

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MICROSOFT CORPORATION,
Petitioner,

v.

D3D TECHNOLOGIES, INC.,
Patent Owner.

IPR2021-01325
Patent 10,795,457 B2

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

LEE, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

I. INTRODUCTION

Microsoft Corporation (“Petitioner”) filed a Petition (Paper 2 (“Pet.”)) requesting an *inter partes* review of claims 70–80, 84, 89–97, 99, 103, and 107 (“challenged claims”) of U.S. Patent No. 10,795,457 B2 (Ex. 1001, “the ’457 patent”) pursuant to 35 U.S.C. §§ 311–319. D3D Technologies, Inc. (“Patent Owner”) filed a Preliminary Response. Paper 7 (“Prelim. Resp.”). Petitioner filed a Preliminary Reply to Patent Owner’s Preliminary Response (Paper 9, “Prelim. Reply”) and Patent Owner filed a Preliminary Sur-Reply (Paper 10, “Prelim. Sur-Reply”).

We have authority to determine whether to institute review under 35 U.S.C. § 314 and 37 C.F.R. § 42.4. Upon consideration of the contentions and the evidence of record at this juncture, we conclude Petitioner has shown a reasonable likelihood that it would prevail in establishing unpatentability at least one challenged claim of the ’457 patent. Accordingly, we institute an *inter partes* review of all challenged claims of the ’457 patent on all grounds set forth in the Petition.

II. BACKGROUND

A. *Real Parties-in-Interest*

Petitioner identifies only itself as the real party-in-interest. Pet. 107. Patent Owner identifies only itself as the real party-in-interest. Paper 3, 2.

B. *Related Matters*

Each party identifies the following district court litigation involving the ’457 patent as related matter: *D3D Technologies, Inc. v. Microsoft Corporation.*, No. 6:20-cv-1699 (M.D. Fla. Sept. 16, 2020). Pet. 107; Paper 3, 2.

Petitioner has filed petitions for *inter partes* review of related patents: (1) U.S. Patent No. 8,384,771 B1 (IPR2021-00647); (2) U.S. Patent No.

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9,349,183 B1 (IPR2021-00648); (3) U.S. Patent No. 9,980,691 B2 (IPR2021-00877 and IPR2021-00878); and U.S. Patent No. 9,473,766 B2 (IPR2021-00703). We instituted review in each of IPR2021-00647, IPR2021-00648, IPR2021-00703, and IPR2021-00878.

C. The '457 Patent

The '457 patent relates to three-dimensional medical imaging. Ex. 1001, code (57). In particular, it relates to an interactive 3D cursor which facilitates selection and manipulation of a three-dimensional volume within a three-dimensional image. *Id.* The selected volume may be transparency adjusted as well as filtered to remove selected items from view. *Id.* Location indicators, annotations, and registration markers may be overlaid on the selected volume. *Id.*

The '457 patent states:

In accordance with an aspect of the invention an apparatus comprises: a computing device; and a human machine interface comprising a three-dimensional cursor that has a non-zero volume; the human-machine interface moving the three-dimensional cursor within a three-dimensional image responsive to a first input; the human-machine interface selecting a volume of the three-dimensional image designated by the three-dimensional cursor responsive to a second input; and the human-machine interface presenting a modified version of the selected volume of the three-dimensional image responsive to a third input. . . . In some implementations, the human-machine interface presents the three-dimensional cursor with measurement markings on at least one edge, surface or side. . . . In some implementations, the human-machine interface automatically generates and presents a statistical representation of the selected volume of the three-dimensional image. . . . In some implementations, the human-machine interface presents multiple axial computed tomography images associated with the selected volume using reference lines.

Ex. 1001, 3:31–4:5.

Figure 1A illustrates a 3D cursor selecting a volume of interest from a three-dimensional medical image (*id.* at 4:33–34) and is reproduced below:

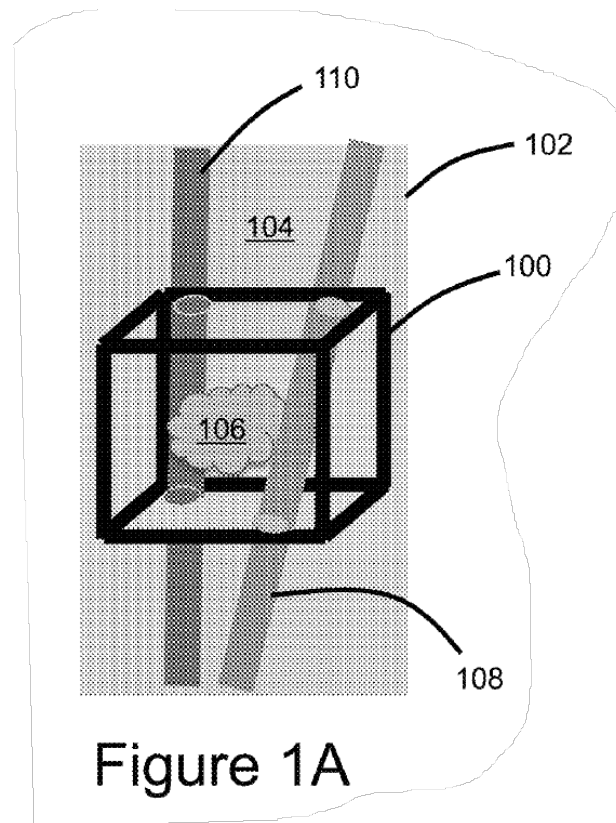


Figure 1A illustrates 3D (three-dimensional) cursor 100 overlaid on three dimensional medical image 102. Ex. 1001, 5:42–43. As shown, 3D cursor 100 defines a cubic volume of interest. *Id.* at 5:43–44. Medical image 102 could include any portion of a body, or an entire body. *Id.* at 5:45–46. The image includes background material 104, such as fat, lobulated mass 106, tubular-shaped vein 108, and artery 110. *Id.* at 5:49–51. 3D cursor 100 can be moved relative to the image by manipulating an IO device such as a mouse. *Id.* at 5:51–53. “A button click or other input designates (selects) the portion of the image that is located inside the three-dimensional volume of the 3D cursor 100.” *Id.* at 5:54–56.

Figure 1D illustrates filtering of selected areas of the selected volume of interest (Ex. 1001, 4:41–42), and is reproduced below:

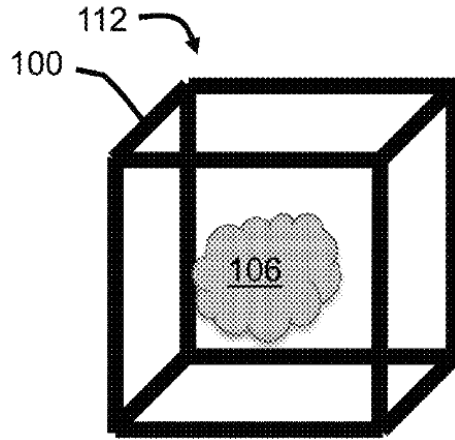


Figure 1D

Figure 1D illustrates filtering of selected areas or tissues of selected image portion 112 to remove those areas or tissues from view. *Id.* at 6:18–20. In this example, background material 104, vein 108, and artery 110 have been removed from view, leaving only lobulated mass 106. *Id.* at 6:20–22.

Figure 7 illustrates an association of multiple variously computed tomography images with the 3D cursor and is reproduced below:

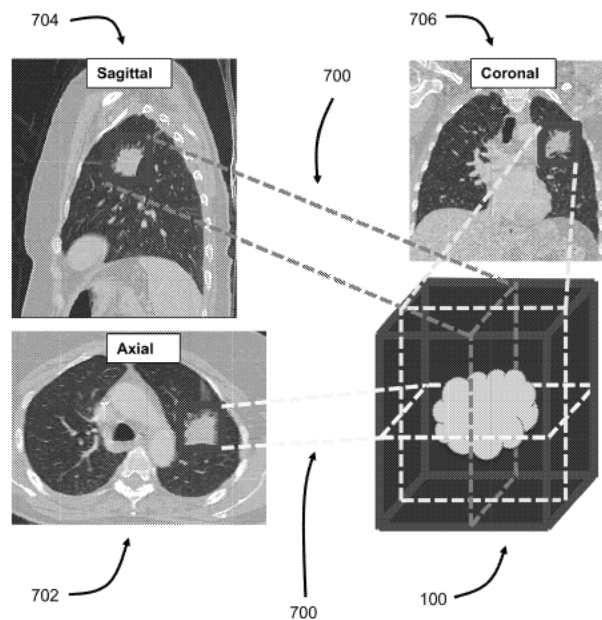


Figure 7

Figure 7 illustrates “association of multiple computed tomography (CT) images of the chest in lung windows with the interactive 3D cursor 100 using reference lines 700.” *Id.* at 8:37–39. The illustration includes axial image 702, sagittal image 704, and coronal image 706. *Id.* at 8:39–42. A corresponding visible boundary of the 3D cursor, such as in color red, may be presented. *Id.* at 8:53–55.

Figure 8 illustrates an association of axial computed tomography slices with the 3D cursor and is reproduced below:

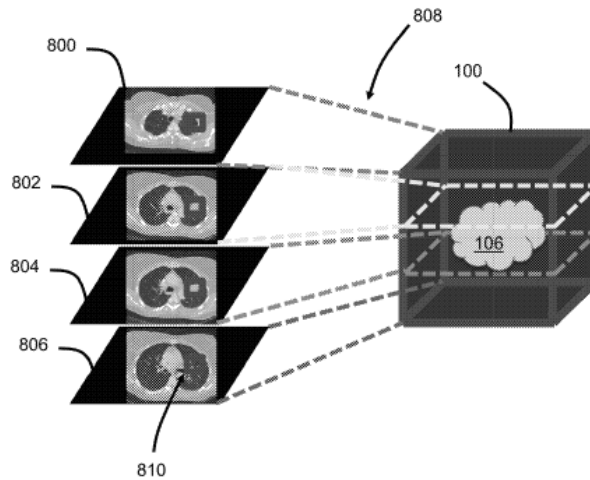


Figure 8

Figure 8 illustrates “association of multiple axial computed tomography (CT) slices 800, 802, 804, 806 of the chest in lung windows with the interactive 3D cursor 100 using reference lines 808.” *Id.* at 8:56–59. The CT slices show the location of the 3D cursor, i.e., the slice area that includes a cross-section of the 3D cursor, which in the illustrated example has selected a left upper lobe mass. *Id.* at 8:59–63.

Claims 70 and 89 are independent and reproduced below:¹

- [70pre] An apparatus comprising:
 - [70a] a computing device; and
 - [70b] a human-machine interface comprising a three-dimensional cursor that has a non-zero volume;
 - [70c] the human-machine interface configured to select a volume of the three-dimensional image designated by the three-dimensional cursor, wherein the three-dimensional cursor encloses the volume of the three-dimensional image responsive to an input; and
 - [70d] the human-machine interface configured to present a modified version of the selected volume of the three-dimensional image responsive to another input;
 - [70e] wherein the human-machine interface is further configured to display:
 - orthogonal cross-sectional imaging slices, wherein the slices are marked with a corresponding visible boundary of the three-dimensional cursor,
 - [70f] reference lines from the three-dimensional cursor to the orthogonal cross-sectional imaging slices,
 - [70g] the three-dimensional cursor and results from a statistical analysis performed on contents of the three-dimensional cursor.

Ex. 1001, 15:53–16:6.

¹ The bracketed captions are used by Petitioner to reference the elements. We use the same here for ease of reference, understanding, and consistency.

- [89pre] An apparatus comprising:
- [89a] a computing device; and
 - [89b] a human-machine interface comprising a three-dimensional cursor that has a non-zero volume;
 - [89c] the human-machine interface configured to select a volume of the three-dimensional image designated by the three-dimensional cursor, wherein the three-dimensional cursor encloses the volume of the three-dimensional image responsive to an input; and
 - [89d] the human-machine interface configured to present a modified version of the selected volume of the three-dimensional image responsive to another input;
 - [89e] wherein the human-machine interface is further configured to display:
 - a stack of contiguous cross-sectional imaging slices, wherein the slices are marked with a corresponding visible boundary of the three-dimensional cursor,
 - [89f] reference lines from the three-dimensional cursor to the stack of contiguous cross-sectional imaging slices,
 - [89g] the three-dimensional cursor and results from a statistical analysis performed on contents of the three-dimensional cursor.

Ex. 1001, 17:10–31.

D. Evidence relied on by Petitioner

Petitioner relies on the following patent document references:²

² The '457 patent issued from Application 15/878,463, filed Jan. 24, 2018, which is a continuation-in-part of Application 14/877,442, filed Oct. 7, 2015, now Pat. 9,980,691, which is a continuation-in-part of Application 12/176,569, filed July 21, 2008, now Pat. 9,349,183, which is a continuation-in-part of Application 11/941,578, filed Nov. 16, 2007, now Pat. 8,384,771. Ex. 1001, codes (21, 22, 63). The '457 patent also claims

Name	Patent Document	Exhibit
Acosta ³	US 2006/0279569 A1	1005
Tomoda ⁴	US 2004/0059214 A1	1006
Avila ⁵	US 6,413,219 B1	1007
Bitter ⁶	US 2005/0228250 A1	1008
Tako ⁷	WO 2017/066373 A1	1011

Petitioner also relies on the Declaration of Henry Fuchs, Ph.D.
Ex. 1003.

E. Asserted Grounds of Unpatentability

Petitioner asserts that the challenged claims of the '457 patent are unpatentable based on the following grounds:

Claims Challenged	35 U.S.C. § ⁸	Reference(s)/Basis
70–80, 84	103	Acosta, Avila, Bitter
70–80, 84, 89–97, 99, 103	103	Acosta, Avila, Bitter, Tomoda
74	103	Acosta, Avila, Bitter, Tako

priority to Provisional Application 60/877,931, filed Dec. 28, 2006. *Id.* at code (60).

³ Published Dec. 14, 2006.

⁴ Published Mar. 25, 2004.

⁵ Issued July 2, 2002.

⁶ Published Oct. 13, 2005.

⁷ Published Apr. 20, 2017; based on PCT/US20 16/956727, filed Oct. 13, 2016; claims priority to Provisional Application 62/241,447, filed Oct. 14, 2015.

⁸ The Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011) (“AIA”), amended 35 U.S.C. §§ 102 and 103. Based on the record before us at this juncture (*see, e.g.*, Pet. 2–4; Ex. 1001), we preliminarily determine that the '457 patent has an effective filing date after the effective date of the applicable AIA amendments. We, therefore, refer to the AIA version of 35 U.S.C. §§ 102 and 103.

Claims Challenged	35 U.S.C. § ⁸	Reference(s)/Basis
74, 93, 107	103	Acosta, Avila, Bitter, Tomoda, Tako

Petitioner regards January 24, 2018, as the priority date of the '457 patent. Pet. 3.

III. DISCRETIONARY DENIAL OF THE PETITION

Patent Owner contends in its Preliminary Response that we should exercise discretion under 35 U.S.C. § 314(a) to deny institution of *inter partes* review in view of parallel district court proceeding. Prelim. Resp. 37–44 (citing, e.g., *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB Mar. 20, 2020) (precedential) (“*Fintiv*”). Petitioner asserts, in its Preliminary Reply, however, that the circumstances have changed with respect to parallel litigation in district court, because as of January 10, 2022, “Patent Owner is no longer asserting the '457 Patent.” Prelim. Reply 1. Patent Owner, in its Preliminary Sur-Reply, confirms that “the '457 patent is no longer asserted in the co-pending litigation.” Prelim. Sur-Reply 1.

Because the '457 patent is no longer being asserted in parallel district court litigation initially noted by the parties in the Petition and in the Preliminary Response, discretionary denial as originally requested by Patent Owner in its Preliminary Response is moot and need not be reached. Patent Owner asserts that under *Fintiv* Factor 6, “the Board should deny institution of trial because the merits of this Petition are particularly weak.” Prelim. Sur-Reply 1. The assertion is misplaced where, as here, there is no longer any parallel litigation involving the '457 patent. The *Fintiv* factors are not at issue in this circumstance.

IV. ANALYSIS

A. *Burden of Proof*

To prevail at trial in its challenge to Patent Owner's claims, if review is instituted, Petitioner must demonstrate by a preponderance of the evidence that the claims are unpatentable. 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d) (2021). That burden never shifts to the patentee. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

B. *Level of Ordinary Skill in the Art*

Petitioner asserts that a person of ordinary skill in the art at the time of the '457 patent ("POSITA") "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. 3–4 (citing Ex. 1003 ¶¶ 21–22). Patent Owner has not made its own assertion of the level of ordinary skill. Prelim. Resp. 12. However, Patent Owner states: "Patent Owner mostly agrees with [Petitioner's] position, but believes that the use of the term 'at least' is inappropriate inasmuch as it would extend to persons having more than ordinary skill." *Id.*

Petitioner's use of the qualifier "at least" renders Petitioner's articulation vague and potentially overlapping with the level of skill of an expert. On this record, we adopt Petitioner's articulation of the level of ordinary skill, but delete the qualifier "at least" for the level of education and for the amount of experience, to keep the level from being vague and overbroad and extending into the level of an expert. What remains appears consistent with what is reflected by the content of the applied prior art

references. *Cf. Okajima v. Bourdeau*, 261 F.3d 1350, 1354–55 (Fed. Cir. 2001) (the applied prior art may reflect an appropriate level of skill).

In summary, one with ordinary skill in the art at the pertinent time period would have had a Bachelor’s degree in an academic area emphasizing electrical engineering, computer science, or a similar discipline, and two years of experience in the field working with, teaching, or researching stereoscopic and/or virtual/augmented reality (VR/AR) display technologies.

C. Claim Construction

We use the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b), including construing the claim in accordance with the ordinary and customary meaning of such claim as understood by one of ordinary skill in the art and the prosecution history pertaining to the patent. 37 C.F.R. § 42.100(b). The claim construction standard set forth in *Phillips v. AWH Corp.*, 415 F.3d 1303 (Fed. Cir. 2005) (en banc) is applicable.

Claim terms are generally given their ordinary and customary meaning as would be understood by one with ordinary skill in the art in the context of the specification, the prosecution history, other claims, and even extrinsic evidence including expert and inventor testimony, dictionaries, and learned treatises, although extrinsic evidence is less significant than the intrinsic record. *Phillips*, 415 F.3d at 1312–17. Usually, the specification is dispositive, and it is the single best guide to the meaning of a disputed term. *Id.* at 1315.

The specification may reveal a special definition given to a claim term by the patentee, or the specification or prosecution history may reveal an intentional disclaimer or disavowal of claim scope by the inventor. *Id.* at 1316. If an inventor acts as his or her own lexicographer, the definition

must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). The disavowal, if any, can be effectuated by language in the specification or the prosecution history. *Poly-America, L.P. v. API Indus., Inc.*, 839 F.3d 1131, 1136 (Fed. Cir. 2016).

Only those claim terms that are in controversy need to be construed, and only to the extent necessary to resolve the controversy. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co. Matal*, 868 F.3d 1013, 1017 (Fed. Cir. 2017); *Wellman, Inc. v. Eastman Chem. Co.*, 642 F.3d 1355, 1361 (Fed. Cir. 2011); *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

“three-dimensional cursor”

The term “three-dimensional cursor” is recited in each of independent claims 70 and 87. Petitioner asserts:

In related litigation proceedings, Petitioner and Patent Owner agreed to construe “cursor” as “an indicator movable within a three-dimensional image, image space, and volume.” MS-1025. For the purposes of this petition, Petitioner will use this construction. It follows then that a “**3D** cursor” is a “3D indicator movable within a three-dimensional image, image space, and volume.” MS-1003, ¶[49].

Pet. 8 (footnote omitted). Patent Owner has not proposed a construction for either “cursor,” “3D cursor,” or “three-dimensional cursor.” Nor has Patent Owner expressed disagreement in this proceeding with Petitioner’s proposed construction for “three-dimensional cursor.” On this record, we see no error with Petitioner’s proposed construction for “three-dimensional cursor” and will, for purposes of institution, adopted it as the construction for “three-dimensional cursor.”

In summary, “three-dimensional cursor” means “three-dimensional indicator movable within a three-dimensional image, image space, and volume.”⁹

We discuss the term “measurement markings,” recited in claims 74 and 93, in the analysis below within the context of claims 74 and 93.

D. Alleged Obviousness of Claims 70–80, 84, 89–97, 99, and 103 over Acosta, Avila, and Bitter

1. The Law on Obviousness

A claim is unpatentable under 35 U.S.C. § 103 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 to a person having ordinary skill in the art to which said subject matter pertains. *See 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 skill in the art; and (4) where in evidence, so-called secondary considerations, including commercial success, long-felt but unsolved needs, failure of others, and unexpected results (“the *Graham* factors”). *Graham v. John Deere Co. of Kansas City*, 383 U.S. 1, 17–18 (1966).

2. Overview of Acosta

Acosta relates to imaging of three-dimensional (3D) volume data sets. Ex. 1005 ¶ 4. Acosta describes using a computerized axial tomography

⁹ This is consistent with the construction we provided for “three-dimensional cursor” in the decision instituting review in related *inter partes* review proceeding IPR2021-00878 involving Petitioner and Patent Owner, where we adopted the construction for “cursor” as agreed to by the parties in related district court litigation. IPR2021-00878, Paper 14, 16–17.

(CAT) scanner or a magnetic resonance imaging (MRI) device to generate a 3D volume data set that is imaged or displayed for analysis by medical personnel. *Id.* Acosta describes that one conventional way of generating an image of a 3D volume set is to cross-section the 3D volume data set into a plurality of two-dimensional or 2D cross-sections or slices, and then to generate the image of the 3D volume data set by stacking the 2D slices in order resulting in a composite complete image. *Id.* ¶ 6.

Acosta also describes using a 3D sampling probe for fast visualization and analysis of large 3D volume data sets. *Id.* ¶ 59. Acosta describes that the sampling probes are typically created as a 3D sub-volume of the whole 3D volume data set to be visualized and analyzed. *Id.* Additionally, Acosta describes:

A number of sampling probes can be created, shaped, sized, and moved interactively by the user within the whole 3D volume data set. The intersection of the sampling probe with the whole 3D volume data set is texture mapped onto the surface of the sampling probe, or volume rendered with varying degrees of transparency within the sampling probe. As used herein, the term “interactive” or “interactively” refers to changing or re-drawing an image in response to user input at a rate sufficiently fast that the user perceives an instantaneous or real-time change in the image, without perceptible delay or lag.

Id. ¶ 60.

Figure 15 of Acosta illustrates three opaque sampling probes (Ex. 1005 ¶ 45) and are reproduced below:

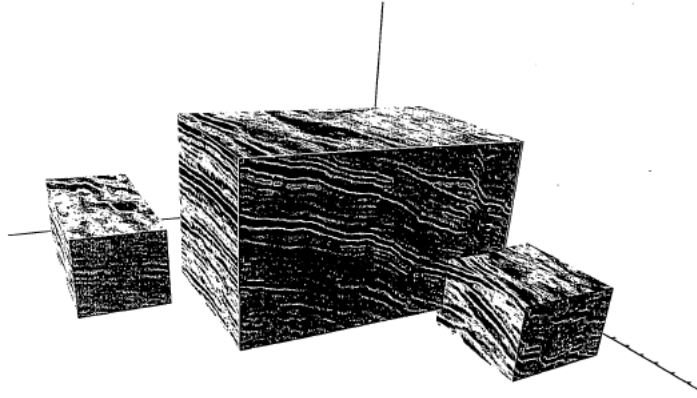


FIG. 15

Figure 15 shows three active probes, and the user has selected not to display the data contained in the background planes and in the remainder of the data volume outside of the active probes. *Id.* ¶ 157. Acosta describes that the ability to move and intersect the probes with each other throughout the 3D volume data set enables the user to better interpret and track a feature within the volume. *Id.*

Figure 2 of Acosta, reproduced below, shows a block diagram of a 3D sampling probe program which creates, operates, and moves the 3D sampling probe. *Id.* ¶ 32.

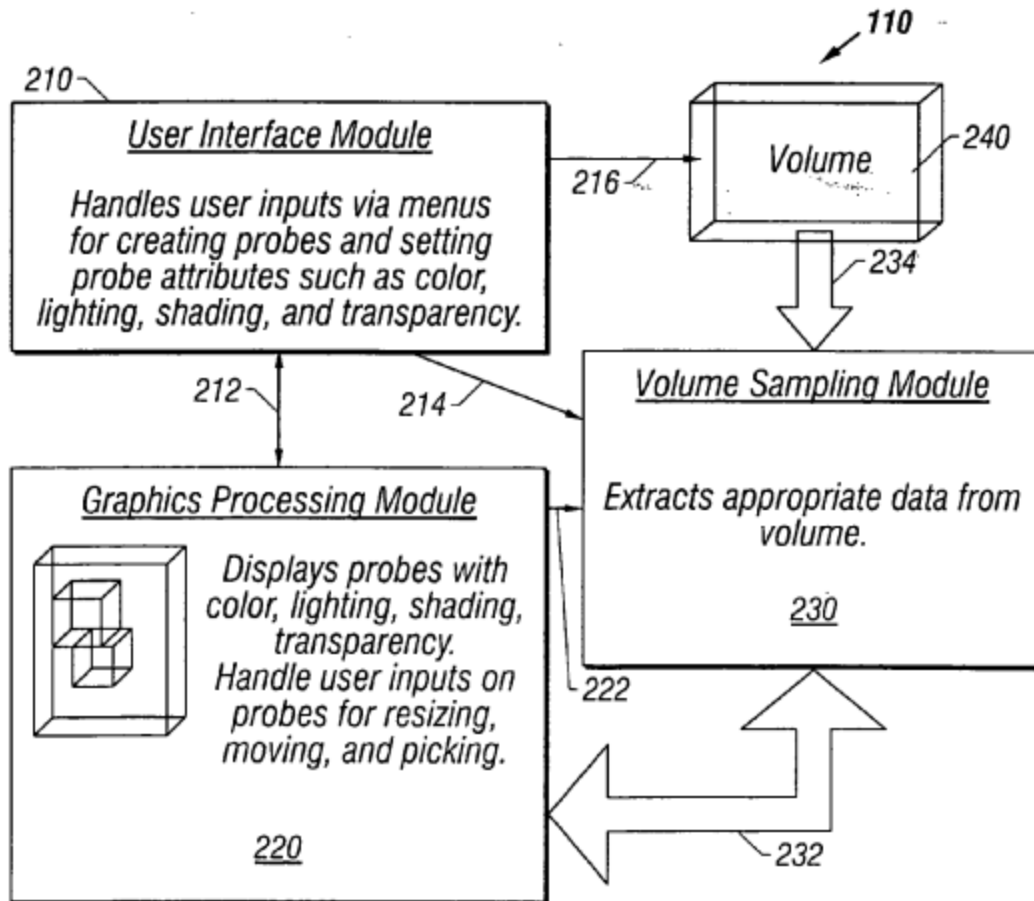


FIG. 2

Figure 2 shows a block diagram of 3D sampling probe program 110 including User Interface Module (UIM) 210, Graphics Processing Module (GPM) 220, and Volume Sampling Module (VSM) 230. *Id.* ¶ 88. A 3D volume data set is illustrated as data volume 240, also referred to as a 3D volume. *Id.*

UIM 210 handles user interface to receive commands, instructions, and input data from the user. *Id.* ¶ 90. UIM 210 receives user input as the user manipulates an input device to move, size, and shape the 3D sampling probe. *Id.* ¶¶ 90, 94. UIM 210 receives from the user identification of 3D volume set 240. *Id.* ¶ 91. UIM 210 also receives input from the user for

moving the position of the 3D sampling probe within the data volume and selecting the content of the displayed image, such as the 3D sampling probe's intersection with the 3D volume. *Id.* ¶¶ 94, 96.

To carry out the foregoing functions, UIM 210 sends a request to VSM 230 to load the 3D volume set identified by the user. *Id.* ¶ 97. Data volume 240 stores the 3D volume data set. *Id.* ¶ 89. Voxel data from data volume 240 is transferred to VSM 230 via data pathway 234. *Id.*

UIM 210 communicates via pathway 212 with GPM 220 that performs the display and imaging. *Id.* ¶ 97. GPM 220 processes data for imaging 3D sampling probes. *Id.* ¶¶ 98–99. GPM also processes the re-shaping and move requests that are received by UIM 210 from the user. *Id.* ¶ 99. VSM 230 extracts the appropriate data from data volume 240 at the request of GPM 220 and transfers the data to GPM 220 via data pathway 232. *Id.* ¶ 102.

3. *Overview of Avila*

Avila relates to a system for displaying a three-dimensional image at a predetermined orientation along with, in a spaced-apart relationship, three cut plane images representing mutually orthogonal planar cuts through the three-dimensional data volume. Ex. 1007, code (57). Each of the cut planes has a positional relationship to the data volume graphic that corresponds to the positional relationship of the respective cut plane to the data volume. *Id.* Any one of the four images can be active in the sense that images are reconstructed in real-time as a track ball is moved. *Id.*

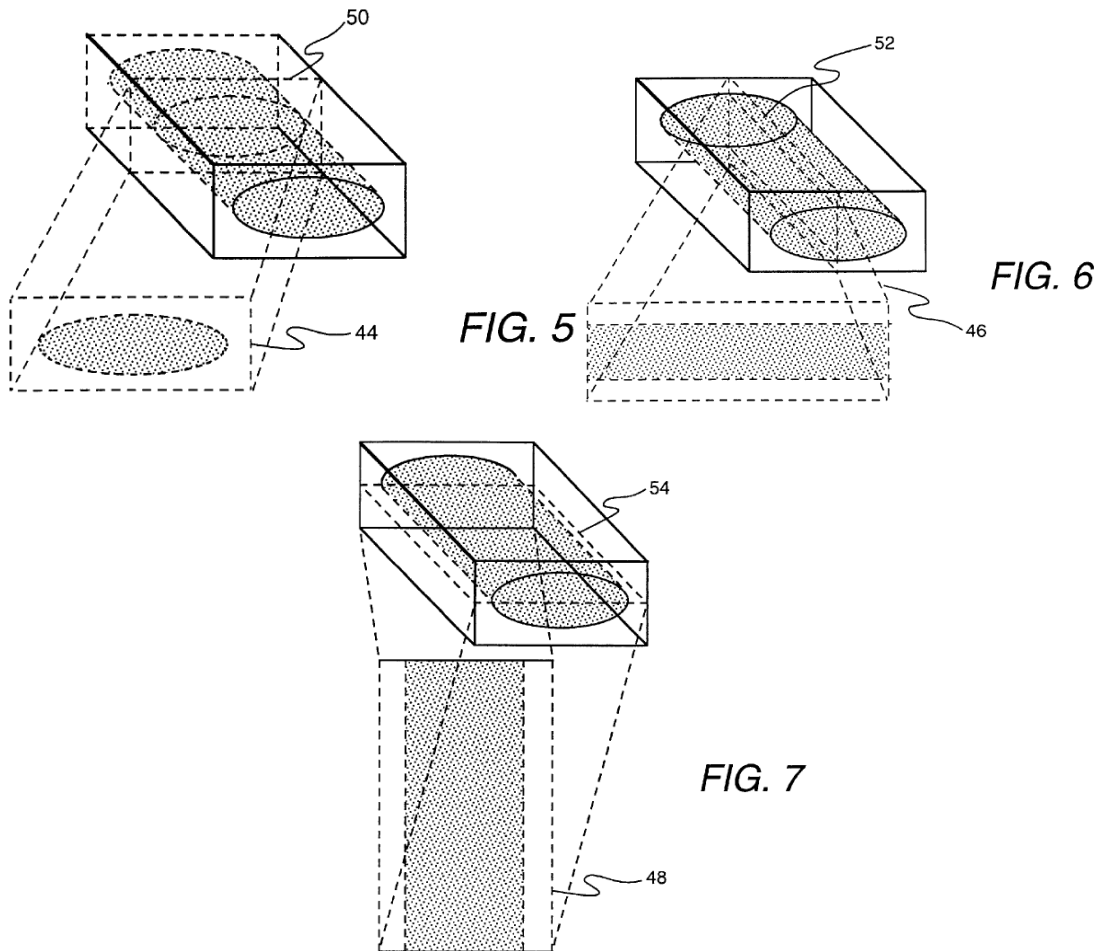
Avila describes:

In an ultrasound imaging system which scans a human body and collects multiple images (e.g., B mode) in memory to form a data volume derived from a three-dimensional object volume, an image representing that data volume is displayed,

accompanied by a plurality of images representing individual slices taken at different angles and intersecting at a point in the data volume. In a preferred embodiment, three images representing mutually orthogonal slices in the data volume are displayed. The display mode is hereinafter referred to as the “orthogonal cut planer” mode.

Id. at 2:48–57.

Figures 5, 6, and 7 are diagrams depicting respective individual slices obtained from the data volume through orthogonal planes (Ex. 1007, 3:39–41) and are reproduced below:



Figures 5–7 depict respective individual slices 44, 46, and 48 of imaging data taken along respective mutually orthogonal planes 50, 52, and 54 intersecting a point inside a data volume 40. *Id.* at 5:51–54.

Avila describes:

Upon entering the 3D mode, the operator must first select the XY-dimension and location of the region of interest (ROI) within the data volume (step 108). This selection is accomplished by manipulating a region of interest box which appears in a default position on the display screen when the 3-D mode key has been depressed. The region of interest box can be sized and translated in the X and Y directions to encompass an image structure which appears on a sector scan image. The region of interest box is translated by moving the trackball and is sized by operation of a four-sided rocker switch incorporated in the operator interface.

Id. at 6:12–23. When the system enters an “orthogonal cut plane” mode, the video processor causes to be displayed on screen 58 of display 18 an orientation box together with three-dimensional image 60 and three additional images 62, 64, and 66 representing slices of data taken at mutually intersecting planes that are mutually orthogonal and intersect at a point in the data volume. *Id.* at 6:41–65. Figure 10 illustrates the multiple images concurrently displayed in the orthogonal cut plane mode (*id.*, at 3:47–50) and is reproduced below:

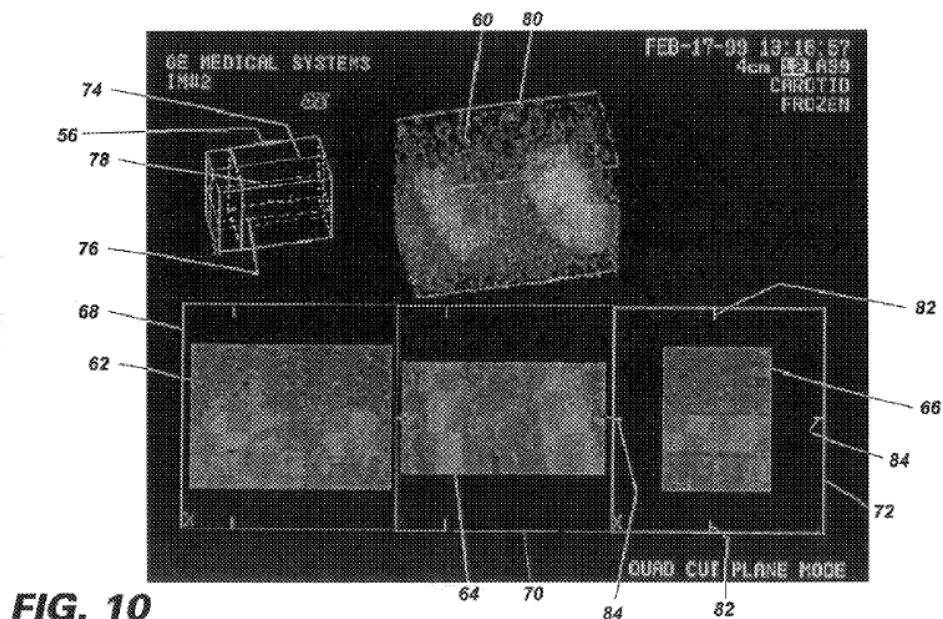


Figure 10 shows the positions of the three cut planes being indicated on orientation box 56 by respective parallelograms imaged in colors which match the colors of frames 68, 70, and 72 containing cut plane images 62, 64, and 66 respectively. *Id.* at 7:10–12. For instance, parallelogram 74 superimposed on orientation box 56 corresponds to and indicates the position of cut plane 62 being displayed inside frame 68; parallelogram 76 superimposed on orientation box 56 corresponds to and indicates the position of cut plane 64 being displayed inside frame 70; and parallelogram 78 superimposed on orientation box 56 corresponds to and indicates the position of cut plane 66 being displayed inside frame 72. *Id.* at 7:12–20. Furthermore, with regard to projected image 60 and the cut plane images, Avila states:

[E]ach parallelogram comprises two solid straight lines, indicating the intersection of the respective cut plane with surfaces of the data volume which are visible in projected image 60, and two dashed straight lines, indicating the intersection of the respective cut plane with hidden surfaces of the data volume shown in projected image 60.

Id. at 7:20–26. In summary, “[t]he orthogonal cut plane mode displays four images (60, 62, 64, and 66 in FIG. 10) and a wire-frame orientation box 56.”

Id. at 7:50–52. Avila describes that only one of the four images is “active” at any time, meaning that it can be manipulated using an interface device such as a trackball. *Id.* at 7:52–55.

4. *Overview of Bitter*

Bitter relates to system and method to enable visualization and navigation of complex 2D or 3D data models of internal organs, where the models are generated from 2D data sets produced by a medical imaging acquisition device such as a CT or an MRI device. Ex. 1008 ¶¶ 3, 6.

Specifically, a user interface is provided for displaying medical images and enabling user interaction with the medical images. *Id.* ¶ 7. Bitter describes:

The User interface [UI] comprises an image area that is divided into a plurality of views for viewing corresponding 2-dimensional and 3-dimensional images of an anatomical region. The UI displays a plurality of tool control panes that enable user interaction with the images displayed in the views. The tool control panes can be simultaneously opened and accessible.

Id. Figure 5b is an exemplary diagram of a graphical user interface (“GUI” 90) according to Bitter (Ex. 1008 ¶ 91) and is reproduced below:

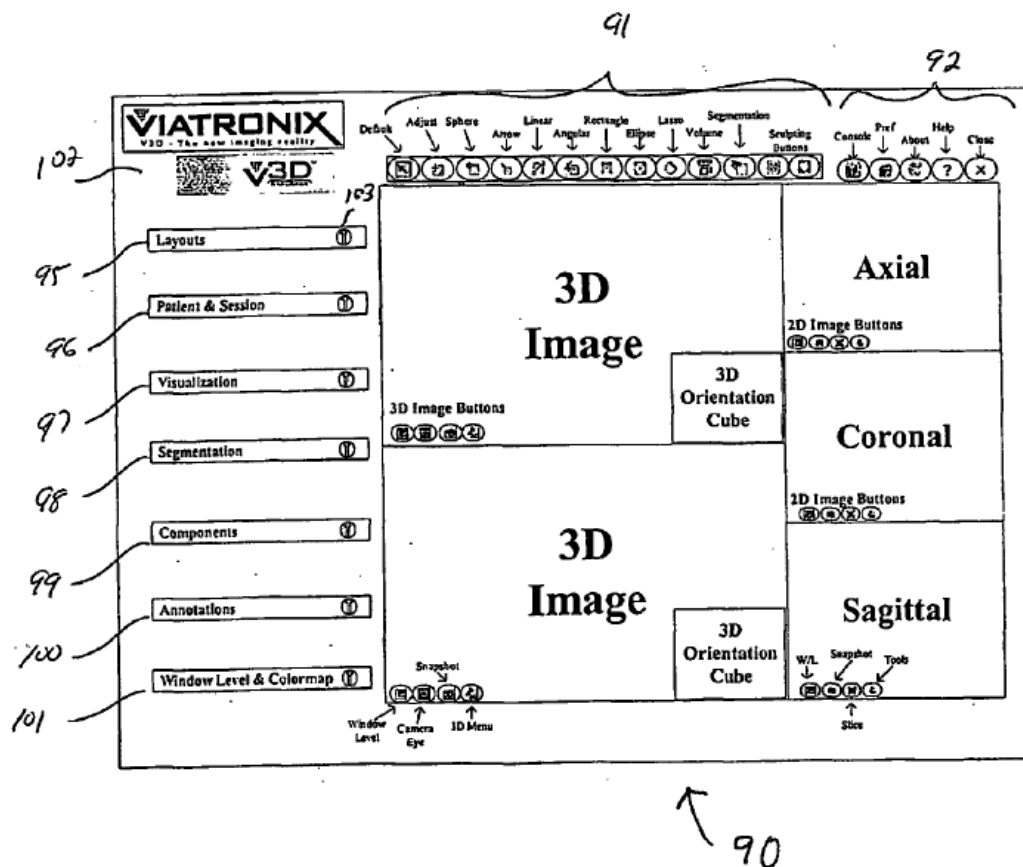


Fig. 5(b)

Figure 5b shows an image area in which it is displayed one or more image views, and an area for displaying tools. *Id.* ¶ 92. Each view comprises an area for displaying a 2D or 3D image. *Id.* Specifically, Figure

5b illustrates an image window configuration that displays two 3D views of an anatomical area of interest and three 2D views (axial, coronal, sagittal). *Id.* ¶ 109. GUI 90 provides different areas for displaying tool buttons 91 and application buttons 92. *Id.* ¶ 91. “A freehand Selection Tool button (or alternatively referred to as ‘Lasso’ or Region of Interest (ROI) tool) allows a user to encircle an abnormality, vessel, lesion or other area of interest with a ‘lasso’ drawn with the mouse pointer (253, FIG. 17). *Id.* ¶ 126.

GUI 90 includes a plurality of panes 95–101 that provide specific features, control, and information. *Id.* ¶ 95. Each pane comprises a pane expansion selector 103 (arrow) to expand or contract the pane, and pressing the arrow toggles the display of the pane. *Id.* GUI 90 is able to show multiple panes as open and accessible at the same time. *Id.* Numeral 95 designates a layout pane; numeral 96 designates a patient and session pane; numeral 97 designates a visualization pane; numeral 98 designates a segmentation pane; numeral 99 designates a components pane; numeral 100 designates an annotations pane; and numeral 101 designates a colormap pane. *Id.*

Visualization pane 97 allows a user to control the way in which the GUI displays certain features on the images, such as “Patient Information.” *Id.* ¶ 96. Segmentation pane 98 allows a user to select one of various Automatic Segmentation features, one of which allows the user to preset buttons to automatically segment specific types of areas or organs, such as air, tissue muscle, bone. *Id.* ¶ 100. Components pane 99 provides a listing of all components generated by the user via the segmentation process. *Id.* ¶ 102. Annotations pane 100 is where annotations and measurements are listed. *Id.* ¶ 104. The annotations pane also displays the type of annotation, e.g., what type of measurement, was made, and the user-specified color of

the annotation. *Id.* A user can also remove all annotations through a Remove All button within the annotations pane. *Id.* The tool control panes 95–101 are arranged as stacked rollout panes that can open individually. *Id.* ¶ 105.

Bitter describes that its system includes a GUI module which receives input from a mouse click or a keyboard to execute various functions such as interactive manipulation, e.g., artery selection, of a 3D model. *Id.* ¶ 37.

Bitter also describes an annotations module as follows:

[T]he annotations (measurement) module provides functions that allow a user to measure or otherwise annotate images. Annotations include imbedded markers and annotations that the user generates during the course of the examination. The annotations allows the user to add comments, notes, and remarks during the evaluation, and label Components. As noted above, the V3D Explorer treats measurements as annotations. By using Measurements, the user can add comments and remarks to each annotation made during the evaluation. These remarks, along with any values and/or statistics associated with the measurement, are displayed in the Annotations pane.

Id. ¶ 121. Bitter further describes a Volume Annotation button which can be selected to obtain the volume of a component. *Id.* ¶ 127. Activating the Volume Annotation tool allows the user to click anywhere on a component and attain its volume, in cubed millimeters, average and maximum volumes, and the standard deviation. *Id.* These volume values will be listed in the Annotation pane and a label will be displayed on the image. *Id.*

Bitter also calculates statistics regarding the intensity distribution within the displayed region of interest. *Id.* ¶ 128. Bitter describes: “Various methods for generating the annotation and calculating the ROI statistics can be invoked to compute a histogram of the intensity distribution in the ROI and calculates the mean, maximum, minimum, and standard

deviation of the intensity within the ROI.” *Id.* Bitter further discloses displaying raw density values for the location on the display where a mouse pointer is positioned. *Id.* ¶¶ 92, 112

5. *Independent Claim 70*

a) *Recitation [70pre]*

The preamble of claim 70, identified above as [70pre], recites: “An apparatus comprising.” Petitioner asserts that “the extent the preamble is limiting, AABC [Acosta-Avila-Bitter combination (Pet. 24)] renders obvious [70pre].” Pet. 27. Essentially, Petitioner identifies Acosta’s computer system referred to in paragraph 61 of Acosta and the software or sampling probe program illustrated in Figure 1 of Acosta. *Id.* Acosta states: “The present invention may be implemented using hardware, software, or a combination thereof, and may be implemented in a computer system or other processing system. One embodiment of a software or program structure 100 for implementing the present invention is shown in FIG.1.” Ex. 1005 ¶ 61.

Petitioner’s assertions are supported by the cited evidence. Patent Owner does not present contrary arguments in this regard. We are sufficiently persuaded that Acosta’s computer system together with the sampling probe program of Figure 1 meet the “[a]pparatus” recitation of [70pre].

b) *Limitation [70a]*

In limitation [70a], claim 70 recites: “a computing device.” Petitioner identifies the same computer system referred to in Acosta’s paragraph 61 and the software or sampling probe program illustrated in Figure 1 of Acosta. Pet. 29. Patent Owner presents no contrary argument in this regard. We are sufficiently persuaded that Acosta’s computer system

together with the sampling probe program of Figure 1 meet the “computing device” recitation of limitation [70a].

c) *Limitation [70b]*

In limitation [70b], claim 70 recites: “a human-machine interface comprising a three-dimensional cursor that has a non-zero volume.” Petitioner identifies Acosta’s UIM 210 and connected components as Acosta’s human-machine interface, citing an annotated version of Figure 2 of Acosta. Pet. 30 n.5. Figure 2 of Acosta, as annotated by Petitioner, is reproduced below:

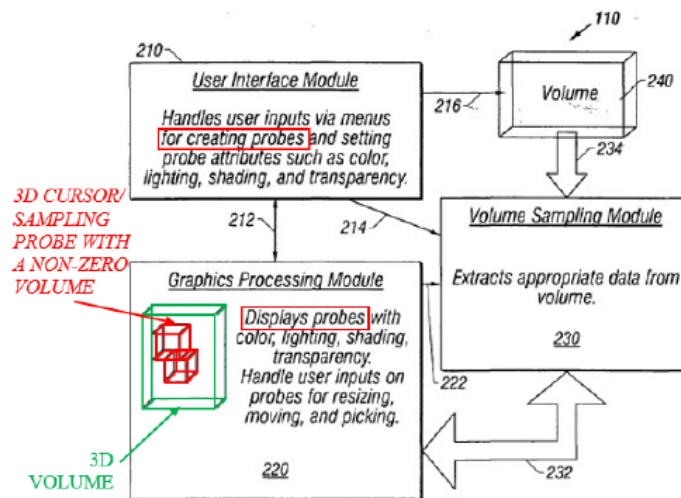


FIG. 2

MS-1005, FIG. 2

Figure 2 is a block diagram of Acosta’s 3D sampling probe program.

Ex. 1005 ¶ 32. Petitioner’s color annotations specially note the creation and display of sampling probes.

Petitioner further cites to the following disclosure of Acosta:

UIM 210 interfaces with the user through a variety of menus through which the user can select various options and settings, either through keyboard selection or through one or more user-manipulated input devices, such as a “mouse”, or a 3D pointing device. ***UIM 210 receives user input as the user manipulates the input device to move, size, shape, etc. a 3D sampling probe.***

Pet. 30 (citing Ex. 1005 ¶ 90) (emphasis added by Petitioner).

On page 33 of the Petition, Petitioner color-annotates Figure 15 of Acosta, as shown below:

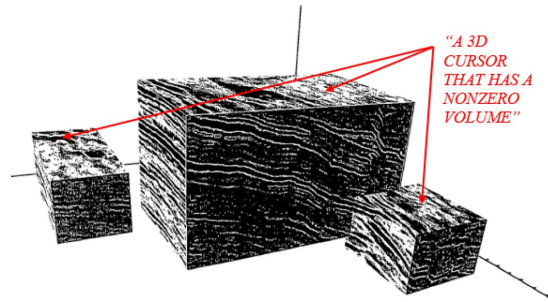


Figure 15 illustrates Acosta’s sampling probes, which Petitioner identifies by red-colored annotation as 3D cursors having a non-zero volume.

Petitioner further explains that UIM 210 receives inputs from the user to create the 3D sampling probes, that such information includes the size, shape, and initial location of the probe, and that such information can also include attributes such as color, lighting, shading, and transparency. *Id.* at 31 (citing Ex. 1005 ¶¶ 93, 94). Petitioner asserts that “A POSITA would have understood that Acosta’s sampling probe is a ‘**3D cursor**’ that **has a non-zero volume.**” Pet. 34 (citing Ex. 1003 ¶¶ 107–110).

Petitioner’s assertions are supported by the cited evidence. Patent Owner does not present arguments to the contrary. We are sufficiently persuaded that Acosta discloses limitation [70b].

d) Limitation [70c]

In limitation[70c], claim 70 recites: “the human-machine interface configured to select a volume of the three-dimensional image designated by the three-dimensional cursor, wherein the three-dimensional cursor encloses the volume of the three-dimensional image responsive to an input.”

Petitioner explains:

Acosta's "UIM 210 receives input from the user to *move* the position or location of a 3D sampling probe *within the data volume*. In a preferred embodiment, a user manipulates a mouse to 'click' onto a surface of the probe to be moved, and then moves the mouse to move the probe throughout the geographic space defined by the data volume." MS-1005, ¶[0094]; *see also* ¶¶[0022], [0037], [0060], [0085]-[0086], [0090], [0099], [0106], [0109], [0115]-[0119], [0014], FIG. 7 (reproduced below). A POSITA would have understood that the 3D sampling probe/cursor can be moved within the 3D image, image space, and volume to select any region of interest. MS-1003, ¶[111].

Pet. 35 (Figure 7 omitted). Petitioner further explains:

Acosta's *UIM 210 can select a volume of the three-dimensional image designated and enclosed by the three-dimensional sampling probe/cursor in response to a user input*. For instance, a user can "select the content of [a] displayed image" which "could include only the 3D sampling probe, i.e., its intersection with the 3D volume. Additionally, the 3D sampling probe could be displayed either with or without a bounding box that defines the outer geometry of the probe." MS-1005, ¶[0096].

Id. at 36.

Petitioner's assertions are supported by the cited evidence. Patent Owner does not present arguments to the contrary. We are sufficiently persuaded that Acosta discloses limitation [70c].

e) Limitation [70d]

In limitation [70d], claim 70 recites: "the human-machine interface configured to present a modified version of the selected volume of the three-dimensional image responsive to another input." Petitioner cites to the following disclosure of Acosta:

UIM 210 [receives as] *inputs from the user* information to create one or more 3D sampling probes. Such information includes size, shape, and initial location of the probe. *Such information can also include imaging attributes such as color, lighting,*

shading, and transparency (or opacity). *By adjusting opacity* as a function of data value, certain portions of the data volume are more transparent, thereby allowing a viewer to see through surfaces.

Ex. 1005 ¶ 93 (quoted at Pet. 38–39) (emphasis by Petitioner). Petitioner further explains:

“GPM 220 processes data for imaging of 3D sampling probes with the color, lighting, shading, transparency, and other attributes selected by the user.” MS-1005, ¶[0098]. The GPM 220 can process user input provided through the UIM 210 to modify attributes (e.g., color, lighting, shading, and transparency) of the selected volume within the 3D sampling probe through the UIM 210. MS-1005, ¶¶[0098]-[0099]. A POSITA would have understood that user input to modify the attributes can be received while generating the 3D sampling probe/cursor to select a volume of interest and/or after the 3D sampling probe (e.g., a default 3D sampling probe/cursor) is already displayed (“another user input”). MS-1005, ¶¶[0103], [0106]; MS-1003, ¶¶[114]-[115].

Pet. 39. Petitioner’s assertions are supported by the cited evidence.

Notwithstanding Patent Owner’ argument to the contrary, discussed below, we are sufficiently persuaded that Acosta discloses limitation [70d].

Patent Owner argues: “At the passages referenced in the petition, Acosta describes user selection of attributes of a 3D sampling probe, not presenting *a modified version of a selected volume* of a three-dimensional image.” Prelim. Resp. 26. Patent Owner explains:

It is apparent that the “inputs” being referred to are attributes such as the size, shape, and initial location of *the 3D sampling probe*, not any attributes of a selected volume of a three-dimensional image. In other words, Acosta makes it plain that it is the attributes of a cursor in the process of being established are selected; a necessary but independent activity prior to any selection of a volume. *See, e.g., id.* at Fig. 5, steps 502, 504. Further, to the extent this passage is read as describing user modifiable information relating to *image* attributes such as

“color, lighting, shading, and transparency (or opacity)” it is apparent that these attributes refer to modification of the presentation of a data volume and not presentation of a modified version of a selected data volume as required by claim 70. *See* Ex. 1001 at 15:57–64.

Id. at 26–27. Also, referring to paragraph 99 of Acosta, Patent Owner asserts that Acosta merely is describing how GPM 220 processes probe re-shaping and probe move requests received from the user, i.e., actions concerning the sampling probe. *Id.* at 27. Patent Owner asserts: “All of the instances cited by the Petition relate to Acosta’s teachings concerning the drawing and redrawing *of the sampling probe* [with a new shape or at a new location], not the presentation of a *modified version of a selected volume* as required by claim 70.” *Id.* at 28. For reasons discussed below, Patent Owner’s argument is unavailing.

When set, the size, shape, and location of the probe in a three-dimensional image represents a selected data volume. In a circumstance where the probe’s size, shape, and location is unchanged, but another aspect of the probe is changed, such as color, lighting, shading, or transparency, then a modified version of a previously selected data volume indeed is presented. Such a scenario is not precluded by the cited text of Acosta. The cited disclosure of Acosta does not require a change in an already specified size, shape, or location of the probe each time another aspect of the probe such as color, lighting, shading, or transparency is changed. We credit the testimony of Dr. Fuchs that “[a] POSITA would have understood that user input to modify the attributes can be received while creating the 3D sampling probe/cursor to select a volume of interest and/or after the 3D sampling probe (e.g., a default 3D sampling probe/cursor) is already

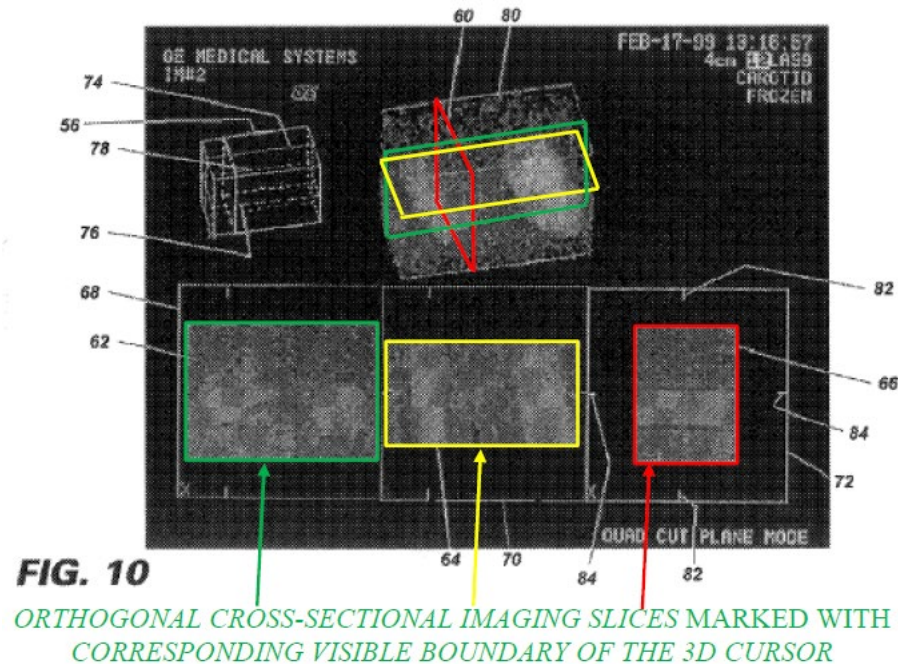
displayed (“another user input”). MS-1005, ¶¶[0103], [0106].” Ex. 1003 ¶ 115.

On this record, we are sufficiently persuaded that Acosta discloses limitation [70d].

f) Limitation [70e]

In limitation [70e], claim 70 recites: “wherein the human-machine interface is further configured to display: orthogonal cross-sectional imaging slices, wherein the slices are marked with a corresponding visible boundary of the three-dimensional cursor.” Petitioner relies on Avila’s display of orthogonal imaging slices. Pet. 39. Petitioner explains:

As explained above in Sections III.A.2-III.A.3, the Acosta-Avila combination renders obvious ***displaying orthogonal cross-sectional imaging slices***. For instance, as shown in Avila’s FIG. 10 below, in the “orthogonal cut plane” mode, “three images 62, 64, and 66 representing slices of data taken at mutually intersecting planes that are mutually orthogonal and intersect at a point in the data volume” ***can be displayed on screen 58***. MS-1007, 6:39–67, 7:1–50. These slices are also marked with a corresponding visible boundary of the selected 3D volume (3D cursor). For example, ***the outline of the slices 62, 64, and 66 shown in frames 68, [70], and 72 correspond to the visible boundary of the 3D sampling probe/cursor***. MS-1003, ¶[116].



MS-1007, FIG. 10

[the above Figure is Petitioner's color annotated version of Avila's Figure 10, which shows images displayed in an orthogonal cut plane mode]

Pet. 39–40.

Regarding motivation to combine teachings of Acosta and Avila, Petitioner explains:

[A] POSITA would have combined Avila's display interface that shows orthogonal cross-sectional imaging slices and a selected 3D ROI on the same display screen (see Avila's FIG. 10) with Acosta's teachings so that a viewer (e.g., a physician) could see a 3D image of an anatomical structure and corresponding 2D orthogonal cross-sectional imaging slices in areas of interest. MS-1003, ¶[61]. In other implementations, the 3D sampling probe/cursor can be displayed along with background portions of the 3D volume and 2D cross-sectional imaging slices. MS-1007, 6:12–67; MS-1005, ¶[0096]. In this manner, the viewer would have multiple views of the selected 3D ROI by itself or within a 3D image (options disclosed by Acosta) along with relevant slice views. MS-1005, ¶[0096]; MS-1003, ¶[61].

Pet. 17.

Petitioner's explanation about reasoning to combine teachings such that orthogonal cross-sectional imaging slices would be displayed in Acosta's system has evidentiary support and rational underpinning. Patent Owner presents no argument regarding the alleged reasoning to combine teachings. We are sufficiently persuaded by Petitioner's articulation of the reasoning to combine such that orthogonal cross-sectional imaging slices as taught by Avila would be displayed in Acosta together with the 3D cursor.

However, for reasons discussed below, as argued by Patent Owner (Prelim. Resp. 23–24), we are not sufficiently persuaded that Avila's orthogonal image slices are “marked with corresponding visible boundary of the three-dimensional cursor” as Petitioner contends and as is required by limitation [70e].

Specifically, in Petitioner's color-annotated illustration of Avila's Figure 10 shown above, Petitioner places colored markings around orthogonal imaging slices 62, 64, and 66. In that regard, Petitioner cites to paragraph 116 of the Declaration of Dr. Fuchs. Pet. 40. Dr. Fuchs' testimony in paragraph 116 of his Declaration also includes the same color-annotated Figure 10 of Avila. Ex. 1003 ¶ 116. It is Petitioner's and Dr. Fuch's position that the outline of the orthogonal imaging slices in Avila's Figure 10 are color marked. In our view at this stage, that is incorrect and reflects a misreading of the pertinent portions of the disclosure of Avila, i.e., Ex. 1007, 7:4–20.

Avila states:

In particular, as shown in FIG. 10, cut plane image 62 is framed by a frame 68, cut plane image 64 is framed by a frame 70, and cut plane image 66 is framed by a frame 72. *Each of frames 68, 70, and 72 has the same rectilinear or square shape, but is presented on the display monitor in a different color, e.g., red,*

blue, and yellow. In accordance with a preferred embodiment of the invention, the positions of the three cut planes are indicated on orientation box 56 by respective parallelograms imaged in colors which match *the colors of frames 68, 70 and 72.* For example, a parallelogram 74 superimposed on orientation box 56 corresponds to and indicates the position of cut plane 62 being displayed inside frame 68, a parallelogram 76 superimposed on orientation box 56 corresponds to and indicates the position of cut plane 64 being displayed inside frame 70, and a parallelogram 78 superimposed on orientation box 56 corresponds to and indicates the position of cut plane 66 being displayed inside frame 72.

Ex. 1007, 7:4–20 (emphasis added).

Thus, contrary to Petitioner’s assertion, it is not the outlines of orthogonal imaging slices 62, 64, and 66 which are color marked, but the outlines of frames 68, 70, and 72 which are color marked. For that reason, we are not sufficiently persuaded by Petitioner that Avila’s orthogonal cross-sectional imaging slices 62, 64, and 66 are “marked with corresponding visible boundary of the three-dimensional cursor” as is required by limitation [70e].

g) Conclusion

Based on our above discussion on limitation [70e], Petitioner has not shown a reasonable likelihood that it would prevail in establishing that claim 70 would have been obvious over Acosta, Avila, and Bitter.

6. Dependent Claims 71–80 and 84

Each of claims 71–80 and 84 depends, directly or indirectly, from claim 70 and thus includes all of the limitations of claim 70. The deficiency of the prior art, discussed above in the context of claim 70, equally applies to claims 71–80 and 84. Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of any of claims 71–80 and 84 over Acosta, Avila, and Bitter.

E. Alleged Obviousness of Claims 70–80, 84, 89–97, 99, and 103 over Acosta, Avila, Bitter, and Tomoda

1. Overview of Tomoda

Tomoda relates to processing of three-dimensional images. Ex. 1006, code (57). It discloses an apparatus which “comprises a ROI-specifying unit to specify a three-dimensional (3D) ROI (region of interest) at a region to be targeted in a three-dimensional space formed by the images, a deciding unit to decide one or more sections of the sections crossing the three-dimensional ROI, and a display unit to display images of the decided sections.” *Id.*; *see also id.* ¶ 13. A 3D ROI of any shape can be used. *Id.* ¶ 11.

Tomoda’s three-dimensional image is composed of sectional images. *Id.* ¶ 12. Tomoda states:

The sectional images used in the present invention, which compose a 3D image, includes an axial image of a section (axial plane) perpendicular to the body axis of an object (patient), coronal image of a section (coronal plane) perpendicular to the axial plane but in parallel with the front of the object body, sagittal image of a section (sagittal plane) perpendicular to both the axial plane and the coronal plane, and oblique image of an oblique plane other than the axial, coronal[,] and sagittal planes.

Id.

Tomoda describes host computer 6 producing two-dimensional images from original 3D image data. *Id.* ¶ 72. In these images, through a user interface, a spherical, three-dimensional ROI is specified at a desired region. *Id.* Thereafter, from the original 3D images, one or more sections that span across the specified spherical ROI are searched and their sectional images are displayed. *Id.* ¶ 73.

Figure 7 shows sagittal images displayed with a specified spherical ROI (*id.* ¶ 29) and is reproduced below:

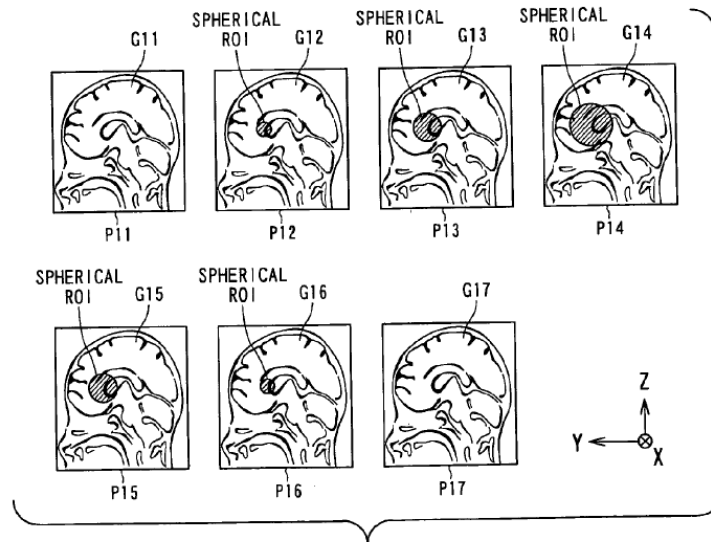


FIG. 7

Figure 7 consists of seven images P11 to P17 of a patient's head, in sagittal planes crossing the spherical ROI. *Id.* ¶ 66. Figures 9A and 9B show the positional relationship between the sagittal planes and the spherical ROI (*id.* ¶ 32) and are reproduced below:

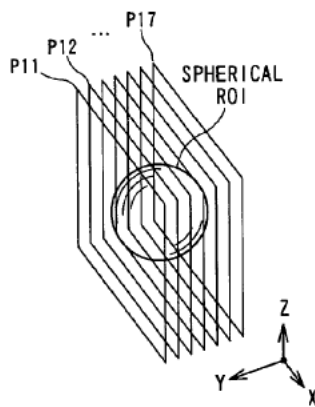


FIG. 9A

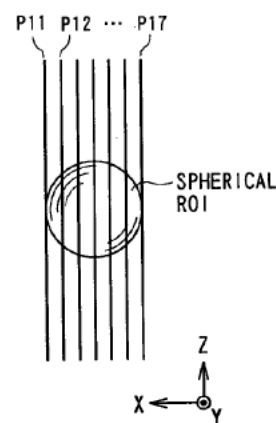


FIG. 9B

Figures 9A and 9B show the positional relationship between sagittal plane images P11 to P17 in Figure 7 and the spherical ROI each crosses. *Id.* ¶ 66.

2. *The role of Tomoda in the Applied Combination*

Petitioner explains the role of Tomoda in its applied combination of prior art references as follows:

In the Acosta-Avila-Bitter-Tomoda Combination (hereinafter “**AABT**”), Acosta’s 3D sampling probe would have been used to select the ROI, Avila’s layout would have been used to simultaneously display a 3D image and corresponding 2D cross-sectional image slices; Bitter would have been used to conduct measurements and generate and display statistical analysis on the selected ROI; and Tomoda’s method would have been used to: 1) show visible boundaries on the 2D slices corresponding to the selected 3D volume; and, in some implementations when desired, 2) display the original contiguous 2D radiological slices corresponding to the volume of Acosta’s 3D sampling probe within Avila’s layout. MS-1006, FIGS. 7–12; MS-1005, ¶¶[0059]–[0061], [0083], [0085], [0090]–[0094], FIGS. 2, 15. The use of Tomoda’s contiguous cross-sectional imaging slices in place of Avila’s orthogonal cross-sectional imaging slices is not inconsistent with Avila’s teachings. Avila teaches that the orthogonal cut plane mode in which orthogonal cross-sectional imaging slices are displayed is just one of several modes and that the slices can be obtained at various angles (including arbitrary angles) “thus allowing the user to obtain the exact view desired regardless of the anatomy.” MS-1007, 2:48–3:2, 5:30–47; *see also* 2:34–42 (incorporating by reference U.S. Patent 5,934,288 (MS-1015) describing the “cut plane mode” accommodates slices at an arbitrary angle and location). Accordingly, it would have been obvious to a POSITA that when the user is interested in viewing contiguous slices, Tomoda’s teachings would have been incorporated into Avila’s display interface so that Tomoda’s contiguous cross-sectional imaging slices would have been displayed instead of Avila’s cross-sectional imaging slices. MS-1003, ¶[88].

Pet. 78–79.

Based on the Petitioner’s articulation, for claims 70 and 87, Tomoda is applied for its teaching to “show visible boundaries on the 2D slices corresponding to the selected 3D volume.” And additionally for claim 87,

Tomoda is applied for its teaching to “display the original contiguous 2D radiological slices corresponding to the volume of Acosta’s 3D sampling probe within Avila’s layout.” We note that claim 87 requires the display of “a stack of contiguous cross-sectional imaging slices.”

3. *Independent Claim 70*

a) *Limitation [70e]*

The analysis of recitation [70pre] and limitations [70a], [70b], [70c], and [70d] is the same as that described above in Section II.D.5 for those elements in the context of alleged unpatentability over Acosta, Avila, and Bitter. Petitioner has adequately accounted for those elements of claim 70. We continue here with the analysis of limitation [70e]: “wherein the human-machine interface is further configured to display: orthogonal cross-sectional imaging slices, wherein the slices are marked with corresponding visible boundary of the three-dimensional cursor.”

We also discussed above in Section II.D.5 how Petitioner adequately has shown motivation to combine the teaching of Acosta and Avila such that orthogonal cross-sectional imaging slices as taught by Avila would be displayed in Acosta together with the 3D cursor. What Petitioner needs to account for here is the remainder of limitation [70e]. i.e., “wherein the slices are marked with corresponding visible boundary of the three-dimensional cursor.”

Petitioner relies on Figures 7 and 8 of Tomoda. Pet. 83–84. Figures 7 and 8, as color annotated by Petitioner on pages 83 and 84 of the Petition, are reproduced below:

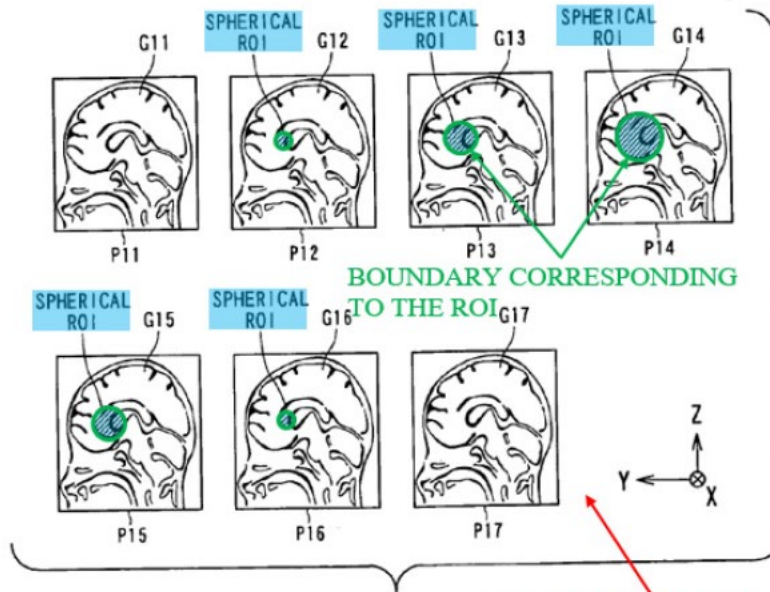


FIG. 7 SAGITTAL IMAGES

MS-1006, FIG. 7

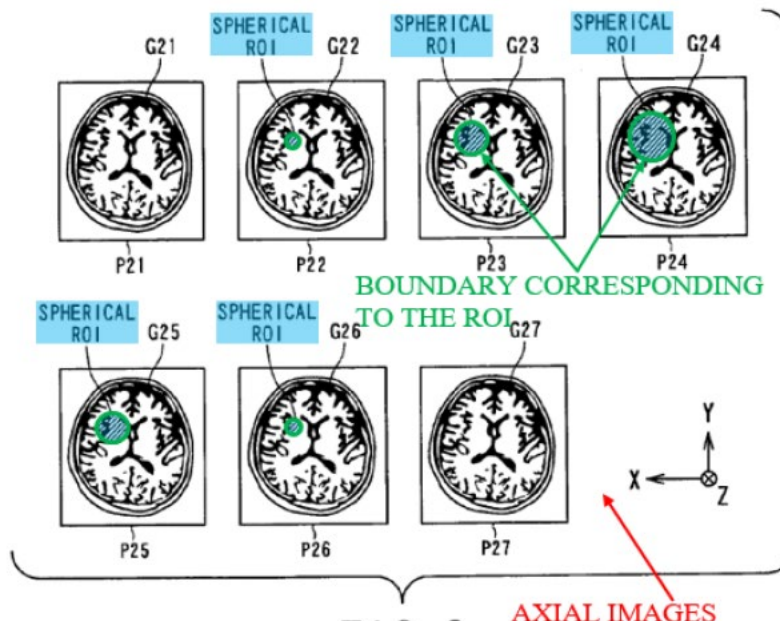


FIG. 8

Figure 7 shows a series of sagittal images on display and Figure 8 shows a series of axial images on display. Ex. 1006 ¶¶ 29–30. Petitioner asserts that in Tomoda’s Figures 7 and 8, “2D slices are marked up with a visible

boundary to show portions of the 2D slices (highlighted in blue) that include portions of a 3D ROI, referred to as a spherical ROI in Tomoda.” Pet. 83.

Petitioner explains:

For example, a slice, such as Tomoda’s slice G12 (FIG. 7) or G22 (FIG. 8), would be displayed in place of Avila’s image 62, 64, or 66. Cross-sectional slices at orthogonal angles, such as the axial, sagittal, or coronal slices, can be displayed as images 62, 64, and 66 such that *the displayed slices are marked with a corresponding visible boundary of the 3D cursor/sampling probe*. MS-1006, ¶¶[0012], [0065]-[0066], FIGS. 7–8; MS-1003, [119].

Id. at 84. With regard to motivation to display 2D images marked with marked with corresponding visible boundary of the three-dimensional cursor, Petitioner further explains:

By viewing 2D image slices with a boundary corresponding to a 3D ROI, a user would have been able to easily locate the ROI in a 2D image, study the ROI and its characteristics (e.g., tissue content, size, relative intensities). The user would also be able to adjust the size of the 3D cursor and/or modify the 3D ROI to more accurately capture the area of interest to the user.

Pet. 78 (citing Ex. 1003 ¶ 86).

Petitioner’s assertions are supported by the cited evidence.

Notwithstanding Patent Owner’s argument to the contrary, discussed below, we are sufficiently persuaded that the combined teachings of Acosta, Avila, and Tomoda teaches limitation [70e]. Further, we find that Petitioner’s articulated reasoning to combine the teachings of Acosta, Avila, and Tomoda, resulting in satisfaction of limitation [70e], has rational underpinning and is sufficient persuasive.

Patent Owner argues that according to claim 70, the three-dimensional cursor must enclose the volume of the three-dimensional image, but the

slices G12 and G22 used by Petitioner as examples do not have their spherical ROIs “extend to the edge of the volume shown in the slices.”

Prelim. Resp. 31. On that basis, Patent Owner asserts that “[t]hat region of interest is not a corresponding boundary of the three-dimensional cursor because the boundary of the three dimensional cursor extends to the edges of the volume from which the slices are taken under Petitioner’s proposed combination.” *Id.* at 31–32.

The argument is unavailing, because claim 70 does not require the three-dimensional cursor to enclose the entire volume of the three-dimensional image taken. The pertinent language is in limitation [70c]: “the human-machine interface configured to select a volume of the three-dimensional image designated by the three-dimensional cursor, wherein the three-dimensional cursor encloses the volume of the three-dimensional image responsive to an input.” In the wherein clause, the term “the volume” has its antecedent basis in the immediate prior language which states the human-machine interface is configured to select a volume of the three-dimensional image designated by the three-dimensional cursor. Thus, the three-dimensional cursor not only designates a volume of the three-dimensional image but also encloses that designated volume. It does not need to enclose the entire volume of the image taken. Patent Owner points to no language in the ’457 patent disclosure that indicates the three-dimensional cursor must enclose the entire volume of the three-dimensional image taken. On this record, it is unreasonable to read limitation [70c] that narrowly. Tomoda’s slices G12 and G22 do satisfy the wherein clause of limitation [70c]. The spherical ROIs in those slices do extend to the edge of the volume designated or selected by the 3D cursor in the proposed combination.

For the foregoing reasons, we are sufficiently persuaded that Petitioner's proposed combination of Acosta, Avila, and Tomoda discloses limitation [70e].

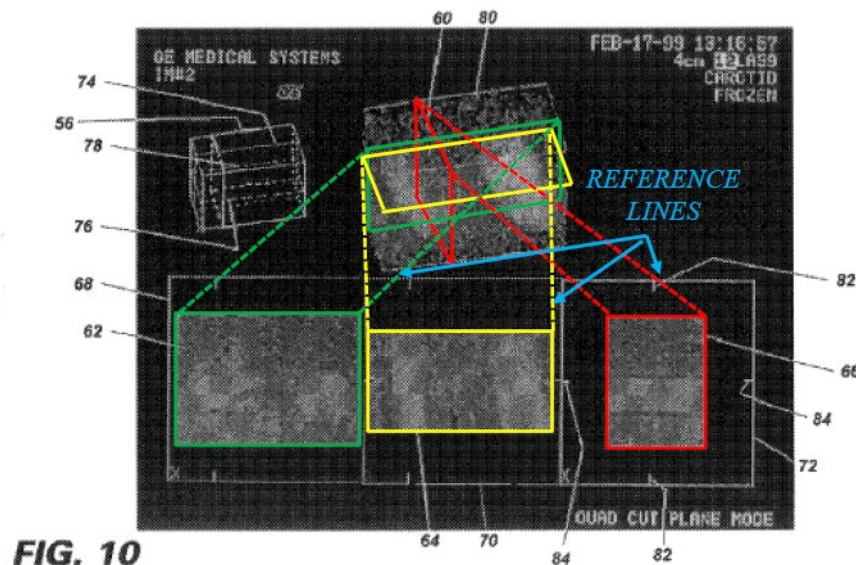
b) Limitation [70f]

In limitation [70f], claim 70 recites: “[wherein the human-machine interface is further configured to display:] reference lines from the three-dimensional cursor to the orthogonal cross-sectional imaging slices.”

Petitioner relies on Figures 5–7 of Avila, which according to Petitioner include “*reference lines extending from the selected volume (e.g., volume selected by the 3D sampling probe/cursor) to the orthogonal cross-sectional imaging slices.*” Pet. 41–42. Petitioner asserts that “[t]hese reference lines make it easier for a viewer to understand the relationship and orientation of the slices with respect to the selected volume and each other.” *Id.* at 41 (citing Ex. 1003 ¶ 120). Petitioner explains:

Although these reference lines are not included in Avila's FIG. 10, it would have been obvious for a POSITA to include them in Avila's FIG. 10 display interface (example shown below) because doing so would have made it easier for a viewer to understand which orthogonal cross-sectional imaging slices correspond to particular portions of the volume selected by the 3D sampling probe/cursor. MS-1003, ¶[121]; *see supra* Section III.A.3. Bitter, for example, explains that it was difficult to relate 2D images to the associated 3D image, but experienced radiologists or trained personnel could mentally link the 2D images to the 3D images. MS-1008, ¶[0005]. Like visual training wheels, instead of leaving to chance whether the user could mentally link the 2D and 3D images, it would have been obvious for a POSITA to have modified Avila's FIG. 10 to display reference lines (similar to the ones shown in FIGS. 5–7) extending from 3D image to the slices 62, 64, and 66. *See e.g.*, MS-1015, FIGS. 9A, 9B, ¶¶[0032], [0038], [0053], [0073], *supra* Section III.A.5. In doing so, any user could immediately

understand where a displayed slice is located within the 3D image. MS-1003, ¶[121].



MS-1007, FIG. 10

[The drawing is Figure 10 of Avila showing multiple images displayed in Avila’s orthogonal cut plane mode, with colored annotations added by Petitioner]

Id. at 42–43.

Petitioner’s assertions are supported by the cited evidence. Notwithstanding Patent Owner’s argument to the contrary, we are sufficiently persuaded that the combined teachings of Acosta and Avila reasonably would have suggested limitation [70f] to one with ordinary skill in the art.

Patent Owner argues that “although Avila does use reference lines in connection with Figures 4–7 to explain how individual slices of the ultrasound data correspond to a data volume from which they are obtained, when it comes to the actual display of the cut plane images Avila does not employ the use of such references lines.” Prelim. Resp. 24. Patent Owner notes that Avila relies, instead, “on coordinated colors of frames within

which the two-dimensional reference slices are displayed to allow the user to visually identify where in the three-dimensional image the slices are taken from.” *Id.* at 24–25 (citing Ex. 1007, 7:1–27). According to Patent Owner, an assertion of obviousness under such a circumstance reflects the improper use of hindsight. *Id.* at 25. Further according to Patent Owner, one with ordinary skill in the art “undertaking any combination of Acosta-Avila-Bitter would clearly follow the teachings of Avila and use the color coding of the frames within which the cut plane images are presented.” *Id.* at 25. Patent Owner also asserts that “[a]dding reference lines would only clutter the display being provided and if anything, obscure, not enhance, the user’s ability to visualize the information being depicted.” *Id.* at 25–26.

Patent Owner’s argument is misplaced and unavailing. Petitioner has articulated specific and adequate reasoning with rational underpinning to support the proposed modification. Even assuming that color coding is more preferred by Avila, the most preferred choice is not the only implementation that may be obvious. *See In re Mouttet*, 686 F.3d 1322, 1334 (Fed. Cir. 2012) (“This court has further explained that just because better alternatives exist in the prior art does not mean that an inferior combination is inapt for obviousness purposes.”); *cf. In re Fulton*, 391 F.3d 1195, 1200 (Fed. Cir. 2004) (holding that “a particular combination” need not “be the preferred, or the most desirable, combination described in the prior art in order to provide motivation”); *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994) (“A known or obvious composition does not become patentable simply because it has been described as somewhat inferior to some other product for the same use.”). As for Patent Owner’s assertion of the reference lines generating clutter, we are of the view that the advantages and benefits articulated by Petitioner outweigh the potential that the reference lines would create visual

obstruction on the display. *See Winner Int’l Royalty Corp. v. Wang*, 202 F.3d 1340, 1349 n.8 (Fed. Cir. 2000) (“The fact that the motivating benefit comes at the expense of another benefit . . . should not nullify its use as a basis to modify the disclosure of one reference with the teachings of another. Instead, the benefits, both lost and gained, should be weighed against one another.”).

For the foregoing reasons, we are sufficiently persuaded that the combined teachings of Acosta and Avila reasonably would have suggested limitation [70f] to one with ordinary skill in the art.

c) Limitation [70g]

In limitation [70f], claim 70 recites: “[wherein the human-machine interface is further configured to display:] the three-dimensional cursor and results from a statistical analysis performed on contents of the three-dimensional cursor.” Petitioner relies on Bitter for this feature. Pet. 44. Petitioner asserts that Bitter discloses a Volume Annotation button which can be selected to perform statistical analysis on a region of interest in a three-dimensional image. *Id.* (citing Ex. 1008 ¶¶ 89, 127). Petitioner asserts that “Bitter’s statistical analysis includes determining the mean, maximum, minimum and standard deviation of the intensity, and density values.” *Id.* (citing Ex. 1008 ¶¶ 92, 126–128, 112, 121, 132, Figs. 16(a)-16(b)).

Petitioner explains: “[B]oth Avila and Bitter disclose display interfaces showing 3D and 2D medical images, but Bitter explicitly describes displaying the results of statistical analysis performed on ROIs in the images. MS-1007, FIG. 10; MS-1008, FIG. 5B; MS-1003, ¶¶ [75]-[76].” Pet. 24. Petitioner also explains:

By displaying the 2D slices, a 3D image or cursor, reference lines extending from the 3D cursor to corresponding

portions of the 2D slices, and statistical data regarding the displayed image, a user (e.g., physician) can view a ROI (or portions thereof) in multiple views, have an improved sense of the size and dimensions of structures within the ROI, and examine the images with the benefit of statistical data. MS-1003, ¶[80].

Id. at 26–27. Additionally, Petitioner asserts:

[A] POSITA would have combined the teachings of Bitter with Acosta and Avila so that a viewer may also view ***statistical analysis performed on contents of the 3D sampling probe/cursor***. Additionally, showing these statistical analysis results when the user has identified a ROI would have been obvious because 1) the underlying voxels all have position in 3D space data (x, y, z), which makes measuring dimensions obvious; and 2) calculating the mean, max, standard deviation, or other statistical data using the voxel values (e.g., density) would have been a routine statistical determination and obvious. MS-1003 ¶[124].

Pet. 46.

Petitioner’s assertions are supported by the cited evidence. Patent Owner presents no argument directed to Petitioner’s accounting for limitation [70g]. We are sufficiently persuaded that the teachings of Acosta, Avila, and Bitter reasonably would have suggested limitation [70g].

d) Conclusion

Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 70 over Acosta, Avila, Bitter, and Tomoda.

4. Independent Claim 89

Claim 89 is the same as claim 70, except that claim 70’s recitation of “orthogonal cross-sectional imaging slices” in limitations [70e] is replaced by claim 89’s recitation of “a stack of contiguous cross-sectional imaging slices” in limitation [89e], and claim 70’s recitation of “the orthogonal cross-

sectional imaging slices” in limitations [70f] is replaced by claim 89’s recitation of “the stack of contiguous cross-sectional imaging slices” in limitation [89f]. The parties’ arguments for claim 89 is the same as their arguments for claim 70, except for limitations [89e] and [89f]. Further, the arguments for limitation [89f] are the same as the arguments for limitation 70[f], except that a reference is made to features of limitation [89e]. In this circumstance, we need only further address limitation [89e]. Our analysis of the rest of claim 89 is the same as our analysis of the corresponding limitations of claim 70.

In limitation [89e], claim 89 recites: “ wherein the human-machine interface is further configured to display: a stack of contiguous cross-sectional imaging slices, wherein the slices are marked with a corresponding visible boundary of the three-dimensional cursor.”

Petitioner asserts:

As explained in Sections III.B.1-III.B.2, in the AABT, it would have been obvious to a POSITA to combine the teachings of Tomoda with the teachings of Acosta, Avila, and Bitter so that Acosta’s human-machine interface would *display*: 1) *visible boundaries on the 2D slices corresponding to the 3D sampling probe/cursor*; and, in some implementations when desired, to 2) *a stack of original contiguous cross-sectional imaging slices corresponding to a 3D ROI selected by Acosta’s 3D sampling probe/cursor*. MS-1003, ¶[159].

Pet. 85.

Specifically, Petitioner explains:

It would have been obvious to a POSITA to combine Tomoda’s teachings with AABC so that, in some implementations of the combination, a user could view original contiguous cross-sectional imaging slices corresponding to a 3D ROI selected by Acosta’s 3D sampling probe/cursor. MS-1003, ¶¶[84]-[85]. Advantageously, a medical practitioner, such as a

physician, would have been able to see a stack of contiguous cross-sectional 2D image slices including marked up segments of the ROI, have a better understanding of the organ/tissue content within the 3D cursor, and perform a better diagnosis/treatment plan for a patient based on the improved viewing. MS-1003, ¶[85].

By viewing 2D image slices with a boundary corresponding to a 3D ROI, a user would have been able to easily locate the ROI in a 2D image, study the ROI and its characteristics (e.g., tissue content, size, relative intensities). The user would also be able to adjust the size of the 3D cursor and/or modify the 3D ROI to more accurately capture the area of interest to the user. For instance, by viewing contiguous slices, a user may realize that a selected ROI may not have fully captured a tumor of interest. The user may then modify the size or shape of the ROI and view all parts of the tumor of interest in the 2D slices. MS-1003, ¶[86].

Furthermore, by viewing a stack of contiguous cross-sectional 2D imaging slices with marked up boundaries, a physician would have had a better sense of how the ROI changes from one image to another, e.g., how the size, shape, and tissue contents within the ROI change from one 2D image slice to another. MS-1003, ¶[87].

Id. at 77–78.

Petitioner’s contentions regarding motivation to combine teachings are supported by the cited evidence. Patent Owner does not present contrary arguments in that regard. We are sufficiently persuaded that properly combined teachings of Acosta, Avila, Bitter, and Tomoda yields a human-machine interface which displays: (1) visible boundaries on the 2D slices corresponding to the 3D sampling probe/cursor; and (2) a stack of original contiguous cross-sectional imaging slices corresponding to a 3D ROI selected by Acosta’s 3D sampling probe/cursor.

Petitioner asserts that “Avila’s display would have been modified to display three contiguous image slices (such as slices P13-P15 in Tomoda’s

FIG. 7) in frames 68, 70, and 72 instead of orthogonal cross-sectional slices.” Pet. 88–89. In that regard, Petitioner explains:

Avila’s display software would simply be modified to allow a user to select contiguous slices for display and manipulation instead of orthogonal cross-sectional slices and corresponding changes to the display of the orientation box and 3D image would be made to indicate the corresponding location of the contiguous slices. *Id.* In instances where reference lines are used as explained above in [70f], the reference lines would extend from the 3D sampling probe/cursor to the stack of contiguous cross-sectional imaging slices that are displayed in place of the orthogonal cross-sectional slices. *Id.*

Id. at 90.

Petitioner’s assertions are supported by the cited evidence. The articulated reasoning to combine teachings also has rational underpinning. Patent Owner makes the same argument it made for limitation [70e], i.e., that the spherical visible boundary on Tomoda’s slices do not extend to cover the entirety of the image taken, as is alleged required by limitation [89c] (which reads identically as limitation [70c]). Prelim. Resp. 34. The argument was discussed and rejected above in our discussion of limitation [70e].

For the foregoing reasons, Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 89 over Acosta, Avila, Bitter, and Tomoda.

5. *Claims 74 and 93*

Claim 74 depends from claim 70 and further recites: “wherein the human-machine interface is configured to present the three-dimensional cursor with measurement markings on at least one edge, surface or side. Ex. 1001, 16:17–20. Claim 93 recites the same but depends from claim 89.

Id. at 17:41–44. The '457 patent illustrates measurement markings in its Figure 2, reproduced below:

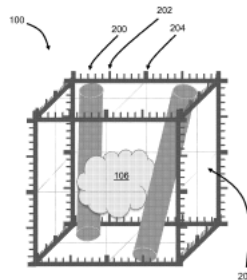


Figure 2

Figure 2 illustrates measurement markings on the edges and sides of a 3D cursor. *Id.* at 4:43–44. The specification of the '457 patent states:

FIG. 2 illustrates an implementation of the 3D cursor 100 with dimensional measurement markings. Dimensional measurement markings may be available as a feature that can be turned ON and OFF. In the illustrated example, the 3D cursor is a 2 cm by 2 cm by 2 cm cube. The dimensional measurement markings include tick marks 200, 202, and 204 that respectively designate 1 mm, 5 mm, and 1 cm increments along the edges of the cube (and thus representing three dimensions).

Ex, 1001, 6:47–7:8.

In light of the above-quoted disclosure of the '457 patent, we understand “measurement markings” as *markings which serve as constituent unit measurement indicators sufficient for a user or viewer to determine a total measurement.*

Petitioner asserts:

Bitter teaches using Annotations such as markers for performing measurements (in a ROI). MS-1008, ¶¶[0121]–[0126], [0041]. For example, a “Volume Annotation tool allows the user to click anywhere on a component (255[,] FIG. 17) and attain its volume, in cubed millimeters, average and maximum volumes, and the standard deviation. These values will be listed

in the Annotation pane (as shown in FIGS. 16a and b, for example), and a label will be displayed on the image.” MS-1008, ¶[0121], FIG. 17 (reproduced below). Bitter teaches that a component, such as a volume of interest, can be selected by the user and have associated annotations. MS-1008, ¶¶[0102], [0099], [0078], [0047], FIG. 9.

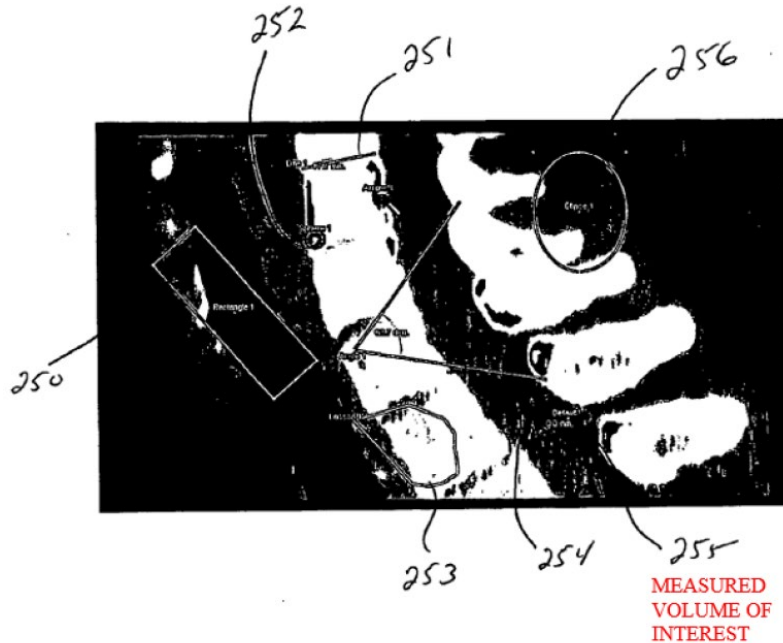
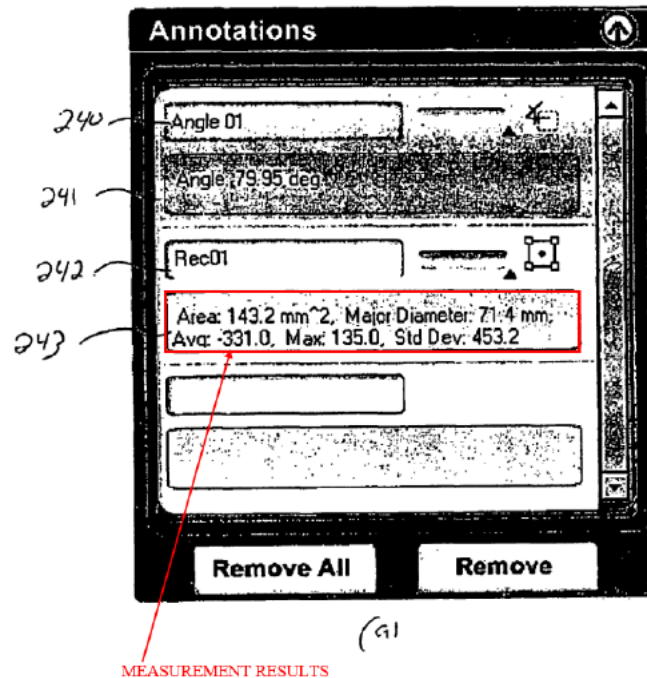


Fig 17

[Figure 17 shows a visualization pane with Petitioner’s annotation for where a measured volume would appear.
Ex. 1008 ¶ 27.]



[Figures 16a illustrate measurement annotations in Bitter's Annotation pane. Ex. 1008 ¶¶ 26, 127.]

Pet. 51–53.

Petitioner appears to regard either a complete or total measurement itself or a marker for a location where a measurement would be determined by the system to be a measurement marking. We disagree. As discussed above, we read “measurement markings” as *markings which serve as constituent unit measurement indicators sufficient for a user or viewer to determine a total measurement*. Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claims 74 and 93 over Acosta, Avila, Bitter, and Tomoda.

6. Claims 71–73, 75–80, 84, 90–92, 94–97, 99, and 103

Claims 71–73, 75–80, and 84 each depend directly from claim 70. Claims 90–92, 94–96, 99, and 103 each depend directly from claim 89. Claim 97 depends from claim 96. Patent Owner does not present arguments

against these dependent claims additional to those it has asserted with respect to independent claims 70 and 89. We have reviewed the assertions of Petitioner and the evidence cited by Petitioner. We are sufficiently persuaded that Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claims 71–73, 75–80, 84, 90–92, 94–97, 99, and 103 over Acosta, Avila, Bitter, and Tomoda.

*F. Alleged Obviousness of Claim 74
over Acosta, Avila, Bitter, and Tako*

Claim 74 depends from claim 70, and further recites: “wherein the human-machine interface is configured to present the three-dimensional cursor with measurement markings on at least one edge, surface or side.” Ex. 1001, 16:17–20. The deficiency of the Petition with respect to the alleged obviousness of claim 70 over Acosta, Avila, and Bitter, as discussed above, equally applies to the alleged obviousness of claim 74 over Acosta, Avila, Bitter, and Tako. Tako, as applied by Petitioner, does not relate to the issues involved in that deficiency. Petitioner’s application of Tako relates only to the limitation of the wherein clause additionally recited in claim 74.

Accordingly, Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claim 74 over Acosta, Avila, Bitter, and Tako.

*G. Alleged Obviousness of Claims 74, 93, and 107
over Acosta, Avila, Bitter, Tomoda, and Tako*

1. Overview of Tako

Tako discloses an augmented reality surgical navigation method including preparing a multi-dimensional virtual model associated with a patient, identifying in the virtual model a virtual view, corresponding to a surgeon’s current view of the patient, rendering a virtual image from the

virtual model based on the identified virtual view, and combining the virtual image with the surgeon's current view to form an augmented reality view of the patient on a display. Ex. 1011, code (57). Tako describes that its disclosed system is implemented on a modeling system such as the surgical graphical tool SNAP "which integrates with operating room technology to provide advanced 3D capabilities and augmented reality." *Id.* ¶ 68.

Regarding SNAP, Tako describes:

A SNAP case refers to a 3D texture or 3D objects created using one or more scans of a patient (CT, MR, fMR, DTI, etc.) in DICOM file format. It also includes different presets of segmentation for filtering specific ranges and coloring others in the 3D texture. It may also include 3D objects placed in the scene including 3D shapes to mark specific points or anatomy of interest, 3D Labels, 3D Measurement markers, 3D Arrows for guidance, and 3D surgical tools.

Id. ¶ 63. Tako states: "The SNAP tool provides neurosurgeons with unique virtual-reality guidance to determine the safest and most efficient pathway to remove cerebral tumors and treat vascular anomalies, for example, among other uses." *Id.* ¶ 68. Tako further states: "With the SNAP tool, surgeons can execute their surgery plan while in the operating room utilizing a particular patient's actual CT/MRI (and other) scans, allowing enhanced accuracy and efficiency." *Id.* ¶ 70.

Additionally, Tako describes that a head mounted display ("HMD") can be utilized to provide images to the surgeon. *Id.* ¶¶ 79, 103. Figures 24B and 25 are reproduced below:

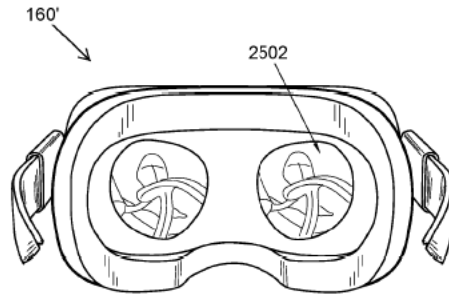


Fig. 24B

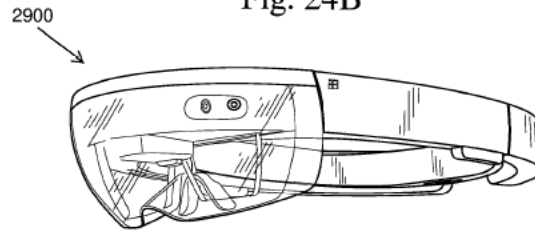


Fig. 25

Figures 24B and 25 are sample illustrations of the head mounted displays used in Tako. *Id.* ¶¶ 44, 45.

2. *Claims 74 and 93*

Claim 74 depends from claim 70 and claim 93 depends from claim 89. Ex. 1001, 16:16–19, 17:41–44. Each of claims 74 and 93 additionally recites: “wherein the human-machine interface is configured to present the three-dimensional cursor with measurement markings on at least one edge, surface or side.” *Id.*

Petitioner asserts: “Tako explicitly teaches that 3D Measurement markers can be used to mark specific points or anatomy of interest to assist surgeons.” Pet. 100. Petitioner cites to the following disclosure of Tako: “It may also include 3D placed in the scene including 3D shapes to mark specific points or anatomy of interest, 3D Labels, 3D *Measurement markers*, 3D Arrows for guidance, and 3D surgical tools.” Ex. 1011 ¶ 63 (cited at Pet. 92) (emphasis added). The assertion has two infirmities. First, Petitioner does not explain what the so called “Measurement markers” in Tako mean.

If they are merely complete measurement results or locations to place complete measurement results like what Petitioner relies on in Bitter as discussed above, then these Tako Measurement markers do not meet the requirements of claims 74 and 93. Second, we do not see where Petitioner has accounted for where the measurement markers must be located to meet claims 74 and 93, i.e., “on at least one edge, surface or side” of the 3D cursor.

For the foregoing reasons, Petitioner has not shown a reasonable likelihood that it would prevail in establishing obviousness of claims 74 and 93 over Acosta, Avila, Bitter, Tomoda, and Tako.

3. *Claim 107*

Claim 107 depends from claim 89 and further recites: “wherein the human-machine interface is configured to present the modified version of the selected volume inside the three-dimensional cursor with an extended reality headset.” Ex. 1001, 18:31–34.

Petitioner asserts that Tako in combination with Acosta, Avila, Bitter, and Tomoda “teaches that the modified version can be presented ‘with an extended reality headset.’ MS-1003, ¶[176].” Pet. 100. Specifically, Petitioner relies on Tako’s use of a head mounted display (“HMD”). *Id.* at 93 (citing Ex. 1011 ¶¶ 58, 79, 103, Figs. 24B, 25; Ex. 1003 ¶ 95).

Petitioner asserts that “a POSITA would have used Tako’s HMD in conjunction with Avila’s display.” *Id.* at 97 (citing Ex. 1003 ¶¶ 101, 102). Regarding motivation to combine, Petitioner explains:

It would have been obvious for a POSITA to combine the teachings of AABC or AABT [Acosta, Avila, Bitter, Tomoda] with the teachings of Tako to attain the various benefits described in Tako by virtue of using Tako’s HMD that supports an augmented (extended) reality display. MS-1003, ¶[99]. For

instance, Tako explains that, by virtue of SNAP and Tako's augmented reality display, "surgeons can execute their surgery plan while in the operating room utilizing a particular patient's actual CT/MRI (and other) scans, allowing enhanced accuracy and efficiency. SNAP also provides innovative features that allow surgeons to see behind arteries and other critical structures." MS-1011, ¶¶[0070], [0144], [0146]. For neurosurgeons, Tako's augmented reality system provides "guidance to determine the safest and most efficient pathway to remove cerebral tumors and treat vascular anomalies." MS-1011, [0068].

Id. at 96.

Petitioner further explains:

By using a HMD with or without a display monitor, a surgeon "no longer needs to take his eyes off the microscope or endoscope [] to look at patient scans, planning software or a MD6DM model because the virtual image and the real optical image are projected side by side," simultaneously. MS-1011, ¶¶[0114], [0121], FIGS. 3. A POSITA would also have known that a HMD offers a user/viewer greater freedom and flexibility because 3D images can be viewed in various locations, positions, and directions without being confined to a display monitor's fixed location. MS-1003, ¶[100]. The HMD allows the user to move while viewing or interacting with images. In a medical environment, the enhanced realism provided by HMDs can be beneficial for training new physicians or practicing mock surgeries by simulating more realistic experiences of performing surgeries using 3D images of tissues upon which surgery is to be performed. MS-1003, [100].

Id. at 96–97.

Petitioner's assertions are supported by the cited evidence. Patent Owner does not present contrary arguments beyond those it asserts for claim 89, which are addressed and rejected above. We are sufficiently persuaded that the combined teachings of Acosta, Avila, Bitter, Tomoda, and Tako teach "wherein the human-machine interface is configured to present the

modified version of the selected volume inside the three-dimensional cursor with an extended reality headset.”

Petitioner has shown a reasonable likelihood that it would prevail in establishing obviousness of claim 107 over Acosta, Avila, Bitter, Tomoda, and Tako.

V. CONCLUSION

For the foregoing reasons, we conclude that the information presented in the Petition establishes a reasonable likelihood that Petitioner would prevail in showing that claims 70–73, 75–80, 84, 89–92, 94–97, 99, 103, and 107 of the ’457 patent are unpatentable.

VI. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that *inter partes* review of all challenged claims, i.e., claims 70–80, 84, 89–97, 99, 103, and 107 of the ’457 patent is hereby instituted on all grounds stated in the Petition; and

FURTHER ORDERED that pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial; the trial will commence on the entry date of this decision.

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Patent 10,795,457 B2

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