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Paper 47
Date: December 12, 2024

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

TESLA, INC.,
Petitioner,

v.

AUTONOMOUS DEVICES, LLC,
Patent Owner.

IPR2023-01055
Patent 11,238,344 B1

Before BARBARA A. PARVIS, ROBERT J. WEINSCHENK, and RUSSELL E. CASS, *Administrative Patent Judges*.

PARVIS, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
Granting-in-Part and Denying-in-Part Patent Owner's Motion to Amend
35 U.S.C. § 318(a)

I. INTRODUCTION

We instituted an *inter partes* review of claims 3–18 of U.S. Patent No. 11,238,344 B1 (Ex. 1001, "the '344 patent") owned by Autonomous Devices, LLC ("Patent Owner"). Paper 20 ("Institution Decision" or "Inst.

Dec."). Following institution of the trial, Patent Owner filed a Motion to Amend claims contingent upon a finding of unpatentability. Paper 28 ("Motion to Amend" or "MTA") 1. Patent Owner's Motion to Amend requests "[i]n the event the Board finds any of original claims 6, 7, 10, 11, 12, or 16 unpatentable . . . the Board grant this motion to amend and issue the corresponding substitute claims [among 23, 24, 26, 27, 28, and 29]." MTA 1. The Motion to Amend also submits that "[c]laims 4, 5, and 9 are hereby cancelled" and requests that "the Board issue claims 21, 22, and 25 as substitutes for claims 4, 5, and 9, respectively," noting that "[Patent Owner] does not condition its request regarding claims 21, 22, and 25 on any condition." *Id.* at 1, 24.

We have jurisdiction under 35 U.S.C. § 6. This decision is a Final Written Decision issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73 as to the patentability of the claims on which we instituted trial. For the reasons we discuss below, we determine that Tesla, Inc. ("Petitioner") has proved by a preponderance of the evidence that claims 3, 6–8, and 10–18 of the '344 patent are unpatentable. We grant Patent Owner's request to cancel claims 4, 5, and 9 in Patent Owner's Motion to Amend. We also determine that Petitioner has shown by a preponderance of the evidence that the proposed substitute claims are unpatentable and, therefore, deny Patent Owner's request in its Motion to Amend to issue substitute claims 21–29.

A. Background

Petitioner filed a Petition (Paper 1 ("Pet.")) requesting *inter partes* review of claims 1–20 of the '344 patent. Patent Owner filed a Preliminary Response (Paper 11 ("Prelim. Resp.")) stating that it had disclaimed claims 1, 2, 19, and 20 of the '344 patent. *Id.* at 1 (citing Ex. 2004; 37 C.F.R.

§ 42.107(e)). We determined that the Petition established a reasonable likelihood that Petitioner would prevail with respect to at least one claim. Inst. Dec. 35–36. In light of the disclaimer, we instituted as to only claims 3–18 ("challenged claims") of the '344 patent in this proceeding.[1]

Thereafter, Patent Owner filed a Response. (Paper 26, "PO Resp."), Petitioner filed a Reply (Paper 30, "Pet. Reply"), and Patent Owner filed a Sur-reply (Paper 33, "PO Sur-reply"). Patent Owner also filed a Motion to Amend claims contingent upon a finding of unpatentability. MTA 1. In its Motion to Amend, Patent Owner requested Preliminary Guidance. *Id.* Petitioner filed an Opposition to Patent Owner's Motion to Amend. Paper 31 ("Opp. MTA"). We provided Preliminary Guidance. Paper 32 ("PG"). Patent Owner filed a Reply in support of its Motion to Amend. Paper 34 ("Reply MTA"). Petitioner filed a Sur-reply to Patent Owner's Motion to Amend. Paper 38 ("Sur-reply MTA"). A hearing was held September 18, 2024. A transcript of the hearing is part of the record. Paper 46 ("Hearing Tr.").[2] After the hearing, Patent Owner was authorized to file (and filed) a Sur-sur-reply (Paper 44, "Sur-sur-reply")). Patent Owner did not oppose Petitioner's filing of a responsive paper and Petitioner was authorized to file (and filed) a Sur-sur-sur-reply (Paper 45).

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[1] With authorization, Petitioner filed a Preliminary Reply (Paper 12 ("Prelim. Reply")), and Patent Owner filed a Preliminary Sur-reply. Paper 13 ("Prelim. Sur-reply").

[2] On September 18, 2024, a hearing also was conducted in IPR2023-01054 involving challenges to a related patent. To streamline the hearing in the instant proceeding, the transcript of the hearing in IPR2023-01054 also is entered into the record of the instant proceeding. Paper 46.

B. Real Parties-in-Interest

Petitioner identifies itself as the real party-in-interest. Pet. 1. Patent Owner names itself as the real party-in-interest. Paper 4, 1.

C. Related Matters

The parties inform us that the '344 patent was asserted in *Autonomous Devices LLC v. Tesla, Inc.*, No. 22-cv-1466 (MN) (D. Del.) ("parallel district court proceeding"). Pet. 1; Paper 4, 1. The parties also identify a concurrently filed petition challenging a patent related to the '344 patent in IPR2023-01054 (challenging U.S. Patent No. 10,452,974). Pet. 1; Paper 4, 1.

D. The '344 Patent

The '344 patent is titled "Artificially Intelligent Systems, Devices, and Methods for Learning and/or Using a Device's Circumstances for Autonomous Device Operation." Ex. 1001, code (54). The '344 patent describes "devices, apparatuses, systems, and related methods for providing advanced learning, anticipating, decision making, automation, and/or other functionalities." *Id.* at 1:21–26. The '344 patent describes artificially intelligent devices, systems, and methods

> that enable learning a device's circumstances including objects with various properties along with correlated instruction sets for operating the device, storing this knowledge in a knowledgebase (i.e. neural network, graph, sequences, etc.), and operating a device autonomously.

Id. at 57:58–66.

Figure 2 of '344 patent is depicted below.

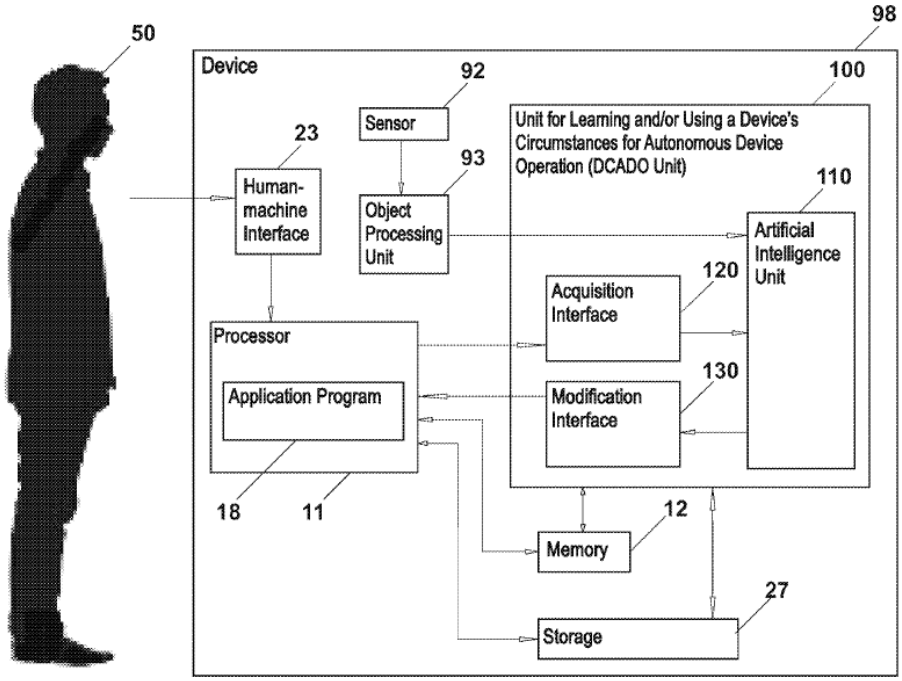

FIG. 2

Figure 2 illustrates an embodiment of device 98 comprising "Unit for Learning and/or Using a Device's Circumstances for Autonomous Device Operation" (DCADO Unit) 100, processor 11, human-machine interface 23, sensor 92, object processing unit 93, memory 12, and storage 27. *Id*. at 66:65–67:4.

Processor 11 is configured to execute instruction sets for operating the device. *Id*. at 67:14–17. User 50 issues an operation direction to application program 18 responsive to which application program's 18 instructions or instruction sets are executed by processor 11 to perform a desired operation on device 98. *Id.* at 68:34–37.

Sensor 92 "comprises the functionality for obtaining or detecting information about [the sensor's] environment" and "can be used to detect objects and/or their properties" near device 98. *Id*. at 69:11–16. Object processing unit 93 "comprises the functionality for processing output from

[s]ensor 92" and can be used "to detect objects and/or their properties." *Id.* at 71:45–49.

DCADO Unit 100 comprises artificial intelligence unit 110, acquisition interface 120, and modification interface 130. *Id.* at 67:5–7. Artificial intelligence unit 110 is "configured to receive a first collection of object representations" that include "one or more representations of objects detected by the sensor." *Id.* at 67:21–27.

Artificial intelligence unit 110 comprises functionality for learning device's 98 operation. *Id.* at 96:34–35. Figure 32 of the '344 patent is depicted below.

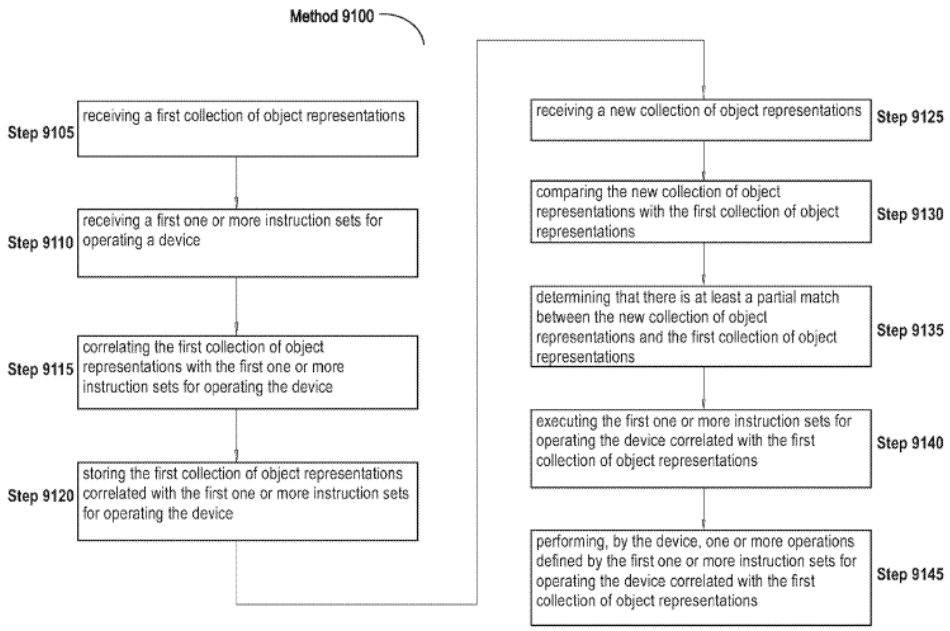

FIG. 32

Figure 32 is an illustration showing an embodiment of method 9100 "for learning and/or using a device's circumstances for autonomous device operation." *Id.* at 150:18–20.

At step 9105 of Figure 32, "a first collection of object representations is received." *Id.* at 150:32–33. "An object representation may include an

electronic representation of an object (i.e., Object 615, etc.) detected in a device's surrounding." *Id*. at 150:37–39. At step 9110, "a first one or more instruction sets for operating a device are received." *Id*. at 152:4–5. At step 9115, "the first collection of object representations is correlated with the first one or more instruction sets for operating the device." *Id*. at 153:26–28. At steps 9125 and 9130, a new collection of object representations is received and "compared with the first collection of object representations." *Id*. at 154:50–55. At step 9135, "a determination is made that there is at least a partial match between" the two collections. *Id*. at 155:39–41. At step 9140, the "first one or more instruction sets for operating the device correlated with the first collection of object representations are executed." *Id*. at 157:11–13.

E. Illustrative Claim

Claims 3–18 of the '344 patent are at issue in this proceeding. Claims 3–18 depend, directly or indirectly, from disclaimed claim 1, and thus incorporate the subject matter of claim 1. Ex. 1001, 170:11–174:33.

Claim 3 is illustrative of the claimed subject matter at issue and is reproduced below, along with disclaimed independent claim 1, from which claim 3 depends.

1. [1.1[3]] A system comprising:

[1.2] one or more processors configured to perform at least:

[1.3] accessing a memory that stores at least a knowledgebase that includes a first circumstance representation correlated with a first one or more instruction sets for operating a first device, wherein the first circumstance representation represents a first circumstance detected at least in part by

[3] Herein we use Petitioner's designations for the elements of claim 1. *See* Pet. 11–22.

one or more sensors of the first device, [1.4] and wherein at least a portion of the first circumstance representation or at least a portion of the first one or more instruction sets for operating the first device is learned in a learning process that includes operating the first device at least partially by a user;

[1.5] generating or receiving a second circumstance representation, wherein the second circumstance representation represents a second circumstance detected at least in part by: the one or more sensors of the first device, or one or more sensors of a second device;

[1.6] anticipating the first one or more instruction sets for operating the first device based on at least partial match between the second circumstance representation and the first circumstance representation; and

[1.7] at least in response to the anticipating, executing the first one or more instruction sets for operating the first device, wherein the first device or the second device autonomously performs one or more operations defined by the first one or more instruction sets for operating the first device.

Ex. 1001, 169:46–170:6.

3. The system of claim 1, wherein the first circumstance representation includes a first one or more object representations, and wherein the second circumstance representation includes a second one or more object representations.

Id. at 170:11–14.

F. Evidence

Petitioner relies on the references summarized in the table below.

Name	Reference	Exhibit
Grotmol	US 9,604,359 B1, filed Jan. 27, 2015, issued Mar. 28, 2017	1004
Hickman	US 8,639,644 B1, filed May 4, 2012, issued Jan. 28, 2014	1005

Petitioner also relies on the Declaration of Jason Janet, Ph.D. (Ex. 1002) and the Second Declaration of Dr. Jason Janet (Ex. 1010) to support its contentions that the challenged claims are unpatentable and that Patent Owner's Motion to Amend should be denied. Patent Owner relies on the Declaration of Eli Saber, Ph.D. (Ex. 2007) to support its contentions that Petitioner has not shown that the challenged claims are unpatentable.

G. Asserted Grounds

Petitioner asserts that the challenged claims of the '344 patent are unpatentable based on the following grounds summarized in the table below (Pet. 4):

Claims Challenged	35 U.S.C. §	Reference(s)/Basis
3–5, 7–9, 13–18	102(a)(2)	Grotmol
10, 11	103	Grotmol
6, 11, 12	103	Grotmol, Hickman

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 complete record now before us (Ex. 1001, codes (22), (63)), we determine that the '344 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. Our analysis would not change under the pre-AIA versions of §§ 102, 103.

II. ANALYSIS— CHALLENGED CLAIMS

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). Petitioner must prove unpatentability by a preponderance of the evidence. *See* 35 U.S.C. § 316(e); 37 C.F.R. § 42.1(d).

"A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference." *Verdegaal Bros., Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631 (Fed. Cir. 1987). To establish anticipation, "all of the elements and limitations of the claim must be shown in a single prior reference, arranged as in the claim." *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001).

A patent 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 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, i.e., secondary considerations.[4] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts a person of ordinary skill in the art,

> would have [had] at least: (1) a bachelor's degree in electrical engineering, computer engineering, computer science, systems engineering, or equivalent course work with two to three years of work experience in computer vision, image/video processing,

[4] Patent Owner does not present objective evidence of nonobviousness.

> and/or machine learning; or (2) a master's degree in electrical engineering, computer engineering, computer science, systems engineering, or equivalent course work with a focus in computer vision, image/video processing, and/or machine learning.

Pet. 4 (citing Ex. 1002 ¶¶ 40–42). Patent Owner adopts Petitioner's proposal. *See* PO Resp. 3.

Considering the subject matter of the '344 patent, the background technical field, and the asserted prior art, we agree with Petitioner's proposed qualifications for an ordinary level of skill, except we decline to adopt "at least" as that language is vague and open-ended. Otherwise, Petitioner's proposed definition is consistent with the level of skill reflected in the specification of the '344 patent and the asserted prior art references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Accordingly, we maintain our determination at the institution stage and except as noted above, we adopt Petitioner's assessment of the level of skill for one of ordinary skill in the art.

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. "In determining the meaning of the disputed claim limitation, we look

principally to the intrinsic evidence of record, examining the claim language itself, the written description, and the prosecution history, if in evidence." *DePuy Spine, Inc. v. Medtronic Sofamor Danek, Inc.*, 469 F.3d 1005, 1014 (Fed. Cir. 2006) (citing *Phillips*, 415 F.3d at 1312–17).

Petitioner provides a construction for "means for processing" recited in disclaimed claim 20. Pet. 5. Patent Owner argues that "construction of this term is unnecessary." Prelim. Resp. 14. We agree. *See Realtime Data, LLC v. Iancu*, 912 F.3d 1368, 1375 (Fed. Cir. 2019) ("The Board is required to construe 'only those terms . . . that are in controversy, and only to the extent necessary to resolve the controversy.'" (quoting *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999)).

Petitioner states that it "applies the ordinary and customary meaning of the claim terms" and "explains the meaning of claim terms" in its element-by-element analysis where appropriate. Pet. 4. In its preliminary response, Patent Owner provided a proposed construction for "object representation," which we discussed at the institution stage. Specifically, Patent Owner asserted the term "object representation" should be construed as "a 'data structure that includes an object property generated by object processing.'" Prelim. Resp. 10. We maintain our analysis as explained further below.

The parties also discuss the term "connections" recited in claim 16. We address the parties' dispute regarding that term below.

1. "object representation"

Petitioner argues that the '344 patent "does not define 'object representations' beyond its use in the phrase 'collection of object representations,' which it defines as 'one or more representations of objects

detect by the sensor at a time.'" Pet. 23 (citing Ex. 1001, 3:42–44). Petitioner argues that the '344 patent describes that the sensor may include a camera or motion picture camera and "provides examples of objects represented in pictures." *Id.* at 24 (citing Ex. 1001, 69:52–63, 72:59–64). Petitioner also argues that the '344 patent describes "various approaches to object recognition." *Id.* (citing Ex. 1001, 75:8–12).

Starting with the language of the claims, claim 18 recites

> wherein the first one or more object representations include: one or more three dimensional representations of one or more objects, one or more digital pictures that depict one or more objects, one or more digital pictures that depict one or more representations of one or more objects, one or more information about one or more properties of one or more objects, *or* one or more computer representations of one or more objects.

Ex. 1001, 173:66–174:6 (emphasis added).

Based on the complete trial record now before us, we maintain our findings regarding claim 18 discussed at the institution stage. Those findings have not been disputed by Patent Owner subsequent to institution. *See generally* PO Resp; PO Sur-reply. Specifically, we find that the limitation in claim 18 recites a list of possible "object representations" including the conjunction "or," which we find links alternatives such that "the first one or more object representations" may include "one or more digital pictures that depict one or more objects" *or* "one or more information about one or more properties of one or more objects." *Id.* We, therefore, find that the language of claim 18 supports Petitioner's position.

We turn to the '344 patent Specification. Importantly, we find that the '344 patent Specification describes multiple embodiments of "object representations." Specifically, the '344 patent Specification describes that

'[i]n *some embodiments*, *the first collection of object representations includes one or more representations of objects detected by the sensor at a time*" (Ex. 1001, 3:43–44 (emphasis added)) and "[i]n *further embodiments*, an object representation of one or more object representations includes *one or more object properties*" (*id.* at 3:59–61 (emphases added)). Neither party relies on the prosecution history of the '344 patent.

Our reviewing court has "cautioned against limiting the claimed invention to preferred embodiments or specific examples in the specification." *Williamson v. Citrix Online, LLC*, 792 F.3d 1339, 1346–47 (Fed. Cir. 2015); *SuperGuide Corp. v. DirecTV Enterprises, Inc.*, 358 F.3d 870, 875 (Fed. Cir. 2004) (noting that "it is important not to import into a claim limitations that are not a part of the claim"). "[I]t is the *claims*, not the written description, which define the scope of the patent right." *Williamson*, 792 F.3d at 1346–47; *see also Phillips*, 415 F.3d at 1312 (noting that "[i]t is a 'bedrock principle' of patent law that 'the claims of a patent define the invention to which the patentee is entitled the right to exclude'"). 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.

We find that the '344 patent refers to a first collection of object representations that includes one or more representations of objects detected by the sensor at a time. We agree with Petitioner that the '344 patent Specification describes a camera as an exemplary sensor. Pet. 24 (citing Ex. 1001, 69:52–63, 72:59–64). No further determinations are needed to resolve disputes between the parties.

2. "connections"

We turn to the parties' dispute regarding the term "connections," which is recited in dependent claim 16. Claim 16 recites the following:

> 16. The system of claims 3, wherein the first circumstance representation correlated with the first one or more instruction sets for operating the first device include at least a portion of the first one or more object representations connected, using at least *one or more connections*, with at least a portion of the first one or more instruction sets for operating the first device.

Ex. 1001, 172:64–173:3 (emphasis added).

In the Petition, relying on the testimony of Dr. Janet, Petitioner argues that "[a]n association between an object representation and an action is a 'connection' between the two." Pet. 39 (citing Ex. 1002 ¶ 208). Dr. Janet testifies "a POSITA would have understood the association between an object representation and an action to be a 'connection' between the two." Ex. 1002 ¶ 208. Dr. Janet further testifies "data structures" for "linking object representations and instruction sets together in memory" would have been understood to "comprise 'one or more connections.'" *Id.*

In its Patent Owner Response, Patent Owner argues "a 'connection' should be construed as a 'relationship that includes a link.'" PO Resp. 6 (citing Ex. 2007 ¶¶ 56–63). Patent Owner argues its "construction is supported by the claims, specification, drawings, and intrinsic record as a whole." *Id.* at 6–10 (citing Ex. 1001, 16:5–6, 103:33–62, 104:3–6, 106:14–65, 108:36–54, 154:10–13, Figs. 13–18A). In particular, Patent Owner argues that the '344 patent's Figure 17 shows connections between nodes that "may include or be associated with a value such as a symbolic label or numeric attribute (i.e. weight, cost, capacity, length, etc.)." *Id.* at (citing Ex. 1001, 104:3–6, Fig. 17). Patent Owner also argues that the '344 patent's

Figure 18A shows connections between knowledge cells that "may include or be associated with at least one of: an occurrence count, a weight, a parameter, or a data." *Id.* at 9 (citing Ex. 1001, 16:5–6, Fig. 17A). Patent Owner further argues "several dictionaries confirm that 'connection' can be defined as a 'relationship that includes a link.'" *Id.* at 10 (citing Ex. 2012; Ex. 2013; Ex. 2007 ¶ 63).

In its Reply, Petitioner disagrees with Patent Owner's proposed construction. Pet. Reply 7–10 (citing Ex. 1010 ¶¶ 24–29). Specifically, Petitioner argues that the '344 patent's Figures 17 and 18A "are described as 'embodiments,'" and the "textual description of FIGS. 17 and 18A" of the '344 patent "does not once use the word 'link.'" *Id.* at 9. Petitioner also argues that Patent Owner relies on examples, that "do not impose a limiting effect" because they "include a permissive 'may.'" *Id.* (citing, e.g., Ex. 1001, 16:5–6, 56:29–34, 103:49–67, 106:19–22; Ex. 1010 ¶¶ 25–27). Petitioner argues "no construction is necessary," but "[t]he meaning that most closely aligns with the breadth of this term in the specification is 'an association or a relationship.'" *Id.* at 10 (citing, e.g., Ex. 2012, 399–400; Ex. 2013, 481; Ex. 1001, 16:5–6, 66:13–33; Pet 39; Ex. 1002 ¶ 208; Ex. 1010 ¶ 29).

In its Sur-reply, Patent Owner maintains that its construction "is well-supported by the intrinsic and extrinsic record." PO Sur-reply 9. Patent Owner argues that its construction "is well-supported" by "particularly Figures 17 and 18A of the '344 patent." *Id.* at 10.

The parties appear to agree that the term "connection" refers to a relationship, but dispute whether it includes a link. PO Resp. 6; Pet. Reply 7–8. The '344 patent describes "FIGS. 18A–18C" as illustrating "embodiments of interconnected Knowledge Cells 800 and updating weights

of Connections 853." *Id.* at 106:14–16. The '344 patent further describes that "[k]nowledge cells may be connected, interrelated, ***or*** interlinked into knowledge structures using statistical, artificial intelligence, machine learning, and/or other models or techniques." *Id.* at 154:10–13. During the hearing, Patent Owner explained that it is "not suggesting" that the term "connections" should be "hardware" connections, but instead Patent Owner's position is that "connections" should be understood in the context "of knowledge cells being connected in the context of learning, basically, computer-related learning." Tr. 105:26–107:19.

For the reasons given below, even if we assume for the purposes of this Decision that the term "connection" means a "relationship that includes a link," as Patent Owner proposes, the asserted prior art still discloses the disputed claim limitation. We, therefore, need not make further determinations regarding this claim construction issue in order to resolve the parties' disputes about the asserted ground of unpatentability. *See Realtime Data*, 912 F.3d at 1375.

D. Anticipation of Claims 3–5, 7–9, and 13–18 by Grotmol

Petitioner asserts that claims 3–5, 7–9, and 13–18 are anticipated by Grotmol. Pet. 4. Patent Owner counters that Grotmol does not disclose the further recitations in claims 7, 8, and 16. PO Resp. 11–23; PO Sur-reply 4–13. Also, Patent Owner's Motion to Amend states that "[c]laims 4, 5, and 9 are hereby cancelled." MTA 1; *see also id.* (requesting "that the Board issue claims 21, 22, and 25 as substitutes for claims 4, 5, and 9, respectively" and Patent Owner "does not condition its request regarding claim 21, 22, and 25 *on any condition*") (emphasis added).

We begin with an overview of Grotmol. We then turn to the parties' contentions regarding claims 3, 7, 8, and 13–18.

1. Grotmol (Ex. 1004)

Grotmol is titled "Apparatus and Methods for Training Path Navigation by Robots." Ex. 1004, (code 54). Grotmol describes an apparatus and methods for training and operating a robotic device to follow a trajectory. *Id.* at code (57).

More specifically, Grotmol describes exemplary mobile robotic apparatus 160, shown in Figure 1 below. *Id.* at 8:57–61.

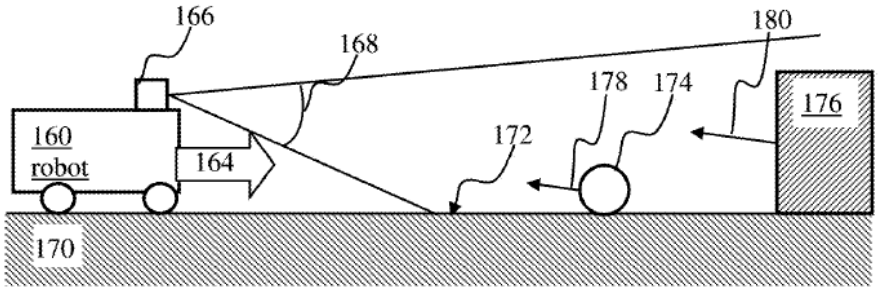

FIG. 1

Figure 1 depicts mobile robotic apparatus 160 that contains sensor component 166. *Id.* at 8:57–61. Sensor component 166 provides "information associated with objects within the field-of-view 168." *Id.* at 8:64–66. Grotmol's sensor 166 comprises "a camera configured to provide an output comprising a plurality of digital image frames." *Id.* at 10:16–20. A user "may train the system to switch between tasks based on the sensory context." *Id.* at 10:45–47.

Grotmol further describes a "mechanism for enabling a robot to learn navigating a target trajectory while reducing deviation from a target path." *Id.* at 38:33–35. The robot comprises robotic vehicle 160, camera 166, and

"a controller configured to store a sequence of images obtained during training phase." *Id.* at 38:36–39. Figure 20A from Grotmol is shown below.

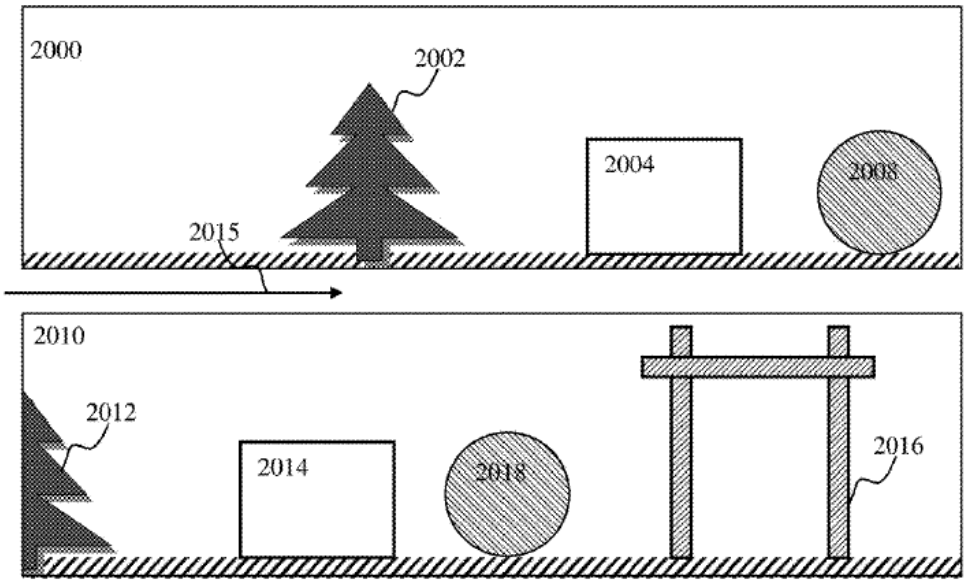

FIG. 20A

Figure 20A illustrates images 2000, 2010 obtained with a camera 166 mounted on a robotic vehicle 160. *Id.* at 38:43–54. Grotmol explains that image 2000 comprises "representations [of] one or more objects, e.g., a tree 2002, a rectangle, a ball 2008, and/or other objects." *Id.* at 38:56–58. Grotmol further explains that image 2010 is obtained after execution of a turn and representations of objects are shifted "relative [to] representations of the same objects in the frame obtained prior to the turn execution." *Id.* at 38:60–65.

During autonomous operation, the control process of the robot is configured to compare a current or recent image with the one or more images from the training buffer. *Id.* at 39:23–28. "Motor commands issued by a trainer corresponding to time instances when the images are acquired" also are stored. *Id.* at 39:17–19. Grotmol describes motor commands are

obtained "by taking the stored motor commands from the training buffer" that correspond to "the best matching stored image." *Id.* at 43:5–9.

2. Disclaimed Independent Claim 1

We begin our analysis with disclaimed independent claim 1 because claim 3, which is at issue in this proceeding, depends directly from claim 1.

a) Elements [1.1] and [1.2]

Element [1.1] of claim 1 (the preamble) recites "[a] system comprising" and element [1.2] recites "one or more processors configured to perform at least." Ex. 1001, 169:46–47. Petitioner argues that Grotmol discloses elements [1.1] and [1.2] by describing a robotic apparatus with one or more processors. Pet. 11–12 (citing Ex. 1004, code (57), 3:27–30, 8:5–15, 10:45–48, 48:1–52, Figs. 7, 8; Ex. 1002 ¶¶ 163–164). Petitioner's argument is supported by the evidence cited in the Petition.

Patent Owner does not contest Petitioner's arguments that Grotmol discloses elements [1.1] and [1.2]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses elements [1.1] and [1.2].

b) Element [1.3]

Element [1.3] is reproduced below.

> [1.3] accessing a memory that stores at least a knowledgebase that includes a first circumstance representation correlated with a first one or more instruction sets for operating a first device, wherein the first circumstance representation represents a first circumstance detected at least in part by one or more sensors of the first device.

Ex. 1001, 169:48–54.

Petitioner argues that Grotmol discloses element [1.3] by describing a memory component that stores training sets, images of scenes from a robot vehicle's operation, and motor controls. Pet. 12–16 (citing, e.g., Ex. 1004, code (57), 3:27–39, 8:66–9:3, 9:8–22, 10:23–26, 33:59–62, 38:36–58, 39:13–28, 43:5–9; Ex. 1002 ¶¶ 165–172). Petitioner argues that Grotmol's disclosure corresponds to the elements of claim 1 as follows: (1) Grotmol's "training sets" correspond to "multiple correlations" recited in the claim; (2) Grotmol's "image of [a] scene from a robot vehicle's operation" corresponds to a "circumstance representation" recited in claim 1; and (3) Grotmol's "motor control indication configured to cause the robot to execute an action" corresponds to "[one or more] instruction set[s] for operation of a first device" recited in claim 1. *Id.* at 13 (citing Ex. 1004, 3:31–39, 8:66–9:3, 10:23–26, 38:36–58, 39:13–22).

Petitioner's argument is supported by the evidence cited in the Petition. For instance, regarding a "circumstance representation," we find that Grotmol's disclosures relied on by Petitioner describe that "the output provided by the sensor component 166 may comprise *a stream of pixel values* associated with one or more digital images." Ex. 1004, 9:1–3 (emphasis added); *see also id.* at 8:31–32 (describing a sensor component that provides "a signal conveying a video frame comprising *a plurality of pixels*" (emphasis added)). We also find that Grotmol discloses "a first one or more instruction sets." *See, e.g.*, Ex. 1004, 3:27–39 (describing a "self-contained robotic apparatus" that includes a "memory component" that is configured "to store training sets," which include "an instance of a motor control indication configured to cause the robot to execute an action"), 10:23–26 (describing that "tasks of the robot may be configured based on a

context"), 39:13–22 (describing that "[d]uring training images (e.g., raw and/or pre-processed) may be stored in a memory buffer" and "[m]otor commands issued by a trainer corresponding to time instances when images are acquired may be stored").

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.3]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [1.3].

c) Element [1.4]

Element [1.4] is reproduced below.

> [1.4] and wherein at least a portion of the first circumstance representation or at least a portion of the first one or more instruction sets for operating the first device is learned in a learning process that includes operating the first device at least partially by a user.

Ex. 1001, 169:54–58.

Petitioner argues that Grotmol discloses element [1.4] by describing training processes in which a robot learns associations between sensory context and respective actions. Pet. 16–17 (citing, e.g., Ex. 1004, 23:3–29, 24:17–20, 24:55–25.5, 33:59–62, 34:49–55; Ex. 1002 ¶ 173). Grotmol's disclosures relied on in the Petition include disclosure of a "listen mode" in which the robot observes "what the teacher teaches" and learns an association (Ex. 1004, 23:3–4) and an "override mode" in which "the robot may execute what it has learned, unless a command is sent by the teacher," in which case the robot performs the action provided by the teacher and tries "to remember it for the next time the same situation occurs" (*id.* at 23:12–21). Grotmol's disclosures relied on in the Petition also include

disclosure of "supervised learning," in which "a user may train simple tasks by demonstrating example tasks to the system." *Id.* at 24:17–20. Petitioner's argument is supported by the evidence cited in the Petition.

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.4]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [1.4].

d) Element [1.5]

Element [1.5] is reproduced below.

> [1.5] generating or receiving a second circumstance representation, wherein the second circumstance representation represents a second circumstance detected at least in part by: the one or more sensors of the first device, or one or more sensors of a second device.

Ex. 1001, 169:59–63.

Petitioner argues that Grotmol discloses element [1.5] by describing a processor that "receives additional digital pictures from the camera over time." Pet. 17–18 (citing Ex. 1004, 33:27–32, 38:36–39, 39:23–28; Ex. 1002 ¶¶ 174–176). Petitioner's argument is supported by the evidence cited in the Petition.

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.5]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [1.5].

e) Element [1.6]

Element [1.6] is reproduced below.

> [1.6] anticipating the first one or more instruction sets for operating the first device based on at least partial match between the second circumstance representation and the first circumstance representation.

Ex. 1001, 169:64–67.

Petitioner argues that Grotmol discloses element [1.6] by describing "calculating a similarity measure between a current image and a stored image" and obtaining "stored motor commands from the training buffer that may correspond to the *best matching* stored image." Pet. 18–20 (citing, e.g., Ex. 1004, 2:29–38, 3:13–15, 3:35–39, 28:19–24, 39:13–41, 40:64–41:18, 43:5–9; Ex. 1002 ¶¶ 177–178).

Petitioner's argument is supported by the evidence cited in the Petition. For instance, Grotmol describes that "a digital image" comprises "a plurality of pixel values." Ex. 1004, 3:13–15. Grotmol also describes the following:

> As used herein the term feature may be used to describe one or more integer or floating point values characterizing the input, e.g., the presence or absence of an edge, comer, shape, texture, color, object, at particular locations in the image, values of pixels in an image, patches of color texture, brightness in the image, and/or in the image as a whole.

Id. at Ex. 28:19–24.

Grotmol further describes that "[a] similarity metric may be determined between the shifted/trimmed frames (e.g., 2020, 2040 in FIG. 20B)." *Id.* at 41:8–10. Grotmol describes that "the similarity may be determined by performing a *pixel-wise difference* between the overlapping regions." *Id.* at 41:10–12 (emphasis added).

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.6]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [1.6].

f) Element [1.7]

Element [1.7] is reproduced below.

> [1.7] at least in response to the anticipating, executing the first one or more instruction sets for operating the first device, wherein the first device or the second device autonomously performs one or more operations defined by the first one or more instruction sets for operating the first device.

Ex. 1001, 170:1–6.

Petitioner argues that Grotmol discloses element [1.7] by describing executing motor commands obtained after determining a similarity between a current image and a stored image. Pet. 20–22 (citing Ex. 1004, 2:34–41, 3:12–13, 33:21–32, 34:56–62, 43:4–11; Ex. 1002 ¶¶ 179–182). Petitioner's argument is supported by the evidence cited in the Petition.

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.7]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [1.7].

g) Conclusion—Disclaimed Claim 1

For the reasons given above and the reasons presented by Petitioner, we determine that Petitioner has established by a preponderance of evidence that Grotmol discloses all elements of disclaimed claim 1.

3. Dependent Claim 3

Petitioner argues that Grotmol anticipates claim 3. *See, e.g.*, Pet. 4. Claim 3 depends from disclaimed claim 1 and is reproduced below.

> 3. The system of claim 1, wherein the first circumstance representation includes a first one or more object representations, and wherein the second circumstance representation includes a second one or more object representations.

Ex. 1001, 170:11–14. As discussed above, we maintain our findings at the institution stage regarding construction of the claim term "object representations" recited in claim 3.

Petitioner argues that Grotmol discloses claim 3 by describing images comprising representations of objects, including trees, rectangles, and balls. Pet. 23–25 (citing Ex. 1004, 8:57–9:13, 9:41–52, 38:54–39:12, Fig. 20A; Ex. 1002 ¶¶ 165–173, 184–188). Petitioner, more specifically, argues the following:

> Grotmol discloses that images 2000 and 2010 may "comprise representations of visual field that may be obtained at times t1<t2, respectively." Ex. 1004, 38:54–56. These same images 2000 and 2010 may "comprise *representations* [*of*] *one or more objects*, e.g., a tree 2002, a rectangle, a ball 2008, and/or other objects." Ex. 1004, 38:56–65; *see also id.*, 38:65–39:12 (referring to objects shown within images 2000 and 2010 as "object representations" and "representations").

Pet. 24. In connection with claim 3, Petitioner also identifies Grotmol's disclosure of implementations of "object recognition," in which sensor component 166 provides an output comprising a stream of pixels associated with one or more digital images that is analyzed. *Id.* at 25 (citing Ex. 1004, 8:57–9:13, 9:41–52). Petitioner's argument is supported by the evidence cited in the Petition.

Patent Owner does not offer separate arguments for dependent claim 3 or contest Petitioner's analysis. *See generally* PO Resp.; PO Sur-reply. Based on our review of the entire record, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol discloses all recitations in dependent claim 3.

For the reasons given above and the reasons presented by Petitioner, based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that claim 3 is unpatentable as anticipated by Grotmol.

4. Dependent Claim 7

Claim 7 depends from claim 3 and recites "modifying: the first one or more instruction sets for operating the first device," "anticipating the modified the first one or more instruction sets for operating the first device based on the at least partial match between the second circumstance representation and the first circumstance representation," "executing the modified the first one or more instruction sets," and "autonomously performing, by the first device or by the second device, one or more operations defined by the modified the first one or more instruction sets for operating the first device." The parties dispute whether Grotmol discloses these recitations.

a) The Parties' Arguments for Element [7.1]

In the Petition for element [7.1], Petitioner relies on the following: (1) Grotmol's disclosure of combining corrections by the trainer with robot controller instructions (Pet. 27 (citing Ex. 1004, 34:49–55)); (2) Grotmol's disclosure of compensating for "position mismatch" and "orientation mismatch" (*id.* at 27–28 (citing Ex. 1004, 42:46–43:3, code (57))); and

(3) Grotmol's disclosure of combining motor commands with the output of a PID controller to stabilize robot operation (*id.* at 27–28 (citing Ex. 1004, 43:5–11)). In its overview of Grotmol in the Petition, Petitioner states that Grotmol "describes an 'override mode,' in which a robot will operate autonomously until a teacher sends a command, in which case the robot will apply the teacher's command and 'try to remember it for the next time the same situation occurs.'" *Id.* at 8–9 (citing Ex. 1004, 23:12–22).

In the Patent Owner Response, Patent Owner disputes that the disclosures relied on by Petitioner describe limitation [7.1]. PO Resp. 12–17. Patent Owner argues Grotmol's combining corrections by the trainer with robot controller instructions is deficient because that provides "additional or new instructions," which Patent Owner argues is "not" modifying "the instruction sets that are included with the training sets." *Id.* at 12 (citing Ex. 2007 ¶¶ 77–87) (emphasis omitted). Patent Owner argues Grotmol's compensating for "position mismatch" and "orientation mismatch" and Grotmol's combining motor commands with the output of a PID controller to stabilize robot operation are deficient because "[c]ombining two distinct elements does not mean that either element itself is modified." *Id.* (citing Ex. 2007 ¶¶ 78–79). Patent Owner also argues "[o]verriding an instruction set is not modifying the instruction set." *Id.* at 13 (citing Ex. 2007 ¶¶ 77–79). Patent Owner argues that the declaration testimony of Dr. Janet does not support Petitioner's position because during his deposition "Dr. Janet, confirmed that the modified instruction set must be the correlated instruction set" and that Dr. Janet "could not point to a specific place in Grotmol that discloses an instruction set correlated with a circumstance representation that is modified." *Id.* at 17 (citing Ex. 2008, 19:21–20:4; 24:6–25:9).

In the Reply, Petitioner argues Patent Owner mischaracterizes Grotmol. Pet. Reply 1. Petitioner argues, for example, in Grotmol's "'override' and 'correct' modes," the robot modifies its instruction set responsive to the trainer's input. *Id.* at 2 (citing, e.g., Ex. 1004, 21:64–24:16, 34:49–55; Ex. 1010 ¶¶ 9, 15). Petitioner also argues that "plain meaning" of the term "'modifying' encompasses operations including additions, deletions, or other alterations." *Id.* at 3 (citing, e.g., Ex. 1001, 140:8–141:40, Figs. 2, 12, 30, 31A, 31B; Ex. 1014, 204, 703; Ex. 1010 ¶¶ 10–13). Petitioner also argues Grotmol's modifications are not limited to inserting or adding, but also include removing or editing. *Id.* at 3–5 (citing, e.g., Ex. 1004, 22:1–23:29, 33:59–62, 34:18–35:4; Ex. 1010 ¶¶ 14–18).

In the Sur-reply, Patent Owner maintains that the disclosures Petitioner relies on are deficient in the manner argued in the Patent Owner Response. PO Sur-reply 4–7. Patent Owner also argues "[f]or the first time in its Reply, Petitioner points to the 'override,' 'correct,' and 'undo' modes in Grotmol and argues that these modes disclose modification of existing instruction sets." *Id.* at 4 (citing Reply, 2, 4). Patent Owner argues we "should exclude this new argument." *Id.* at 4–5 (emphasis omitted). Patent Owner also argues that "Petitioner's arguments that 'modifying' encompasses operations including additions, deletions, or other alterations" is "unsupported." *Id.* at 6.

b) Analysis of the Parties' Arguments for Element [7.1]

The parties dispute whether Grotmol discloses "modifying: the first one or more instruction sets for operating the first device, or a copy of the first one or more instruction sets for operating the first device" recited in element 7.1. We first consider Petitioner's argument that Patent Owner's

dispute is premised on an incorrect meaning of "modifying" and that the "plain meaning" of the term "'modifying' encompasses operations including additions, deletions, or other alterations." Pet. Reply 3 (citing, e.g., Ex. 1001, 140:8–141:40, Figs. 2, 12, 30, 31A, 31B; Ex. 1014, 204, 703; Ex. 1010 ¶¶ 10–13). Patent Owner argues "Petitioner's arguments that 'modifying' encompasses operations including additions, deletions, or other alterations" is "unsupported." PO Sur-reply 6. Patent Owner does not propose its own construction. *See generally id.*

Starting with the language of the claim, claim 7 recites "*modifying*: the first one or more *instruction sets* for operating the first device, or a *copy* of the first one or more *instruction sets* for operating the first device." Turning to the '344 patent Specification. Petitioner relies on the '344 patent Specification's description of "Modification Interface 130." Pet. Reply 3 (citing, e.g., Ex. 1001, 140:8–141:40, Figs. 2, 12, 30, 31A, 31B). The '344 patent describes that Modification Interface 130 comprises the functionality to modify "source code, bytecode, compiled, interpretated, or otherwise translated code, machine code, and/or other code." Ex. 1001, 140:41–45. The '344 patent Specification also describes that Modification Interface 130 employs "[c]ode instrumentation, for instance, [that] may involve inserting additional code, overwriting or rewriting existing code, and/or branching to a separate segment of code." *Id.* at 140:58–60.

Neither party relies on the prosecution history of the '344 patent. We find that the intrinsic record including the claim language and the '344 patent Specification supports Petitioner's argument that the "plain meaning" of the term "'modifying' encompasses operations including additions, deletions, or other alterations." We, therefore, determine that the ordinary

and customary meaning of "modifying" is the meaning set forth by Petitioner and "encompasses operations including additions, deletions, or other alterations." Pet. Reply 3. Additionally, claim 7 recites that "instruction *sets*" are being modified, which is consistent with the '344 patent's disclosure that "modifying" encompasses manipulations on code, such as inserting additional code or overwriting or rewriting existing code. *Id.* at 140:41–45, 140:58–60.

To more fully discuss Petitioner's contentions for element [7.1], we turn to Petitioner's contentions for claim 1. More specifically, the recitation of "the first one or more instruction sets for operating the first device" recited in element [7.1] derives antecedent basis from element [1.3], which is reproduced below.

> [1.3] accessing a memory that stores at least a knowledgebase that includes a first circumstance representation correlated with *a first one or more instruction sets for operating a first device*, wherein the first circumstance representation represents a first circumstance detected at least in part by one or more sensors of the first device.

Ex. 1001, 169:48–54 (emphasis added).

As discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.b), Petitioner argues that Grotmol discloses element [1.3] by describing a memory component that stores training sets, images of scenes from a robot vehicle's operation, and motor controls. Pet. 12–16 (citing, e.g., Ex. 1004, code (57), 3:27–39, 8:66–9:3, 9:8–22, 10:23–26, 33:59–62, 38:36–58, 39:13–28, 43:5–9; Ex. 1002 ¶¶ 165–172). Petitioner argues that Grotmol's "motor control indication configured to cause the robot to execute an action" corresponds to "[one or more] instruction set[s] for operation of a first device" recited in claim 1. *Id.* at 13 (citing Ex. 1004,

3:31–39, 8:66–9:3, 10:23–26, 38:36–58, 39:13–22). As discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.b), Grotmol's disclosure supports Petitioner's arguments. *See, e.g.*, Ex. 1004, 3:27–39 (describing a "self-contained robotic apparatus" that includes a "memory component" that is configured "to store training sets," which include "an instance of a motor control indication configured to cause the robot to execute an action"), 10:23–26 (describing that "tasks of the robot may be configured based on a context"), 39:13–22 (describing that "[d]uring training images (e.g., raw and/or pre-processed) may be stored in a memory buffer" and "[m]otor commands issued by a trainer corresponding to time instances when images are acquired may be stored"). Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.3]. *See generally* PO Resp.; PO Sur-reply. For the reasons discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.b), based on the arguments and evidence of record, we find that Grotmol discloses element [1.3].

We turn to limitation [7.1] and the disclosures cited in the Petition, which are: (1) Grotmol's disclosure of combining corrections by the trainer with robot controller instructions (Pet. 27 (citing Ex. 1004, 34:49–55)); (2) Grotmol's disclosure of compensating for "position mismatch" and "orientation mismatch" (*id.* at 27–28 (citing Ex. 1004, 42:46–43:3, code (57))); (3) Grotmol's disclosure of combining motor commands with the output of a PID controller to stabilize robot operation (*id.* at 27–28 (citing Ex. 1004, 43:5–11)); and (4) Grotmol's description of "an 'override mode,' in which a robot will operate autonomously until a teacher sends a command, in which case the robot will apply the teacher's command and

'try to remember it for the next time the same situation occurs." (*id.* at 8–9 (citing Ex. 1004, 23:12–21)). Using Petitioner's plain and ordinary meaning of "modifying," we find that Grotmol's disclosures relied on in the Petition support Petitioner's arguments that Grotmol discloses "modifying: the first one or more instruction sets for operating the first device, or a copy of the first one or more instruction sets for operating the first device" recited in element [7.1]. *See, e.g.*, Ex. 1004, 23:12–22 (describing that "[i]n the override mode, the robot may execute what it has learned, unless a command is sent by the teacher" and that when "the teacher starts sending commands," the robot heeds the teacher's command, "perform[s] the action," and tries "to remember it for the next time the same situation occurs"), 23:21–22 (describing that "[o]nce a behavior only needs fine tuning, the correct mode may be used"), 34:49–55 (disclosing that "[i]n some implementations of supervised training of robots, control instructions (also referred to as *corrections*) produced by the trainer (e.g., human) may be combined with control instructions produced by the robot controller instructions (predictions)") (emphasis added), 42:46–43:3 (describing adjusting "leftwards or rightwards" due to "position mismatch" or "orientation mismatch" and that "shift amount" may be utilized as "an error metric"), 42:5–11 (describing that "motor commands at a given time step may be obtained by taking the stored motor commands from the training buffer that may correspond to the best matching stored image" and that "[t]hose motor commands may be combined with the output from the PID controller in order to stabilize operation of the robot"). As will be discussed below, Petitioner's evidence cited in its Reply provides further support for Petitioner's arguments.

Many of Patent Owner's arguments center on an alleged deficiency that Grotmol's disclosures simply are not "modifying." *See, e.g.*, PO Resp. 12 ("Grotmol only discloses that a trainer may correct or change the operation of a robot"), 13 (arguing "[o]verriding an instruction set is not modifying the instruction set" and "[c]ombining two distinct elements does not mean that either element is itself modified"); PO Sur-reply 5 (arguing that manual control "has nothing to do with" modifying the robot's instruction sets), 6 (arguing "'combining' and 'merging' have nothing to do with the claimed 'modifying' and the two combined/merged elements are not themselves modified but instead are joined together or combined"), 6 (arguing that "'modifying' simply does not include 'combining' or 'merging'"), 7 (arguing that deleting or removing associations is not a modification of an instruction set). Patent Owner's arguments are conclusory. Also, contrary to Patent Owner's arguments, we must consider what Grotmol discloses, for example, providing trainer-produced commands to override or correct control instructions produced by the robot and remembering or learning these new commands by the robot, rather than whether Grotmol uses the exact claim term "modifying." *Cf. In re Gleave*, 560 F.3d 1331, 1334 (Fed. Cir. 2009) (a reference does not have to satisfy an *ipsis verbis* test to disclose a claimed element).

Other of Patent Owner's arguments pertain to an alleged deficiency that Petitioner has not shown that "the . . . instruction sets" are modified. *See, e.g.*, PO Resp. 12 (arguing Petitioner has not shown that "***the instruction sets that are included with the training sets are actually modified***"), 13 (arguing "Petitioner has not established that Grotmol discloses that the instruction sets in training sets are modified"). Patent

Owner's arguments are unavailing. As discussed above, the recitation of "*the* first one or more *instruction sets* for operating the first device" recited in element [7.1] derives antecedent basis from element [1.3]. For the reasons given above, we are persuaded by Petitioner's undisputed arguments and find Petitioner has shown that Grotmol's "motor control indication configured to cause the robot to execute an action," (Ex. 1004, 3:38–39), describes "*the* first one or more *instruction sets* for operating the first device" as recited in element [1.3]. Upon consideration of Petitioner's arguments and evidence for elements [1.3] and [7.1], we find that Petitioner has shown that Grotmol discloses modifying "*the* first one or more *instruction sets* for operating the first device." *See, e.g.*, Ex. 1004, 23:12–22 (describing that "[i]n the override mode, the robot *may execute what it has learned*, unless a command is sent by the teacher" and that when "the teacher starts sending commands," the robot heeds the teacher's command, "perform[s] the action," and tries "*to remember it for the next time the same situation occurs*") (emphases added), 34:49–55 (disclosing that "[i]n some implementations of supervised training of robots, control instructions (also referred to as *corrections*) produced by the trainer (e.g., human) may be combined with control instructions *produced by the robot controller instructions* (predictions)" (emphases added)), 42:5–11 (describing that "motor commands at a given time step may be obtained *by taking the stored motor commands from the training buffer that may correspond to the best matching stored image*" and that "*[t]hose motor commands* may be combined with the output from the PID controller in order to stabilize operation of the robot"). Although the evidence in the Petition shows sufficiently that Grotmol discloses element [7.1], we note that Petitioner's

Reply evidence provides further support. *Id.* at 22:38–43 (describing that in "Override" and "Correct modes, in the absence of training input, the robot "[e]xecutes the action in accordance with the prediction," but if training input is provided, the robot "[e]xecutes that action in accordance with the training input" or executes an action in accordance with a "combined signal" and then "[l]earns the association").

To the extent Patent Owner argues that Grotmol does not disclose "modifying[] the first one or more instruction sets" stored in memory for the robot to operate the device (PO Resp. 11–17; PO Sur-reply 4–7), we disagree. Grotmol discloses that stored instruction sets are modified in memory. *See, e.g.*, Ex. 1004, 23:15–22 (describing that the robot performs that action associated with the teacher's override command and will "try to remember it for the next time the same situation occurs"), 22:38–40 (describing that in "Override" mode the robot "[e]xecutes that action in accordance with the training input" and "[l]earns the association"), 22:40–43 (describing that in "Correct" mode the robot "[c]ombine[s] the teaching input and prediction and execute[s] that action" and further "[l]earn[s] the resulting association").

Patent Owner submits the testimony of Dr. Saber (PO Resp. 11 (citing Ex. 2007 ¶¶ 75–87)) in support of its arguments. *See, e.g.*, Ex. 2007 ¶¶ 78, 79. Dr. Saber's testimony restates Patent Owner's arguments without further persuasive explanation or support. We find that Dr. Saber's testimony does not undermine Petitioner's showing for the same reasons given above.

We turn to whether Petitioner's reply arguments and submission of Dr. Janet's Supplemental Declaration were improper, as Patent Owner contends. PO Sur-reply 4–5. We determine such responsive argument and

evidence are not improper. *See* 37 C.F.R. § 42.23(b); *see also* Consolidated Trial Practice Guide ("Consolidated Practice Guide")[5] at 73 (a "petitioner may file a reply to a patent owner response" and a "party also may submit rebuttal evidence in support of its reply"); 84 Fed. Reg. 64,280 (Nov. 21, 2019). We find Petitioner's reply arguments and Dr. Janet's testimony in his Supplemental Declaration (Ex. 1010) simply provide further details to support that arguments and evidence in the Petition are correct. The Petition sets forth the disclosures of Grotmol that Petitioner relies on in full and include a detailed element-by-element analysis identifying the portions of Grotmol that disclose the elements of claim 7. Petitioner's Reply and Dr. Janet's Supplemental Declaration testimony do no more than fairly and directly respond to Patent Owner's Response and Dr. Saber's testimony. *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).

For the reasons given, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol discloses element [7.1]. We find that Patent Owner's arguments do not undermine Petitioner's showing.

c) The Parties' Arguments and Analysis for the Remaining Recitations in Claim 7

With respect to the remaining recitations in claim 7, including "anticipating," "executing," and "autonomously performing," Petitioner supports its arguments with specific citations to Grotmol. Pet. 28–30 (citing, e.g., Ex. 1004, 2:29–38, 28:19–24, 34:49–55, 39:13–41, 40:64–41:18,

[5] Available at https://www.uspto.gov/TrialPracticeGuideConsolidated.

42:46–43:3, 43:5–11; Ex. 1002 ¶¶ 177–182, 191–195). Patent Owner disputes Petitioner's showing for the remaining recitations in claim 7. Patent Owner's arguments, however, are based on Patent Owner's alleged deficiency that Grotmol does not disclose modifying instruction sets used in the training sets. *Id.* at 14–17. We find that Patent Owner's arguments (*id.*) do not undermine Petitioner's showing for the same reasons given for element [7.1].[6] Based on our review of the entire record, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol discloses all recitations in dependent claim 7.

d) Conclusion—Claim 7

Based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that claim 7 is unpatentable as anticipated by Grotmol. We find that Patent Owner's argument and evidence does not undermine Petitioner's showing.

5. Dependent Claim 8

Claim 8 depends from claim 3 and recites

[6] Patent Owner argues that "Petitioner apparently concedes" that "Grotmol itself never explicitly discloses anticipating the modified instruction set" because Petitioner argues that "[a] POSITA would understand" Grotmol to teach "anticipating the modified the first one or more instruction sets for operating the first device based on the at least partial match between the second circumstance representation and the first circumstance representation." PO Resp. 14. We find that Patent Owner's argument does not undermine Petitioner's showing because "'the dispositive question regarding anticipation [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." *AstraZeneca LP v. Apotex, Inc.*, 633 F.3d 1042, 1055 (Fed. Cir. 2010) (quoting *In re Baxter Travenol Labs.*, 952 F.2d 388, 390 (Fed. Cir. 1991)).

> 8. [8.1] The system of claim 3, wherein the one or more processors are further configured to perform at least:
> modifying at least one of: the first circumstance representation, a copy of the first circumstance representation, the second circumstance representation, or a copy of the second circumstance representation [8.2] and wherein the at least partial match between the second circumstance representation and the first circumstance representation includes: (i) at least partial match between the modified the second circumstance representation and the first circumstance representation, (ii) at least partial match between the modified the copy of the second circumstance representation and the first circumstance representation, (iii) at least partial match between the second circumstance representation and the modified the first circumstance representation, (iv) at least partial match between the second circumstance representation and the modified the copy of the first circumstance representation, (v) at least partial match between the modified the second circumstance representation and the modified the first circumstance representation, (vi) at least partial match between the modified the copy of the second circumstance representation and the modified the copy of the first circumstance representation, (vii) at least partial match between the modified the second circumstance representation and the modified the copy of the first circumstance representation, or (viii) at least partial match between the modified the copy of the second circumstance representation and the modified the first circumstance representation.

Ex. 1001, 171:6–36.

For claim 8, Petitioner supports its arguments with specific citations to Grotmol. Pet. 30–32 (citing, e.g., Ex. 1004, 3:42–46, 4:18–22, 4:58–63, 30:47–31:8, 31:61–32:5; Ex. 1002 ¶¶ 177–178, 196–197). Patent Owner does not dispute Petitioner's showing for element [8.1]. Based on our review

of the entire record, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol discloses element [8.1].

The parties dispute whether Grotmol discloses element [8.2]. Pet. 31–32; PO Resp. 18– 21; Pet. Reply 5– 7; PO Sur-reply 8–9. We discuss the parties' dispute below.

a) The Parties' Arguments for Element [8.2]

In the Petition, Petitioner relies on arguments for elements [1.6] and [8.1] for its arguments for element [8.2]. Pet. 31. Petitioner argues that Grotmol discloses element [1.6] by describing "calculating a similarity measure between a current image and a stored image" and obtaining "stored motor commands from the training buffer that may correspond to the best matching stored image." Pet. 18–20 (citing, e.g., Ex. 1004, 2:29–38, 3:13–15, 3:35–39, 28:19–24, 39:13–41, 40:64–41:18, 43:5–9; Ex. 1002 ¶¶ 177–178). Petitioner argues element [8.1] is disclosed by Grotmol's description "that pixels from individual image instances are selected, scaled, normalized, and/or equalized." Pet. 30 (citing Ex. 1004, 3:42–46, 4:18–22, 4:58–63, 30:47–31:8, 31:61–32:5). Petitioner also relies on the testimony of Dr. Janet regarding the understanding that a person of ordinary skill in the art would have had of Grotmol's disclosures. *Id.* at 31 (citing Ex. 1002 ¶¶ 177–178, 196–197).

In the Patent Owner Response, Patent Owner first argues

> Petitioner's sole argument that Grotmol discloses using the modified image in the matching process is that "[a] POSITA would understand that where either the current image or the stored image have been modified, the partial match would be determined using the modified current image (i.e., modified second circumstance representation) or the modified stored image (i.e., modified first circumstance representation)."

PO Resp. 19 (citing Pet. 31). Patent Owner next argues that "Petitioner appears to concede" that "Grotmol itself never discloses matching using the modified circumstance representation." *Id.* Patent Owner also argues a person of ordinary skill in the art "would not have understood based on Grotmol's disclosure that the modified image would be used in the matching." *Id.* at 20. Patent Owner further argues that Dr. Janet's deposition testimony supports Patent Owner's position. *Id.* (citing Ex. 2008, 75:14–19). Patent Owner argues that "Dr. Janet attempted to supplement his opinions regarding claim 8 at his deposition," but Patent Owner acknowledges that Petitioner "does not rely on them." *Id.* at 20–21 (citing Ex. 2008, 57:21–58:12, 61:18–63:21, 63:22–64:9, 77:21–80:2, 86:7–87:2, 93:4–13).

In the Reply, Petitioner states that Patent Owner "acknowledges that Grotmol discloses modifying images (circumstance representations), but nonetheless contends that the modified images are not used 'in a matching.'" Pet. Reply 5 (citing PO Resp. 18–19). Petitioner disputes that Grotmol is deficient, arguing that "[f]or example, the Petition [Pet. 30] cited Grotmol's disclosure at col. 3:42–46 that describes 'comparing individual scaled [image] features' and 'based on the comparison, determining a similarity measure for a given training set.'" *Id.* (citing Ex. 1004, 3:42–46). Petitioner also disputes that Grotmol is deficient by referring to images that are normalized after they are correlated with instructions and arguing that "[t]hese images are used for matching purposes." *Id.* at 5–6 (citing Pet. 9, 14–15, 30–31; Ex. 1004, 3:42–46, 4:18–22, 4:58–63, 30:47–31:2, 30:54–31:8, 31:61–32:5; Ex. 1010 ¶ 21). Petitioner also provides further examples, including annotated versions of Figures 20A and 20B of Grotmol, that Petitioner argues show "how the circumstance representations (images)

are modified and used in a matching process." *Id.* at 6–7 (citing Ex. 1004, 39:42–54, 40:20-41:18, Figs. 20A, 20B).

In the Sur-reply, Patent Owner maintains "[n]othing in Grotmol discloses that any image is modified and then used in the claimed matching procedure." PO Sur-reply 8 (citing PO Resp. 18–21). Patent Owner argues that Grotmol's disclosures relied on by Petitioner do "not mention anything about images themselves" being modified. PO Sur-reply 8. Patent Owner argues that Grotmol describes modifying "input data, not images." *Id.* (citing, e.g., Ex. 1004, 4:18–22, 4:58–63, 30:47–31:8, 31:61–32:5). Patent Owner argues another example cited by Petitioner "merely uses particles associated with images" and does not describe "modifying any images and using the modified images in any matching." *Id.* at 9 (citing Ex. 1004, 39:42–54).

b) Analysis of the Parties' Arguments for Element [8.2]

The parties dispute whether Grotmol discloses using the modified "at least one of: the first circumstance representation, a copy of the first circumstance representation, the second circumstance representation, or a copy of the second circumstance representation" in "the at least partial match."

The recitation of "the first circumstance representation" derives antecedent basis from element [1.3], which is reproduced below.

> [1.3] accessing a memory that stores at least a knowledgebase that includes *a first circumstance representation* correlated with a first one or more instruction sets for operating a first device, wherein the first circumstance representation represents a first circumstance detected at least in part by one or more sensors of the first device.

Ex. 1001, 169:48–54 (emphasis added). As discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.b), Petitioner argues that Grotmol discloses element [1.3] by describing a memory component that stores training sets, images of scenes from a robot vehicle's operation, and motor controls. Pet. 12–16 (citing, e.g., Ex. 1004, code (57), 3:27–39, 8:66–9:3, 9:8–22, 10:23–26, 33:59–62, 38:36–58, 39:13–28, 43:5–9; Ex. 1002 ¶¶ 165–172). Petitioner argues that Grotmol's "image of [a] scene from a robot vehicle's operation" corresponds to a "circumstance representation" recited in claim 1. *Id.* at 13 (citing Ex. 1004, 3:31–39, 8:66–9:3, 10:23–26, 38:36–58, 39:13–22). Grotmol's disclosures relied on by Petitioner describe that "the output provided by the sensor component 166 may comprise *a stream of pixel values* associated with one or more digital images." Ex. 1004, 9:1–3 (emphasis added); *see also id.* at 8:31–32 (describing a sensor component that provides "a signal conveying a video frame comprising *a plurality of pixels*" (emphasis added)). Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.3]. *See generally* PO Resp.; PO Sur-reply. For the reasons discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.b), based on the arguments and evidence of record, we find that Grotmol discloses element [1.3].

The recitation of "the second circumstance representation" derives antecedent basis from element [1.5], which recites "generating or receiving a second circumstance representation." Petitioner argues that Grotmol discloses element [1.5] by describing a processor that "receives additional digital pictures from the camera over time." Pet. 17–18 (citing Ex. 1004, 33:27–32, 38:36–39, 39:23–28; Ex. 1002 ¶¶ 174–176). Patent Owner does

not contest Petitioner's arguments that Grotmol discloses element [1.5]. *See generally* PO Resp.; PO Sur-reply. For the reasons discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.d), based on the arguments and evidence of record, we find that Grotmol discloses element [1.5].

The recitation of "partial match" derives antecedent basis from element [1.6], which recites "anticipating the first one or more instruction sets for operating the first device based on at least partial match between the second circumstance representation and the first circumstance representation." Petitioner argues that Grotmol discloses element [1.6] by describing "calculating a similarity measure between a current image and a stored image" and obtaining "stored motor commands from the training buffer that may correspond to the best matching stored image." Pet. 18–20 (citing, e.g., Ex. 1004, 2:29–38, 3:13–15, 3:35–39, 28:19–24, 39:13–41, 40:64–41:18, 43:5–9; Ex. 1002 ¶¶ 177–178). Grotmol describes that "a digital image" comprises "a plurality of pixel values." Ex. 1004, 3:13–15. Grotmol also describes the following:

> As used herein the term feature may be used to describe one or more integer or floating point values characterizing the input, e.g., the presence or absence of an edge, comer, shape, texture, color, object, at particular locations in the image, values of pixels in an image, patches of color texture, brightness in the image, and/or in the image as a whole.

Id. at 28:19–24.

Grotmol further describes that "[a] similarity metric may be determined between the shifted/trimmed frames (e.g., 2020, 2040 in FIG. 20B)." *Id.* at 41:8–10. Grotmol describes that "the similarity may be

determined by performing a *pixel-wise difference* between the overlapping regions." *Id.* at 41:10–12 (emphasis added).

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [1.6]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [1.6].

We turn to limitation [8.2] and the disclosures cited in the Petition. Pet. 31 (relying on arguments for elements [1.6] and [8.1] for its arguments for element [8.2]); *see also id.* at Pet. 18–20, 30–31 (citing Ex. 1004, 2:29–38, 3:13–15, 3:35–39, 3:42–46, 4:18–22, 4:58–63, 28:19–24, 30:47–31:8, 31:61–32:5, 39:13–41, 40:64–41:18, 43:5–9). We find that Grotmol's disclosures in the Petition support Petitioner's arguments (Pet. 18–20, 30–32) that Grotmol discloses limitation 8.2. For instance, Grotmol describes that "a digital image" comprises "a plurality of pixel values." Ex. 1004, 3:13–15. Grotmol also describes modifying the digital image. *See*, *e.g.*, *id.* at 3:42–46 (describing "scaling individual pixels of the set of pixels by a scaling factor" and "scaling features of the subset by a scaling factor"), 4:18–22 (describing "applying a transformation to an instance of the sensory input," which "may be configured to produce a scaled input based on analysis of the history"), 30:47–31:8 (describing that "the normalization may comprise shifting and/or scaling input features to a given value range . . . for an 8-bit pixel value" and "[i]n some implementations data for one or more inputs may be scaled"), 31:61–32:5 (describing that "[e]qualization may be applied").

Importantly, Grotmol specifically describes modifying the digital image and comparing the modified image to find a match as follows:

> During training, *images (e.g., raw and/or pre-processed) may be stored in a memory buffer (training buffer)*. In one or more implementations, preprocessing operations may comprise *resampling, cropping, light balancing, and/or feature extraction.* Motor commands issued by a trainer corresponding to time instances when the images are acquired may be stored. Additional sensory information (e.g., vehicle motion information, ambient environment information, vehicle operational parameters) corresponding to time instances when the images are acquired may be stored.
>
> During autonomous operation, control process of the robot *may be configured to compare a given (e.g., the most recent, current) image with one or more the images from the training buffer*.

Ex. 1004, 39:13–41 (emphases added).

Grotmol describes another example of a "shift and trim operation," which produces a "*shifted and trimmed version of the image*" and determining a "*similarity metric . . . between the shifted/trimmed frames*." *Id.* at 40:64–41:18 (emphases added). Grotmol describes that "the similarity may be determined by performing pixel-wise difference between the overlapping regions . . . of the given image and the *matching image*." *Id.* (emphasis added).

Furthermore, in its Reply, Petitioner provides annotated versions of Figures 20A and 20B of Grotmol, reproduced below.

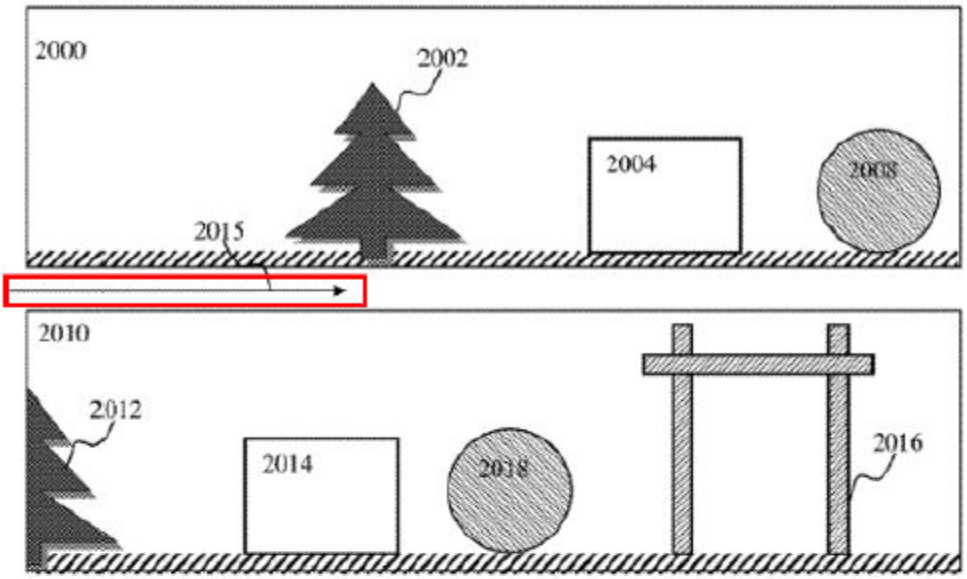

FIG. 20A

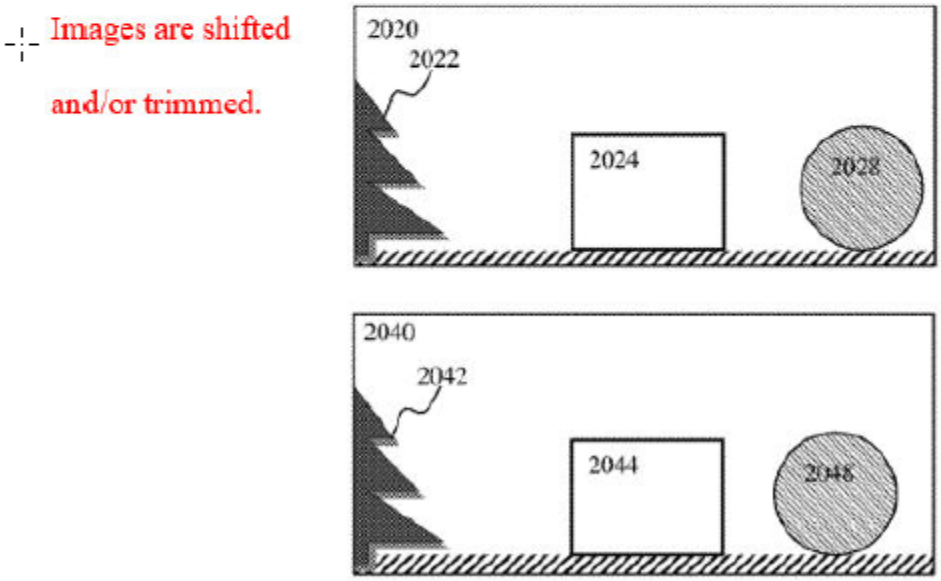

FIG. 20B

Figures 20A and 20B of Grotmol illustrate the shifting and trimming of images 2000 and 2010 to obtain output frames 2020 and 2040, which depicted the trimmed version of image 2000 and the shifted and trimmed version of image 2010, respectively. Ex. 1004, 40:64–67. Figures 20A and

20B reproduced in Petitioner's Reply include Petitioner's red textual annotation next to Figure 20B stating that "[i]mages are shifted and/or trimmed." Pet. Reply 7.

Figure 20A illustrates exemplary images 2000, 2010 for use with training path navigation. Ex. 1004, 38:43–57. Image 2000 comprises representations of tree 2002, ball 2008, and other objects. *Id.* Image 2010 is obtained subsequent to turn execution and the representation of objects in image 2010 are, therefore, shifted. *Id.* at 38:61–63.

Figure 20B "illustrates the output of the shift and trim operation" performed on images 2000 and 2010, which results in a trimmed version of image 2000 depicted as frame 2020 and a shifted and trimmed version of image 2010 depicted as frame 2040. *Id.* at 40:64–67. Grotmol describes using "shifted/trimmed frames 2020 and 2040" in Figure 20B in a match. *Id.* at 40:67–41:2 (describing "matching images"), 41:8–9 (describing determining a "similarity metric . . . between the shifted/trimmed frames (e.g., 2020, 2040 in FIG. 20B)"), 41:9-14 (describing determining similarity "by performing a pixel-wise different between the overlapping regions (e.g., the frames 2020, 2040 in FIG. 20B)").

We turn to Patent Owner's arguments, starting with Patent Owner's first and second arguments. Specifically, Patent Owner argues "Petitioner's sole argument that Grotmol discloses using the modified image in the matching process is that '[a] POSITA would understand that where either the current image or the stored image have been modified, the partial match would be determined using the modified current image (i.e., modified second circumstance representation) or the modified stored image (i.e., modified first circumstance representation).'" PO Resp. 19 (citing Pet. 31).

Patent Owner next argues that "Petitioner appears to concede" that "Grotmol itself never discloses matching using the modified circumstance representation." *Id.*

Patent Owner's arguments are based on an incorrect characterization of the Petition. Regarding the Petition, Patent Owner's characterization of the Petition as including a "sole argument" is not consistent with the Petition's statement "[a]s described with respect to limitations [1.6] and [8.1]." Pet. 31. As discussed above, the recitation of "the at least partial match" in limitation [8.2] derives antecedent basis from limitation [1.6]. As also discussed above, Petitioner identifies disclosures for limitation [1.6] that describe that recitation as well as the recitation in limitation [8.2]. We find no deficiency in Petitioner referring to its contentions for limitation [1.6] and limitation [8.1], which is the immediately preceding recitation in claim 8.

Patent Owner's argument that Petitioner conceded appears to be based on Petitioner's reference to a "POSITA." PO Resp. 19 (citing Pet. 31). Based on the complete record now before us, we do not find Petitioner's reference to a "POSITA" (Pet. 31) to be a concession. 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 Lilly v. Los Angeles Biomedical Res. Inst.*, 849 F.3d 1073, 1074–75 (Fed. Cir. 2017). We, however, further find that Petitioner's argument and Grotmol's disclosures are sufficient and the testimony of Dr. Janet is not needed to resolve the issues relating to element [8.2].

We next turn to Patent Owner's argument that a person of ordinary skill in the art "would not have understood based on Grotmol's disclosure

that the modified image would be used in the matching." PO Resp. 20. Patent Owner makes a similar argument in its Sur-reply. PO Sur-reply 8 (arguing "[n]othing in Grotmol discloses that any image is modified and then used in the claimed matching procedure"). For the reasons given above, we disagree. *See, e.g.*, Ex. 1004, 39:13–41 (describing that "preprocessing operations may comprise resampling, cropping, light balancing, and/or feature extraction" and "[d]uring autonomous operation, control process of the robot may be configured to compare a given (e.g., the most recent, current) image with one or more the images from the training buffer"); 40:64–41:18 (describing producing a "shifted and trimmed version of the image" and determining a "similarity metric . . . between the shifted/trimmed frames"). As discussed in more detail above, Grotmol includes additional supporting disclosures. *Id.* at 3:42–46, 4:18–22, 30:47–31:8, 31:61–32:5.

We turn to Patent Owner's argument that Dr. Janet's deposition testimony supports Patent Owner's position. PO Resp. 20 (citing Ex. 2008, 75:14–19). Patent Owner also argues that "Dr. Janet attempted to supplement his opinions regarding claim 8 at his deposition," but Patent Owner acknowledges that Petitioner does not rely on them. *Id.* at 20–21 (citing Ex. 2008, 57:21–58:12, 61:18–63:21, 63:22–64:9, 77:21–80:2, 86:7–87:2, 93:4–13). As an initial matter, Patent Owner's citations do not appear to be correct. Nonetheless, for the reasons given above, we find Petitioner's argument and evidence shows that Grotmol discloses limitation [8.2] even without considering Dr. Janet's testimony.

Finally, we turn to Patent Owner's argument that Grotmol's disclosures relied on by Petitioner do "not mention anything about images

themselves" being modified. PO Sur-reply 8. Patent Owner argues that Grotmol describes modifying "input data, not images." *Id.* (citing, e.g., Ex. 1004, 4:18–22, 4:58–63, 30:47–31:8, 31:61–32:5). Patent Owner's argument is not consistent with Grotmol's disclosure of a "a digital image," which comprises "a plurality of pixel values." Ex. 1004, 3:13–15. Grotmol, similarly, describes that "the term feature may be used to describe one or more integer or floating point values characterizing the input." *Id.* at 28:19–24.

Patent Owner cites testimony of Dr. Saber (PO Resp. 18–21 (citing Ex. 2007 ¶¶ 88–96)) that restates Patent Owner's arguments without further persuasive explanation or support. *See, e.g.*, Ex. 2007 ¶¶ 88–96. Upon review of Dr. Saber's testimony, we find that it does not undermine Petitioner's showing for the same reasons given above.

For the reasons given, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol discloses element [8.2]. We find that Patent Owner's arguments do not undermine Petitioner's showing.

c) Conclusion—Claim 8

Based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that claim 8 is unpatentable as anticipated by Grotmol. We find that Patent Owner's argument and evidence does not undermine Petitioner's showing.

6. Dependent Claim 16

Claim 16 depends from claim 3 and further recites

> wherein the first circumstance representation correlated with the first one or more instruction sets for operating the first device include at least a portion of the first one or more object representations connected, using at least one or more

> connections, with at least a portion of the first one or more instruction sets for operating the first device.

Ex. 1001, 172:64–173:3. The terms "the first circumstance representation," "correlated" and "the first one or more instruction sets for operating a first device" derive antecedent basis from limitation [1.3]. The term "object representations" derives antecedent basis from claim 3, which recites "wherein the first circumstance representation includes a first one or more object representations." Grotmol discloses storing connected object representations and instruction sets as trained behaviors. Pet. 38–39; Ex. 1004, 33:24–27, 33:59–62.

Patent Owner argues "[w]hen properly construed, each claimed connection is a relationship that includes a link." PO Resp. 21. Patent Owner argues "Grotmol discloses that 'an acquired image may be compared with one or more images from the training buffer' to cause a motor command to be issued." *Id.* at 22 (citing Ex. 1004, code (57)). Patent Owner argues "[b]y contrast, the connections disclosed in the '344 patent are relationships that include links to connect two elements." *Id.* (citing Ex. 2007 ¶¶ 99–100). Patent Owner also argues "[e]ven if Patent Owner's proposed construction is not adopted," Grotmol does not disclose "connections" because in Grotmol, "[a]n image is only associated with the motor control command, not connected including a specific connection, let alone connected in a relationship that includes a link." *Id.* at 22–23 (citing Ex. 2007 ¶ 100).

Patent Owner's arguments are unavailing. Grotmol discloses that "[t]rained behaviors of the robotic device may be configured based on learning of associations between *sensory context (e.g., presence of an obstacle in front of the robotic vehicle)* and a respective action (e.g., right turn) during training." Ex. 1004, 33:59–62 (emphasis added). In particular,

"[a] given training set may comprise an instance of the video frame . . . and an instance of a motor control indication configured to cause the robot to execute an action." *Id.* at 3:36–39 (cited in Pet. 12 for limitation [1.3]). Additionally, Grotmol discloses an "implementation" in which "images" that are "obtained with a camera" "comprise representations of visual field that may be obtained at times t1<t2, respectively." *Id.* at 38:54–56 (cited in Pet. 24 for claim 3). These images also may "comprise representations [of] one or more objects, e.g., a tree 2002, a rectangle, a ball 2008, and/or other objects." *Id.* at 38:56–65; *see also id.*, 38:65–39:12 (referring to objects shown within images 2000 and 2010 as "object representations" and "representations").[7] As discussed above, Grotmol discloses that "motor commands at a given step may be obtained by taking the stored motor commands from the training buffer that may correspond to the best matching stored image." *Id.* at 43:5–9 (cited in Pet. 14 for limitation [1.3]). In other words, Grotmol links specific images comprising representations of one or more objects to specific motor commands so that when a new image matches the stored image, the robot performs the linked motor command. *Id.* at 3:36–39, 33:59–62, 38:54–39:12, 43:5–9; Ex. 1010 ¶ 32.

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). U.S. Patent No. 10,452,974 B1 challenged in IPR2023-01054 is related to the '344 patent challenged here. Our construction analysis here is consistent with that in the

[7] Petitioner relies on Grotmol's disclosures of images comprising representations of objects in its arguments for claim 3. *See, e.g.*, Pet. 24 (citing Ex. 1004, 38:54–39:12).

IPR2023-01054 proceeding and our determinations are for the most part the same, with the exception that here we do not need to make a finding that Patent Owner's construction is the one that is most consistent with the ordinary meaning and intrinsic evidence. Instead, we determine that even if we assume that the term "connection" means a "relationship that includes a link," as Patent Owner proposes and the -01054 Final Decision adopts, the asserted prior art still discloses the disputed claim limitation. *See* § II.C.2. Thus, our analysis, findings, and conclusions in the instant proceeding would not change even if we were to adopt the claim construction analysis and determinations set forth in the IPR2021-01054 Final Decision. Importantly, Petitioner's evidence here (*see, e.g.*, Ex. 1004, 3:36–39, 33:59–62, 38:54–39:12, 43:5–9) differs from the evidence relied on in the related IPR2023-01054 case. Also, the recitations of claim 16 in this proceeding differ from the recitations in claim 7 challenged in IPR2023-01054.

Patent Owner submits the testimony of Dr. Saber in support of its position. PO Resp. 21–23 (citing Ex. 2007 ¶¶ 97–100). Dr. Saber's testimony restates Patent Owner's argument without further persuasive explanation or support. We find that Dr. Saber's testimony does not undermine Petitioner's showing for the same reasons given above.

For the reasons given, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol discloses the recitations in claim 16.

Based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that claim 16 is unpatentable as anticipated by Grotmol. We find that Patent Owner's arguments and evidence do not undermine Petitioner's showing.

7. Dependent Claims 13–15, 17, and 18

Petitioner supports its arguments for dependent claims 13–15, 17, and 18 with specific citations to Grotmol. Pet. 32–48 (citing, e.g., Ex. 1002 ¶¶ 164–182, 177–178, 184–188, 198–207, 209–225). Petitioner's argument is supported by the evidence cited in the Petition. Patent Owner does not offer arguments for dependent claims 13–15, 17, and 18 or contest Petitioner's analysis. *See* PO Resp. 11 (stating "[r]egarding Ground 1, Petitioner fails to show that Grotmol anticipates claims 7, 8, and 16 of the '344 patent"); *see also generally* PO Resp.; PO Sur-reply (not arguing claims 13–15, 17, and 18).

For the reasons presented by Petitioner, based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that dependent claims 13–15, 17, and 18 are unpatentable as anticipated by Grotmol.

E. Unpatentability of Claims 10 and 11 as Obvious over Grotmol

Petitioner asserts that claims 10 and 11 would have been obvious over Grotmol and the knowledge of a person of ordinary skill in the art. Pet. 4, 53–55. Patent Owner disputes Petitioner's showing for claims 10 and 11. We address the parties' disputes below.

1. The Parties' Arguments for Claim 10

In the Petition, Petitioner argues that "Grotmol discloses that a human trainer ('user') can operate a robot during a training process for learning correlations." Pet. 53 (citing Ex. 1004, 23:3–11, 39:13–22). Petitioner also argues "Grotmol discloses that multiple learning processes can be done to train multiple behaviors for the robot, including 'simple tasks' and 'complex tasks.'" *Id.* (citing Ex. 1004, 24:17–67, 26:1–20). Petitioner argues that

claim 10 would have been obvious to a person of ordinary skill in the art in view of Grotmol's disclosure of training "behaviors involving different levels of complexity in order to take advantage of the varying skills and knowledge of trainers." *Id.* at 53–54 (citing, e.g., Ex. 1002 ¶ 233).

In the Patent Owner Response, Patent Owner argues that "Grotmol fails to disclose the claimed 'another user' and 'another learning process.'" PO Resp. 23–24 (citing Ex. 2007 ¶¶ 103–112). Patent Owner argues that "[n]othing in Grotmol suggests that one user trains the robot for simple tasks and another user trains the robot for complex tasks" and that Petitioner's argument is "an unjustified leap." *Id.* at 25 (emphasis omitted); *see also id.* at 26–27 (making similar argument and stating "Grotmol does not even mention another user"). Patent Owner also argues that the discussion in the Institution Decision in IPR2023-01054 for claim 4 supports its position that Grotmol does not teach "another learning process." *Id.* at 26 (emphasis omitted). Patent Owner further argues that a person of ordinary skill in the art would not have modified Grotmol as proposed by Petitioner "due to the complexities of combining the mixed knowledge into a single knowledgebase" and Petitioner "has not established" that its proposed modification is "unusually simple" and "the technology particularly straightforward." *Id.* at 27–28 (citing Ex. 2007 ¶¶ 109–112). Patent Owner also argues that Dr. Janet's deposition testimony confirms that he and Petitioner failed to perform a proper obviousness analysis regarding claim 10. *Id.* at 28–29 (citing Ex. 2008, 94:20–97:20, 98:16–23).

In the Reply, Petitioner responds that the "Petition explained that 'Grotmol discloses a memory that stores a knowledgebase[ ] including multiple correlations (training sets).'" Pet. Reply 12 (citing Pet. 12–14, 53;

Ex. 1004, code (57), 3:31–39, 8:66–9:3, 10:23–26, 38:36–58, 39:13–22; Ex. 1010 ¶ 35). Petitioner also argues that its obviousness arguments are supported by additional teachings in Grotmol as follows: (1) Grotmol's teaching of Adaptive controller 1 receiving behavior 1 and adaptive controller 2 receiving behavior 2 supports its position (*id.* at 13 (citing Ex. 1004, 25:10–26:48, Fig. 10B; Ex. 1010 ¶ 36)); (2) Grotmol's teaching that the "BrainOS" software platform that is configured such that different users can change learned behaviors (*id.* at 13–14 (citing, e.g., Ex. 1004, 34:18–21; Ex. 1010 ¶¶ 37, 40); and (3) Grotmol's teaching that "learning is user dependent" (*id.* at 14–15 (citing Ex. 1004, 33:21–35; Ex. 1002 ¶ 233; Ex. 1010 ¶¶ 38–39; Ex. 1013 ¶¶ 70–71, 194–198)). Petitioner also submits Dr. Saber's deposition testimony in support of its position. *Id.* at 13–14 (citing Ex. 1011, 166:12–18).

In the Sur-reply, Patent Owner maintains that Petitioner's obviousness ground is deficient because Grotmol discloses only a single user. PO Sur-reply 13–14. Patent Owner disputes Petitioner's reliance on Grotmol's teachings relating to the "BrainOS" software platform and user dependent learning on the basis that Grotmol does not disclose more than one user generating the "various correlations." *Id.* Patent Owner also disputes Petitioner's citation of Dr. Saber's deposition testimony arguing that Petitioner mischaracterizes the testimony. *Id.* at 14 (citing Ex. 1011, 166:12–18, 185:21–186:5; Ex. 1012, 78:15–83:16).

2. Analysis of the Parties' Arguments for Claim 10

Claim 10 recites

> 10. The system of claim 3, wherein the knowledgebase further includes a third circumstance representation correlated with a second one or more instruction sets for operating the first

> device, and wherein the third circumstance representation represents a third circumstance detected at least in part by the one or more sensors of the first device, and wherein at least a portion of the third circumstance representation or at least a portion of the second one or more instruction sets for operating the first device is learned in another learning process that includes operating the first device at least partially by another user.

Ex. 1001, 171:48–58.

We start with the disclosures cited in the Petition. Pet. 53–54 (citing Ex. 1004, 23:3–11, 24:17–67, 26:1–20, 39:13–22). Grotmol teaches that a trainer sends commands to a robot during training and the robot learns associations. Ex. 1004, 23:3–11 (describing the robot "learn[ing] an association" by observing a teacher), 39:13–22 (describing that "[d]uring training" images are "stored in a memory buffer (training buffer)," "[m]otor commands issued by a trainer corresponding to time instances when the images" also are stored, and "[a]dditional sensory information (e.g., vehicle motion information, ambient environment information, vehicle operations parameters) corresponding to time instances when the images are acquired" also are stored). Grotmol also teaches that the robot learns multiple behaviors and training a robot to perform certain tasks involves hierarchical learning. Ex. 1004, 24:17–67 (describing "[a]pparatus and methods for hierarchical learning" including a user training a robot to perform "simple tasks" and "complex task[s]" and organizing "simple 'low level' behaviors into hierarchies"), 26:1–20 (describing that after a "user is done training a particular behavior, he may create another module and activate it" and the "system may be configured to learn the second behavior from the user"). We find that Grotmol's disclosures in the Petition support Petitioner's arguments (Pet. 53–54) and Dr. Janet's testimony (Ex. 1002 ¶ 233) that claim 10 would

have been obvious over Grotmol and the knowledge of a person of ordinary skill in the art.

We turn to Petitioner's argument that claim 10 would have been obvious to a person of ordinary skill in the art in view of Grotmol's teaching of training "behaviors involving different levels of complexity in order to take advantage of the varying skills and knowledge of trainers." *Id.* at 53–54 (citing, e.g., Ex. 1004, 23:3–11, 24:17–67, 26:1–20, 39:13–22; Ex. 1002 ¶ 233). We also note Dr. Janet's testimony that a person would have made Petitioner's proposed modification to avoid "the inefficiency" of imposing a limit of training a robot by a single user, considering the learning processes of interoperable robots. Ex. 1002 ¶ 233. We find that Petitioner's argument (Pet. 53–54) and Dr. Janet's testimony (Ex. 1002 ¶ 233) are supported by Grotmol's teaching of training the robot to perform simple and complex tasks, as well as training the robot using hierarchical learning comprised of low level behaviors. *See, e.g.*, Ex. 1004, 24:17–67; 26:1–20.

Petitioner arguments and evidence in the Reply provide further support. Pet. Reply 12–15 (citing, e.g., Pet. 12–14, 53; Ex. 1004, code (57), 3:31–39, 8:66–9:3, 10:23–26, 25:10–26:48, 33:21–35, 34:18–21, 38:36–58, 39:13–22, Fig. 10B; Ex. 1010 ¶¶ 35–40). Indeed, Grotmol teaches multiple "users" controlling behaviors by describing that the "BrainOS software platform may be configured to *enable users* to selectively remove a learned behavior (and/or a portion therefore) via an undo and/or time machine operation." Ex. 1004, 34:18–21 (emphasis added). Furthermore, consistent with Petitioner's argument that a person of ordinary skill in the art would have modified Grotmol "to take advantage of the varying skills and knowledge of trainers" (Pet. 53–54; Ex. 1002 ¶ 233), Grotmol describes user

dependent learning. *See, e.g.*, Ex. 1004, 33:21–23 (describing that "[t]raining of the robot's controller may be based on the *user observing* robot's actions and sending one or more target control commands to the robot") (emphasis added). We also find Petitioner's arguments and evidence is further supported by Grotmol's additional descriptions of multiple training sets, behaviors, and modules. *Id.* at 3:35–36 (describing that a "memory component may be configured to store training *sets*") (emphasis added), 25:10–14 (describing that "a high level behavior" activates "a low level behavior"), 25:21–22 (describing that a "classifier included in the switcher may learn to predict which module to select depending on visual context").

We turn to Patent Owner's arguments, starting with Patent Owner's argument that "Grotmol fails to disclose the claimed 'another user' and 'another learning process.'" PO Resp. 23–24 (citing Ex. 2007 ¶¶ 103–112); *see also* PO Sur-reply 13–14 (disputing Petitioner's reliance on Grotmol's teachings relating to the "BrainOS" software platform and user dependent learning on the basis that Grotmol does not disclose more than one user generating the "various correlations"). Patent Owner argues that "[n]othing in Grotmol suggests that one user trains the robot for simple tasks and another user trains the robot for complex tasks" and that Petitioner's argument is "an unjustified leap." *Id.* at 25 (emphasis omitted); *see also id.* at 26–27 (making similar argument and stating "Grotmol does not even mention another user"). We disagree with Patent Owner.

Petitioner's ground is not anticipation, but instead, Petitioner argues that claim 10 would have been obvious over Grotmol and the knowledge of a person of ordinary skill in the art. Grotmol discloses various robot training processes that are performed by a human, referenced in Grotmol using the

terms "trainer," "user," and "teacher." Ex. 1004, 23:3–4 (referring to "the teacher"), 33:21–23 (referring to "the user"), 39–17–19 (referring to "a trainer"). Patent Owner's dispute appears to be on the basis that Grotmol does not use the term "another user" recited in claim 10. In light of Grotmol's disclosures discussed herein and the knowledge of a person of ordinary skill in the art (Ex. 1002 ¶ 233; Ex. 1010 ¶ 39), we find that Petitioner's position is consistent with and supported by the evidence of record and not undermined by Patent Owner's argument and evidence.

We next turn to Patent Owner's argument that the discussion in the Institution Decision in IPR2023-01054 for claim 4 supports its position that Grotmol does not teach "another learning process." PO Resp. 26 (emphasis omitted). The referenced claim 4 recites "another learning process" that includes "obtaining or receiving the fourth one or more instruction sets for operating *the second device*." In contrast, claim 10 recites "wherein the knowledgebase further includes a third circumstance representation correlated with a second one or more instruction sets for operating *the first device*" and "at least a portion of the third circumstance representation or at least a portion of the second one or more instruction sets for operating *the first device* is learned in *another learning process*" (emphases added). Our discussion regarding Grotmol's teachings relating to first and second robots in the Institution Decision for IPR2023-01054 does not pertain to claim 10 here, which does not recite that limitation.

We next turn to Patent Owner's argument that a person of ordinary skill in the art would not have modified Grotmol as proposed by Petitioner "due to the complexities of combining the mixed knowledge into a single knowledgebase" and Petitioner "has not established" that its proposed

modification is "unusually simple" and "the technology particularly straightforward." PO Resp. 27–28 (citing Ex. 2007 ¶¶ 109–112; *Arendi S.A.R.L. v. Apple Inc.*, 832 F.3d 1355, 1361 (Fed. Cir. 2016)). As discussed above, Grotmol expressly discloses storing "mixed" knowledge, such as "simple" and "complex" tasks, in one knowledgebase. Ex. 1004, 24:17–67, 26:1–20, 33:27–32, 39:13–19, Fig. 8. We find that Petitioner's proposed modification of that express disclosure, specifically that "another" user would have operated Grotmol's "training handset" to train a robot (*id.* at 33:27–32), is an unusually simple and technologically particularly straightforward modification.

We also are persuaded that Petitioner has demonstrated that a person of ordinary skill in the art would have had a reasonable expectation of success. *See, e.g.*, Pet. 54 (explaining that it would have been obvious "to have a second user perform an additional training resulting in an additional correlation stored in the knowledgebase"); Ex. 1002 ¶ 233. Petitioner's argument is consistent with Grotmol's teachings, for example, by involving only a "second user" sending target control commands via the training handset. *See, e.g.*, Ex. 1004, 33:21–24. Patent Owner's asserted "complexities of combining the mixed knowledge" in "a single knowledgebase" is conclusory and not consistent with the knowledgebase storing training sets involving simple and complex tasks, as well as learning organized hierarchically.

Finally, we turn to Patent Owner's argument that Dr. Janet's deposition testimony confirms that he and Petitioner failed to perform a proper obviousness analysis regarding claim 10. PO Resp. 28–29 (citing Ex. 2008, 94:20–97:20, 98:16–23). Dr. Janet's testimony relied on by Patent

Owner (*id.*) pertains to a different claim, not claim 10 challenged here. Also, we find Patent Owner's argument is not based on a correct characterization of Dr. Janet's testimony, which pertains to what Hickman teaches and that Hickman compliments Grotmol, in his opinion. Ex. 2008, 94:20–97:20, 98:16–23.

We now address Petitioner's citation to Dr. Saber's deposition testimony in support of its position and Patent Owner's arguments that Petitioner mischaracterizes that testimony. Pet. Reply 13–14 (citing Ex. 1011, 166:12–18); PO Sur-reply 14 (citing Ex. 1011, 166:12–18, 185:21–186:5; Ex. 1012, 78:15–83:16). We find that Petitioner has demonstrated unpatentability of claim 10 based on evidence other than Dr. Saber's testimony, so we do not rely on Petitioner's argument regarding Dr. Saber's testimony.

Regarding Patent Owner's reliance on the testimony of Dr. Saber (PO Resp. 23–29 (citing Ex. 2007 ¶¶ 103–112)), upon review, we find that Dr. Saber's testimony does not undermine Petitioner's showing. Dr. Saber's testimony restates Patent Owner's arguments without further persuasive explanation or support and does not undermine Petitioner's showing for the same reasons given above.

For the reasons given, we determine that Petitioner demonstrates by a preponderance of the evidence that Grotmol in view of the knowledge of a person of ordinary skill in the art teaches the features recited in dependent claim 10. For the reasons given, we also are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modification of Grotmol in view of the knowledge of a person of ordinary skill in the art. Pet. 53–55.

3. Conclusion—Claim 10

Based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that claim 10 is unpatentable as obvious over Grotmol and the knowledge of a person of ordinary skill in the art. We find that Patent Owner's argument and evidence do not undermine Petitioner's showing.

4. Claim 11

We turn to the parties disputes as to whether claim 11 would have been obvious over Grotmol and the knowledge of a person of ordinary skill in the art. The Petition includes alternative contentions that claim 11 would have been obvious over the combination of Grotmol and Hickman. As discussed below, we find Petitioner has shown that claim 11 would have been obvious over Grotmol and Hickman. We, therefore, need not make a determination as to whether claim 11 would have been obvious over Grotmol in view of the knowledge of a person of ordinary skill in the art.

F. Unpatentability of Claims 6, 11, and 12 as Obvious over Grotmol and Hickman

Petitioner asserts that claims 6, 11, and 12 would have been obvious over Grotmol and Hickman. Pet. 4, 55–65. We begin with an overview of Hickman. We then turn to the parties' contentions.

1. Hickman (Ex. 1005)

Hickman is titled "Shared Robot Knowledge Base for Use with Cloud Computing System." Ex. 1005, code (54). Hickman describes the following:

> The advantages of a shared robot knowledge base 306 multiply as robots are deployed around the world. If information about a particular object is "public" and therefore accessible by all robots, then information that a single robot learns about that object and uploads to the shared robot knowledge base 306 may

> be accessible by other robots all around the world. In operation, many millions or even many billions of robots may ultimately access the shared robot knowledge base 306. As a result, the shared robot knowledge base 306 enables robots to benefit from the collective information learned by many other robots.

Ex. 1005, 11:31–41.

2. Overview—Claims 6, 11, and 12

Claims 6, 11, and 12 recite additional features relating to a "second device," a "third device," a "fourth device" where each device is an autonomous device, such as a robot. Claims 6 and 12 recite features in which a device autonomously performs operations based on instructions learned by a different autonomous device. More specifically, claim 6 recites "wherein the second device autonomously performs the one or more operations defined by the first one or more instruction sets for operating the first device." Claim 12 recites "wherein the fourth device autonomously performs one or more operations defined by the second one or more instruction sets for operating the third device." Claim 11 recites that "the knowledgebase" that stores instructions for operating a first device also "includes a third circumstance representation correlated with a second one or more instruction sets for operating a *third device*" (emphasis added).

Petitioner argues that claims 6, 11, and 12 would have been obvious over the combination of Grotmol and Hickman. *See, e.g.*, Pet. 4, 55. Petitioner relies on Grotmol's teaching of an "autonomous robotic system." *Id.* at 8, 55 (citing, e.g., Ex. 1004, code (57), 33:12–58). Petitioner argues that Hickman "discloses a 'shared robot knowledge base [that] is updated based on robot experiences so that any particular robot may benefit from the prior experiences of other robots.'" *Id.* (citing Ex. 1005, code (57)).

Petitioner provides a detailed analysis in support of its position that the combination of Grotmol and Hickman teaches the limitations in claims 6, 11, and 12. *Id.* at 55–65. More specifically, first, Petitioner provides reasons to combine Grotmol and Hickman. *Id.* at 55–58. Petitioner then provides an element-by-element analysis of each of claims 6, 11, and 12 showing where Petitioner contends each recited feature is taught or suggested by the prior art.

Patent Owner argues that Petitioner's obviousness analysis is deficient because the Petition lacks explanation and specificity. PO Resp. 34–60, 62. Many of Patent Owner's arguments center on the allegation that Petitioner was required to identify claim elements missing from Grotmol and that, as a result, Petitioner attempts an anticipation analysis. *See, e.g., id.* at 60 ("Petitioner and its expert attempt to have their cake and eat it too, purportedly pursuing obviousness grounds for claims 6, 10, 11 and 12 (and no anticipation grounds for these claims) even though Petitioner's expert testified at his deposition that Grotmol itself discloses all the elements" of those claims.) Patent Owner, similarly, argues that "Petitioner's obviousness analysis is . . . deficient because it fails to explain what specific claim limitation is missing from Grotmol and how Hickman discloses the missing limitation" (*id.* at 38, 60, 62); and Dr. Janet's deposition testimony confirms that "he and Petitioner failed to perform a proper obviousness analysis" (*id.* at 44, 50, 59, 62). Patent Owner also characterizes the Petition as lacking a "mapping the disclosure of the references to the specific language of the claims" (*id.* at 36); and relying improperly on "high level concepts from Grotmol and Hickman" without explanation as to how each element of the claims is taught or suggested by either reference (*id.* at 47–48).

We find that Patent Owner's arguments mischaracterize the Petition and Dr. Janet's deposition testimony. In contrast to Patent Owner's arguments, Petitioner explains that it relies on Grotmol's teachings of an "autonomous robotic system" and Hickman's teachings relating to a "shared robot knowledge base [that] is updated based on robot experiences so that any particular robot may benefit from the prior experiences of other robots." Pet. 55 (citing 33:13–58; Ex. 1005, code (57)); *see also id.* at 8 (citing, e.g., Ex. 1004, code (57)). Also, the Petition includes detailed, well-supported reasons to combine the asserted art and an element-by-element analysis for each of claims 6, 11, and 12.

Patent Owner also argues that: (1) Petitioner's reasoning to combine is deficient because Hickman teaches away from Petitioner's combination and Petitioner relies on improper hindsight analysis; and (2) Petitioner has not shown that every feature recited in claims 6, 11, and 12 is taught by the combination of Grotmol and Hickman. PO Resp. 34–60, 62. Below, we address these two disputes between the parties. Specifically, first we address the parties' dispute regarding Petitioner's reasons reasoning to combine Grotmol and Hickman. Second, we turn to the parties' arguments regarding Petitioner's showing for the features recited in claims 6, 11, and 12.

3. The Parties' Dispute Regarding Petitioner's Reasons to Combine Grotmol and Hickman

Petitioner argues that a person of ordinary skill in the art would have made Petitioner's proposed combination "to further facilitate the sharing of learned behaviors" among autonomous devices. Pet. 56. Petitioner relies on three "advantages" described by Hickman. *Id.* (citing Ex. 1005, 1:38–41, 5:41–46, 11:31–41). More specifically, Petitioner's first asserted advantage is that in Hickman "information that a single robot learns" is uploaded to a

"shared robot knowledge base" that is "accessible by other robots," which "enables robots to benefit from the collective information learned by many other robots." *Id.* (quoting Ex. 1005, 11:31–41). Petitioner's second asserted advantage is that in Hickman "dividing application execution and storage between client devices and the cloud computing system allows more processing to be performed by the cloud computing system, thereby taking advantage of the cloud computing system's processing power and capability, for example." *Id.* (quoting Ex. 1005, 5:41–46). Petitioner's third asserted advantage is that Hickman's cloud computing may "free users from certain hardware and software installation and maintenance tasks." *Id.* (quoting Ex. 1005, 1:38–41).

Petitioner also relies on the testimony of Dr. Janet and an article as further support that a person of ordinary skill in the art would have "readily appreciated the advantages" of Petitioner's proposed combination of Grotmol and Hickman. *Id.* at 56–57 (citing, e.g., Ex. 1002 ¶¶ 143–150; Ex. 1006, 183). Petitioner also argues that its proposed combination "would have been expected and predictable" because "Grotmol expressly contemplates the sharing of trained configurations among robots, and Hickman's expansion upon this idea does not interfere with Grotmol's autonomous robotic system." *Id.* at 57 (citing Ex. 1002 ¶¶ 143–150); *see also id.* at 55–56 (citing Ex. 1004, 33:12–58 (describing that the "trained configuration may be loaded to one or more other robots in order to provide learned behaviors"). Petitioner provides further argument and evidence regarding reasons to combine in its discussion of claims 6, 11, and 12. *Id.* at 58–65.

We find that Petitioner provides articulated reasoning with rational underpinning to support Petitioner's modification of Grotmol and Hickman. We also find that Petitioner provides argument and evidence supporting that a person of ordinary skill in the art would have had a reasonable expectation of success.

Patent Owner argues that Petitioner's reasoning to combine is deficient because Hickman teaches away from Petitioner's combination and Petitioner relies on improper hindsight analysis. PO Resp. 34–60, 62. Regarding teaching away, Patent Owner, more specifically, argues the following:

> Hickman discloses storing instruction sets and images separately in separate knowledgebases (images in Unique Object Knowledge Base 307 and instructions in Task Knowledge Base 309, see Ex. 1005, Fig. 3), which a POSA would have found to be incompatible with Grotmol's disclosure of training sets or correlations with images and instruction sets correlated and stored together. Ex. 2007, ¶¶121-123. Further, Hickman teaches away from the claimed "circumstance representations" because Hickman focuses on manipulating a single object and single object information and such information is not a circumstance representation. Ex. 2007, ¶¶121-123. In addition, instances of single object information (where each row of the Unique Object Knowledge Base 307 disclosed in Hickman is single object information) are learned from separate circumstances, further confirming that single object information is not a circumstance representation.

PO Resp. 35. Patent Owner makes similar arguments with respect to claims 6, 11, and 12. *See, e.g., id.* at 39–41, 43, 45–50, 52–54, 57, 59.

Patent Owner's arguments that Hickman teaches away are unavailing. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the

path that was taken by the [inventor]." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994); *see also In re Mouttet*, 686 F.3d 1332, 1333–134 (Fed. Cir. 2012) ("[A] reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discourage from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant.").

We find that the organization of Hickman's knowledge bases does not undermine Petitioner's proposed combination of Grotmol and Hickman because the proposed combination simply integrates Hickman's teaching of sharing knowledge between different robots through a cloud computing system. Even to the extent that Petitioner's proposed combination incorporates the specific organization of Hickman's knowledge bases, Patent Owner's arguments are not consistent with Hickman's disclosures, which includes description of a general knowledge base and description of different implementations, including implementations in which task data is stored in the same knowledge base as image data and implementations in which fields are expanded in the unique object knowledgebase. *See, e.g.*, Ex. 1005, 12:5–18, 15:28–37, 18:34–19:34, Fig. 3. Patent Owner's responsive arguments to the contrary in its Sur-reply (PO Sur-reply 20–23) are conclusory and Patent Owner's argument that the single knowledge base "is a critical part of the claimed invention" is contrary to the recitations in claims 6, 11, and 12, which do not prohibit multiple knowledge bases or require the structure Patent Owner argues.

Patent Owner's remaining arguments including that Hickman's instances of single object information is not a circumstance representation do not undermine Petitioner's proposed combination for the same reasons.

PO Resp. 35–37, 40. The Petition does not rely on Hickman's disclosure of circumstance representation. Additionally, Patent Owner's arguments are not consistent with Hickman's disclosures, which describe a knowledge base storing instructions for interacting with multiple objects. Ex. 1005, 2:48–64, 4:66–5:2, 6:53–57, 8:36–44, Fig. 3. Patent Owner's responsive arguments to the contrary in its Sur-reply (PO Sur-reply 23–24) are conclusory and unavailing as they maintain that Hickman is deficient for not disclosing circumstance representations, although Petitioner relies on Grotmol for that teaching.

We turn to whether Petitioner's reply arguments and submission of Dr. Janet's Supplemental Declaration were improper, as Patent Owner contends. *See*, *e.g.*, PO Sur-reply 1–4, 21–22. We determine such responsive argument and evidence are not improper. *See* 37 C.F.R. § 42.23(b); *see also* Consolidated Practice Guide at 73 (a "petitioner may file a reply to a patent owner response" and a "party also may submit rebuttal evidence in support of its reply"); 84 Fed. Reg. 64,280 (Nov. 21, 2019). We find Petitioner's reply arguments and Dr. Janet's testimony in his Supplemental Declaration (Ex. 1010) simply provide further details to support that the arguments and evidence in the Petition are correct. The Petition sets forth the teachings of Grotmol and Hickman that Petitioner relies on in full and include a detailed reasoning to combine the references and element-by-element analysis identifying the portions of the references that teach the elements of claims 6, 11, and 12. Petitioner's Reply and Dr. Janet's Supplemental Declaration testimony do no more than fairly and directly respond to Patent Owner's Response and Dr. Saber's testimony. *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).

Patent Owner's argument that Petitioner relies on improper hindsight analysis (PO Resp. 34–60) is based on a mischaracterization of the Petition. Contrary to Patent Owner's argument, Petitioner provides three reasons to make its proposed combination that are advantages expressly described in Hickman. In particular, as explained above, Petitioner relies on Hickman's description that in its system "information that a single robot learns" is uploaded and "accessible by other robots," which "enables robots to benefit from the collective information learned by many other robots" (Pet. 56 (quoting Ex. 1005, 11:31–41)) and in its system "dividing application execution and storage between client devices and the cloud computing system allows more processing to be performed by the cloud computing system, thereby taking advantage of the cloud computing system's processing power and capability" (*id.* (quoting Ex. 1005, 5:41–46)). Petitioner's also asserts that a person of ordinary skill in the art would have made the proposed combination because Hickman's cloud computing may "free users from certain hardware and software installation and maintenance tasks." *Id.* (quoting Ex. 1005, 1:38–41). Petitioner provides additional support for its reasoning to combine Grotmol and Hickman. *Id.* at 56–57 (citing, e.g., Ex. 1002 ¶¶ 143–150; Ex. 1006, 183).

Patent Owner submits the testimony of Dr. Saber in support of its position. *See, e.g.*, PO Resp. 41–59 (citing Ex. 2007 ¶¶ 121–158). Dr. Saber's testimony restates Patent Owner's arguments without further persuasive explanation or support. We find that Dr. Saber's testimony does

not undermine Petitioner's showing for the same reasons given herein for Patent Owner's arguments.

Based on the complete record before us, we are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modification of Grotmol and Hickman. For the reasons given herein, we find that Petitioner also has shown that a person of ordinary skill in the art would have had a reasonable expectation of success. We find that Patent Owner's arguments and evidence do not undermine Petitioner's showing.

4. Claim 6

Claim 6 depends from claim 3 and recites the following:

> 6 The system of claim 3, wherein the system further comprising:
> a server that receives from the first device at least one of: the first circumstance representation, or the first one or more instruction sets for operating the first device, and wherein the second device receives from the server at least one of: the first circumstance representation, or the first one or more instruction sets for operating the first device, and wherein the second device autonomously performs the one or more operations defined by the first one or more instruction sets for operating the first device.

Ex. 1001, 170:27–37.

Petitioner relies on the combination of Grotmol and Hickman for claim 6. The recitations in claim 6 of "the first circumstance representation" and "the first one or more instruction sets for operating the first device" derive antecedent bases from element [1.3]. With respect to element [1.3], Petitioner argues that Grotmol discloses these recitations. *See, e.g.*, Pet. 12–16 (citing, e.g., Ex. 1004, code (57), 3:27–39, 8:66–9:3, 9:1–3, 9:8–22, 10:23–26, 33:59–62, 38:36–58, 39:13–28, 43:5–9). Petitioner

provides further argument and evidence regarding Grotmol's disclosures for claim 6. *Id.* at 58–59 (citing, e.g., Ex. 1004, 24:31–25:5, 33:12–58).

Regarding the recitations of "a server that receives from the first device" and "the second device receives from the server," Petitioner argues Hickman discloses "a system wherein learned robot behaviors are uploaded to a shared knowledge base for use in other robots." *Id.* at 59. Petitioner relies on Hickman's disclosures relating to a shared knowledge base for use with a cloud computing system including Hickman's disclosure that its "cloud computing system may be configured to (i) send and receive data and queries to and from multiple robots, (ii) send data retrieved from the shared robot knowledge base to robots, and (iii) update data in the shared robot knowledge base based on data received from robots." *Id.* at 59–61 (citing, e.g., Ex. 1005, code (57), 5:7–11, 5:20–23, 26:21–27:21, 29:33–41, Fig. 6).

Petitioner argues it would have been understood to be "advantageous" to a person of ordinary skill in the art "to share learned skills [of Grotmol] among robots" and that "Hickman discloses such a system." *Id.* at 59 (citing Ex. 1004, 24:31–25:5, Ex. 1002 ¶¶ 240–243). Petitioner argues "[i]n the combination of Grotmol and Hickman, the training configuration learned by operation of a robot described in Grotmol would be uploaded to the server containing the 'shared robot knowledge base' described in Hickman, and a second robot would receive the circumstance representations and instructions stored in the knowledge base in order to perform autonomous operation." *Id.* at 60 (citing Ex. 1002 ¶¶ 242–244).

Patent Owner disputes Petitioner's showing. PO Resp. 41–44 (citing, e.g., Ex. 2007 ¶¶ 131–136); PO Sur-reply 20–25. We addressed many of Patent Owner's arguments above in our overview and discussion of

Petitioner's reasoning to combine Grotmol and Hickman. *See* §§ II.F.2–.3. Patent Owner also argues that neither Grotmol nor Hickman discloses all elements recited in claim 6. *See, e.g.*, PO Resp. 41–42 (arguing Hickman fails to teach "circumstance representation" and "a correlation of the claimed circumstance representation with the claimed instruction set"), 42 (arguing Hickman's knowledgebase is "simple" and does not disclose "a correlation with an instruction set for operating a second device or other specifically claimed elements of the correlation"), 43 ("[N]either reference discloses the specifically claimed devices operating using correlations in the claimed manner"). Petitioner relies on Grotmol for the elements of claim 6 that Patent Owner argues are missing from Hickman. *See, e.g.*, Pet. 58–59 (citing Ex. 1004, code (57), 24:31–25:5, 33:12–58). One cannot show non-obviousness by attacking references individually where the rejections are based on combinations of references. *In re Merck & Co., Inc.*, 800 F.2d 1091, 1097 (Fed. Cir. 1986); *In re Keller*, 642 F.2d 413, 426 (CCPA 1981).

Patent Owner's arguments also are based on mischaracterizations of Grotmol and Hickman. As discussed above with respect to disclaimed independent claim 1 (*see* Section II.D.2.b), Petitioner argues that Grotmol discloses element [1.3] by describing a memory component that stores training sets, images of scenes from a robot vehicle's operation, and motor controls. Pet. 12–16 (citing, e.g., Ex. 1004, code (57), 3:27–39, 8:66–9:3, 9:8–22, 10:23–26, 33:59–62, 38:36–58, 39:13–28, 43:5–9; Ex. 1002 ¶¶ 165–172). Patent Owner does not dispute Petitioner's showing for element [1.3]. For the reasons given above (Section II.D.2.b), we find that Grotmol's disclosure supports Petitioner's arguments and Dr. Janet's testimony. *See, e.g.*, Ex. 1004, 3:27–39 (describing a "self-contained robotic

apparatus" that includes a "memory component" that is configured "to store training sets," which include "an instance of a motor control indication configured to cause the robot to execute an action"), 10:23–26 (describing that "tasks of the robot may be configured based on a context"), 39:13–22 (describing that "[d]uring training images (e.g., raw and/or pre-processed) may be stored in a memory buffer" and "[m]otor commands issued by a trainer corresponding to time instances when images are acquired may be stored"). Grotmol also describes that training a robot "may be based on the user observing [the] robot's actions and sending one or more target control commands to the robot," the "trained configuration may be stored," and "the trained configuration may be loaded to one or more other robots in order to provide learned behaviors." *Id.* at 33:12–58.

Hickman's disclosures also support Petitioner's arguments and Dr. Janet's testimony. *See, e.g.*, Ex. 1005, code (57) (describing that Hickman "discloses shared robot knowledge bases for use with cloud computing systems"), 5:7–11, 5:20–23, 26:21–27:21, 29:33–41, Fig. 6). Indeed, Hickman discloses that the "cloud computing system may be configured to (i) send and receive data and queries to and from multiple robots, (ii) send data retrieved from the shared robot knowledge base to robots, and (iii) update data in the shared robot knowledge base based on data received from robots." *Id.* at 5:7–11.

Patent Owner submits the testimony of Dr. Saber in support of its position. *See, e.g.*, PO Resp. 41–44 (citing Ex. 2007 ¶¶ 131–136). Dr. Saber's testimony restates Patent Owner's arguments without further persuasive explanation or support. We find that Dr. Saber's testimony does

not undermine Petitioner's showing for the same reasons given with respect to Patent Owner's arguments discussed herein.

Based on the complete record before us, we find that the combination of Grotmol and Hickman teaches all elements recited in claim 6. We also are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modification of Grotmol and Hickman. We find that Patent Owner's argument and evidence do not undermine Petitioner's showing.

5. Claim 11

Claim 11 depends from claim 3 and recites the following:

> 11. The system of claim 3, wherein the knowledgebase further includes a third circumstance representation correlated with a second one or more instruction sets for operating a third device, and wherein the third circumstance representation represents a third circumstance detected at least in part by one or more sensors of the third device, and wherein at least a portion of the third circumstance representation or at least a portion of the second one or more instruction sets for operating the third device is learned in another learning process that includes operating the third device at least partially by: the user, or another user.

Ex. 1001, 171:59–172:2.

The recitation of "the knowledgebase" in claim 11 derives antecedent basis from the recitation of "a knowledgebase" in element [1.3]. Also, element [1.3] recites that the "knowledgebase" includes "a *first* circumstance representation correlated with a *first* one or more instruction sets for operating a *first* device," which is similar to the recitation in claim 11 of "a *third* circumstance representation correlated with a *second* one or more instruction sets for operating a *third* device," except that claim 11 recites a "second" one or more instruction sets and a "third" circumstance

representation and device (emphases added). Also, claim 1 recites "wherein "the *first* circumstance representation represents a *first* circumstance detected at least in part by one or more sensors of the *first* device," which is similar to the recitation in claim 11 of "wherein the *third* circumstance representation represents a *third* circumstance detected at least in part by one or more sensors of the *third* device," except that claim 11 recites a "third" circumstance representation, circumstance, and device. Claim 11 also recites "and wherein at least a portion of the third circumstance representation or at least a portion of the second one or more instruction sets for operating the third device is learned in another learning process that includes operating the third device at least partially by: the user, or another user."

As discussed above (Section II.E.4), Petitioner presents arguments for obviousness of claim 11 over Grotmol and the knowledge of a person of ordinary skill in the art, which Petitioner refers to as "Ground 2." Pet. 53–55. Petitioner, alternatively, relies on the combination of Grotmol and Hickman for claim 11, which Petitioner refers to as "Ground 3." Pet. 55–65. As discussed above (*see* Section II.E.4), we do not make a determination as to whether claim 11 would have been obvious over Grotmol in view of the knowledge of a person of ordinary skill in the art (Ground 2) in light of our determination here that claim 11 would have been obvious over Grotmol and Hickman (Ground 3).

In presenting its case for claim 11 and "Ground 3" (Pet. 55, 61–63), Petitioner relies on other portions of the Petition arguing, for example, that its position is support by its arguments for "Grounds 1 and 2." Pet. 61. In its arguments for claim 11 and "Ground 2" (*id.*), Petitioner relies on its arguments "for claim 10." *Id.* at 54. Petitioner also relies on its reasoning to

combine. Pet. 62 ("As explained above, it would have been obvious to combine Hickman's shared robot knowledge base with Grotmol's autonomous robot system such that the shared knowledgebase includes the training of multiple robots by multiple users.").

Petitioner, additionally, presents arguments specifically for claim 11 and Ground 3. For instance, Petitioner argues that Grotmol discloses "multiple training (learning) processes" for "train[ing] multiple behaviors" and loading a robot "with another trained configuration from a training process involving operation of a different robot by a user." *Id.* at 61 (citing Ex. 1004, 33:24–35). Petitioner also relies on Hickman's disclosures relating to a shared robot knowledge base for use with a cloud computing system described for example and Hickman's disclosure of "'coaching' from *humans*." *Id.* at 62 (quoting Ex. 1005, code (57), 23:36–48) (emphasis added).

We find that Petitioner provides sufficiently specific arguments for claim 11 and Ground 3. Petitioner need not repeat its arguments for the same claim and Ground 2, for example. Also, as discussed above, Petitioner explains that the recitations in claim 11 are sufficiently similar to other features recited in claim 11, as well as features recited in claim 1 from which claim 11 indirectly depends, and Petitioner specifically references its analysis of those features from Grounds 1 and 2. Pet. 61. Thus, Petitioner need not repeat its arguments where Grotmol teaches training an autonomous device as set forth with respect to claim 1, Ground 1, which is anticipation by Grotmol. We find that Petitioner sets forth its case with sufficient specificity as to where Petitioner contends Grotmol and Hickman teach the specific features recited in claim 11.

Patent Owner disputes Petitioner's showing. PO Resp. 45–51 (citing, e.g., Ex. 2007 ¶¶ 137–145); PO Sur-reply 20–25. We addressed many of Patent Owner's arguments above in our overview and discussion of Petitioner's reasoning to combine Grotmol and Hickman. *See* §§ II.F.2–.3. We address Patent Owner's remaining arguments here.

Patent Owner argues "Grotmol discloses one user operating one device in one learning process and even when loaded into a second device, this is still knowledge of one user operating one device in one learning process." PO Resp. 45–46; *see also id.* at 46 (arguing "[b]ut Grotmol discloses one user operating one device in one learning process"). Contrary to Patent Owner's argument, Grotmol teaches multiple learning processes for the robot. Ex. 1004, 24:17–67 (cited for claim 10 in Pet. 53) (describing "[a]pparatus and methods for hierarchical learning" including a user training a robot to perform "simple tasks" and "complex task[s]" and organizing "simple 'low level' behaviors into hierarchies"), 26:1–20 (cited for claim 10 in Pet. 53) (describing that after a "user is done training a particular behavior, he may create another module and activate it" and the "system may be configured to learn the second behavior from the user").

Hickman also describes multiple learning processes. For instance, Hickman teaches collecting and storing information about "prior experiences" of robots.

> The present application discloses shared robot knowledge bases for use with cloud computing systems. In one embodiment, the cloud computing system collects data from a robot about an object the robot has encountered in its environment, and stores the received data in the shared robot knowledge base. In another embodiment, the cloud computing system sends instructions for interacting with an object to a robot, receives feedback from the robot based on its interaction with the object, and updates data in

> the shared robot knowledge base based on the feedback. In yet another embodiment, the cloud computing system sends instructions to a robot for executing an application based on information stored in the shared robot knowledge base. In the disclosed embodiments, *information in the shared robot knowledge bases is updated based on robot experiences so that any particular robot may benefit from prior experiences of other robots*.

Ex. 1005, code (57) (emphasis added).

Patent Owner also argues "Petitioner cannot simply pick and choose high level concepts from Grotmol and Hickman to read on the claimed invention." PO Resp. 47. Patent Owner's argument mischaracterizes the Petition. For instance, regarding the recitation in claim 11 that the "knowledgebase" includes "a third circumstance representation correlated with a second one or more instruction sets for operating a third device, and wherein the third circumstance representation represents a third circumstance detected at least in part by one or more sensors of the third device," Petitioner's arguments are supported, for example, by Grotmol's description of "methods for hierarchical learning," which includes organizing "simple 'low level behaviors into hierarchies'" and training "extra 'high level' classifiers or 'switchers' to control which low level behaviors should be active in a given context." Ex. 1004, 24:17–27 (citing in Pet. 53 for claim 10). Grotmol further describes that the "task" of "playing fetch" is "complex" and involves "grasp[ing]" and object to "bring it back to base." Ex. 1004, 24:31–33 (citing in Pet. 53 for claim 10). Grotmol describes that "the user may train a component of the fetch behavior," for example, by "train[ing] the robot to perform a grasping behavior in various contexts (e.g., 'grasping a target')." Ex. 1004, 24:49–55 (citing in Pet. 53 for claim 10); *see also* Ex. 1004, 26:1–20 (describing that a user may train the system on a

second behavior such as turning and grasping a target) (citing in Pet. 53 for claim 10).

Additionally, regarding the recitation in claim 11 of "and wherein at least a portion of the third circumstance representation or at least a portion of the second one or more instruction sets for operating the third device is learned in another learning process that includes operating the third device at least partially by: the user, or another user," as discussed above, Grotmol teaches multiple learning processes including multiple circumstances representations and multiple instruction sets. With respect to learning processes that includes operating a third device at least partially by the user or another user, regarding the grasping behavior described in Grotmol (Ex. 1004, 2417–67, 26:1–20), Hickman teaches a robot moving a cup by first grasping the cup using instructions *received from cloud computing system 401*. Ex. 1005, 26:21–27:21 (cited in Pet. 62). Grotmol also describes that training a robot "may be based on the user observing [the] robot's actions and sending one or more target control commands to the robot," the "trained configuration may be stored," and "the trained configuration may be loaded to one or more other robots in order to provide learned behaviors." Ex. 1004, 33:24–35 (cited in Pet. 61). Furthermore, Petitioner's argument is supported by Hickman's disclosures, including Hickman's description that "past experiences from many different robots" include "'coaching' from *humans*." *Id.* at 23:36–48 (cited in Pet. 62) (emphasis added). One cannot show non-obviousness by attacking references individually where the rejections are based on combinations of references. *Merck*, 800 F.2d at 1097; *Keller*, 642 F.2d at 426.

Patent Owner also argues that a statement in our Institution Decision in IPR2023-01054 supports Patent Owner's position. PO Resp. 48 (citing IPR2023-01054, Paper 20, 35). That statement pertains to obviousness over Grotmol and the knowledge of a person of ordinary skill in the art. In that same Institution Decision, we stated that "we find that Petitioner has sufficiently shown for purposes of institution that this limitation would have been obvious over the combination of Grotmol and Hickman." IPR2023-01054, Paper 20, 35–36.

Patent Owner submits the testimony of Dr. Saber in support of its position. *See, e.g.*, PO Resp. 45–51 (citing Ex. 2007 ¶¶ 137–145). Dr. Saber's testimony restates Patent Owner's arguments without further persuasive explanation or support. We find that Dr. Saber's testimony does not undermine Petitioner's showing for the same reasons given with respect to Patent Owner's arguments discussed herein.

Based on the complete record before us, we find that the combination of Grotmol and Hickman teaches all elements recited in claim 11. We also are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modifications of Grotmol in view of Hickman. We find that Patent Owner's argument and evidence do not undermine Petitioner's showing.

6. Claim 12

Claim 12 depends from claim 3 and recites the following:

> 12. The system of claim 3, wherein the knowledgebase further includes a third circumstance representation correlated with a second one or more instruction sets for operating a third device, and wherein the third circumstance representation represents a third circumstance detected at least in part by one or

> more sensors of the third device, and wherein the one or more processors are further configured to perform at least:
>
> generating or receiving a fourth circumstance representation, wherein the fourth circumstance representation represents a fourth circumstance detected at least in part by one or more sensors of a fourth device;
>
> anticipating the second one or more instruction sets for operating the third device based on at least partial match between the fourth circumstance representation and the third circumstance representation; and
>
> at least in response to the anticipating the second one or more instruction sets for operating the third device, executing the second one or more instruction sets for operating the third device, wherein the fourth device autonomously performs one or more operations defined by the second one or more instruction sets for operating the third device.

Ex. 1001, 172:3–26.

For claim 12, Petitioner relies on the combination of Grotmol and Hickman. In particular, for claim 12, Petitioner relies on its contentions for claim 11. Pet. 63–65. Petitioner also argues "Grotmol and Hickman further disclose that the knowledgebase can be shared to perform autonomous operation of any number of other devices." *Id.* at 64 (citing Ex. 1004, 33:27–32; Ex. 1005, 11:31–41; Ex. 1002 ¶¶ 245–248). Petitioner argues "[i]n Grotmol, the autonomous operation of a robot is performed by acquiring an image (circumstance representation) during operation of the robot, comparing the acquired image to images in the knowledgebase to determine whether there is a match, and executing an operation defined by an instruction correlated with a matched image." *Id.* at 64–65 (citing Ex. 1004, code (57), 39:13–41; Ex. 1002 ¶ 249).

Patent Owner refers to its arguments discussed above with respect to claim 11. *See, e.g.*, PO Resp. 52. We find that those arguments do not

undermine Petitioner's showing for the same reasons given with respect to claim 11. Additionally, we addressed many of Patent Owner's other arguments above in our overview and discussion of Petitioner's reasoning to combine Grotmol and Hickman. *See* §§ II.F.2–.3.

Patent Owner also argues that neither Grotmol nor Hickman discloses all features recited in claim 12. *See, e.g., id.* at 52–54 (arguing Grotmol "discloses one user operating one device in one learning process" and "Hickman discloses a single object information that is not a circumstance representation") (emphasis omitted), 55 (arguing "the simple knowledgebase in Hickman never mentions, let alone discloses anything like the concept of a correlation with an instruction set for operating a third device"), 56–57 (arguing "neither reference discloses the specifically claimed devices operating using correlations in the claimed manner."). One cannot show non-obviousness by attacking references individually where the rejections are based on combinations of references. *Merck*, 800 F.2d at 1097; *Keller*, 642 F.2d at 426.

Patent Owner submits the testimony of Dr. Saber in support of its position. *See, e.g.*, PO Resp. 51–59 (citing Ex. 2007 ¶¶ 147–158). Dr. Saber's testimony restates Patent Owner's arguments without further persuasive explanation or support. We find that Dr. Saber's testimony does not undermine Petitioner's showing for the same reasons given with respect to Patent Owner's arguments discussed herein.

Based on the complete record before us, we find that the combination of Grotmol and Hickman teaches all elements recited in claim 12. We also are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support

Petitioner's modification of Grotmol and Hickman. We find that Patent Owner's argument and evidence do not undermine Petitioner's showing.

7. Conclusion—Claims 6, 11, and 12

For the reasons given, we determine that Petitioner demonstrates by a preponderance of the evidence that the combination of Grotmol and Hickman teaches the features recited in dependent claims 6, 11, and 12. For the reasons given, we also are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modification of Grotmol and Hickman. *See, e.g.*, Pet. 55–58. We find that Patent Owner's argument and evidence do not undermine Petitioner's showing.

Based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that claims 6, 11, and 12 are unpatentable as obvious over the combination of Grotmol and Hickman.

III. ANALYSIS—PROPOSED SUBSTITUTE CLAIMS

Patent Owner filed a Motion to Amend. MTA. Patent Owner's Motion to Amend requests "[i]n the event the Board finds any of original claims 6, 7, 10, 11, 12, or 16 unpatentable . . . the Board grant this motion to amend and issue the corresponding substitute claims [among 23, 24, 26, 27, 28, and 29]." MTA 1. The Motion to Amend also submits that "[c]laims 4, 5, and 9 are hereby cancelled" and requests that "the Board issue claims 21, 22, and 25 as substitutes for claims 4, 5, and 9, respectively," noting that "[Patent Owner] does not condition its request regarding claims 21, 22, and 25 on any condition." *Id.* at 1, 24. For the reasons discussed above, we have determined that Petitioner has proved, by a preponderance of evidence, that

claims 6, 7, 10, 11, 12, and 16 of the '344 patent are unpatentable. We, therefore, proceed to address Patent Owner's Motion to Amend.

Proposed substitute claim 21 is illustrative[8] and is reproduced below with Patent Owner's annotations showing in underlined language subject matter added to the corresponding original claim, and bracketed text added at the beginning of each claim element to correspond with designation of claim elements.

> 21. A system comprising:
>
> [21.1]one or more processors configured to perform at least:
>
> [21.2]accessing a memory that stores at least a knowledgebase that includes a first circumstance representation correlated with a first one or more instruction sets for operating a first device, wherein the first circumstance representation represents a first circumstance detected at least in part by one or more sensors of the first device, and wherein at least a portion of the first circumstance representation or at least a portion of the first one or more instruction sets for operating the first device is learned in a learning process that includes operating the first device at least partially by a user;
>
> [21.3]generating or receiving a second circumstance representation, wherein the second circumstance representation represents a second circumstance detected at least in part by: the one or more sensors of the first device, or one or more sensors of a second device;
>
> [21.4]anticipating the first one or more instruction sets for operating the first device based on at least partial match between the second circumstance representation and the first circumstance representation; and
>
> [21.5]at least in response to the anticipating, executing the first one or more instruction sets for operating the first device, wherein the first device or the second device autonomously

[8] The parties agree that proposed substitute claims 22–29 were amended to recite the same amended features recited in claim 21. *See* MTA 21–23; Opp. MTA 19–25.

performs one or more operations defined by the first one or more instruction sets for operating the first device;

[21.6]wherein the first circumstance representation includes a first one or more object representations, and wherein the second circumstance representation includes a second one or more object representations;

[21.7]wherein the second circumstance representation represents the second circumstance detected at least in part by the one or more sensors of the first device, and wherein the first device autonomously performs the one or more operations defined by the first one or more instruction sets for operating the first device;

[21.8] wherein the first one or more object representations of the first circumstance representation comprise a first object representation and a second object representation;

[21.9] wherein the first object representation includes a first data structure generated at least by:

[21.10] processing one or more digital pictures to detect: a type of a first object, a location of the first object, and a size of the first object; and

[21.11] in response to the processing, generating the first data structure that includes: a label indicating the detected type of the first object, a coordinate indicating the detected location of the first object, and a computer model indicating the detected size of the first object;

[21.12] wherein the second object representation includes a second data structure generated at least by:

[21.13] processing one or more digital pictures to detect: a type of a second object, a location of the second object, and a size of the second object; and

[21.14] in response to the processing, generating the second data structure that includes: a label indicating the detected type of the second object, a coordinate indicating the detected location of the second object, and a computer model indicating the detected size of the second object;

[21.15] wherein the first data structure and the second data structure are correlated with the first one or more instruction sets for operating the first device.

MTA App. A 1–3.

A. Legal Standard

Petitioner bears the burden of persuasion to show that any proposed substitute claim is unpatentable by a preponderance of the evidence. *Lectrosonics, Inc. v. Zaxcom, Inc.*, IPR2018-01129, Paper 15 (PTAB Feb. 15, 2019) (precedential); 37 C.F.R. § 42.121(d)(2). "Before considering the patentability of any substitute claims, however, the Board first must determine whether the motion to amend meets the statutory and regulatory requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121." *Lectrosonics*, Paper 15 at 4–8. Patent Owner bears the burden of persuasion to show by a preponderance of the evidence that the motion to amend complies with these requirements. 37 C.F.R. § 42.121(d)(1). Specifically, a patent owner must make an initial showing to demonstrate the following: (1) that a "reasonable number of substitute claims" have been proposed for each challenged claim (35 U.S.C. § 316(d)(1)(B)); (2) that the proposed amendments respond to a ground of unpatentability involved in the trial (37 C.F.R. § 42.121(a)(2)(i)); and (3) the amendments do not seek to enlarge the scope of the claims and do not introduce new matter (35 U.S.C. § 316(d)(3)). *Lectrosonics*, Paper 15 at 4–8.

B. Compliance with the legal requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121

Patent Owner bears the burden to ensure that its Motion to Amend complies with the legal requirements set forth in 35 U.S.C. § 316(d) and 37 C.F.R. § 42.121. *Lectrosonics*, Paper 15 at 4, 7–8. For the reasons that follow, we determine that Patent Owner has satisfied that burden.

1. Proposal of a Reasonable Number of Substitute Claims

A motion to amend must "propose a reasonable number of substitute claims." 35 U.S.C. § 316(d)(1)(B); *see also* 37 C.F.R. § 42.121(a)(3) ("A

motion to amend may cancel a challenged claim or propose a reasonable number of substitute claims."). "There is a rebuttable presumption that a reasonable number of substitute claims per challenged claim is one (1) substitute claim." *Lectrosonics*, IPR2018-01129, Paper 15 at 4; *see also* 37 C.F.R. § 42.121(a)(3). Here, Patent Owner proposes no more than one substitute claim for each challenged claim. MTA 1–2, App. A 1–26. Petitioner does not argue otherwise. *See generally* Opp. MTA; Sur-reply MTA. We determine that this requirement is met.

2. Amendments Response to a Ground of Unpatentability

"A motion to amend may be denied where. . . [t]he amendment does not respond to a ground of unpatentability involved in the trial." 37 C.F.R. § 42.121(a)(2)(i). Upon review of Patent Owner's arguments, we agree that proposed substitute dependent claims 21–29 recite new limitations, and new combinations of limitations, that directly respond to the grounds of unpatentability involved in the trial. *See* MTA 3, 19–23, App. A 1–26. Petitioner does not argue otherwise. *See generally* Opp. MTA; Sur-reply MTA. We determine that this requirement is met.

3. No Enlargement of the Scope of the Claims

An amendment may not seek to enlarge the scope of the claims of the patent. 35 U.S.C. § 316(d)(3); 37 C.F.R. §§ 42.121(b)(1), 42.121(b)(2). Proposed substitute claims 21–29 (i) retain all limitations of their original corresponding claims 4–7, 9–12, and 16 (including the original dependent and independent claims from which claims 4–7, 9–12, and 16 depend), and (ii) further include additional limitations as compared to respective claims 4–7, 9–12, and 16. Proposed substitute claims 21–29 do not enlarge the scope of the claims of the challenged patent. *See* MTA 3–4, App. A 1–26.

Petitioner does not argue otherwise. *See generally* Opp. MTA; Sur-reply MTA. We determine that this requirement is met.

4. No Introduction of New Matter

An amendment may not introduce new matter. 35 U.S.C. § 316(d)(3); 37 C.F.R. §§ 42.121(b)(1), 42.121(b)(2). New subject matter is any addition to the claims that lacks sufficient support in the subject patent's original disclosure. *See TurboCare Div. of Demag Delaval Turbomach. v. Gen. Elec. Co.*, 264 F.3d 1111, 1118 (Fed. Cir. 2001) ("When [an] applicant adds a claim . . . , the new claim[] . . . must find support in the original specification."). Patent Owner also is required to show written description support in "the original disclosure of the patent for each claim that is . . . amended," and in "an earlier-filed disclosure for each claim for which benefit of the filing date of the earlier filed disclosure is sought." 37 C.F.R. §§ 42.121(b)(1), 42.121(b)(2).

Patent Owner has identified adequate written description support for proposed substitute claims 21–29. *See* MTA 4–17. Petitioner does not argue otherwise. *See generally* Opp. MTA; Sur-reply MTA. We determine that each proposed substitute claim is supported by the original disclosure of the '344 patent and does not seek to add new matter. We determine that this requirement is met.

C. Unpatentability of Proposed Substitute Claims

Proposed substitute claim 21 is illustrative, so we begin by addressing the parties' disputes regarding whether proposed substitute claim 21 would have been obvious over the combination of Grotmol and Hickman.

1. Obviousness of Proposed Substitute Claim 21 over Grotmol and Hickman

Proposed substitute claim 21 includes amendments to original claim 4. We find that Petitioner supports its arguments that dependent claim 4 is anticipated by Grotmol with specific citations to Grotmol and Dr. Janet's declaration. Pet. 25–26 (citing, e.g., Ex. 1002 ¶¶ 173–176, 179–182, 189). Petitioner's argument and Dr. Janet's testimony are supported by the evidence cited in the Petition. Patent Owner does not offer arguments for dependent claim 4 or contest Petitioner's analysis and, instead, Patent Owner states that claim 4 is canceled. *See* MTA 1, 24; *see also generally* PO Resp.; PO Sur-reply. For the reasons presented by Petitioner, based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that dependent claim 4 is unpatentable as anticipated by Grotmol.

Below we address the parties' disputes regarding proposed substitute claim 21 and the features recited in Patent Owner's amendments.

a) The Parties' Dispute Regarding Petitioner's Reasons to Combine Grotmol and Hickman

Petitioner relies on its reasons to combine Grotmol and Hickman presented in the Petition. Opp. MTA 13–16. Petitioner adds to those reasons that a person of ordinary skill in the art would have been motivated to combine Hickman's teaching of "flexibility in design" of knowledge bases with Grotmol's teachings "because the combination merely entails the simple substitution of one known element for another to obtain predictable results." *Id.* at 14 (citing Ex. 1010 ¶¶ 74–76; Ex. 1005, 10:57–11:7, 11:47–20:20, Fig. 3); *see also* Sur-reply MTA (arguing that Hickman "provides significant flexibility in the design and arrangement of data in its

knowledge bases"). Petitioner also argues "[t]he choice of whether to include one knowledge base, as in Grotmol, or various knowledge bases, as in Hickman, would be a designer's choice." *Id.* (citing Ex. 1010 ¶ 76; Ex. 1005, 10:57–11:7). Petitioner further argues "[t]he use of the data structures like those disclosed in Hickman (e.g., data structures 313–316) in Grotmol's system would have been accomplished by programming and memory storage techniques" well within the capabilities of a person of ordinary skill in the art and such a person would have had a reasonable expectation of success. *Id.* (citing Ex. 1010 ¶¶ 76–77).

In its Reply, Patent Owner argues "[f]or the limitations discussed in Sections III.A.1-4 and III.B.1-4 (and all other added limitations), Petitioner has not presented any obviousness rationale/analysis (e.g., motivation to combine or modify, pro/con considerations, reasonable expectation of success) ***tied to the claim language, which dooms the alleged combinations of the references***." Reply MTA 11. Patent Owner's argument mischaracterizes Petitioner's Opposition.

We find Petitioner's arguments in its Opposition to be supported by the evidence of record and not undermined by Patent Owner's argument. In particular, Hickman describes different arrangements of data in knowledge bases.

> The shared robot knowledge base 306 may include multiple component and/or sub-component knowledge bases. The shared robot knowledge base 306 may contain additional or fewer knowledge bases than the ones shown in FIG. 3. Similarly, the distribution of the information across the various component knowledge bases shown FIG. 3 is merely one example of one embodiment. The contents of the knowledge bases may be combined into a single common knowledge base or distributed across multiple different knowledge bases in a different fashion

> than described herein. Similarly, in some embodiments, the functionality of the cloud processing engine 305 may be combined with the functionality of the shared robot knowledge base 306 and/or other components of the cloud computing system 304. Additional systems and sub-systems that are not illustrated in FIG. 3 may be utilized to queue and process queries from robots, return data to the robots in response to the received queries, receive data from robots, and update information in the shared robot knowledge base 306 based on the received data.

Ex. 1005, 10:57–11:7.

Additionally, Grotmol describes one knowledge base design. *See, e.g.*, Ex. 1004, 33:13–35, 38:33–41, Fig. 8. We find that the disclosures of Hickman and Grotmol support Petitioner's position that the choice of which knowledge base to implement would have been up to a designer, would have been predictable, and would have been well-within the capabilities of a person of ordinary skill in the art. Opp. MTA 13–15 (citing, e.g., Ex. 1004, 33:13–35, 38:33–41, Fig. 8; Ex. 1005, 10:57–11:7, Fig. 3). Those same disclosures further support Petitioner argument that its proposed combination "merely entails the simple substitution of one known element for another to obtain predictable results." *Id.* at 14 (citing Ex. 1010 ¶¶ 74–76; Ex. 1005, 10:57–11:7, 11:47–20:20, Fig. 3).

We find unavailing Patent Owner's arguments that: (1) Petitioner has not presented an "obviousness rationale/analysis (e.g., motivation to combine or modify, pro/con considerations, reasonable expectation of success)" and (2) Petitioner's argument is not sufficiently tied to the claim language. Reply MTA 11. Petitioner's reasoning is sufficiently articulated with rational underpinning and supports Petitioner's modification of Grotmol and Hickman. Additionally, Petitioner provides an element-by-element analysis of the proposed substitute claims, which we discuss below.

In its Sur-reply, Petitioner refers to its argument on page 14 of its Opposition that it would have been obvious to make Petitioner's proposed combination because the combination merely entails the simple substitution of one know element for another to obtain predictable results. Sur-reply MTA 2 (citing Ex. 1010 ¶ 76). Petitioner also argues that it would have been obvious for a person of ordinary skill in the art to combine the teachings of Grotmol and Hickman such that "the object size ('physical dimensions')" in Hickman's specification (SPC) field and "the object coordinates" in Hickman's location data (LOC) field are "'detected' by processing digital pictures," as expressly taught by Grotmol. Sur-reply MTA 2–3 (citing Opp. MTA 14; Ex. 1010 ¶¶ 74–75; Ex. 1004, 4:9–11, 10:26–32, 28:19–25, 31:23–27, 39:13–17, 48:65–67, Fig. 10A).

In its Sur-sur-reply, Patent Owner argues that Petitioner presents impermissible new arguments regarding the combination of Grotmol and Hickman in its Sur-reply. Sur-sur-reply 4–9. Patent Owner also argues that Petitioner presents impermissible new arguments regarding limitations [21.9]–[21.14]. *Id.* We disagree with Patent Owner and do not find that any arguments presented by Petitioner in its Sur-reply are impermissible. Instead, we determine Petitioner's Sur-reply argument and evidence are not improper. *See* 37 C.F.R. § 42.121(e)(3) ("The petitioner may file a sur-reply that is limited to responding to the preliminary guidance and/or arguments made in the patent owner's reply brief"). We find Petitioner's Sur-reply arguments simply provide further details to support that arguments and evidence in the Opposition are correct. Petitioner's Sur-reply does no more than fairly and directly respond to the Preliminary Guidance and Patent Owner's Reply.

Petitioner did not file any declaration with its Sur-reply and Patent Owner did not request authorization to file a declaration with its Sur-sur-reply. In our Order granting additional briefing, therefore, we stated "Patent Owner's Sur-sur-reply shall be limited to responding to the issues raised in Petitioner's MTA Sur-reply, and may not introduce new declaration or affidavit evidence." Paper 43, 3.

Petitioner filed an unopposed, authorized Sur-sur-sur-reply subsequent to Patent Owner's Sur-sur-reply. Upon review of the record prior to and including Patent Owner's Sur-sur-reply, we are persuaded by Petitioner's argument and evidence, so Petitioner's arguments and evidence in Petitioner's Sur-sur-sur-reply are not needed for our determinations herein.

Upon consideration, we find that Patent Owner's Sur-sur-reply does not undermine Petitioner's position for the reasons given herein. *See generally* § III.C.1. Importantly, Petitioner has directed us to disclosures in Grotmol and Hickman that support Petitioner's arguments and reasoning to combine. *See SightSound Techs., LLC v. Apple Inc.*, 809 F.3d 1307, 1318−19 (Fed. Cir. 2015) (affirming the Board's obviousness determination that was based on the "[f]inding that the reason to combine was manifested by the references themselves"). For instance, as discussed above, Hickman expressly describes different arrangements of data in knowledge bases. Ex. 1005, 10:57–11:7. Additionally, as will be discussed further below (*see* § III.C.1.c), both Hickman and Grotmol disclose a robot interacting with an object and collecting data about physical attributes of the object via sensors. *See, e.g.*, Ex. 1005, 3:46–55, 6:60–67; Ex. 1004, 39:13–17, 28:19–25, 10:26–32, 31:23–27. We, therefore, further find that Petitioner's argument

and the disclosures of Grotmol and Hickman are sufficient and the testimony of Dr. Janet is not needed to resolve the disputes between the parties relating to Petitioner's reasoning to combine the teachings of Grotmol and Hickman in the manner recited in the proposed substitute claims.

Based on the complete record before us, we are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modifications of Grotmol and Hickman for Patent Owner's proposed substitute claims. For the reasons given herein, we find that Petitioner also has shown that a person of ordinary skill in the art would have had a reasonable expectation of success. We find that Patent Owner's arguments and evidence do not undermine Petitioner's showing.

b) Element [21.8]

Element [21.8] recites "<u>wherein the first one or more object representations of the first circumstance representation comprise a first object representation and a second object representation</u>." MTA App. A 2. Petitioner argues "as illustrated in Grotmol's FIGS. 20A, 20B, image 2000 is an example part of a '***first circumstance representation***' and 'may comprise representations one or more objects, e.g., a tree 2002, a rectangle, a ball 2008, and/or other objects,' any two of which are part of the '***first object representation***' and the '***second object representation***,' respectively." Opp. MTA 19–20 (citing Ex. 1004, 38:43–39:12, Figs. 20A, 20B).

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [21.8]. *See generally* PO Resp.; PO Sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [21.8].

c) Elements [21.9]–[21.11]

Elements [21.9]–[21.11] are reproduced below.

> [21.9] wherein the first object representation includes a first data structure generated at least by:
>
> [21.10] processing one or more digital pictures to detect: a type of a first object, a location of the first object, and a size of the first object; and
>
> [21.11] in response to the processing, generating the first data structure that includes: a label indicating the detected type of the first object, a coordinate indicating the detected location of the first object, and a computer model indicating the detected size of the first object.

MTA App. A 2–3.

Petitioner argues that the combination of Grotmol and Hickman teaches elements [21.9]–[21.11]. Opp. MTA 20–22 (citing, e.g., Ex. 1005, 6:60–67, 10:41–56, 11:9–24:64, Fig. 3; Ex. 1010 ¶¶ 88–90). Petitioner's arguments are supported by Hickman's disclosure of data structure 313 of unique object knowledge base 307 that includes "location data (LOC)" corresponding "to a particular unique object identifier (UID)." Ex. 1005, 13:64–14:6. Location data (LOC) provides "the location of the unique object" and "may include GPS [Global Positioning System] coordinates and/or other location-based information." *Id.* Petitioner's arguments also are supported by Hickman's disclosure of data structure 314 of general object knowledge base 308, which stores a "general object identifier (GID)" that "is a unique identifier corresponding to a particular 'type' of object." *Id.* at 15:38–41. Hickman describes that a GID in conceptual data structure 314 may have corresponding "specification data (SPC)" that "may include physical attributes associated with the particular 'type' of object," "manufacturer data (MFG)," and "model data (MOD)." *Id.* at 17:20–18:14.

In our Preliminary Guidance, we stated "[w]e find Petitioner's contentions and evidence insufficient to demonstrate that Hickman teaches "*processing one or more digital pictures to detect . . . a size of a first object*" recited in claim element [21.10] and "*generating the first data structure that includes . . . a computer model indicating the detected size of the first object*" recited in claim element [2.11]." PG 7. We further stated the following:

> We find Petitioner's contentions unpersuasive, based on the current record, because Hickman does not teach or suggest detecting "a size" of the first and second objects recited in claim element [2.10]. Instead, Hickman describes that "image data received from the robot" is analyzed "to determine whether the object in the image data received from the robot corresponds to a general object identifier (GID) in the general object knowledgebase 308," which "corresponds to a particular 'type' of object." Ex. 1005, 17:1–16. Physical attribute data is stored in connection with the GID. *Id.* at 18:4–14 (describing data stored in connection with the GID as including "physical dimensions (height, width, depth, shape, volume, area, etc.)"), 18:15–16 (describing that a "type" of "coffee mug" might have "a height (6 inches)" and "width (4 inches)"). Thus, based on the record before us, we are not persuaded that Hickman's physical attribute data is detected.

Id. at 7–8. We also discussed Petitioner's contentions regarding a combination of Hickman's specification data and model data made in connection with element [21.11] and stated that we found those contentions "unpersuasive, based on the current record." *Id.* at 8–9.

In Patent Owner's Reply, Patent Owner argues the "preliminary guidance confirms that Grotmol-Hickman does not disclose or suggest "detecting, physical attribute data." Reply MTA 4. Patent Owner further argues "[a]s the Board correctly noted, beyond storing attribute data, Hickman does not disclose detecting physical attributes (including location

and size) of an object, and Petitioner has not established this point." *Id.* at 4–5 (citing PG 7–8) (emphasis omitted). Patent Owner acknowledges that our preliminary guidance refers to only a deficiency relating to "'generating the first data structure that includes … a computer model indicating the ***detected*** size of the first object.'" *Id.* at 5 (citing PG 8–9). Patent Owner then argues "since Hickman does not disclose detecting any physical attributes as the Board noted and as discussed above, Hickman also does not disclose generating the first data structure that includes a coordinate indicating the detected location." *Id.*

In its Sur-reply, Petitioner argues that the analysis in our Preliminary Guidance was "incorrect." Sur-reply MTA 1. Petitioner, more specifically, argues as follows:

> GHC further discloses and renders obvious that the object size ("physical dimensions") provided by the SPC field and the object coordinates provided by the LOC field can be "detected" by processing digital pictures. For example, Hickman explains that data in its knowledge bases can be entered and updated automatically by authorized robots. TESLA1005, 3:8–11, 3:16–26, 3:46–55, 5:7–12, 10:53–56, 11:20–30. Hickman's cloud system receives images from robots or information about objects detected in images and uses that information to update its knowledge bases. TESLA1005, 25:24–46, FIG. 4. Further, in the combination, Grotmol's robots share images and their features and training sets with Hickman's cloud system. Opposition, 13–16. Grotmol expressly teaches that the image features that would be sent to Hickman's cloud include locations and sizes of objects detected in images acquired by the robot. TESLA1004, 10:31–32 ("object size, location"), 39:13–17, 28:19–25, 4:9–11, 10:26–32, 31:23–27, 48:65–67, FIG. 10A (depicting image feature extractors). Detecting the size and location of objects from digital pictures is thus expressly disclosed in Grotmol and would have been straightforward and obvious to implement in the GHC. Hickman similarly confirms that its robots too can

> detect the information that it sends to the cloud system, including object location and size information for updating the knowledgebases. TESLA1005, FIG. 3, 6:60–67, 10:41–56, 11:9–24:64.

Sur-reply MTA 3–4.

In its Sur-sur-reply, Patent Owner argues that the arguments in Petitioner's Sur-reply are new and impermissible. Sur-sur-reply MTA 4–6. We address Patent Owner's arguments in that regard in our discussion of Petitioner's reasoning to combine. *See* § III.C.1.a.

Patent Owner also argues that: (1) Hickman has "very broad" language and does not teach "a first data structure" recited in limitation [21.9]; (2) "each row in Hickman's tables represents an object from a *different* circumstance" and is "unlike the claimed first/second object representations and their corresponding first/second data structures representing objects of the same recited first circumstance;" and (3) "there is not even a hint in GHC that portions of Grotmol's image depicting objects can be replaced by rows containing object data in Hickman." *Id.* at 4–5.

Patent Owner further argues that "while Hickman disclose receiving images," Hickman "does not disclose or suggest ***processing images to detect*** object properties." *Id.* at 6. Patent Owner also disputes Petitioner's reliance on Grotmol arguing "Grotmol discloses ***comparing images based on image features (corners, edges, etc.), but not processing object properties such as type/location/size***." *Id.*

Upon consideration of the complete record now before us, we are persuaded by Petitioner's arguments and evidence and find Patent Owner's arguments and evidence do not undermine Petitioner's position. We start by discussing Patent Owner's arguments that: (1) Hickman has "very broad" language and does not teach "a first data structure" recited in limitation

[21.9]; (2) "each row in Hickman's tables represents an object from a *different* circumstance" and is "unlike the claimed first/second object representations and their corresponding first/second data structures representing objects of the same recited first circumstance;" and (3) "there is not even a hint in GHC that portions of Grotmol's image depicting objects can be replaced by rows containing object data in Hickman." *Id.* at 4–5.

With respect to Patent Owner's first argument, Hickman describes that "robot knowledge base 306" illustrated in Figure 3 includes "a unique object knowledge base 307" and "a general object knowledge base 308." Ex. 1005, 11:42–44. Hickman describes a "*data structure* 313 for the unique object knowledge base 307" (*id.* at 12:5–6 (emphasis added)) and a "*data structure* 314 of the general object knowledge base 308" (*id.* at 18:4–6 (emphasis added)). Below we discuss the teachings relied on by Petitioner to show that the generated data structure includes "a label indicating the detected type of the first object, a coordinate indicating the detected location of the first object, and a computer model indicating the detected size of the first object" as recited in element [21.11].

With respect to Patent Owner's second and third arguments, we begin by noting that "knowledgebase" and "first circumstance representation" derive antecedent basis from element [1.3]. For element [1.3], Petitioner argues that Grotmol discloses "a memory that stores a knowledgebase" that includes "multiple correlations (training sets), where each correlation includes a '*circumstance representation*'[] (*image of scene from a robot vehicle's operation*) correlated with an 'instruction set for operation of a first device"[] (motor control indication configured to cause the robot to execute an action)." Pet. 13. Petitioner's analysis for element [1.3] is addressed

above and is not disputed by Patent Owner as Patent Owner disclaimed independent claim 1.

Petitioner argues "[l]ike Grotmol, Hickman discloses the storage of training data, including images and instructions, in a memory." Opp. MTA 13 (citing Ex. 1004, 33:13–35, 38:33–41, Fig. 8; Ex. 1005, Fig. 3). Petitioner's argument is supported by Hickman's disclosure of its knowledge base architecture that similarly stores object and task data (Ex. 1005, 11:42–44) and its data structures that include "image data (IMG)" (*id.* at 12:5–9, 16:55–59, Fig. 3). Hickman's Figure 3 provides further detail and is reproduced below.

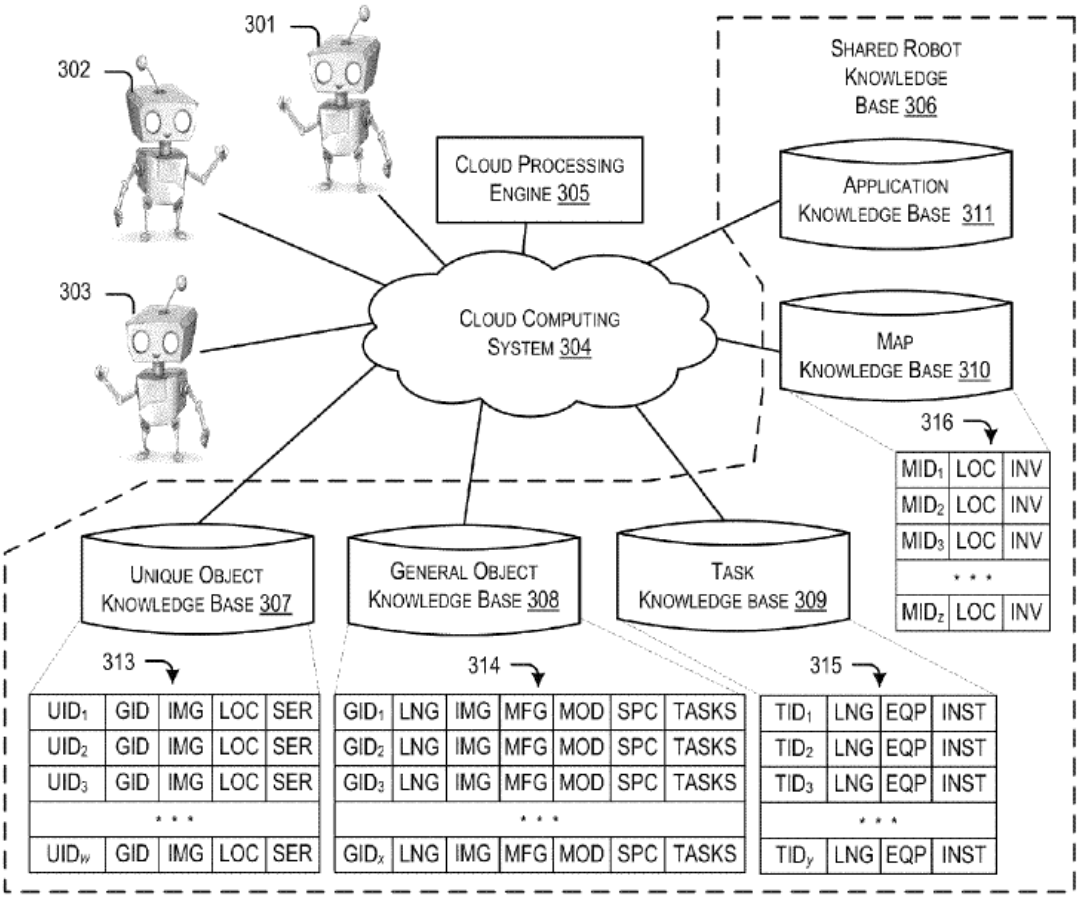

FIGURE 3

Figure 3 above, illustrates multiple robots 301, 302, 303 interacting with cloud computing system 304 that have shared robot knowledge base 306. Ex. 1005, 10:37–40. As shown in Figure 3, shared robot knowledge base 306 includes "unique object knowledge base 307," "general object knowledge base 308," and "task knowledge base 309." *Id.* at 11:43–45. As also illustrated in Figure 3, "data structure 313 for the unique object knowledge base 307" includes "an individual unique object identifier (UID)" that "may have the following corresponding data: (i) a general object identifier (GID); (ii) image data (IMG); (iii) location data (LOC); and (iv) serial number data (SER)." *Id.* at 12:5–9. As further illustrated in Figure 3 "data structure 314 for the general object knowledge base 308" includes "an individual general object identifier (GID)" that "may have the following corresponding data: (i) language data (LNG); (ii) image data (IMG); (iii) manufacturer data (MFG) (if applicable); (iv) model number data (MOD) (if applicable); (v) specification data (SPC); and (vi) task data (TASKS)." *Id.* at 15:28–34.

Petitioner argues "applying Hickman's use of knowledge base(s) to facilitate sharing across a cloud computing system would have involved the modification of Grotmol's storage structure to include one or more knowledge bases with Hickman's *data structures*." Opp. MTA 14 (citing Ex. 1010 ¶ 76) (emphasis added). Above, we explain why we find persuasive Petitioner's reasoning for making its proposed combination. *See* §§ II.F.3, III.C.1.a. Patent Owner's arguments improperly attempt to show non-obviousness by attacking references individually where the rejections are based on combinations of references. *Merck*, 800 F.2d at 1097; *Keller*, 642 F.2d at 426.

We turn to Patent Owner's arguments that neither Grotmol nor Hickman teach "processing one or more digital pictures to detect: a type of a first object, a location of the first object, and a size of the first object." Reply MTA 4–5; Sur-sur-reply MTA 6. We disagree and instead find that Petitioner's arguments are consistent with and supported Grotmol's and Hickman's teachings. For instance, Hickman discloses a robot interacting with an object, collecting data via sensors, and entering data obtained from that interaction into the shared robot knowledge base. Ex. 1005, 3:16–26 (describing that "robots may enter data into the shared robot knowledge base," including, for example, "data about objects they encounter"), 3:46–55 (describing a robot "interacting with [an] object" and determining that "the object weighs more or less than indicated" by received data associated with the object) 6:60–67 (describing a robot collecting "data via one or more sensors" and uploading "the data to the cloud computing system 102"). Hickman also discloses its cloud system receiving and processing images from robots updating its knowledge bases with information as a result of the image processing. Ex. 1005, 25:24–46 (describing "[a]fter obtaining image data associated with the object 405, the robot 404 sends an identification query 406 to the cloud processing engine 402," which "may include some of the image data associated with the object 405" and "the cloud processing engine 402 may analyze the image data" and may extract "meaningful information from the image via digital image processing techniques"), 13:32–34 (describing that "*image data (IMG)* may be used in connection with object recognition *algorithms executed by the cloud processing engine 305* to identify a 'unique' object") (emphases added). Additionally, Grotmol discloses detecting locations and sizes of objects in images acquired by the

robot. Ex. 1004, 39:13–17 (describing storing images in memory and performing preprocessing operations including "*feature* extraction") (emphasis added), 28:19–25 (describing that "[a]s used herein the term *feature* may be used to describe one or more integer or floating point values *characterizing the input*, e.g., the presence or absence of an edge, corner, shape, texture, color, object, *at particular locations in the image*") (emphases added), 10:26–32 (describing that a context may include "state of the environment (e.g., *object size*, *location*)"), 31:23–27 (describing in "*vision based* robotic navigation" the "*size* of a target," such as "a ball 174 in FIG1" may be used for "feature scaling" that is "within a visual frame" and may contribute to a "*distance* determination") (emphases added).

Furthermore, in addition to the disclosures above, Hickman also discloses that data structure 313 of unique object knowledge base 307 includes "location data (LOC)" corresponding "to a particular unique object identifier (UID)." Ex. 1005, 13:64–14:6. Hickman discloses that location data "corresponds to the location of the unique object" and "may include GPS [Global Positioning System] coordinates and/or other location-based information." *Id.* Hickman further discloses, for example, that "location data (LOC) corresponding to a 'unique' car may include GPS coordinates indicating the last recorded location of the car" and "location data (LOC) corresponding to a 'unique' musical instrument may include GPS coordinates and links to map information" that describe the location of the musical instrument in a closet. *Id.* at 14:15–27.

Hickman further discloses data structure 314 of the general object knowledge base 308 including "specification data (SPC)" corresponding to an "individual general object identifier (GID)." *Id.* at 18:4–7. Hickman

describes that the specification data "may include physical attributes associated with the particular 'type' of object," such as "physical dimensions (height, width, depth, shape, volume, area, etc.)." *Id.* at 18:10–14.

For the reasons given herein (*see* Section III.C.1.a), we are persuaded that Petitioner provides articulated reasoning with rational underpinning to support Petitioner's proposed modification. Based on the arguments and evidence of record, we find that Hickman teaches elements [21.9]–[21.11]. We find that the arguments and evidence of Patent Owner do not undermine Petitioner's showing.

d) Elements [21.12]–[21.14]

Elements [21.12]–[21.14] are reproduced below.

> [21.12] wherein the second object representation includes a second data structure generated at least by:
>
> [21.13] processing one or more digital pictures to detect: a type of a second object, a location of the second object, and a size of the second object; and
>
> [21.14] in response to the processing, generating the second data structure that includes: a label indicating the detected type of the second object, a coordinate indicating the detected location of the second object, and a computer model indicating the detected size of the second object.

MTA App. A 3.

Petitioner argues as follows:

> For reasons similar to those noted above with respect to features 2–4, GHC [the Grotmol Hickman combination] renders obvious feature [21.12]–[21.14] when a second object representation including a second data structure is generated in response to the detection of a second object. TESLA1010, ¶94. The second data structure may correspond to a data structure that includes a combination of a row in the unique object knowledge base and a row in the general object knowledge base. TESLA1010, ¶94.

Opp. MTA 23.

In our Preliminary Guidance, we stated "[f]or the reasons given for claim elements [21.10] and [21.11], based on the current record, we find Petitioner's contentions for claim elements [21.13] and [21.14] unpersuasive." PG 9. In its Reply, Patent Owner states "[f]or limitations [21.12]–[21.14], the opposition merely cites its earlier analysis of [21.9]–[21.11] (Opp., 23) that fails for at least the same reasons as presented above." Reply MTA 6. In its Sur-reply, Petitioner relies on the arguments in its Opposition and the arguments discussed with respect to elements [21.10] and [21.11]. Sur-reply MTA 1–5.

In its Sur-sur-reply, Patent Owner argues "only a single object-related row from the modified figure 5 table might be used to map to the first data structure, while other rows cannot be used to map to the second data structure since these rows represent objects from different circumstances." Sur-sur-reply 5; *see also id.* (arguing a person of ordinary skill in the art "would not have found that GHC would be feasible for the recited multi-object first circumstance since Grotmol's image *depicting two objects in the same circumstance* cannot logically be replaced by two object-related rows of the hypothetical figure 5 table because the two rows represent *objects from different circumstances*."). Also, Patent Owner again argues that Petitioner has not shown that the location and size data is "detected by processing pictures." Sur-sur-reply 6.

Patent Owner's arguments are unavailing. Patent Owner's arguments appear to be based on Hickman's disclosure that "corresponding image data" for a unique object identifier or general object identifier may include images "of the unique object." *See, e.g.*, Ex. 1005, 13:25–31, 16:55–62. Patent

Owner appears to assume that these images would have been obtained "from different circumstances." Sur-sur-reply 5. Petitioner, however, argues that it would have been obvious to modify "*Grotmol's storage structure* to include one or more knowledge bases with Hickman's data structures." Opp. MTA 14.

More specifically, Petitioner relies on Grotmol's "image of a scene from a robot vehicle's operation" for disclosing "circumstance representation." Pet. 13 (citing Ex. 1004, 3:31–39, 8:66–9:3, 10:23–26, 38:36–58, 39:13–22). Grotmol's disclosures support Petitioner's argument. *See, e.g.*, Ex. 1004, 3:31–39 (describing that the "first sensor component may be configured to provide a signal conveying a *video frame* comprising a plurality of pixels") (emphasis added), 10:23–26 (describing "[i]n some implementations of robotic vehicle navigation, output of the sensor 166 in FIG. 1 may comprise representations of one or more objects (e.g., targets, and/or obstacles)"), 39:13–22 (describing that "[d]uring training" images "are acquired" and "may be stored"). Patent Owner's arguments improperly attempt to show non-obviousness by attacking references individually where the rejections are based on combinations of references. *Merck*, 800 F.2d at 1097; *Keller*, 642 F.2d at 426.

We turn to Patent Owner's argument that Petitioner has not shown that the location and size data is "detected by processing pictures." Sur-sur-reply 6. We find Patent Owner's argument unavailing for the same reasons given for elements [21.9]–[21.11].

Based on the arguments and evidence of record, we find that Hickman teaches elements [21.12]–[21.14]. We find that the arguments and evidence of Patent Owner do not undermine Petitioner's showing.

e) Element [21.15]

Element [21.15] recites "wherein the first data structure and the second data structure are correlated with the first one or more instruction sets for operating the first device." MTA App. A 3. Petitioner argues a person of ordinary skill in the art would have understood that in the Grotmol and Hickman combination the first and second data structures are correlated with the first one or more instruction sets for operating the first device. Opp. MTA 24 (citing Ex. 1004, 4:8–11, 8:57–9:3, 12:16–25, 17:21–34; Ex. 1010 ¶ 97). Petitioner also argues that "Hickman teaches that for each detected object, the knowledge base can store a data structure that includes 'relevant tasks that a robot may perform with the object' in the task data (TASK) field." *Id.* (citing Ex. 1005, 2:65–3:8, 15:28–43, 18:34–20:20; FIG. 3).

Petitioner's arguments are supported by the cited evidence. *See, e.g.*, Ex. 1004, 8:57–9:3 (describing the "sensor component 166" providing "information associated with objects within the field-of-view 168"), 12:16–25 (describing teaching a "robot one or more possible obstacle avoidance trajectories"), 17:21–34 (describing using "an image of an obstacle (e.g., wall representation in the sensor input 402) combined with rover motion" to generate a context and then "one or more commands [are] configured to avoid a collision between the rover and the obstacle"); *see also id.* at 39:17–19 (describing that "[m]otor commands issued by a trainer corresponding to time instances when the images are acquired may be stored") (cited in Pet. 13 (in connection with Petitioner's arguments for element [1.3]).

Patent Owner argues that Hickman does not disclose element [21.15]. *See generally* Reply MTA; Sur-sur-reply 7–9. Petitioner, however, relies on the combination of Grotmol and Hickman. We find Patent Owner's arguments for [21.15] to be unavailing for the same reasons given for

elements [21.9]–[21.14]. Furthermore, we find that Petitioner's arguments are specifically tied to elements recited in proposed substitute claim 21 and, for recitations that derive antecedent basis from elements recited in the original claims, Petitioner need not repeat arguments it made in the Petition for the elements recited in original claims.

Based on the arguments and evidence of record, we find that Hickman teaches element [21.15]. We find that the arguments and evidence of Patent Owner do not undermine Petitioner's showing.

f) Conclusion—Proposed Substitute Claim 21

For the reasons given, we determine that Petitioner demonstrates by a preponderance of the evidence that the combination of Grotmol and Hickman teaches the features recited in proposed substitute claim 21. For the reasons given, we also are persuaded by a preponderance of the evidence that Petitioner provides sufficiently articulated reasoning with rational underpinning to support Petitioner's modification of Grotmol and Hickman. *See, e.g.*, Pet. 55–58. We find that Patent Owner's argument and evidence do not undermine Petitioner's showing.

Based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that proposed substitute claim 21 is unpatentable as obvious over the combination of Grotmol and Hickman.

2. Obviousness of Proposed Substitute Claims 22–29

We turn to Petitioner's argument that proposed substitute claims 22–25 and 27–29 would have been obvious over Grotmol and Hickman and proposed substitute claim 26 would have been obvious over

Grotmol, the knowledge of a person of ordinary skill in the art, and Hickman.

Proposed substitute claims 22 and 25 include amendments to original claims 5 and 9, respectively. With respect to original claims 5 and 9, we find that Petitioner supports its arguments that dependent claims 5 and 9 are anticipated by Grotmol with specific citations to Grotmol and Dr. Janet's declaration. Pet. 25–27, 32–33 (citing, e.g., Ex. 1002 ¶¶ 165–172, 174–176, 179–182, 189–190, 198). Petitioner's argument and Dr. Janet's testimony are supported by the cited evidence. Patent Owner does not offer arguments for dependent claims 5 or 9 or contest Petitioner's analysis and, instead, Patent Owner states that claims 5 and 9 are canceled. *See* MTA 1, 24; *see also generally* PO Resp.; PO Sur-reply. For the reasons presented by Petitioner, based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that dependent claims 5 and 9 are unpatentable as anticipated by Grotmol.

Patent Owner's amendments to claims 22 and 25 recite the same features discussed above with respect to proposed substitute claim 21. *See generally* MTA App. For the same reasons given for proposed substitute claim 21, based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that proposed substitute claims 22 and 25 are unpatentable as obvious over the combination of Grotmol and Hickman.

We turn to proposed substitute claims 23, 24, and 26–29. Proposed substitute claims 23, 24, and 26–29 include amendments to original claims 6, 7, 10, 11, 12, and 16, respectively. Above, we provide the reasons for our determination that Petitioner has proved, by a preponderance of evidence,

that original claims 6, 7, 10, 11, 12, and 16 are unpatentable on grounds presented by Petitioner.

Patent Owner's amendments to claims 23, 24, and 26–29 recite the same features discussed with respect to proposed substitute claim 21. *See generally* MTA App. For the same reasons given for proposed substitute claim 21, based on the arguments and evidence of record, we determine that Petitioner has proved, by a preponderance of evidence, that proposed substitute claims 23, 24, and 27–29 would have been obvious over Grotmol and Hickman and proposed substitute claim 26 would have been obvious over Grotmol, the knowledge of a person of ordinary skill in the art, and Hickman.

IV. CONCLUSION[9]

Petitioner has proved by a preponderance of the evidence that claims 3, 6–8, and 10–18 of the '344 patent are unpatentable. The outcome for the challenged claims is set forth in the table below. In summary:

Claims Challenged	35 U.S.C. §	Reference(s)	Claims Shown Unpatentable	Claims Not shown Unpatentable
3–5, 7–9, 13–18[10]	102(a)(2)	Grotmol	3, 7, 8,	

[9] 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).

[10] Prior to institution, Patent Owner disclaimed claims 1, 2, 19, and 20 of the '344 patent. *See* Prelim. Resp. 1 (citing Ex. 2004; 37 C.F.R. § 42.107(e)).

Claims Challenged	35 U.S.C. §	Reference(s)	Claims Shown Unpatentable	Claims Not shown Unpatentable
			13–18[11]	
10, 11	103	Grotmol	10[12]	
6, 11, 12	103	Grotmol, Hickman	6, 11, 12	
Overall Outcome			3, 6–8, 10–18	

Motion to Amend Outcome	Claims
Original Claims Cancelled by Amendment	4, 5, 9
Substitute Claims Proposed in Amendment	21–29
Substitute Claims: Motion to Amend Granted	
Substitute Claims: Motion to Amend Denied	21–29
Substitute Claims: Determined Unpatentable	
Substitute Claims: Not Reached	

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 3, 6–8, and 10–18 of the '344 patent are unpatentable;

FURTHER ORDERED that Patent Owner's request to cancel claims 4, 5, and 9 in its Motion to Amend is *granted*;

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[11] Patent Owner's Motion to Amend submits that "[c]laims 4, 5, and 9 are hereby cancelled" and requests that "the Board issue claims 21, 22, and 25 as substitutes for claims 4, 5, and 9, respectively," noting that "[Patent Owner] does not condition its request regarding claims 21, 22, and 25 on any condition." MTA 1, 24.

[12] We do not determine whether Petitioner has shown that claim 11 would have been obvious over Grotmol alone in light of our determination that Petitioner has shown by a preponderance of the evidence that claim 11 would have been obvious over Grotmol and Hickman.

FURTHER ORDERED that Petitioner has shown by a preponderance of the evidence that proposed substitute claims 21–29 are unpatentable and Patent Owner's request to issue substitute claims 21–29 is *denied*; 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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