 ¶¶ 32, 55, 57; Ex. 1003 ¶ 195).

We find Petitioner's contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner's contentions and Dr. Zyda's testimony are consistent with and supported by the cited portions of Murphy. Patent Owner does not dispute Petitioner's arguments or evidence regarding element 1j. Based on the complete record now before us, we find that Petitioner has shown that Murphy teaches element 1j of claim 1.

k) *Elements 1k and 1l*

Elements 1k and 1l are reproduced below.

displaying, in said DU, an image for said left eye based on said alternate viewing angle, said view point for said left eye and said volume of interest ; and
displaying, in said DU, an image for said right eye based on said alternate viewing angle, said view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce an alternate three-dimensional image to said user.

Ex. 1001, 17:48–56.

i. The Parties' Contentions

Petitioner refers back to its earlier contentions for elements 1f and 1g that recite displaying based on the initial viewing angle. Pet. 72. Petitioner points to Murphy's description of display units, such as head mounted displays. *Id.* Petitioner asserts Murphy's display unit "displays an image for said left eye that has been generated in accordance with the processes described above for [1i], [1d], and [1a] (i.e., based on said alternate viewing angle, said view point for said left eye and said volume of interest)." Pet. 72 (citing Ex. 1010 ¶¶ 17, 20, 50, Fig. 4; Ex. 1003 ¶ 196). Petitioner also asserts Murphy's display unit "projects an image for the right eye that has been generated in accordance with the processes described above for [1i], [1e], and [1a]." *Id.* (citing Ex. 1010 ¶¶ 17, 20, 50, Fig. 4; Ex. 1003 ¶ 197).²³ Petitioner further asserts "because the 3D image generated in Murphy is displayed in stereoscopic form, with different view points being presented to the observer's left and right eyes, respectively, the image for the left eye and the image for the right eye based on the alternate view angle produce an alternate three-dimensional image to the user." *Id.* at 72–73 (citing Ex. 1010 ¶ 50; Ex. 1003 ¶ 197).

As we noted with respect to element 1h (*see* § II.G.3.h), Patent Owner asserts "the claims specifically require that although the viewing angle is altered and the volume of interest reoriented, the left eye and right eye

²³ Petitioner's assertion further reads "(i.e., based on said alternate viewing angle, said view point for said left eye and said volume of interest." *Id.* Petitioner reproduces the claim language, except Petitioner refers to "said left eye" rather than "said right eye." *Id.* Petitioner, however, refers to element 1l that recites "said right eye." We treat Petitioner's reference to "said left eye" instead of "said right eye" as a typographical error. *Id.* Dr. Zyda's testimony includes the same typographical error. Ex. 1003 ¶ 197.

images that are displayed remain based on the initial view points” and that “[s]uch a feature would not exist in a Murphy-Guang combination.” PO Resp. 56. Patent Owner asserts a “Murphy-Guang combination” would “in connection with shifting convergence points and displaying from alternate viewing angles, provide such a display using new view points for the left eye / right eye.” *Id.* at 59–60.

Petitioner responds (1) that the claims are not limited as asserted by Patent Owner; and (2) that even if the claims are so limited, Petitioner has shown the asserted prior art meets the claim limitations. Petitioner’s contentions that the claims are not limited as asserted by Patent Owner are discussed with respect to claim construction. *See* §§ II.C.2.d, II.C.5. Petitioner’s contentions for the second responsive argument are discussed with respect to element 1h. *See* § II.G.3.h.

As we noted with respect to element 1h (*see* § II.G.3.h), Patent Owner disputes Petitioner’s response. For completeness, we repeat certain of Patent Owner’s arguments here.

In its Sur-reply, Patent Owner responds Petitioner’s “new argument that ‘bodily incorporation of Guang into Murphy is not required to demonstrate obviousness’ is both too late and contrary to the position” Petitioner took in its petition. PO Sur-reply 16. Patent Owner asserts that in the Petition, Petitioner asserts “that, ‘A POSITA would have been motivated to modify 3D stereoscopic viewing system of Murphy to include ‘dynamic adjustment of an eye convergence point for stereo display’ to allow the user to, for instance, view stereoscopic images “clearly and most comfortably” as described in Guang.’” *Id.* at 16–17 (citing Pet. 57). Patent Owner asserts “[t]hat is, the petition itself proposed the ‘bodily incorporation’ of Guang that the reply now says is unnecessary.” *Id.* at 17.

Patent Owner also asserts “Patent Owner has explained how Guang teaches changing a convergence point of left eye and right eye views when a viewer is moving through a series of images by correspondingly moving the view points for the left eye and the right eye.” *Id.* at 17 (citing PO Resp. 56–58; Ex. 1014 ¶ 110). Patent Owner asserts “nothing in Guang . . . adopts a different strategy for changing a convergence point by maintaining the left eye / right-eye viewpoints fixed.” *Id.*

ii. Our Analysis

Patent Owner’s contentions are based on Guang’s teachings. PO Resp. 55–60, PO Sur-reply 15–18. Petitioner’s assertion, however, is that elements 1k and 1l are taught by Murphy. Pet. 72–73. Petitioner does not rely on Guang for elements 1k and 1l. *Id.* Indeed, Petitioner does not rely on Guang for any recitation in claim 1 other than element 1h. *Id.* at 61–73.

Also, Patent Owner’s contentions are premised on its claim construction proposal, which we do not adopt for the reasons given in our claim construction discussion. *See* §§ II.C.2.d, II.C.5. Patent Owner does not take into account that the claims do not require that “said view point for said left eye” and “said view point for said right eye” be the same as any view point associated with “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user.” *See supra* § II.C.5.b.

Petitioner’s assertion for elements 1k and 1l relies on its assertion for the similar recitations in in elements 1f and 1g, which is not contested by Patent Owner. Pet. 72. For the left eye, Petitioner also asserts Murphy’s display unit “displays an image for said left eye that has been generated in accordance with the processes described above for [1i], [1d], and [1a] (i.e., based on said alternate viewing angle, said view point for said left eye and

said volume of interest.” *Id.* at 72 (citing Ex. 1010 ¶¶ 17, 20, 50, Fig. 4; Ex. 1003 ¶ 196). For the right eye, Petitioner also asserts Murphy’s display unit “projects an image for the right eye that has been generated in accordance with the processes described above for [1i], [1e], and [1a].” *Id.* (citing Ex. 1010 ¶¶ 17, 20, 50, Fig. 4; Ex. 1003 ¶ 197).

We find Petitioner’s contentions persuasive, and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy. As we discussed with respect to elements 1f and 1g (*see supra* Section II.G.g), Murphy describes that “an example of an output device that can be used in the present system” includes “head mounted displays (HMD) in the form of glasses or goggles, which allow a user to wear a display system on their head.” Ex. 1010 ¶ 20; *see also id.* ¶ 17 (describing an immersive virtual reality that is accomplished “through the use of such devices as Head Mounted Displays (HMD’s), earphones, and input devices such as gloves or wands.”). Murphy describes displaying the image using “a stereoscopic display, or any other virtual reality display system.” *Id.* ¶ 50.

As we also discussed with respect to elements 1f and 1g (*see* Section II.G.g), Figure 4 shows block 410, i.e., “Display Image” follows block 401 “Receive Geometry Selection,” referred to with respect to element 1a (*see* Section II.G.3.c), block 409 “Volume Rendering,” and block 417 “Receive User Manipulation,” in which a user controls the system through a user interface. Ex. 1010 ¶¶ 41, 44, 50, 55, 57, Fig 4. Dr. Zyda testifies that “the image that is displayed” for each of the left and right eyes “at block 410 is generated based on, among other things, volume of interest selected at block 401 as well as the viewpoint and viewing angle selected at block 409.” Ex. 1003 ¶¶ 190–191 (citing Ex. 1010 ¶ 50).

Dr. Zyda testifies with respect to element 1i, “[a]s I discussed above . . . for element 1[c], incorporated herein, Murphy discloses selecting a viewing angle by rotating the 3D model.” *Id.* ¶ 194. Dr. Zyda also testifies with respect to element 1j, “[a]s I discussed above with respect to element [1i], Murphy teaches *changing the viewpoint* of the 3D volume such that an alternate angle is presented to the user.” *Id.* ¶ 195 (citing Ex. 1010 ¶¶ 32, 55, 57) (emphasis added). As discussed for element 1c (*see Section II.G.e*), Murphy describes “the user can control the system, at block 417, through an input device and the user interface” and that the “user can manipulate the scenario such as by selecting a pre-defined view of the image, moving the image, rotating the image, [and] zooming in on the image.” Ex. 1010 ¶ 55. Murphy also describes “Interaction with the Virtual Patient takes many forms” including that “the viewers can select pre-defined views, they can move and rotate the Virtual Patient in any direction or angle, [and] they can zoom in to view particular features in detail.” *Id.* ¶ 57. Murphy describes “[a]t block 410, the system can display the resulting image.” *Id.* ¶ 50.

As we explained with respect to claim construction, the recitations in claim 1 encompass performance of other steps so as to display based on “said view point for said left eye” and “said view point for said right eye.” For instance, the claims do not exclude repeating the “selecting” steps recited in 1d and 1e, moving the image, zooming towards or away from the image after shifting the convergence point, retrieving a previously stored selection, or taking other steps to obtain the initial view points. Independent claim 1 uses the term “comprising,” which means that the named elements are essential, but other elements also may be included to constitute additional components within the scope of the claim. *Genentech*, 112 F.3d at 501.

Even assuming the view points change as a result of the shifting, in addition to describing rotating the image, consistent with Petitioner's contentions and Dr. Zyda's testimony (*see, e.g.*, Pet. 72–73; Ex. 1003 ¶¶ 194–197), Murphy describes selecting “a pre-defined view,” “moving the image,” and “zooming in on the image” with respect to step 417. Ex. 1010 ¶ 55. Murphy also describes these same features and explains that “[i]nteraction with the Virtual Patient takes many forms.” *Id.* ¶ 57. We are persuaded by Petitioner's arguments and evidence, including the testimony of Dr. Zyda, that Murphy teaches displaying based on “said view point” for said left eye and said right eye. Pet. 71–73; Ex. 1003 ¶¶ 194–197; Pet. Reply 21–23; Ex. 1035 ¶¶ 29–31.

Patent Owner relies on attorney argument and does not provide the testimony of a declarant regarding the understanding of a person of ordinary skill in the art of the combined teachings of Murphy and Guang and whether they teach elements 1k and 1l. *See generally* PO Resp. Patent Owner's arguments are not supported by objective evidence. Argument of counsel cannot take the place of evidence lacking in the record. *Meitzner*, 549 F.2d at 782. Also, as Petitioner notes, “[a] person of ordinary skill is also a person of ordinary creativity, not an automaton.” *KSR*, 550 U.S. at 421.

Above, we discuss the parties' contentions as to whether element 1h is met even if the claims require that the shifting of the convergence point occur while holding all viewpoints unaltered. *See* § II.G.3.h. As we discuss, although we determine the claims are not limited in the manner proposed by Patent Owner, even assuming the claims are so limited, we are persuaded by Petitioner's contentions that the prior art meets the claim recitations. *Id.* Because Petitioner has shown that the combination of Murphy and Guang teaches the shifting of the convergence point occur while holding all

viewpoints unaltered, for those same reasons, Petitioner has shown that the combination of Murphy and Guang teaches elements 1k and 1l even if with a requirement that “said view point for said left eye” and “said view point for said right eye” be the same as any view point associated with “wherein a convergence point of said image for said left eye and said image for said right eye is shifted to provide a different perspective of the volume of interest to said user.” *See* § II.G.3.h.

For the reasons given, based on the complete record now before us, we find that Petitioner has shown that the combination of Murphy and Guang teaches elements 1k and 1l of claim 1. Petitioner’s contentions have not been undermined by Patent Owner’s arguments or evidence.

l) Conclusion

For the reasons given, we are persuaded that Petitioner establishes that the combination of Murphy and Guang teaches all limitations recited in claim 1. Also, we are persuaded that Petitioner has articulated reasoning with a rational underpinning as to why one of ordinary skill in the art would have combined the teachings of Murphy and Guang in the manner recited in claim 1.

Accordingly, based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claim 1 is unpatentable under 35 U.S.C. § 103(a) over the combination of Murphy and Guang.

4. Independent Claims 7 and 13

Independent claims 7 and 13 are similar to independent claim 1. Petitioner’s analysis of these claims for this challenge largely relies on Petitioner’s analysis of claim 1. Pet. 81–83, 85–90. Petitioner accounts for all differences between the claims. *Id.* For instance, in contrast to claim 1,

which recites a method, the preamble of claim 7 recites a “non-transitory computer readable medium having computer readable code thereon” and claim 13 recites a “computer system” comprising “a memory,” “a processor,” “a communications interface,” and “an interconnection mechanism coupling the memory, the processor and the communications interface.” Ex. 1001, 18:43–44, 20:8–15.

Petitioner contends “[t]o the extent the preamble is limiting,” Murphy discloses the preamble of claim 7. Pet. 80. Petitioner contends that Murphy discloses “that all of the ‘system and method disclosed’ in Murphy, such as those discussed above for claim 1, ‘can be implemented via a general-purpose computing device in the form of a computer 501.’” *Id.* (citing Ex. 1010 ¶ 66; Ex. 1003 ¶ 217). Petitioner also points to Murphy’s disclosure that “computer 501 ‘comprises a variety of computer readable media’” such as “‘system memory 512 compris[ing] computer readable media in the form of volatile memory, such as random access memory (RAM), and/or non-volatile memory, such as read only memory (ROM)’ as well as ‘mass storage device 504 which can provide non-volatile storage of computer code, computer readable instructions, data structures, program modules, and other data for the computer 501.’” *Id.* at 80–81 (citing Ex. 1010 ¶¶ 68–69). Petitioner asserts “[t]hese memory devices in Murphy contain ‘program modules’” that allow the invention of Murphy to be carried out. *Id.* at 81 (citing Ex. 1010 ¶¶ 68–70; Ex. 1003 ¶ 217). Murphy describes that “program modules” include “by way of example, an operating system 505 and application software 506.” Ex. 1010 ¶ 70.

Petitioner also contends that “[t]o the extent the preamble is limiting,” Murphy discloses the preamble of claim 13. Pet. 85. Petitioner again points to computer 501, as well as “‘components of the computer 501’ including

“one or more processors or processing units 503, a system memory 512, and a system bus 513 that couples various system components including the processor 503 to the system memory 512.” *Id.* (quoting Ex. 1010 ¶ 66; citing Ex. 1010, Fig. 5; Ex. 1003 ¶ 246). Petitioner points to “bus 513” for the recitation “interconnection mechanism” in claim 13. *Id.* at 86–87 (citing Ex. 1010 ¶¶ 66–67, Fig. 5; Ex. 1003 ¶ 250).

Patent Owner does not argue claims 7 and 13 separately from claim 1. *See generally* PO Resp. For the reasons given in our discussion of claim 1 and for the further reasons given above, Petitioner has proved, by a preponderance of the evidence, that claims 7 and 13 are unpatentable under 35 U.S.C. § 103(a) over the combination of Murphy and Guang.

5. *Dependent Claims 2, 8, and 14*

Petitioner asserts that claims 2, 8, and 14 are unpatentable as obvious over the combination of Murphy and Guang. Pet. 73–75. Patent Owner does not address separately Petitioner’s patentability challenges to dependent claims 2, 8, and 14. *See generally* PO Resp.

Claim 2 is reproduced below.

[2a] The method of claim 1 further comprising selecting items of said image to be filtered, said selecting items of said image to be filtered comprising:

[2b] selecting items of said image to be subtracted from said image to produce a filtered image;

[2c] displaying, in said DU, a filtered image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest; and

[2d] displaying, in said DU, a filtered image for said right eye based on said initial viewing angle, said view point for said right eye, and said volume of interest and wherein said filtered image for said left eye and said filtered image for

said right eye produce a filtered three-dimensional image to said user.

Ex. 1001, 17:57–18:3.

Petitioner contends that Murphy teaches elements 2a and 2b by disclosing filtering out selected items by completely removing them from the image, either by hiding, cutting away, or making completely transparent. Pet. 73–75 (citing Ex. 1010 ¶¶ 32, 44, 57). Petitioner asserts that Murphy teaches selecting recited in element 2b by (1) disclosing that the user has the ability to control attributes, such as whether to hide or show, associated with anatomical features, and (2) disclosing that the user chooses regions to cut away or make transparent. *Id.* at 73–74 (citing Ex. 1010 ¶¶ 32, 44, 57). Petitioner also refers to its contentions for claim 1 for elements 2c and 2d. *Id.* at 74–75. Petitioner cites Dr. Zyda’s testimony as further supporting evidence. *Id.* at 73–75 (citing Ex. 1003 ¶¶ 198–202).

We have reviewed Petitioner’s contentions and cited supporting evidence addressing how the combination of Murphy and Guang teaches claim 2. As explained above (*see* Section II.C.4), we determine that determine the term “subtracted” is not limited to requiring an “actual elimination of data (voxels) from the underlying three-dimensional model from which the images are created” (PO Resp. 21), as proposed by Patent Owner and, instead, “should be viewed ‘more expansively’” so as to encompasses the ’183 patent’s embodiments of “filtering,” “ignoring,” and “eliminat[ing] [tissue] from the observed volume” (Pet. Reply 3–4), as proposed by Petitioner. As also explained above (*see* Section II.C.4), our analysis, findings, and conclusions in the instant proceeding do not change even if we adopt the precise definition set forth in the IPR2021-00647 Final

Decision, i.e., that “subtracted” means “withdrawn or taken away, as a part from a whole.

We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy and Guang. For instance, regarding elements 2a and 2b, Murphy discloses “the ability to control attributes associated with each anatomical feature, such as color and opacity, the ability to [h]ide and show each anatomical feature, and the ability for user to manipulate the image with zoom, pan, and rotation control.” Ex. 1010 ¶ 32. Murphy also discloses that “[p]re-defined segments (such as particular interesting organs) or arbitrarily-chosen regions of the Virtual Patient can be made transparent to whatever degree desired.” *Id.* ¶ 44. Murphy further discloses that viewers “can cut away sections arbitrarily with cutting planes, spheres, etc.” *Id.* ¶ 57.

Claims 8 and 14 are similar to claim 2. Petitioner’s analysis of these claims for this challenge relies on Petitioner’s analysis of claim 2. Pet. 83, 90–91.

Patent Owner does not dispute Petitioner’s arguments or evidence regarding claims 2, 8, and 14.²⁴ Upon consideration, we agree with

²⁴ Patent Owner has presented argument and evidence, including the testimony of a declarant, for a related patent challenged in IPR2021-00647 having claims with recitations similar to the recitations of claim 2 of the ’183 patent. *See, e.g.*, IPR2021-00647, Paper 14, 46–48; Tr. 55:8–12. Patent Owner, however, has not presented the same argument and evidence in the instant proceeding. Patent Owner has acknowledged that some arguments relate to only the challenged patent in IPR2021-00647. Tr. 51:22–52:7. Regardless of whether Patent Owner has provided an acknowledgement, any arguments not presented in the instant proceeding have been waived. Paper

Petitioner's assertions of obviousness of dependent claims 2, 8, and 14 over Murphy and Guang.

Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claims 2, 8, and 14 are unpatentable under 35 U.S.C. § 103(a) over the combination of Murphy and Guang.

6. *Dependent Claims 3, 9, and 15*

Petitioner asserts that claims 3, 9, and 15 are unpatentable as obvious over the combination of Murphy and Guang. Pet. 75–76. Patent Owner does not address separately Petitioner's patentability challenges to dependent claims 3, 9 and 15. *See generally* PO Resp.

Claim 3 is reproduced below.

[3a] The method of claim 1 further comprising selecting items of said image to be colored, said selecting items of said image to be colored comprising:

[3b] sorting voxels of said items by a property of said voxel;

[3c] applying colors to groups of sorted voxels to obtain a colored image;

[3d] displaying, in said DU, a colored image for said left eye based on said initial viewing angle, said view point for said left eye and said volume of interest; and

[3e] displaying, in said DU, a colored image for said right eye based on said initial viewing angle, said view point for said right eye, and said volume of interest and wherein said colored image for said left eye and said colored image for said right eye produce a colored three-dimensional image to said user.

Ex. 1001, 18:4–19.

11, 8 (“Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.”)

We have reviewed Petitioner's contentions and cited supporting evidence addressing how the combination of Murphy and Guang teaches claim 3. Pet. 75–76 (citing Ex. 1010 ¶¶ 32, 38, 42, 45; Ex. 1003 ¶¶ 203–207). We find Petitioner's contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner's contentions and Dr. Zyda's testimony are consistent with and supported by the cited portions of Murphy and Guang. For instance, regarding element 3b, i.e., “sorting voxels of said items by a property of said voxel,” Murphy discloses performing image segmentation by “creating new segment volumes” in which “all voxels that are inside the desired segment fall on one side of the threshold value, and all voxels that are outside the desired segment fall on the other side of the threshold value.” Ex. 1010 ¶ 42. We find that the values of these voxels (which are compared with a threshold) are properties of the voxels. Murphy's teaching that the voxel values are compared with a threshold to assign the voxels to a segment therefore teaches claim 6's “sorting voxels of said items by a property of said voxel.” *See id.*

Regarding element 3c, i.e., “applying colors to groups of sorted voxels to obtain a colored image,” Murphy describes “volume rendering” that involves “the forming of an RGBA volume from the data,” which is a “3D dataset with 4 vectors in each voxel, namely, the red, green, blue and opacity values.” Ex. 1010 ¶ 45. As Murphy renders color for “each voxel,” which therefore includes those voxels in segment volumes, Murphy discloses “applying colors to groups of sorted voxels to obtain a colored image.” *Id.*; Ex. 1003 ¶ 205.

Claims 9 and 15 are similar to claim 3. Petitioner's analysis of these claims for this challenge relies on Petitioner's analysis of claim 3. Pet. 83–84, 91.

Patent Owner does not dispute Petitioner's arguments or evidence regarding the additional features of claims 3, 9, and 15.²⁵ Upon consideration, we agree with Petitioner's assertions of obviousness of dependent claims 3, 9, and 15 over Murphy and Guang.

Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claims 3, 9, and 15 are unpatentable under 35 U.S.C. § 103(a) over the combination of Murphy and Guang.

7. *Dependent Claims 4, 10, and 16*

Petitioner asserts that claims 4, 10, and 16 are unpatentable as obvious over the combination of Murphy and Guang. Pet. 77–79. Patent Owner does not address separately Petitioner's patentability challenges to dependent claims 4, 10, and 16. *See generally* PO Resp.

Claim 4 is reproduced below.

[4a] The method of claim 1 further comprising zooming in on a portion of said image, said zooming in on a portion of said image comprising:

[4b] selecting a new viewpoint for a left eye;

[4c] selecting a new viewpoint for a right eye;

[4d] displaying, in said DU, an image for said left eye based on said initial viewing angle, said new view point for said left eye and said volume of interest; and

²⁵ Patent Owner has presented argument and evidence, including the testimony of a declarant, for a related patent challenged in IPR2021-00647 having claims with recitations similar to the recitations of claim 3 of the '183 patent. *See, e.g.*, IPR2021-00647, Paper 14, 50–52. Patent Owner, however, has not presented the same argument and evidence in the instant proceeding. Any arguments not presented in the instant proceeding have been waived. Paper 11, 8 (“Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.”)

[4e] displaying, in said DU, an image for said right eye based on said initial viewing angle, said new view point for said right eye, and said volume of interest and wherein said image for said left eye and said image for said right eye produce a three-dimensional image to said user.

Ex. 1001, 18:20–32.

We have reviewed Petitioner’s contentions and cited supporting evidence addressing how the combination of Murphy and Guang teaches claim 4. Pet. 77–79 (citing, *e.g.*, Ex. 1010 ¶¶ 32, 55, 57; Ex. 1003 ¶¶ 208–213. We find Petitioner’s contentions persuasive and we credit the testimony of Dr. Zyda because Petitioner’s contentions and Dr. Zyda’s testimony are consistent with and supported by the cited portions of Murphy and Guang. For instance, Murphy discloses that “viewers can select pre-defined views, they can move and rotate the Virtual Patient in any direction or angle, [and] they can zoom in to view particular features in detail.” Ex. 1010 ¶ 57. Dr. Zyda credibly explains that “[a] POSITA would have further understood that Murphy’s ability to freely ‘move and rotate the Virtual Patient in any direction or angle’ includes moving toward (or away from) a volume of interest—*i.e.*, decreasing (or increasing) the distance between the 3D volume and the user’s viewpoint.” Ex. 1003 ¶ 210 (citing Ex. 1010 ¶ 57). We further credit Dr. Zyda’s testimony that “decreasing the distance between the 3D volume and the user’s viewpoint corresponds to a selection of new viewpoints for each of the user’s eyes in which the image is enlarged as viewed by the user.” Ex. 1003 ¶ 210 (citing Ex. 1009, 4:56–5:29). Our analysis, findings, and conclusions are the same using the correct claim construction and also using Patent Owner’s proposed construction. *See* § II.C.6.

Claims 10 and 16 are similar to claim 6. Petitioner’s analysis of these claims for this challenge relies on Petitioner’s analysis of claim 6. Pet. 84, 91–92.

Patent Owner does not dispute Petitioner’s arguments or evidence regarding claims 4, 10, and 16.²⁶ Upon consideration, we agree with Petitioner’s assertions of obviousness of dependent claims 4, 10, and 16 over Murphy and Guang.

Based on the complete record now before us, Petitioner has proved, by a preponderance of the evidence, that claims 4, 10, and 16 are unpatentable under 35 U.S.C. § 103(a) over the combination of Murphy and Guang.

8. *Dependent Claims 5, 11, and 17*

Claim 5 depends directly from claim 1 and further recites “wherein said DU is selected from the group consisting of a display unit incorporating polarized lenses, a display unit wherein multiplexed images are viewed via shuttered lenses, virtual reality displays having a display unit with unique left and right eye pixel displays, and other types of three-dimensional (3D) displays.” Claims 11 and 17 depend directly from independent claims 7 and 13, respectively, and recite the same further recitation.

²⁶ Patent Owner has presented argument and evidence, including the testimony of a declarant, for a related patent challenged in IPR2021-00647 having claims with recitations similar to the recitations of claim 4 of the ’183 patent. *See, e.g.*, IPR2021-00647, Paper 14, 54–55. Patent Owner, however, has not presented the same argument and evidence in the instant proceeding. Any arguments not presented in the instant proceeding have been waived. Paper 11, 8 (“Patent Owner is cautioned that any arguments not raised in the response may be deemed waived.”)

We have reviewed Petitioner’s contentions and cited supporting evidence addressing how the combination of Murphy and Guang teaches the additional limitations of claims 5, 11, and 17. Pet. 79 (citing Ex. 1010 ¶¶ 17, 20–22, 50; Ex. 1003 ¶ 215). Based on the complete record now before us, Petitioner has established that the combination of Murphy and Guang teaches the limitations of dependent claims 5, 11, and 17. For instance, Murphy describes “[a]t block 410, the system can display the resulting image” using “a stereoscopic display, or any other virtual reality display system.” Ex. 1010 ¶ 50. Murphy also describes by way of example using “head mounted displays (HMD) in the form of glasses or goggles, which allow a user to wear a display system on their head.” Ex. 1010 ¶ 20. Murphy also describes “[a]nother example” of using “shuttered glasses” that give “an accurate 3-d representation.” *Id.* ¶ 21.

Patent Owner does not address separately Petitioner’s patentability challenges to dependent claims 5, 11, and 17. *See generally* PO Resp. For the reasons given here, in addition to the reasons explained above addressing independent claims 1, 7, and 13, based on the entire record, Petitioner has proved, by a preponderance of the evidence, that dependent claims 5, 11, and 17 are unpatentable under 35 U.S.C. § 103 as obvious over the combination of Murphy and Guang.

9. *Dependent Claims 6, 12, and 18*

Claim 6 depends directly from claim 1 and further recites “wherein said convergence point comprises a point where a center theta-alpha ray from said viewpoint of said left eye and a center theta-alpha ray from said viewpoint of said right eye intersect.” Claims 12 and 18 depend directly from independent claims 7 and 13, respectively, and recite the same further recitation.

Petitioner incorporates its contentions for claim 1. Pet. 80, 85–86, 92. Patent Owner does not address separately Petitioner’s patentability challenges to dependent claims 6, 12, and 18. *See generally* PO Resp.

For reasons explained above addressing independent claims 1, 7, and 13, and further based on Petitioner’s assertions for these dependent claims, which are supported by the cited evidence, Petitioner has proved, by a preponderance of the evidence, that claims 6, 12, and 18 are unpatentable under 35 U.S.C. § 103(a) over the combination of Murphy and Guang.

III. CONCLUSION

Petitioner has proved by a preponderance of the evidence that claims 1–18 of the ’183 patent are unpatentable. The outcome for the challenged claims is set forth in the table below.²⁷ In summary:

Claims Challenged	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatent-able	Claims Not shown Unpatent-able
1, 5–7, 11–13, 17, 18	102	Jones	1, 5–7, 11–13, 17, 18	
1, 5–7, 11–13, 17, 18	103(a)	Jones	1, 5–7, 11–13, 17, 18	

²⁷ 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), (b)(2).

Claims Challenged	35 U.S.C. §	Reference(s)/ Basis	Claims Shown Unpatent- able	Claims Not shown Unpatent- able
2–5, 8–10, 14– 16	103(a)	Jones, Schoolman	2–5, 8–10, 14–16	
1–18	103(a)	Murphy, Guang	1–18	
Overall Outcome			1–18	

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 1–18 of the '183 patent are unpatentable; 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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