Trials@uspto.gov
571-272-7822

Paper 46
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.

IPR2023-01054
Patent 10,452,974 B1

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

CASS, *Administrative Patent Judge*.

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

TESLA 1026
Tesla, Inc. v. Autonomous Devices LLC
IPR2024-00745

I. INTRODUCTION

A. Background

In this *inter partes* review, Tesla, Inc. ("Petitioner") challenges the patentability of original claims 4, 5, 7, and 11 of U.S. Patent No. 10,452,974 B1 (Ex. 1001, "the '974 patent"), which is assigned to Autonomous Devices, LLC ("Patent Owner"). Also at issue is Patent Owner's Contingent Motion to Amend (Paper 28, "MTA") requesting that: (1) to the extent any of original claims 4, 5, 7, or 11 are found unpatentable, they be replaced with substitute claims 21, 22, 23, and 24, respectively; and (2) claims 14 and 15 be cancelled and replaced with substitute claims 25 and 26.

We have jurisdiction under 35 U.S.C. § 6. This Final Written Decision, issued pursuant to 35 U.S.C. § 318(a), addresses issues and arguments raised during the trial in this *inter partes* review. For the reasons discussed below, Petitioner has proven by a preponderance of the evidence that original claims 4 and 11 are unpatentable. Petitioner has not proven by a preponderance of the evidence that any of original claims 5 and 7 are unpatentable. With respect to Patent Owner's Motion to Amend, Petitioner has proven that proposed substitute claims 21 and 24–26 are unpatentable.

B. Procedural History

In the Petition, Petitioner challenged claims 1–20 of the '974 patent. Pet. 3–4. Following the Petition, Patent Owner filed a Preliminary Response, in which it disclaimed claims 1–3, 6, 8–10, 12–13, and 16–20 of the '974 patent. Paper 11 ("Prelim Resp.") 1 (citing Ex. 2004; 37 C.F.R. § 42.107(e)). We instituted trial on claims 4–5, 7, 11, and 14–15. Paper 20 ("Inst. Dec.") 61. Following institution, 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").

During the trial, Patent Owner also filed a Contingent Motion to Amend arguing that, if the Board finds any of original claims 4, 5, 7, or 11 unpatentable, it should issue the corresponding substitute claims 21–24 presented in the Motion to Amend. Paper 28 ("MTA"). In its Motion to Amend, Patent Owner also cancelled original claims 14 and 15 and requested that the Board issue claims 25 and 26 as substitutes for those claims. *Id.* at 1–2. Petitioner filed an Opposition (Paper 31 (Pet. MTA Opp.")), and we issued Preliminary Guidance on Patent Owner's Motion to Amend (Paper 32 ("Prelim. Guid.")). Following the Preliminary Guidance, Patent Owner submitted a Reply (Paper 34, "PO MTA Reply"), and Petitioner submitted a Sur-reply (Paper 38, "Pet. MTA Sur-reply").

Petitioner submitted a Declaration of Jason Janet, Ph.D. with its Petition (Ex. 1002, "Janet Decl.") and another Declaration from Dr. Janet in opposition to the Motion to Amend (Ex. 1010, "Supp. Janet Decl.") to support its contentions that the claims at issue in the Motion are unpatentable. Patent Owner submitted a Declaration of Dr. Eli Saber, Ph.D (Ex. 2007, "Saber Decl.") with its Patent Owner Response.

An oral hearing was held on September 18, 2024, a transcript of which appears in the record. Paper 45, "Tr." Following the hearing, with our permission, Patent Owner submitted a Sur-sur reply responding to Petitioner's Sur-reply in opposition to the Motion to Amend. Paper 44, "PO MTA Sur-sur reply".

C. Applied References

In this proceeding, 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
Tolstedt	US 2010/0063663 A1, filed Sep. 11, 2008, pub. Mar. 11, 2010	1015

Petitioner relied on Grotmol and Hickman in its Petition, and Grotmol, Hickman, and Tolstedt in its Opposition to the Motion to Amend. Pet. 3–4; Pet. MTA Opp. 10–12.

D. Asserted Grounds

Petitioner asserts that the remaining challenged original claims of the ’974 patent are unpatentable based on the following grounds summarized in the table below (Pet. 3–4):

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
4, 5, 7[1]	102(a)(2)	Grotmol
11	103	Grotmol in view of the knowledge of a person of ordinary skill
4, 11	103	Grotmol, Hickman

Petitioner asserts that the proposed amended claims are unpatentable based on the following grounds:

[1] We do not include the claims disclaimed by Patent Owner in this table.

Claim(s) Challenged	35 U.S.C. §	Reference(s)/Basis
21–26	103	Grotmol, Hickman
24	103	Grotmol in view of the knowledge of a person of ordinary skill, Hickman
21–23, 25, 26	103	Grotmol, Tolstedt
24	103	Grotmol in view of the knowledge of a person of ordinary skill, Tolstedt

Pet. MTA Opp. 10–11.

E. 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.

F. Related Matters

The parties inform us that the ’974 patent was asserted in *Autonomous Devices LLC v. Tesla, Inc.*, No. 22-cv-1466 (MN) (D. Del.) (the “parallel district court proceeding”). Pet. 1; Paper 4, 1. The parties also identify a concurrently filed petition, IPR2023-01055, challenging U.S. Patent No. 11,238,344 (the “’344 patent”), a continuation of the ’974 patent. Pet. 1; Paper 4, 1.

G. The ’974 Patent

The ’974 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 ’974 patent is directed to “devices, apparatuses, systems, and related methods for providing advanced learning, anticipating, decision making, automation,

and/or other functionalities." *Id.* at 1:10–13. The '974 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 57:49–57.

Figure 2 of the '974 patent is depicted below.

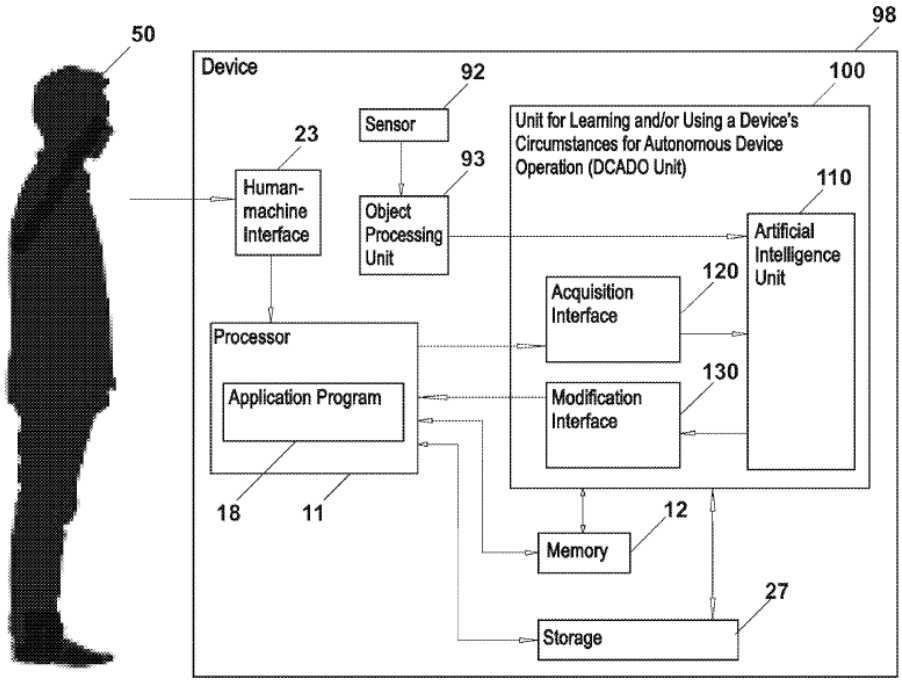


FIG. 2

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 66:55–66:60.

Processor 11 is configured to execute instruction sets for operating the device. Ex. 1001, 67:4–7. "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 68:26–30. 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 69:4–9. 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 71:38–43. DCADO Unit 100 comprises artificial intelligence unit 110, acquisition interface 120, and modification interface 130. *Id.* at 66:62–64. 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 67:13–17.

Artificial intelligence unit 110 comprises functionality for learning device's 98 operation. *Id.* at 96:27–28. An embodiment of this functionality is shown in Figure 32 of the '974 patent, depicted below.

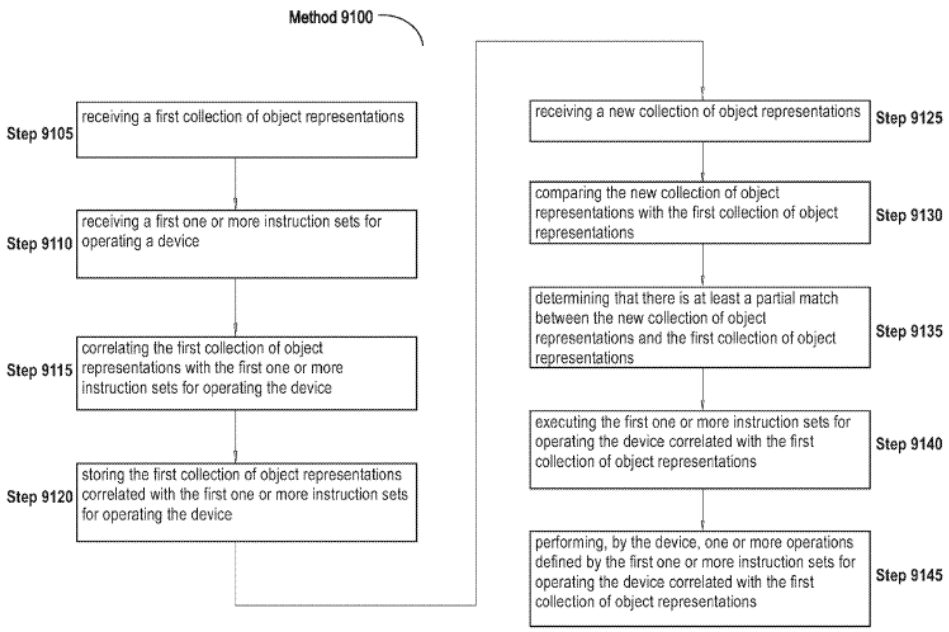


FIG. 32

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 150:7–9. At step 9105 of Figure 32, "a first collection of object representations is received." *Id.* at 150:21–22. "An object representation may include an electronic representation of an object (i.e. Object 615, etc.) detected in a device's surrounding." *Id.* at 150:26–28. At step 9110, "a first one or more instruction sets for operating a device are received." *Id.* at 151:60–61. 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 153:15–17. At steps 9125 and 9130, a new collection of object representations is received and "compared with the first collection of object representations." *Id.* at 154:39–44. At step 9135, "a determination is made that there is at least a partial match between" the two collections. *Id.* at 155:27–29. 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 156:66–157:1.

H. Illustrative Original Claim

Original claims 4–5, 7, and 11 of the '974 patent are at issue in this proceeding. These claims depend, directly or indirectly, from disclaimed claim 1, and thus incorporate the subject matter of claim 1. Ex. 1001, 170:16–172:26.

Claim 4 is illustrative of the claimed subject matter at issue and is reproduced below, along with disclaimed independent claim 1, from which it depends.

> 1.[1.1[2]] A method implemented using a computing system that includes one or more processor circuits, the method comprising:
>
> [1.2] accessing a memory that stores at least a knowledgebase that includes: a first correlation including a first circumstance representation correlated with a first one or more instruction sets for operating a first device and a second correlation including a second circumstance representation correlated with a second one or more instruction sets for operating the 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 the second circumstance representation represents a second circumstance detected at least in part by the one or more sensors of the first device,
>
> [1.3] and wherein at least a portion of the first correlation and at least a portion of the second correlation are learned in a learning process that includes operating the first device at least partially by a user;

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

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

[1.5] anticipating the first one or more instruction sets for operating the first device learned in the learning process based on at least partial match between the third circumstance representation and the first circumstance representation; and

[1.6] at least in response to the anticipating, executing the first one or more instruction sets for operating the first device learned in the learning process, 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 learned in the learning process.

4. [4.1] The method of claim 1, wherein the learning process includes: generating or receiving the first circumstance representation, and generating or receiving the second circumstance representation; and,

[4.2] obtaining or receiving the first one or more instruction sets for operating the first device, and obtaining or receiving the second one or more instruction sets for operating the first device,

[4.3] and wherein the knowledgebase further includes a fourth correlation including a fourth circumstance representation correlated with a fourth one or more instruction sets for operating the second device, and wherein the fourth circumstance representation represents a fourth circumstance detected at least in part by the one or more sensors of the second device, and wherein at least a portion of the fourth correlation is learned in another learning process that includes: generating or receiving the fourth circumstance representation; and obtaining or receiving the fourth one or more instruction sets for operating the second device.

Ex. 1001, 169:36–170:4, 170:15–36 (indents and bracketed paragraph identifiers added).

II. ANALYSIS OF ORIGINAL CLAIMS

A. Legal Standards

"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.[3] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966).

B. Level of Ordinary Skill in the Art

Petitioner asserts that a person of ordinary skill in the art,

[3] Patent Owner does not present objective evidence of nonobviousness in this proceeding.

> 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, 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 definition of a person of ordinary skill in the art. PO Resp. 6.

Considering the subject matter of the '974 patent, the background technical field, and the asserted prior art, we agree with Petitioner's proposed qualifications for the person of ordinary skill in the art, 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 '974 patent and the asserted prior art references. *See Okajima v. Bourdeau*, 261 F.3d 1350, 1355 (Fed. Cir. 2001).

Accordingly, 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).

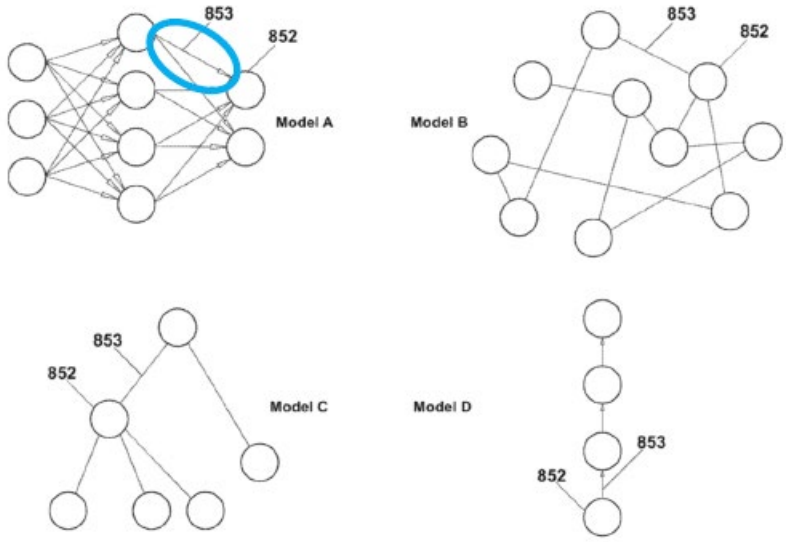
Petitioner provides a construction for "means for generating or receiving," "means for anticipating," and "means for executing" in disclaimed claim 19. Pet. 4–5. Patent Owner argues that "construction of these terms is unnecessary" due to the disclaimer of claim 19. PO Resp. 15. We agree. *See Realtime 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) (alteration in original)).

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. The parties also dispute the meaning of the term "connection" in the phrases "a first connection is generated to connect the first correlation with the second correlation" and "a second connection is generated to connect the second correlation with the first correlation" in claim 7. PO Resp. 10–14; Pet. Reply 13–16; PO Sur-reply 14–17. We discuss the parties' dispute regarding that claim language below.

1. "connection"

Claim 7 recites, in pertinent part, that "a first connection is generated to connect the first correlation with the second correlation" and "a second connection is generated to connect the second correlation with the fourth correlation." Ex. 1001, 170:63–67. Patent Owner argues that the term "connection" should be construed to mean "a relationship that includes a link." PO Resp. 11. Petitioner disagrees, arguing that "no construction is necessary and that the plain and ordinary meaning should apply," and that the ordinary meaning of "connection" is "an association or a relationship." Pet. Reply 15–16.

To support its construction, Patent Owner points to its annotated version of Figure 17 of the '947 patent, reproduced below.

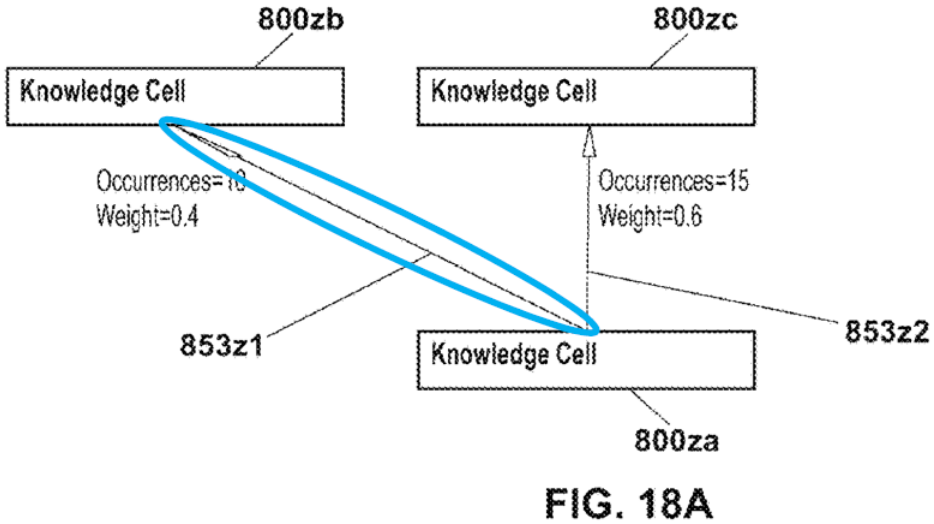


Patent Owner's annotated version of Figure 17 of the '947 patent showing "Connection 853" in blue. PO Resp. 11 (citing Ex. 1001, Fig. 17; Ex. 2007 ¶¶ 56–62).

Patent Owner argues that, "[i]n describing Figure 17," the '974 patent "states that 'machine learning, knowledge structuring or representation, decision making, pattern recognition, and/or other artificial intelligence

functionalities may include a network of Nodes 852 (also referred to as neurons, etc.) and Connections 853 similar to that of a brain.'" PO Resp. 11–12 (citing Ex. 1001, 103:46–52). According to Patent Owner, "Node 852 can store any data, object, data structure, and/or other item, or reference thereto," such as "at least a portion of a circumstance representation" or "object representation," or "an instruction set," and "the two nodes may be in a relationship that includes a connection or link," such as "Connections 853." *Id.* at 12 (citing Ex. 1001, 103:42–66). Patent Owner also points to the '974 patent's disclosure that "Connection 853 may include or be associated with a value such as a symbolic label or numeric attribute (i.e. weight, cost, capacity, length, etc.)." *Id.* (citing Ex. 1001, 63–66).

Patent Owner argues that Figure 18A of the '974 patent, reproduced below with Petitioner's annotation, "also makes clear that a connection is a relationship that includes a link."



Patent Owner's annotated version of Figure 18A of the '974 patent showing Connection 853 in blue. PO Resp. 13 (citing Ex. 1001, Fig. 18A; Ex. 2007 ¶ 59).

According to Patent Owner, the '974 patent Specification "further explains that, in this particular use, connections between correlations (each

knowledge cell depicted in Fig. 18A includes a correlation, *see* Figs. 13–16) 'may include or be associated with at least one of: an occurrence count, a weight, a parameter, or data." *Id.* (citing Ex. 1001, 15:59–60). Patent Owner also points to the '974 patent Specification's statement that, in Figure 18A, "Knowledge Cell 800za is connected to Knowledge Cell 800zb and Knowledge Cell 800zc by Connection 853zl and Connection 853z2, respectively," and that each of these connections "may include or be associated with occurrence count, weight, and/or other parameters or data." *Id.* (citing Ex. 1001, 106:9–14).

Additionally, Patent Owner argues, when knowledge cells (including correlations) are "connected, interrelated, or interlinked into knowledge structures using statistical, artificial intelligence, machine learning, and/or other models or techniques," connections "are used to indicate and track relationships including links to enable more efficient autonomous device operation" and "are used to create paths through the knowledgebase for efficient storage and autonomous operation." PO Resp. 14 (citing Ex. 1001, 106:6–57, 108:31–35, 153:66–154:2, Fig. 22). "This disclosure," Patent Owner contends, "confirms that, with respect to claim 7, connections are relationships that include links." *Id.* (citing Ex. 2007 ¶¶ 56–62). Finally, Patent Owner cites to the testimony of its expert, as well as "several dictionaries" that "confirm that 'connection' can be defined as a 'relationship that includes a link.'" *Id.* (citing Ex. 2007 ¶¶ 56–62; Ex. 2012; Ex. 2013).

Petitioner responds that Patent Owner's construction of "connection" as requiring a "link" is "unsupported by the intrinsic record of the '974 patent and an unjustified departure from the term's plain and ordinary

meaning." Pet. Reply 13 (citing Ex. 1010 ¶¶ 30–35). Petitioner argues that Patent Owner's proposed construction "attempts to import a requirement for a connection[] to include a 'link' by mere reference to ***examples*** in the specification where a 'link' is disclosed," but that "even these examples are not specifically described in terms of 'connections.'" *Id.* at 14 (citing Ex. 2007 ¶¶ 55–62; Ex. 1010 ¶¶ 30–31; PO Resp. 11). "For example," Petitioner asserts, the '974 patent describes Figure 17 and 18A as "embodiments." *Id.* (citing Ex. 1001, 56:17–23). The '974 patent also states that Model A in Figure 17 "***may*** include a network of Nodes 852 . . . and Connections 853 similar to that of a brain," that "[e]ach of Connection 853zl and Connection 853z2 ***may*** include or be associated with occurance count, weight, ***and/or other parameter or data***," and that a "connection ***may include or be associated with*** at least one of: an occurrence count, a weight, a parameter, or a data" which, according to Petitioner, "are precisely the type of non-limiting language that does not limit the scope of a claim term." *Id.* (citing Ex. 1001, 15:58–60, 103:42–51, 106:11–14,). Furthermore, Petitioner contends, "the textual description of FIGS. 17 and 18A does not once use the word 'link,'" and the '974 patent Specification "broadly describes 'connections'—both 'direct' and otherwise—at col. 66:3–23 without ever referring to or mandating that a connection include a 'link' as proposed by PO." *Id.* at 14–15 (citing Ex. 1001, 66:3–23).

Finally, Petitioner argues that Patent Owner's construction is problematic because the meaning of the term "link" is "unclear" and not defined by the '974 patent Specification, and Patent Owner's expert failed to define or clarify the meaning of the term "link." Pet. Reply 15 (citing Ex. 1012, 12:12–36:5; Ex. 1010 ¶¶ 32–33). And, according to Petitioner,

Patent Owner fails to explain why it "cherry-picked" one particular definition from the various available definitions of "connection" in the dictionaries it cites. *Id.* (citing PO Resp. 14; Ex. 2012; Ex. 2013). Petitioner concludes its argument by submitting that "no construction" of "connection" "is necessary and that the plain and ordinary meaning should apply," and that the "plain and ordinary meaning" of "connection" is "an association or a relationship." *Id.*(citing Ex. 1001, 15:58–60, 66:3–23; Ex. 2012, 399–400; Ex. 2013, 481; Ex. 1010 ¶¶ 34–35).

Patent Owner responds that "Petitioner's over-broad proposal for the alleged plain and ordinary meaning of 'connection' as 'an association or relationship' contradicts the intrinsic record and would effectively render the term meaningless since the connection in claim 7 is recited to narrow what is recited in independent claim 1." PO Sur-reply 14 (emphasis omitted). Patent Owner argues that the '974 patent Specification "***specifically provides disclosure of a link in Figures 17 and 18A***, and that the patent states that '[k]nowledge cells . . . may be . . . ***interlinked*** into knowledge structures." *Id.* at 16 (citing Ex. 1001, 153:66–67). According to Patent Owner, its construction "is consistent with the term's customary meaning and is supported by the claims, specification, drawings, and intrinsic record as a whole." *Id.* (citing PO Resp. 9–14).

Based on the full trial record, we find that Patent Owner's construction is the one that is most consistent with the ordinary meaning of the term when viewed in light of the claim language and specification of the '974 patent.

We first look to the ordinary and customary meaning of the claim language. The American Heritage Dictionary, cited by Patent Owner, includes multiple definitions of the term "connection," as follows:

> **1.a** The act of connecting. **b.** The state of being connected. **2.** One that connects: a link: *a faulty connection in the circuit.* **3.** An association or a relationship: *There appeared to be no connection between the two crimes.* **4.** The logical or intelligible ordering of words or ideas; coherence. **5.** Reference or relation to something else; context: *In this connection, the agreement can be seen as a step toward peace.* **6.** A person, especially one of influence or position, with whom one is associated, as by kinship, interests in common, or marriage: *used her connections to land a job.* **7.** A conveyance or scheduled run providing continuing service between means of transportation: *missed my connection in Atlanta.* **8.** A line of communication between two points in a telephone or similar wired system. **9.** *Slang.* **a.** A drug dealer. **b.** A purchase of illegal drugs.

Ex. 2012, 399–400 (emphasis in original). Webster's Third New International Dictionary provides similar definitions. Ex. 2013, 481.

The American Heritage Dictionary also provides the following definitions for "connect":

> **1.** To join or fasten together. **2.** To associate or consider as related: *no reason to connect the two events.* See Synonyms at **join.** **3.** To join to or by means of a communications circuit: *Please connect me to the number in San Diego.* **4.** To plug in (an electrical cord or device) to an outlet. *–intr.* **1.** To become joined or united: *two streams connecting to form a river.* **2.** To be scheduled so as to provide continuing service as between airplanes or buses. **3.** To establish a rapport or relationship; relate: *The candidate failed to connect with the voters.* **4.** *Sports.* To hit or play a ball successfully: *The batter connected for a home run.*

Ex. 2012, 399 (emphasis in original).

From these dictionaries, it is apparent that the term "connection" has different meanings depending on the context in which it is used. To determine which meaning is most appropriate for the term "connection" in claim 7, we look to the intrinsic evidence, including the claim language and the '974 patent Specification. As to the claim language, claim 1, upon which claim 7 depends, recites a method implemented using a computer with one or more processors, and a memory that stores a knowledgebase including "a first correlation between a first circumstance representation and a first instruction set for operating a first device" and "a second correlation including a second circumstance representation correlated with a second one or more instruction sets for operating the first device." Ex. 1001, 169:36–45. Claim 7 also recites "generat[ing]" a "first connection" to "connect the first correlation with the second correlation." *Id.* at 170:63–65.

Thus, the context of the claim language involves a computer that "generate[s]" "connections" that connect two or more different items of information or data in a knowledgebase stored in a computer memory. In light of this context, we believe the most appropriate definition of "connection" involves the joining or linking of two or more items of information or data. This is consistent with Patent Owner's construction that a connection is "a relationship that includes a link," because a link, in the context of claim 7, joins together two or more items of information or data. Because claim 7 also recites that the connections are "generated to connect" the correlations, the claim language also makes clear that the "link" that joins the correlations must be generated by the computer of claim 1.

This understanding is consistent with the '974 patent Specification. In the context of Figure 17 (reproduced above), the Specification explains that

the system may include a neural network with Nodes 852 (which may each be a "data object, data structure, and/or other item") linked by Connections 853. Ex. 1001, 103:42–52, 103:63–66, Fig. 7. This disclosure suggests that "connections" involve links between two or more nodes, which may each be a data object, data structure, and/or other item. Additionally, in the context of Figure 18A (reproduced above), the Specification also explains that "Knowledge Cell 800za is connected to Knowledge Cell 800zb and Knowledge Cell 800zc by Connection 853z1 and Connection 853z2, respectively," and that each of these connections "may include or be associated with occurrence count, weight, and/or other parameter or data." *Id.* at 106:6–14, Fig. 18A. This disclosure also suggests a link that joins two or more knowledge cells that is generated by the computer system and can be associated with an occurrence count, weight, or other parameter. Furthermore, the Specification states that "[k]nowledge cells . . . may be . . . ***interlinked*** into knowledge structures" using the connections (links) described. *Id.* at 16 (citing Ex. 1001, 153:66–67) (emphasis added).

We think the meaning of "connection" proposed by Patent Owner is more appropriate for the context of claim 7 than Petitioner's proposal that the term "connection" should be construed to mean "an association or a relationship." Pet. Reply 15–16. Petitioner's proposal is not tied to the claim language or the '974 patent Specification, but instead appears to be an attempt to select the broadest definition set forth in the dictionary. This broad definition would appear to encompass any generalized "relationship" or "association," such as, for example, a conceptual connection between two events (such as crimes) or two people (such as by relation). Even in the context of a computer, Petitioner's construction would appear to cover any

set of data that has any relationship, such as data that is stored in the same physical memory. Thus, Petitioner's construction would appear to encompass storing the first and second correlations in the same memory, as claim 1 recites, and applying this construction would mean that the limitation in claim 7 reciting a connection between the first and second correlations would be superfluous.

We are not persuaded by Petitioner's argument that Patent Owner's proposed construction attempts to read a limitation from the preferred embodiment in the '974 patent Specification into the claims. See Pet. Reply 13–14. Here, we are not importing a limitation from the Specification into the claims, but rather are using the Specification (and claim language) to provide context to determine which of the various "ordinary meanings" of the term "connection" is appropriate for claim 7. Similarly, we are not persuaded by Petitioner's argument that the '974 patent uses permissive language to describe its embodiments because, again, we are not reading those embodiments into the claim, but simply using them to provide context as to the most appropriate ordinary meaning of the disputed claim term.

Finally, we are not persuaded by Petitioner's argument that the meaning of the term "link" is unclear. Pet. Reply. 15. As is apparent from the dictionary definitions of "connection" and "connect" in the record, a "link" joins two or more things together. *See* Ex. 2012, 399–400 (defining "connection" as "One that connects: a link," and "connect" as "to join or fasten together"). We also agree with Patent Owner that the '974 patent Specification "specifically provides disclosure of a link in Figures 17 and 18A," and states that '[k]nowledge cells . . . may be . . . ***interlinked*** into

knowledge structures" using the links described, which provides further guidance as to the term's meaning. *Id.* at 16 (citing Ex. 1001, 153:66–67).

Consequently, we construe the term "connection" in claim 7 to mean "a relationship that includes a link," and a "connection is generated to connect" to mean that the computer of claim 1 generates a relationship that includes a link between the recited elements.

D. Ground 1: Anticipation of Claims 4–5, and 7 by Grotmol

Petitioner asserts that claims 4–5, and 7 are anticipated by Grotmol. Pet. 3–4. Patent Owner disagrees. Prelim. Resp. 14–34. We discuss below Petitioner's challenge to claims 5 and 7. We need not reach Petitioner's challenge in this Ground to claim 4 because we find that Petitioner has demonstrated that claim 4 is unpatentable in Ground 3 based on the combination of Grotmol and Hickman.

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

1. Overview of 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.

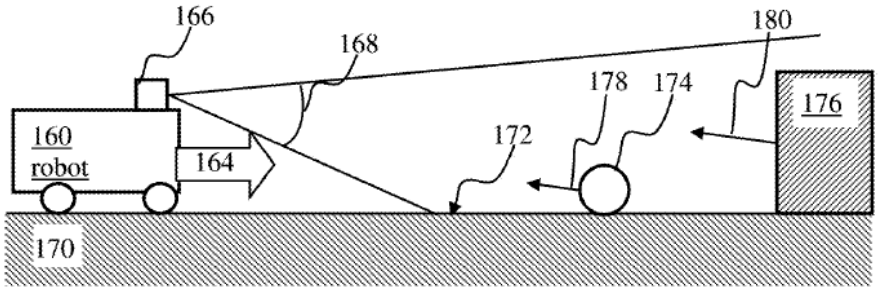


FIG. 1

Figure 1 depicts mobile robotic apparatus 160 that contains sensor component 166. *Id.* 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.

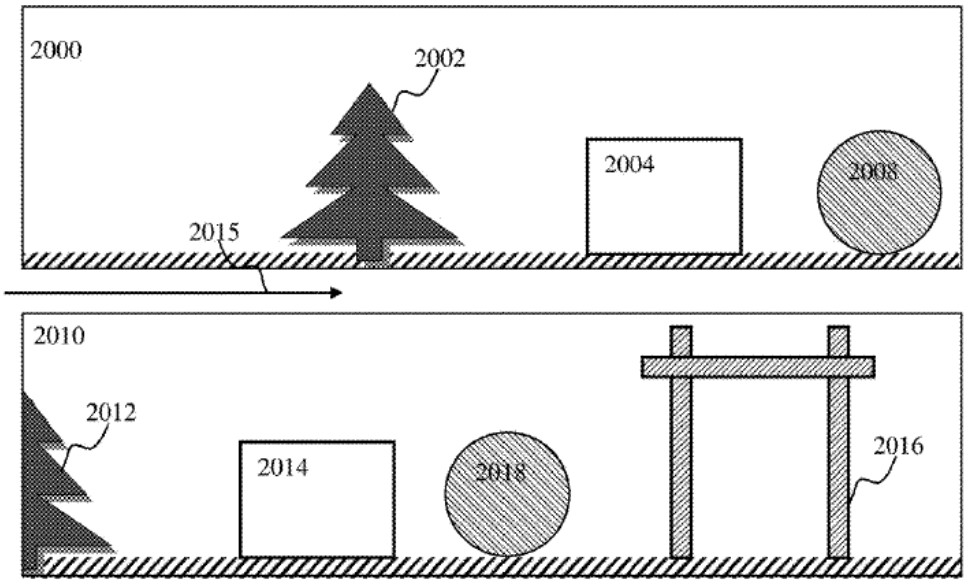


FIG. 20A

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 explains that motor commands are obtained "by taking the stored motor commands from the training buffer" that correspond to "the best matching stored image." *Id.* at 43:4–9.

2. Disclaimed Independent Claim 1

We begin our analysis with disclaimed independent claim 1 because original claims 4, 5, and 7, which are at issue in this Ground, depend from claim 1.

a) [1.1] (preamble) "A method implemented using a computing system that includes one or more processor circuits, the method comprising:"

Petitioner argues that Grotmol discloses the preamble by describing a robotic apparatus with one or more processors. Pet. 11 (citing Ex. 1004, 3:27–30, 8:5–15; Ex. 1002 ¶¶ 65–66).

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses the preamble of claim 1.

b) [1.2] accessing a memory that stores at least a knowledgebase that includes: a first correlation including a first circumstance representation correlated with a first one or more instruction sets for operating a first device and a second correlation including a second circumstance representation correlated with a second one or more instruction sets for operating the 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 the second circumstance representation represents a second circumstance detected at least in part by the one or more sensors of the first device,

Petitioner argues that "Grotmol discloses a 'memory component may be configured to store training sets,' where '[a] given training set may comprise an instance of the video frame, an instance of the binary signal, and an instance of a motor control indication configured to cause the robot to

execute an action.'" Pet. 12 (citing Ex. 1004, code (57), 3:27–39) (alteration in original). "Thus," Petitioner asserts, "Grotmol discloses a memory that stores a knowledgebase including 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 operating a first device' (motor control indication configured to cause the robot to execute an action)." *Id.* at 12–13 (alteration in original).

Petitioner also argues that "[t]he images in Grotmol are 'associated with' or 'correspond to'—*i.e.*, are correlated with—motor control indications issued around the same time." Pet. 13 (citing Ex. 1002 ¶ 68). According to Petitioner, "Grotmol describes training behaviors in a robotic device by 'learning of *associations* between sensory context . . . and a respective action . . . during training.'" *Id.* at 13–14 (citing Ex. 1004, code (57), 33:59–62) (alteration in original). "This association," Petitioner contends, "may be based on the timing of the images and the motor commands." *Id.* at 14 (citing Ex. 1004, 39:17–19, 43:5–9).

Additionally, Petitioner argues, "Grotmol discloses that circumstance representations (images) represent circumstances detected by a sensor of the first device." Pet. 14. "Specifically," Petitioner asserts, "Grotmol discloses the video frame instances are detected by a 'sensor component' of the robotic vehicle." *Id.* (citing Ex. 1004, code (57), 3:31–33). According to Petitioner, Figure 8 of Grotmol shows that "the 'memory' of Grotmol is connected to the 'sensory' functionality through the 'processing' functionality." *Id.* (citing Ex. 1004, 9:1–3). Thus, Petitioner contends, "[b]oth Grotmol and the '974 patent disclose that digital images may come from, for example, a CCD image sensor in the form of color encoded

pixels." *Id.* at 14–15 (citing Ex. 1001, 69:67–70:5, 112:24–32; Ex. 1004, 9:8–22). And, according to Petitioner, "Grotmol further discloses that these pixels are used for object (or circumstance) recognition." *Id.* at 15 (citing Ex. 1004, 8:66–9:3). Finally, Petitioner argues, Grotmol discloses "accessing the training sets stored in the memory component to perform autonomous operation." *Id.* (citing Ex. 1004, code (57), 39:23–28).

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses claim element [1.2].

c) [1.3] and wherein at least a portion of the first correlation and at least a portion of the second correlation are learned in a learning process that includes operating the first device at least partially by a user;

Petitioner argues that "Grotmol discloses that a human ('user') can operate the robot during a training process and '[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.'" Pet. 16 (citing Ex. 1004, 33:59–62). "In both the 'listen mode' and 'override mode,'" Petitioner asserts, "Grotmol teaches that the robot will listen to commands sent by a trainer (user) 'and try to remember it for the next time the same situation occurs.'" *Id.* (citing Ex. 1004, 23:3–29, 24:55–25:5, 34:50–55). According to Petitioner, "Grotmol describes this training as a learning process." *Id.* (citing Ex. 1004, 24:17–20, claim 12). "Accordingly," Petitioner contends, "Grotmol discloses a first correlation and a second

correlation are learned during a learning process in which a user operates the first device." *Id.* at 17 (citing Ex. 1002 ¶ 74).

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses claim element [1.3].

> *d) [1.4] generating or receiving a third circumstance representation, wherein the third circumstance representation represents a third circumstance detected at least in part by the one or more sensors of the first device or at least in part by one or more sensors of a second device;*

Petitioner argues that "Grotmol discloses that its processor or a feature of an application running thereon receives additional digital pictures from the camera over time." Pet. 17 (citing Ex. 1004, 38:36–39, 39:23–28). "In Grotmol," Petitioner asserts, "'the most recent, current' image corresponds to the claimed 'third circumstance representation' and it is compared to the stored images in the training buffer (the claimed first and second circumstance representations)." *Id.* (citing Ex. 1002 ¶¶ 75–76). "Furthermore," according to Petitioner, "Grotmol discloses that the 'most recent, current' image (*i.e.*, third circumstance representation) can be detected by a camera of the robot that was used during the training mode (*i.e.*, first device), or it can be detected by the camera of a different robot (*i.e.*, second device)." *Id.* at 17–18 (citing Ex. 1002 ¶ 76). "Accordingly," Petitioner contends, "Grotmol discloses generating or receiving a third circumstance representation detected by a sensor of the first device or a second device." *Id.* at 18 (citing Ex. 1002 ¶¶ 75–77).

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses claim element [1.4].

> *e) [1.5] anticipating the first one or more instruction sets for operating the first device learned in the learning process based on at least partial match between the third circumstance representation and the first circumstance representation; and*

Petitioner argues that "Grotmol discloses 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.'" Pet. 18 (citing Ex. 1004, 43:5–9). Petitioner asserts that "Grotmol discloses that the matching step may comprise calculating a similarity measure between a current image and a stored image, then determining whether that similarity measure breaches a threshold (*i.e.*, 'at least partial match between the third circumstance representation and the first circumstance representation')." *Id.* (quoting Ex. 1004, 2:30–39). "As used in Grotmol," Petitioner contends, "'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, *values of pixels in an image*, patches of color texture, brightness in the image, and/or in the image as a whole . . . .'" *Id.* at 19 (citing Ex. 1004, 28:19–24) (alteration in original). Additionally, according to Petitioner, a "training set," as used in Grotmol "may comprise 'an instance of the video frame, an instance of the binary signal, and an instance of a motor control indication configured to cause the robot to execute an action.'" *Id.* (citing Ex. 1004, 3:35–39).

Moreover, according to Petitioner, "[b]oth Grotmol and the '974 patent disclose that determining a 'partial match' may comprise pixel-wise difference analysis between two digital pictures." Pet. 19–20 (citing Ex. 1001, 66:24–28, 73:21–54; Ex. 1004, 3:13–15, 41:8–17). "Accordingly," Petitioner contends, "Grotmol discloses anticipating an instruction set for operating the first device learned in the learning process based on a partial match between the third circumstance representation and the first circumstance representation." *Id.* at 20 (citing Ex. 1002 ¶¶ 78–79).

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses claim element [1.5].

> *f) [1.6] at least in response to the anticipating, executing the first one or more instruction sets for operating the first device learned in the learning process, 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 learned in the learning process.*

Petitioner argues that, as described above for limitation [1.5], Grotmol discloses anticipating the learned instruction sets for operating the device by comparing a new image with a stored image and determining whether there is at least a partial match between the images. Pet. 20 (citing Ex. 1002 ¶¶ 78–79). According to Petitioner, "Grotmol further discloses 'executing the first one or more instruction sets for operating the first device learned in the learning process' in response to the 'anticipating.'" *Id.* According to Petitioner, "Grotmol describes that after it is determined that the similarity measure between the new image and image from the training set breaches a

threshold, one or more potential control signals corresponding to the image from the training set that were obtained during a training operation of the robot (the instruction sets correlated with the first digital picture) are determined and executed." *Id.* at 20–21 (quoting Ex. 1004, 2:34–41, 3:12–13).

Additionally, Petitioner argues, "Grotmol discloses that the robot (first device) autonomously performs the operations defined by the first instruction set for operating the device." Pet. 21 (citing Ex. 1004, code (57), 34:56–62, 43:4–11). According to Petitioner, "Grotmol further discloses that training sets for performing autonomous operation may be loaded into the robot used for training (*i.e.*, first device), or may be loaded into another robot (*i.e.*, second device), and therefore, discloses that a first device or a second device autonomously performs the operations defined by the instructions stored in the training set." *Id.* at 21–22 (citing Ex. 1004, 33:21–32). "Accordingly," Petitioner contends, "Grotmol discloses executing the instruction set for operating the first device learned in the learning process, where the first device or the second device autonomously performs an operation defined by the instruction set." *Id.* at 22 (citing Ex. 1002 ¶¶ 80–82).

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses claim element [1.6].

g) Conclusion—Disclaimed Claim 1

After consideration of the contentions and the evidence of record, we find that Petitioner has established by a preponderance of the evidence that Grotmol discloses each recitation of claim 1.

3. Dependent Claim 5

Dependent claim 5 recites as follows:

> 5. The method of claim 1, wherein the anticipating the first one or more instruction sets for operating the first device learned in the learning process based on the at least partial match between the third circumstance representation and the first circumstance representation includes:
>
> determining that a number of at least partially matching portions of the third circumstance representation and portions of the first circumstance representation exceeds a threshold number, or
>
> determining that a percentage of at least partially matching portions of the third circumstance representation and portions of the first circumstance representation exceeds a threshold percentage.

Ex. 1001, 170:38–50.

Petitioner argues that "Grotmol discloses that the control process for autonomous operation may involve comparing a current image (*i.e.*, third circumstance representation) with an image from the training buffer (*i.e.*, first circumstance representation)," and "further discloses that determining a control signal for operation of the robot may involve computing a similarity measure for a given training set and another training set, and determining whether that similarity measure exceeds a threshold." Pet. 29 (citing Ex. 1004, 3:13–15; 3:35–58, 4:30–39, 39:23–41, 41:8–17, 43:5–9). "Thus," Petitioner contends, "Grotmol discloses determining that a number of at least partially matching portions of the third circumstance representation and

portions of the first circumstance representation exceeds a threshold number." *Id.* (citing Ex. 1002 ¶ 95).

Patent Owner responds that "Grotmol's comparison based on a similarity measure, which Petitioner relies on, does not disclose the elements of claim 5," which "requires determining that a ***number*** of at least partially ***matching portions*** exceeds a threshold ***number or percentage (of portions)***." PO Resp. 20 (citing Pet. 29; Ex. 2007 ¶¶ 79–83). Patent Owner argues that "[u]sing the number of at least partially matching portions in the matching process ***involves counting the portions and determining whether this counted number of portions exceeds a numerical threshold***, and Grotmol does not disclose any such counting of portions and numerical threshold." *Id.* at 20–21 (citing Ex. 2007 ¶¶ 79–83). "Further," according to Patent Owner, "using the percentage of at least partially matching portions in the matching process ***involves counting the portions to compute the percentage and determining whether this computed percentage of portions exceeds a percentage threshold***, and Grotmol does not disclose any such counting of portions and percentage threshold," and "Grotmol does not disclose any such counting of portions, computation, and percentage threshold, either." *Id.* at 21 (citing Ex. 2007 ¶¶ 79–83).

Additionally, Patent Owner argues, Grotmol's "similarity measure" does not disclose the language of claim 5. PO Resp. 21–22. According to Patent Owner, "Grotmol discloses comparing a subset of features within a training set, with 'the similarity measure characterizing similarity between features of the subset, and features of the given training set,' ***not the number or percentage of the similar features***." *Id.* at 21 (quoting Ex. 1004, 3:50–52). "A similarity measure," Patent Owner contends, "is for measuring

similarity of elements, not for counting their number or computing their percentage," and thus "a similarity measure is clearly different than the number or percentage of the similar elements after the similarity measure of those elements is determined." *Id.* (citing Ex. 2007 ¶¶ 82–83).

Petitioner responds that Patent Owner "improperly attempts to import a requirement for 'counting' matching portions of circumstance representations in a manner that is not required by the plain language of claim 5." Pet. Reply 9. According to Petitioner, claim 5 merely requires "determining ***that*** a number [or percentage] of at least partially matching portions," which "does not necessarily involve 'counting' since the condition can be determined even without an affirmative counting step." *Id.* at 9–10 (citing Ex. 1010 ¶ 21–22).

Petitioner also argues that "Grotmol's process involves comparing the similarity measure with a threshold, and when that threshold is exceeded by the similarity measure ('a number of at least partially matching portions . . . exceeds a threshold number'), the system has determined that a number (e.g., 1) of the at least partially matching portions of the new image (e.g., the third circumstance representation) and portions of the training set image (e.g., first circumstance representation) exceeds a threshold number (e.g., 0)." Pet. Reply 10 (citing Ex. 1004, 4:30–9, 47:4–6); Ex. 1010 ¶ 24). Additionally, Petitioner asserts, "Grotmol's disclosure that 'shifted/trimmed' portions of a new image (corresponding to portions of a 'third circumstance representation') are compared to 'shifted/trimmed' portions of a subset of images from the training set (referred to in Grotmol as 'the matching search set,' which correspond to a 'first circumstance representation') to determine a 'best match' from the training set." *Id.* at 11 (citing Ex. 1004, 41:8–17;

Pet. 29; Ex. 1010 ¶ 25). According to Petitioner, "the 'shifted/trimmed frames' for which a similarity metric is determined are 'at least partially matching portions.'" *Id.* "For example," Petitioner contends "Grotmol describes how an 'image correlation operation' is performed with the new image and each candidate image in the matching search set to align the new image with each candidate image before the pixel-wise difference is determined between the images." *Id.* (citing Ex. 1004, 40:52–41:16, Figs. 20A, 20B). "Through the image correlation operation and the resulting shifting/trimming of correlated frames," Petitioner argues, one of ordinary skill "would have understood that Grotmol only selectively performs the pixel-wise difference comparison between 'portions' of a new image in a pre-determined 'matching' search set, i.e., between '***at least partially matching portions*** of the third circumstance representation and portions of the first circumstance representation,' as recited in claim 5." *Id.* (citing Ex. 1004, 40:52–55).

Finally, Petitioner argues that Grotmol teaches that "determining a 'best match' between a new image and an image in the 'matching search set' involves determining that a number of shifted/trimmed portions of the new image (i.e., at least partially matching portions) exceeds a threshold." Pet. Reply 12. "The threshold that must be exceeded," according to Petitioner, "is either (a) zero when a 'best match' is determined with a portion of an image from a 'primary particle' of the matching search set or (b) one or more depending on the window size when a 'best match' is determined with a portion of an image from a 'secondary particle' set." *Id.* (citing Ex. 1004, 31:43–42:2).

Patent Owner responds that it has not improperly imported a "counting" requirement into claim 5, but rather "has merely pointed out that using the number of at least partially matching portions in the matching process of claim 5 ***involves counting the portions and determining whether this counted number of portions exceeds a numerical threshold***, and Grotmol does not disclose any such counting of portions and numerical threshold." PO Sur-reply 11 (citing PO Resp. 20–22). "Further," Patent Owner asserts, "using the percentage of at least partially matching portions in the matching process in claim 5 ***involves counting the portions to compute the percentage and determining whether this computed percentage of portions exceeds a percentage threshold***," but "Grotmol does not disclose any such counting of portions, computation, and percentage threshold, either." *Id.* According to Patent Owner, "Petitioner's argument that the claimed determining can be performed without counting is wrong, and Petitioner's expert never explains how the determining steps in claim 5 can be performed without counting." *Id.* (citing Ex. 1010 ¶¶ 21–22).

Patent Owner also argues that Grotmol's "similarity measure" is not, as Petitioner contends, "a number of at least partially matching portions, as required by claim 5." PO Sur-reply 12. The similarity measure, Patent Owner asserts, "is for measuring similarity of compared elements, not for counting their number or computing their percentage." *Id.* (citing Ex. 2007 ¶¶ 82–83) (emphasis omitted). Thus, according to Patent Owner, "a similarity measure of compared elements is clearly different than the number or percentage of the similar elements after the similarity measure of those elements is determined." *Id.*

Additionally, Patent Owner disagrees with Petitioner's argument that Grotmol compares shifted/trimmed images and that "the 'shifted/trimmed frames' for which a similarity metric is determined are 'at least partially matching portions.'" PO Sur-reply 12 (citing Pet. Reply 11). Patent Owner argues that "there is no indication that Grotmol discloses determining that a number of these shifted or trimmed frames that are at least partially matched exceeds a threshold number," but instead "discloses using a similarity measure with this shifted/trimmed images." *Id.* (citing Ex. 1004, 40:52–41:17). "Further," according to Patent Owner, Petitioner's argument that one of ordinary skill "would have understood that Grotmol only selectively performs the pixel-wise difference comparison between 'portions' of a new image and images in a pre-determined 'matching' search set" is "conclusory and unsupported by Grotmol's disclosure." *Id.* at 12–13 (citing Pet. Reply 11).

Finally, Patent Owner argues that "Petitioner's attempt to manufacture the use of a threshold in Grotmol's disclosure of a best match process also fails." PO Sur-reply 13 (citing Pet. Reply 12). According to Patent Owner, "[t]his portion of Grotmol never cites the word threshold or explains how any threshold, much less numeric or percentage threshold as in claim 5 is used." *Id.* (citing Ex. 1004, 41:35–40). Additionally, Patent Owner contends, Petitioner's claim that the threshold is "zero when a 'best match' is determined with a portion of an image from a 'primary particle' of the matching search set or . . . one or more depending on the window size when a 'best match' is determined with a portion of an image from a 'secondary particle set' mischaracterizes Grotmol's disclosure to manufacture a fictional

threshold," which is not mentioned by Grotmol. *Id.* at 13–14 (citing Pet. Reply 12).

Based on the full trial record, we find that Petitioner has failed to sufficiently prove that Grotmol anticipates claim 5. First, we agree with Patent Owner that using the number of at least partially matching portions in the matching process of claim 5 involves counting the matching portions and determining whether this counted number of portions exceeds a numerical threshold. *See* PO Resp. 20–22; PO Sur-reply 11. This understanding reflects the ordinary meaning of the claim language and, without such a counting, it is unclear (and Petitioner does not persuasively explain) how the number of matching portions could be determined. Similarly, we agree with Patent Owner that using the percentage of at least partially matching portions in the matching process in claim 5 involves counting the portions to compute the percentage and determining whether this percentage exceeds a percentage threshold. *Id.*

We also agree with Patent Owner that Grotmol's similarity measure compares the similarity between two images, rather than counting the number of at least partially matching portions of the images and determining whether the result exceeds a threshold number (or percentage), as claim 5 requires. This is evident from Grotmol's disclosure of a "similarity metric," reproduced below, upon which Petitioner relies for claim 5.

> A similarity metric may be determined between the shifted/trimmed frames (e.g., 2020, 2040 in FIG. 20B). In some implementations, the similarity may be determined by performing pixel-wise difference between the overlapping regions (e.g., the frames 2020, 2040 in FIG. 20B) of the given image and the matching image. A norm of the image difference in the overlapping region may be determined for individual

> images from the matching search set. An image corresponding to the lowest norm may be referred to as the best match.

Ex. 1004, 41:8–17; *see also id.* at 2:30–34 ("The similarity measure may characterize similarity between features of the subset and features of the training set."); 4:35–38 ("The method may comprise, responsive to the similarity measure breaching a threshold, selecting one or more training sets from the plurality of training sets."). As is clear from the above disclosure, Grotmol's similarity measure compares the pixels between the two images (or two shifted/trimmed frames created from the images), rather than dividing each image into multiple portions, counting the number of portions of each image that match (or partially match), and determining whether that number (or percentage) exceeds a threshold.

We also do not agree with Petitioner's argument that claim 5 can be met merely by comparing two images because the "threshold number" can be zero and the number of at least partially matching portions can be one, so that a match between two images involves one partially matching portion that exceeds a threshold of zero. *See* Pet. Reply 10. Claim 5 refers to "at least partially matching portion**s**" (plural) of the third circumstance representation and "portion**s**" (again plural) of the first circumstance representation, indicating that multiple (i.e., more than one) portions of the first circumstance representation and multiple portions of the third circumstance representation are considered in the determination. Even if we were to agree with Petitioner that, in general, a threshold number could be zero, Grotmol's comparison of two images as a whole does not count matches between multiple portion**s** of the first circumstance representation and multiple portion**s** of the third circumstance representation as claim 5 requires. Petitioner also does not point to any disclosure in Grotmol of

determining whether a percentage of at least partially matching portions of these circumstance representations exceeds a threshold percentage.

Additionally, we find that Petitioner's assertions about Grotmol's "shifted/trimmed images" do not help Petitioner's argument. *See* Pet. 29; Pet. Reply 11. Grotmol explains that its "shifted/trimmed" images are merely versions of the original images (such as images 2000 and 2010 in Figure 20A) that have been shifted and trimmed to create smaller "shifted/trimmed" images (such as images 2020 and 2040 in Figure 20B). Ex. 1004, 40:55–41:7, Figs. 20A, 20B. These "shifted/trimmed" images, Grotmol explains, may then be compared to determine a similarity metric by performing a pixel-wise difference between them. *Id.* at 41:8–13. Thus, Petitioner's reliance on "shifted/trimmed" images suffers from the same problems discussed above that are presented by comparing two images as a whole, namely that there is no counting of matches between multiple portions of the first shifted/trimmed image and multiple portions of the second shifted/trimmed image, as claim 5 requires.

Dr. Janet supplements Petitioner's above argument by asserting that Grotmol teaches that "determining a 'best match' between a new image and an image in the 'matching search set' involves determining that a number of shifted/trimmed portions of the new image (i.e., at least partially matching portions) exceeds a threshold." Ex. 1010 ¶ 27. Dr. Janet further states that "Grotmol describes how an 'image correlation operation' is performed between the new image and each candidate image in the matching search set to align the images before the pixel-wise difference is determined between the images," and from this one of ordinary skill "would have understood that Grotmol only selectively performs the pixel-wise difference comparison

between 'portions' of a new image and images in a pre-determined 'matching' search set, i.e., between '***at least partially matching portions*** of the third circumstance representation and portions of the first circumstance representation.'" However, Dr. Janet does not sufficiently explain how this portion of Grotmol considers multiple portions of the new image (the first circumstance representation) in this comparison. Dr. Janet also does not explain how multiple images in a pre-determined "matching" search set can be considered to be multiple portions of a "third circumstance representation," since each of these separate images in the "matching" search set would appear to be a separate circumstance representation.

Finally, we disagree with Petitioner's argument that claim 5 is met because Grotmol discloses that the threshold that must be exceeded can be "one or more depending on the window size when a 'best match' is determined with a portion of an image from a 'secondary particle' set." *See* Pet. Reply 12 (citing Ex. 1004, 31:43–42:2). Petitioner relies on the following portion of Grotmol for this disclosure.

> If a match search set image with the best match score (e.g., the lowest norm) belongs to the primary particle set than it may be selected as the best match. If the image with the best match score belongs to the secondary particle set than it may be selected based on an evaluation of image history parameter.

Pet. Reply 12; Ex. 1010 ¶ 27; Ex. 1004, 41:35–40. Again, however, Petitioner does not sufficiently explain how multiple portions of the new image (the first circumstance representation) are considered in the determination of whether a threshold is met, or how the various images in the secondary particle set can be considered to be multiple portions of a "third circumstance representation," since each of the separate images in the

secondary particle set would appear to be a separate circumstance representation.

Consequently, after consideration of the contentions and the evidence of record, we find that Petitioner has not established by a preponderance of the evidence that Grotmol discloses each recitation of claim 5.

4. Dependent Claim 7

a) [7.1] The method of claim 1, wherein the knowledgebase further includes a fourth correlation including a fourth circumstance representation correlated with a fourth one or more instruction sets for operating: the first device, the second device, or a third device,

Petitioner argues that, as discussed above with respect to limitations [1.2] and [1.3], "Grotmol discloses that multiple images may be acquired, with images respectively stored in association with corresponding motor commands issued at the time the image was acquired." Pet. 31. "Accordingly," Petitioner asserts, "Grotmol discloses first, second, third, fourth, etc. correlations, where each correlation includes a circumstance representation correlated with an instruction for operating the robotic device." *Id.* (citing Ex. 1002 ¶¶ 67–74).

Petitioner also argues that Grotmol discloses "that the training sets and training configurations from a first robot (which include the instruction sets for operating first device) can be 'stored' or 'saved.'" Pet. 31 (citing Ex. 1004, 33:12–58). "The saved training configuration," Petitioner asserts, "may then be 'loaded into the robot being trained thereby providing one or more trained behaviors to the robot.'" *Id.* (citing Ex. 1004, 33:27–30). "Further," according to Petitioner, "the 'trained configuration may be loaded to one or more *other robots* in order to provide learned behaviors.'" *Id.* (citing Ex. 1004, 33:30–32). "Thus," Petitioner contends, "Grotmol discloses

a second and third device ('one or more other robots') that can autonomously perform one or more operations defined by one or more instruction sets for operating the first device training configuration from [the] first robot (*e.g.*, training sets with circumstance representations correlated to instruction sets)" that "is loaded into a second or third other robots to 'provide learned behaviors.'" *Id.* at 31–32 (citing Ex. 1002 ¶¶ 98–99).

Patent Owner does not present arguments specifically directed to limitation [7.1] *See* PO Resp.

Petitioner's contentions are supported by the cited portions of Grotmol. After consideration of the contentions and the evidence of record, we find that Petitioner has sufficiently shown that Grotmol discloses claim element [7.1].

b) [7.2] and wherein a first connection is generated to connect the first correlation with the second correlation, and wherein a second connection is generated to connect the second correlation with the fourth correlation.

Petitioner argues that "[t]he '974 patent describes that '[k]nowledge cells [*containing correlations* (*see supra* claim 2)] may be *connected*, interrelated, or interlinked into knowledge structures using statistical, artificial intelligence, machine learning, and/or other models or techniques.'" Pet. 32 (citing Ex. 1001, 153:66–154:2). Petitioner asserts that "Grotmol discloses these 'connections' between . . . the correlations in the knowledg[e]base," for example, by "storing sequences of images with their corresponding instruction sets (*i.e.*, a sequence of knowledge cells)" in "an ordered buffer in a non-volatile memory." *Id.* (citing Ex. 1004, code (57), 38:21–42; Ex. 1002 ¶ 101). "An ordered buffer," according to Petitioner, "is

a region of memory that is allocated for storing data in a specific order or sequence." *Id.* (citing Ex. 1002 ¶ 101). Therefore, Petitioner contends, "Grotmol describes that the training buffer may be ordered temporally, according to when the images were acquired." *Id.* at 32–33 (citing Ex. 1004, 39:65–40:4; Ex. 1002 ¶ 101). According to Petitioner, "Grotmol also describes alternative ways to order the training buffer, such as 'particle filtering,' in which images 'may be moved to a nearby location in the training buffer where the stored image matches closely with the newly arrived image,' and ordering at random." *Id.* at 33 (citing Ex. 1004, 39:42–40:19; Ex. 1002 ¶ 101). Petitioner argues that "[t]he training data stored in memory in an order or sequence corresponds to the claimed first and second 'connections' between the first and second correlations, and the second and fourth correlations." *Id.* (citing Ex. 1002 ¶¶ 100–101).

Patent Owner responds that "Grotmol fails to disclose the claimed 'first connection' and 'second connection' of claim 7 under Patent Owner's proposed construction of 'connection,'" which is "a relationship that includes a link." PO Resp. 22–23 (citing Ex. 2007 ¶¶ 84–90). Patent Owner argues that Grotmol does not disclose this limitation, but instead "merely ***discloses storing information in a sequence*** and fails to disclose any links among training sets." *Id.* at 24 (citing Ex. 2007 ¶ 86). Patent Owner contrasts Grotmol's storage of information in a sequence with the '974 patent, in which "knowledge cells are created and structured in a specific way to store object representations correlated with instruction sets (i.e., correlations), and are connected in the knowledgebase using connections," which "***create paths through the knowledgebase that enhances autonomous operation***." *Id.* (citing Ex. 1001, 95:54–99:10, 131:64–132:26,

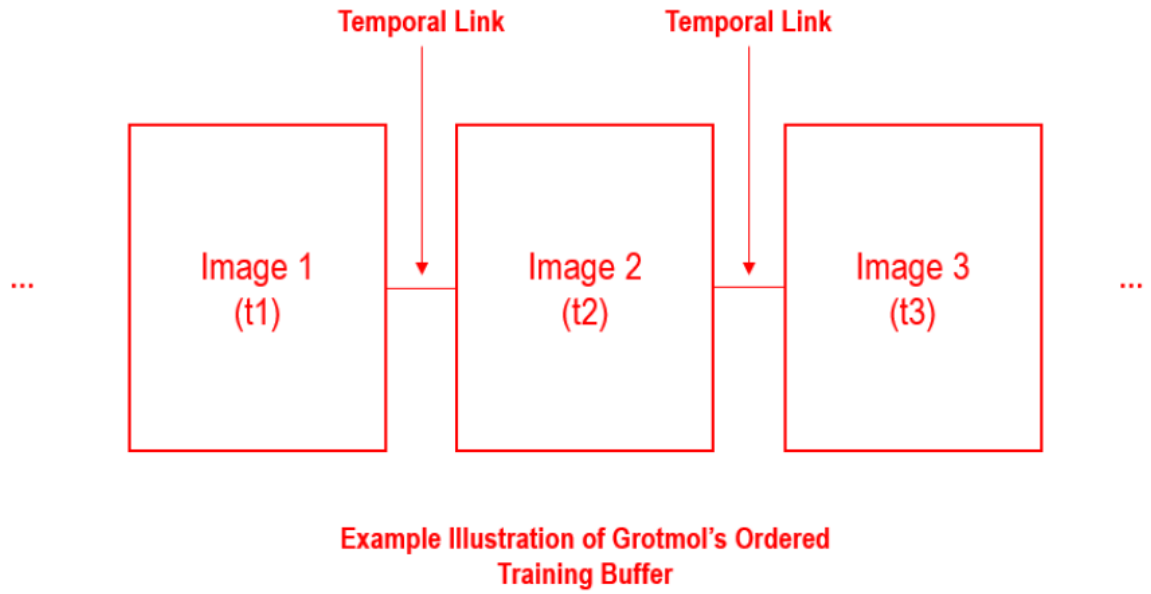
Fig. 22; Ex. 2007 ¶¶ 84–90). According to Patent Owner, Grotmol's "simple sequence" of training data "does not enable anything like this," and that Petitioner "fails to show any support for such connections among knowledge cells (that include correlations) in Grotmol." *Id.* Moreover, Patent Owner contends, "[a] sequence of elements," as in Grotmol, "inherently does not need any connections since the sequence is an ordered group of elements in a single path (i.e., sequence), hence ***Grotmol never discloses connections because Grotmol does not need them***." *Id.* (citing Ex. 2007 ¶¶ 87–90). Thus, Patent Owner asserts, "Grotmol's disclosure of 'an ordered buffer in a non-volatile memory' does not constitute disclosure of the claimed connections or relationships including links." *Id.* at 25 (citations omitted) (citing Ex. 2007 ¶¶ 89–90).

Patent Owner further argues that Grotmol's disclosure that the image may be stored in the training buffer "in some other fashion" than temporally does not disclose the claimed connections because "regardless of the order of the training buffer, ***the order is different from the claimed connections or relationships that include links***." PO Resp. 25 (citing Ex. 2007 ¶¶ 84–90). Additionally, according to Patent Owner, Petitioner fails to point to any portions of Grotmol that disclose "***generation of connections***" as claim 7 requires. *Id.* (citing Ex. 1001, claim 7; Ex. 2007 ¶ 88).

Petitioner responds that Grotmol's storing of "correlations including sequences of images with their corresponding instruction sets (i.e., a sequence of knowledge cells)" in a training buffer that "may be ordered temporally, according to when the images were acquired" creates the claimed first and second connections because "storing data in a sequential manner in a memory creates an association or relationship between the

stored data, e.g., based on the sequential storage locations." Pet. Reply 16 (citing Pet. 32–33; Ex. 1004, code (57), 38:21–42, 39:17–40:19). The "connections" generated by storing a sequence of knowledge cells in a temporally ordered training buffer, Petitioner argues, "allow Grotmol's control process to efficiently identify an image stored in the training buffer as a 'best match' to a new image captured during autonomous operation." *Id.* (citing Ex. 1004, 39:23–48). Additionally, Petitioner asserts, "[t]he sequence of images stored in Grotmol's ordered training buffer serve to connect images that are temporally proximate to a limited number of 'particle' images," and "Grotmol's control process uses these temporal connections to narrow the search space and more efficiently identify a matching image from the training set." *Id.* at 16–17 (citing Ex. 1004, 39:23–48). According to Petitioner, Grotmol's "training buffer also connects the correlations" because "Grotmol's images are correlated with motor control indications (e.g., instruction sets)." *Id.* at 17 (citing Pet. 12–15; Ex. 1010 ¶¶ 39–40).

"Further," Petitioner argues, "even if a 'connection' required a link" as Patent Owner urges, one of ordinary skill "would have understood the connections provided by Grotmol's ordered training buffer to link temporally proximate images (e.g., to a particle image)." Pet. Reply 17 (citing Ex. 1010 ¶ 40). "If the images were not linked," according to Petitioner, "temporally proximate images would not be identified as they are in Grotmol." *Id.* Petitioner provides a figure, reproduced below, to illustrate how "one can easily 'draw' a link to conceptually illustrate the connection between images in Grotmol's ordered buffer similarly to the conceptual links that [Patent Owner] contends exist in the figures of the '974 patent.



Petitioner's drawing illustrating "temporal links" between the images in Grotmol's ordered training buffer. Pet. Reply 18.

Patent Owner responds that "a sequence of elements," as in Grotmol, "inherently does not need any connections since the sequence is an ordered group of elements of a single path (i.e., sequence)," and thus "Grotmol never discloses connections because Grotmol does not need them." PO Sur-reply 17 (citing PO Resp. 24) (emphasis omitted). Patent Owner also argues that Grotmol's disclosure that the images in the training buffer may be ordered "either temporally or in some other fashion" does not disclose the claimed "connections" because, "regardless of the order of the training buffer, the order is different from the claimed connections or relationships that include links." *Id.* at 18 (citing Ex. 2007 ¶¶ 87–90). According to Patent Owner, Petitioner's alleged "temporal link" between images in Grotmol's ordered training buffer is merely "Petitioner's own words unsupported in Grotmol," which "at most indicates that the images are temporally ordered and says nothing about them being connected or in relationships that include links." *Id.* (citing Pet. Reply 17–18). Similarly, Patent Owner asserts, "the figure

Petitioner has created in its Reply" is "conclusory, not contained in Grotmol, and inserts links in Grotmol where Grotmol only discloses temporally ordered, but not connected or linked, images." *Id.* (citing Pet. Reply 18). Additionally, Patent Owner contends, Petitioner "***only mentions images*** as allegedly being linked (which even Grotmol does not disclose) and ***does not address the correlations being connected*** as recited in claim 7." *Id.* "Finally," Patent Owner argues, "claim 7 additionally ***requires generating the first and second connections***, and Petitioner has failed to point to any portions of Grotmol that disclose this generation of connections." *Id.* at 19 (citing Pet. Reply 16–18).

Based on the full trial record, we find that Petitioner has failed to sufficiently show that Grotmol discloses the claimed "connections." As discussed above, we construe the term "connection" in claim 7 to mean "a relationship that includes a link" and the term a "connection is generated to connect" to mean that the computer of claim 1 generates a relationship that includes a link between the recited elements. *See* § II.C.1, *supra*. Thus, we construe the phrase "a first connection is generated to connect the first correlation with the second correlation" to mean that the computer generates a relationship that includes a link between the first correlation and the second correlation, and construe the phrase "a second connection is generated to connect the second correlation with the fourth correlation" to mean that the computer generates a relationship that includes a link between the second correlation with the fourth correlation. *Id.* These phrases are not met merely by showing some sort of generalized "relationship" or "association" between the first correlation and the second correlation, or between the second correlation and the fourth correlation. *Id.*

We do not agree with Petitioner that the claimed "connections" are met merely by ordering images sequentially or temporally in a training buffer. Petitioner has not shown that Grotmol's process of storing images sequentially or temporally in a memory involves generating a relationship that includes a link, as we have interpreted the claim language to require. The mere fact that the images may be "related to" or "associated with" each other based on the time they were captured does not, by itself, create a relationship that includes a link between those images. Indeed, Dr. Janet does not explain in any detail how Grotmol's temporally ordered buffer involves generating a relationship that includes a link between the images. Ex. 1002 ¶¶ 100–101; Ex. 1010 ¶¶ 36–40. To the contrary, Dr. Janet applies Petitioner's proposed construction of the "connection" claim language, which we have rejected, and merely states, in cursory fashion, that "[b]ecause storing data in a sequential manner in a memory creates an association or relationship between the stored data, e.g., based at least on the sequential storage locations, Grotmol discloses the claimed 'first connection' and 'second connection.'" Ex. 1010 ¶ 38. And, although Dr. Janet opines that Grotmol discloses "links" between the images, he fails to explain this opinion in sufficient detail. Ex. 1010 ¶¶ 36–40. For similar reasons, we also find that Grotmol's ordering of stored images in the training buffer "by random selection" does not meet the claimed "connections" because no generation of a relationship that includes a link between the images has been shown. *See* Pet. 33; Ex. 1002 ¶ 101; Ex. 1004, 39:42–40:19.

Petitioner also fails to sufficiently show that Grotmol's discussion of "particle filtering" discloses generating the claimed "connections."

Petitioner and Dr. Janet cite to the following portions of Grotmol that discuss "particle filtering":

> In some implementations, the search space may be narrowed using a form of particle filtering, where **the robot maintains a plurality of particles indicating the likely parts of the path**. That is, [an] individual particle points at a particular image from the training buffer. As a new camera image arrives, the robot may search those images in the training buffer which are close to the particles. **Individual particles may be moved to a nearby location in the training buffer where the stored image matches closely with the newly arrived image**. Particles with poor match with the new image may be deleted. New particles may be created, either in the vicinity of the other particles, or from randomly sampled locations in the training buffer, shown in FIG. 22.
>
> The particle characterized by the best match (e.g., comprising previously used image) may be referred to as the primary particle. In some implementations, the best match image may be complemented by one or more second best image matches, corresponding to secondary particles.
>
> The given image may be compared to images of the primary particle set . . . [or] may be compared to images of one or more secondary particle set(s). . . .

Ex. 1002 ¶ 101 (emphasis in original); Pet. 33; Pet. Reply 16–17; Ex. 1010 ¶ 39; Ex. 1004, 39:40:19.

However, neither Petitioner nor Dr. Janet explains how Grotmol's "particle filtering" discloses "connections" between images. Pet. 33; Pet. Reply 16–17; Ex. 1002 ¶ 101; Ex. 1010 ¶ 39. In his first declaration, Dr. Janet merely states that "Grotmol describes 'particle filtering,'" and quotes the above portions of Grotmol without further explanation. Ex. 1002 ¶ 101. In his second declaration, after quoting some of the same portions of Grotmol, Dr. Janet states that "the sequence of images stored in Grotmol's ordered training buffer serve to connect images that are temporally

proximate to a limited number of 'particle' images," but does not explain how the system allegedly generates "connections" between images that are temporally proximate to "particle" images, or how this connection of images to "particle" images constitutes generation of connections between first and second correlations (or second and fourth correlations) as recited in claim 7. Ex. 1010 ¶ 40; *see* Pet. 33; Pet. Reply 16–17. Similarly, Dr. Janet states that "even if a 'connection' required a link as urged by [Patent Owner]," one of ordinary skill "would have understood the connections provided by Grotmol's ordered training buffer to link temporally proximate images (e.g., to a particle image)." *Id.* Again, however, Dr. Janet does not explain how the use of "particle images" involves generating "connections" (links) between temporally proximate images in the training buffer, other than by simply storing the images in temporal order which, as explained above, we find is insufficient to meet the language of claim 7.

Consequently, Petitioner has failed to sufficiently show that Grotmol discloses limitation [7.2].

c) Conclusion—Claim 7

After consideration of the contentions and the evidence of record, we find that Petitioner has not established by a preponderance of the evidence that Grotmol discloses each recitation of claim 7.

E. Ground 3: Unpatentability of Claims 4 and 11 as Obvious over Grotmol and Hickman[4]

Petitioner asserts that claims 4 and 11 would have been obvious over Grotmol in view of Hickman. Pet. 4, 58–66. We begin with an overview of Hickman, and then turn to the parties' contentions.

1. Overview of Hickman (Ex. 1005)

Hickman is titled "Shared Robot Knowledge Base for Use with Cloud Computing System." Ex. 1005, code (54). Hickman discloses that "[t]he advantages of a shared robot knowledge base 306 multiply as robots are deployed around the world." *Id.* at 11:31–41. "If information about a particular object is 'public' and therefore accessible by all robots," Hickman explains, "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." *Id.* "In operation," according to Hickman, "many millions or even many billions of robots may ultimately access the shared robot knowledge base 306." "As a result," Hickman discloses, "the shared robot knowledge base 306 enables robots to benefit from the collective information learned by many other robots. *Id.*.

2. Motivation to Combine Grotmol and Hickman

Petitioner argues that one of ordinary skill "would have been motivated to combine the autonomous robotic system of Grotmol with the shared robot knowledge base of Hickman." Pet. 58–61 (citing Ex. 1002 ¶¶ 142–149). Petitioner asserts that "Grotmol teaches that the training sets

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[4] Because, as discussed below, we find that Petitioner has demonstrated that claim 11 is unpatentable over the combination of Grotmol and Hickman, we need not reach Petitioner's argument that claim 11 is unpatentable over Grotmol alone.

and training configurations from a first robot can be 'stored' or 'saved,'" and the saved training configuration "may then be 'loaded into the robot being trained thereby providing one or more trained behaviors to the robot.'" *Id.* at 59 (citing Ex. 1004, 33:12–58). "Further," according to Petitioner, "the 'trained configuration may be loaded to one or more *other robots* in order to provide learned behaviors.'" *Id.* (citing Ex. 1004, 33:30–32).

Petitioner argues that "Hickman teaches a shared robot knowledge base that could advantageously be paired with Grotmol's autonomous robotic system in order to further facilitate the sharing of learned behaviors." Pet. 59. Petitioner quotes the following excerpt from Hickman to support its position:

> 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.

Id. (quoting Ex. 1005, 11:31–41). According to Petitioner, "Hickman additionally teaches that '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, 5:42–46). Additionally, Petitioner contends, "Hickman further teaches that cloud computing may 'free users

from certain hardware and software installation and maintenance tasks.'" *Id.* at 59–60 (citing Ex. 1005, 1:38–41).

Petitioner argues that one of ordinary skill "would have been familiar with the teachings of both Grotmol and Hickman and would have readily appreciated the advantages of their combination." Pet. 60 (citing Ex. 1002 ¶¶ 142–149). In support, Petitioner cites a 2014 article in *Science* magazine including an interview with the CEO of the assignee of Grotmol which, Petitioner contends "expressly contemplated the benefits of the kinds of shared robot learning described in Hickman." *Id.* According to Petitioner, this article explains that:

> The Internet, in turn, will allow far-flung robots to share those lessons and skills. A robot that learns how to pick a strawberry without crushing it, for instance, could uplink that skill for the benefit of its kind around the globe.

Id. (quoting Ex. 1006, 183; citing Ex. 1002 ¶ 148).

Petitioner argues that both Grotmol and Hickman "are directed to the same field of the training and autonomous operation of robots," and "Hickman is listed on the face of Grotmol as a cited U.S. patent document." Pet. 60 (citing Ex. 1002 ¶¶ 142–147). Additionally, Petitioner contends, "Grotmol and Hickman also describe a similar problem in which a robot learns how to 'fetch' from a human," where "Grotmol describes the task as 'quite complex'" and "Hickman teaches that the fetch task can be 'optimiz[ed] . . . based on the collective experience of many different robots.'" *Id.* at 60–61 (citing Ex. 1005, 23:49–24:25; Ex. 1004, 24:31–48, 27:28–40, Fig. 9) (alteration in original). Relying on the testimony of Dr. Janet, Petitioner argues that "[t]he resulting combination of Grotmol's autonomous robotic system and Hickman's shared robot knowledgebase would have been expected and predictable." *Id.* at 61 (citing Ex. 1002

¶ 150). "Grotmol expressly contemplates the sharing of trained configuration among robots," according to Petitioner, "and Hickman's expansion upon this idea does not interfere with Grotmol's autonomous robotic system." *Id.* (citing Ex. 1002 ¶¶ 142–149).

Patent Owner responds that Petitioner's proposed combination relies on "impermissible hindsight to arrive at the claimed invention." PO Resp. 38 (citing Ex. 2007 ¶¶ 108–110). Patent Owner argues that "Grotmol discloses one user operating one device in one learning process," and that "[t]he knowledge gained from this process in Grotmol, when loaded into a second device, is still knowledge of one user operating one device in one learning process." *Id.* "Further," according to Patent Owner, "Hickman's simple cloud storage of single object information does not contemplate using correlations, circumstance representations, and other data structures to learn knowledge for autonomous operation as required by claims 4 and 11." *Id.*

Patent Owner criticizes Petitioner's obviousness analysis as deficient "because it fails to explain what claim limitation is missing from Grotmol and how Hickman discloses the missing claim limitation." PO Resp. 38. Patent Owner further argues that Petitioner's use of impermissible hindsight is highlighted by its assertion that "[i]n the combination of Grotmol and Hickman, the shared knowledge base[] would include multiple training sets (i.e., circumstance representations correlated with instruction set) learned during the operation of multiple devices," because "Petitioner is using the claimed use of correlations, multiple users, and multiple devices as a roadmap for its obviousness combination." *Id.* at 39 (citing Pet. 63; Ex. 2007 ¶¶ 109–110; Ex. 1002 ¶ 155). Finally, according to Patent Owner, "it would not have been obvious to one skilled in the art to use Hickman's

simple cloud storage method disclosing no circumstance representations and correlations with Grotmol's single-device training sets to arrive at the inventions of claims 4 and 11." *Id.*

Patent Owner further argues that "Hickman teaches away from the claimed 'fourth correlation'" because "Hickman teaches that images are stored in one knowledgebase 307 while instruction sets are stored ***separately (i.e., uncorrelated)*** in anther knowledgebase 309." PO Resp. 40 (citing Ex. 1005, 13:64–21:39; Ex. 2007 ¶¶ 109–110). "In light of this storage structure," Patent Owner asserts, "and that Grotmol allegedly discloses that training sets stored in memory include correlated images and instruction sets that are stored ***together***, Hickman teaches away from the claimed 'fourth correlation.'" *Id.* (citing Ex. 1004, 3:35–49; Ex. 2007 ¶¶ 109–110) (citation omitted). "Further," according to Patent Owner, "Hickman also teaches away from the fourth circumstance representation since single object information stored in each row of Unique Object Knowledge Base 307 in Hickman is not a circumstance representation." *Id.* (citing Ex. 2007 ¶ 110). Instead, Patent Owner argues, "Hickman focuses on manipulating a single object and uses single object information," which "is not a circumstance representation." *Id.* at 35 (citing Ex. 2007 ¶¶ 104–105). And, Patent Owner contends, "instances of single object information" are "learned from separate circumstances, further proving that single object information is not a circumstance representation." *Id.* at 35–36.

Petitioner responds that "the organization of knowledgebases is not relevant to the combination of Grotmol and Hickman," because the combination "more generally applies Hickman's teachings of facilitating knowledge sharing among different robots through a cloud computing

system and does not rely on the specific organization of knowledgebases in Hickman." Pet. Reply 21 (citing Pet. 58–61). Petitioner argues that Patent Owner's "reliance on other features of Hickman to argue non-obviousness is without merit" because "[t]he test for obviousness is not whether the features of the secondary reference may be bodily incorporated into the structure of the primary reference." *Id.* (citing *Allied Erecting v. Genesis Attachments*, 825 F.3d 1373, 1381 (Fed. Cir. 2016); Ex. 1010 ¶ 49).

Petitioner further asserts that Patent Owner incorrectly describes Hickman because Hickman is not limited to "storing instruction sets and images separately in separate knowledgebases" but instead "discloses different implementations in which the task data can optionally be included or excluded in the same knowledge base as the images." Pet. Reply 23 (citing Ex. 1010 ¶ 51). In support, Petitioner points to Hickman's disclosure that "[i]n some embodiments where the task data (TASKS) includes robot instruction code for performing tasks, the shared robot knowledge base 304 ***may not require a separate task knowledge base 309***," but in other embodiments, the task data "can be looked up in a separate task knowledge base 309." *Id.* Petitioner further contends that Hickman teaches that the unique knowledge base 307 "may contain more or less data corresponding to a particular unique object identifier (UID)" and "may have many more additional categories of data 15 than the categories shown in conceptual data structure 313." *Id.* (citing Ex. 1005, 12:5–18). Thus, Petitioner argues, "Hickman's disclosure, even if limited to the use of the unique object knowledge base 307, would not have taught against the combination of Grotmol and Hickman" because "Hickman contemplates the addition of

other fields to the unique object knowledge base 307 and does not exclude the addition of task data." *Id.* at 23–24 (citing Ex. 1010 ¶ 52).

Petitioner further argues that Patent Owner's assertion that Hickman does not disclose the claimed circumstance representation is "immaterial" because "the Petition does not rely on Hickman's disclosure of circumstance representation." Pet. Reply 24 (citing Ex. 1010 ¶ 54). Moreover, Petitioner asserts, "Hickman clearly discloses robot interactions with multiple objects, not just one," for example, by disclosing that "the shared robot knowledge base includes data about a ***vast number of various objects that robots may encounter and/or interact with in their everyday environments***," and that "[t]he shared robot knowledge base ***may also include robot instructions for interacting with the objects***." *Id.* at 24–25 (citing Ex. 1005, 2:48–64, 6:53–57, 4:66–5:2, 8:36–44). And, Petitioner contends, Patent Owner "fails to explain how Hickman's various knowledge bases that include object identification information, images, tasks, and more . . . do not disclose circumstance representation." *Id.* at 26–27 (citing PO Resp. 35–37; Pet. 11–20, 25–28; Ex. 1010 ¶ 51).

Finally, Petitioner argues that Patent Owner fails to rebut or provide any evidence undermining the reasons set forth in the Petition why one of ordinary skill would have combined Grotmol and Hickman, and thus has no basis for its accusations of "hindsight." Pet. Reply 27.

Patent Owner responds that "Petitioner's claim that 'the organization of knowledgebases is not relevant to the combination of Grotmol and Hickman'" is "undermined by the fact that a key component of the inventions of claims 4 and 11 is the single, mixed knowledgebase that includes mixed knowledge of correlations learned in different learning

processes involving different devices, and different users (in claim 11)." PO Sur-reply 21. Patent Owner argues that Petitioner's "attempt to divorce" Hickman's "very general" teachings of "'facilitating knowledge sharing among different robots through a cloud computing system' (that cannot be used in a proper combination and obviousness analysis due to generality) from ***the specific*** 'organization of knowledgebase in Hickman' (that does not disclose the claimed invention), fails because the manner in which correlations are learned, structure, and claimed in a single knowledgebase is a critical part of the claimed invention." *Id.* at 21–22 (emphasis omitted) (citation omitted).

Patent Owner also contends that its argument against the Grotmol-Hickman combination has nothing to do with "bodily incorporation," but rather with "the fact that Hickman discloses storing instruction sets and images separately in separate knowledgebases," which a person of ordinary skill "would have found to be incompatible with (and to teach away from) Grotmol's disclosure of training sets or correlations with images and instruction sets correlated and stored together that is a fundamental element missing in Hickman required for the alleged Grotmol-Hickman combination to work at all." PO Sur-reply 22 (citing Ex. 2007 ¶¶ 104–105). Moreover, Patent Owner asserts that Petitioner improperly sets forth a new argument that "maps the tasks data disclosed by Hickman to the claimed instruction sets." *Id.* at 22–23 (citing Pet. Reply 21–24).

Additionally, Patent Owner argues that one of ordinary skill "reading Hickman's disclosure of images and instruction sets stored separately would not have been motivated" to make the proposed combination, particularly because Petitioner fails to explain "how to modify/combine Grotmol and

Hickman, and failure to provide evidence of a reasonable expectation of success." PO Sur-reply 23 (citing Ex. 2007 ¶¶ 109–110). Patent Owner further argues that Hickman's statement contemplating "the addition of other fields to the unique object knowledge base 307" says nothing about "Hickman's disclosure of storing instruction sets and images separately that teaches away from the claimed invention." *Id.*

Finally, Patent Owner argues that its "teaching away" arguments are not immaterial to the combination because "Hickman discloses (i) ***storing images and instructions separately in separate knowledgebases (see Ex-1005, Fig. 3) that is not a correlation*** as well as (ii) ***a single object information that is not a circumstance representation***." PO Sur-reply 24. "Hence," Patent Owner contends, "Hickman does not disclose or suggest (and further teaches away from) (i) any correlations and (ii) any circumstance representations." *Id.* "Since ***both*** circumstance representations and correlations are fundamental to the operation of the system in Grotmol," according to Patent Owner, "Hickman must disclose ***both*** the circumstance representations and correlations in order to be combinable with Grotmol at all." *Id.* (citing Ex. 2007 ¶ 106).

Based on the full trial record, Petitioner has sufficiently shown that one of ordinary skill would have been motivated to combine Grotmol and Hickman as Petitioner proposes. We find credible the assertions of Petitioner and Dr. Janet that both Grotmol and Hickman are directed to the same field of the training and autonomous operation of robots, that both references describe a similar problem in which a robot learns how to fetch from a human, and that one of ordinary skill would have understood that Hickman's shared robot knowledge base could have advantageously been

paired with Grotmol's autonomous robotic system to further facilitate the sharing of learned behaviors. *See* Pet. 58–61; Ex. 1002 ¶¶ 142–149.

We do not agree with Patent Owner that Petitioner's combination is based on impermissible hindsight. *See* PO Resp. 38. We disagree with Patent Owner's argument that Hickman does not disclose using "correlations, circumstance representations, and other data structures to learn knowledge for autonomous operation," because Petitioner relies on Grotmol for these elements of the claims. *Id.* We also disagree with Patent Owner's argument that Hickman discloses storing instruction sets and images separately in separate knowledgebases which one of ordinary skill would have found to be incompatible with Grotmol's disclosure of training sets or correlations with images and instruction sets correlated and stored together. *See* PO Resp. 35, 39–40. As Petitioner explains, its combination "generally applies Hickman's teachings of facilitating knowledge sharing among different robots through a cloud computing system and does not rely on the specific organization of knowledgebases in Hickman." *See* Pet. Reply 21.

Similarly, we disagree with Patent Owner's argument that Hickman's disclosure of storing images in one knowledgebase (307) while instruction sets are stored separately in another knowledgebase (309) "teaches away" from the proposed combination, because Petitioner relies on Grotmol for the storage and correlation of images and instruction sets, and one of ordinary skill would have understood that a variety of possible storage systems could have been used. Patent Owner does not point to anything in Hickman that disparages or encourages the storage of images and instruction sets in the same knowledgebase, as Grotmol does. Thus, we agree with Petitioner that Hickman would not have discouraged one of ordinary skill from using

Grotmol's system that stores images and instruction sets in the same knowledgebase.

We also are not persuaded by Patent Owner's argument that Hickman teaches away from the fourth circumstance representation because single object information stored in knowledgebase 307 is not a circumstance representation, and Hickman focuses on manipulating a single object. Even if Patent Owner's characterization of Hickman were true, Petitioner relies on Grotmol to teach the claimed circumstance representations, and relies on Hickman for its teaching of facilitating knowledge sharing among different robots through a cloud computing system. We see nothing in Hickman's disclosure of object manipulation that would discourage one of ordinary skill from applying Hickman's teaching of facilitating knowledge sharing among robots in Grotmol's system, which uses circumstance representations. We also agree with Petitioner that Hickman discloses robot interactions with multiple objects, and is not limited to interactions with only one object. *See* Pet. Reply 24–25; Ex. 1005, 2:53–57 ("In some embodiments, the shared robot knowledge base includes data about a vast number of various objects that robots may encounter and/or interact with in their everyday environments."), 2:57–58 ("The shared robot knowledge base may also include robot instructions for interacting with the objects."). Furthermore, we agree with Petitioner that Patent Owner fails to sufficiently explain how Hickman's various knowledge bases that include object identification information, images, tasks, and more do not disclose circumstance representations. *See* Pet. Reply 26–27 (citing PO Resp. 35–37; Pet. 11–20, 25–28; Ex. 1010 ¶ 51).

Consequently, we find that Petitioner has sufficiently shown that one of ordinary skill would have been motivated to combine Grotmol and Hickman as Petitioner proposes.

3. Dependent Claim 4

Petitioner argues that "Grotmol in combination with Hickman renders obvious the additional requirement of claim 4 that the knowledgebase includes a fourth correlation, which includes a circumstance representation detected by sensors of a second device correlated with an instruction set for operating the second device." Pet. 61 (citing Ex. 1002 ¶¶ 150–155). Petitioner asserts that "Grotmol discloses that the training sets and training configurations from a robot (which include the instruction sets for operating first device) can be 'stored' or 'saved," and the saved training configuration "may then be 'loaded into the robot being trained thereby providing one or more trained behaviors to the robot.'" *Id.* at 62 (citing Ex. 1004, 33:12–58). "Further," according to Petitioner, "the 'trained configuration may be loaded to one or more *other robots* in order to provide learned behaviors.'" *Id.* (citing Ex. 1004, 33:30–32). "Thus," Petitioner contends, "Grotmol discloses that the memory component of a first robot can store the claimed first and second correlations as well as a fourth correlation learned from operating a second robot—i.e., a circumstance detected by the sensor of a second robot correlated with instructions for operating that second robot." *Id.* (citing Ex. 1002 ¶ 152). For example, Petitioner argues, Grotmol discloses "situations in which the user may wish to train the robot to 'find an object, grasp it, and bring it back' (i.e., fetch)," explains that this "task of playing fetch may be quite complex," and "outlines numerous user training

steps that would be needed in order to teach this skill to the robot." *Id.* (citing Ex. 1004, 24:31–25:5).

Petitioner argues that "Hickman discloses such a system wherein learned robot behaviors are uploaded to a shared knowledge base for use in other robots." Pet. 62. More specifically, Petitioner asserts, "Hickman discloses 'a shared robot knowledge bases for use with cloud computing systems'" that "'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[,] . . . sends instructions for interacting with an object to a robot[,] . . . [and] sends instructions to a robot for executing an application based on information stored in the shared robot knowledge base.'" *Id.* at 63 (citing Ex. 1005, code (57)) (ellipses in original). "As noted in Hickman," Petitioner contends, "the '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.'" *Id.* And, according to Petitioner, Hickman discloses that "robot experiences" may include "'coaching' from humans" similar to "the training described in Grotmol." *Id.* (citing Ex. 1005, 23:36–48; Ex. 1002 ¶ 155). "For example," Petitioner asserts, "similar to the 'fetch' behavior described in Grotmol, Hickman describes a human coach training a robot how to properly grasp objects such as a cup, uploading and storing this information on a shared knowledge base (memory), then having another robot obtain these instructions from the memory and executing the instructions." *Id.* (citing Ex. 1005, 26:21–27:21).

"In the combination of Grotmol and Hickman," Petitioner argues, "the shared knowledge base[] would include multiple training sets (i.e.,

circumstance representations correlated with instruction set) learned during the operation of multiple devices." Pet. 63. "Accordingly," Petitioner contends, "the shared knowledge base[] would include training sets learned during operating of a first device (i.e., first and second circumstance representations correlated with first and second instruction sets for operating a first device) as well as trainings sets learned during operation of another device (i.e., fourth circumstance representation correlated with instruction set for operating a second device)." *Id.* (citing Ex. 1002 ¶¶ 150–155).

Patent Owner responds that Grotmol and Hickman fail to disclose "a fourth correlation including a fourth circumstance representation correlated with a fourth one or more instruction sets for operating the second device." PO Resp. 42 (citing Ex. 2007 ¶¶ 113–120). Patent Owner argues that Grotmol does not actually disclose a robot storing a fourth correlation learned from operating a second robot, and that Petitioner's arguments are "Petitioner's own words" and "conclusory." *Id.* Instead, Patent Owner asserts, "Grotmol discloses one user operating one device in one learning process," even when the knowledge is loaded into a second device. *Id.* On the other hand, according to Patent Owner, Hickman "does not disclose or suggest (and further teaches away from) correlations and circumstance representations at all," and instead discloses "storing images and instructions separately in separate knowledgebases" that "is not a correlation," as well as "a single object information that is not a circumstance representation." *Id.* at 42–43 (citing Ex. 1005, Fig. 3; Ex. 2007 ¶¶ 113–120) (emphasis omitted). "Hence," Patent Owner contends, "Hickman does not disclose or suggest (and further teaches away from) ***any*** correlations including ***any*** circumstance representations correlated with any instruction sets." *Id.* at 43.

Next, Patent Owner argues that the Grotmol-Hickman combination fails to disclose the claimed "fourth circumstance representation" that "represents a fourth circumstance detected at least in part by the one or more sensors of the second device." PO Resp. 43 (citing Ex. 2007 ¶ 114). Patent Owner again argues that Grotmol merely discloses "one user operating one device in one learning process" and that there is no detection of "a circumstance with a sensor of a second device." *Id.* (citing Ex. 2007 ¶¶ 114–120). On the other hand, according to Patent Owner, Hickman "discloses ***a single object information that is not a circumstance representation***," and does not "detect[] any circumstances," let alone by a "with a sensor of a second device." *Id.* at 43–44 (citing Ex. 2007 ¶¶ 114–120). Indeed, Patent Owner contends, "Hickman fails to disclose circumstance representations at all" because Hickman's single objects "do not represent a circumstance and are not included in a circumstance representation but in separate single object rows" of "Unique Object Knowledgebase 307 as shown in Figure 3 of Hickman." *Id.* at 47 (citing Ex. 2007 ¶¶ 118–120).

Further, Patent Owner contends, Grotmol and Hickman fail to disclose that "at least a portion of the fourth correlation is learned ***in another learning process***" that includes "generating or receiving ***the fourth circumstance representation***, and obtaining or receiving the fourth one or more ***instruction sets for operating the second device***." PO Resp. 44 (citing Ex. 2007 ¶¶ 115–120). Patent Owner acknowledges that Hickman "discloses a cloud system that can generally learn from multiple devices," but "still discloses only a single object information (not a circumstance representation) and separate (i.e., uncorrelated) instructions" that do not

disclose "a correlation that includes a circumstance representation correlated with an instruction set." *Id.* (citing Ex. 2007 ¶¶ 115–120).

Finally, Patent Owner points to Dr. Janet's deposition testimony, arguing that he was "evasive," "refused to directly answer the questions," and attempted to deviate from the opinions in his declaration, and also confirmed that Hickman discloses storing images and instructions in different databases. PO Resp. 47–50 (citing Ex. 2008, 79:4–10, 82:2–92:11, 93:12–17, 93:24–94:2, 95:15–96:19, 101:8–23, 102:2–103:25, 105:15–16, 105:18–108:6, 131:18–140:9, 143:21–144:13).

Petitioner responds that Patent Owner's arguments are substantially the same as those previously addressed, such as its argument that Grotmol is limited to "one user operating one device in one learning process" and that Hickman "discloses only a single object information (not a circumstance representation) and separate (i.e., uncorrelated) instructions that do not disclose a correlation." Pet. Reply 27–28 (citing PO Resp. 41–46; Ex. 1010 ¶ 59). Patent Owner also relies in its Sur-reply on the obviousness arguments previously discussed in connection with the motivation to combine Grotmol and Hickman. PO Sur-reply 21–25.

Based on the full trial record, Petitioner has sufficiently shown that claim 4 would have been obvious over the Grotmol-Hickman combination. For similar reasons as discussed in Section II.E.2 above concerning motivation to combine Grotmol and Hickman, we disagree with Patent Owner's arguments to the contrary. As discussed above, Patent Owner's argument that "Grotmol discloses one user operating one device in one learning process" and that Hickman does not disclose "correlations" and "circumstance representations" does not properly consider the combination

proposed by Petitioner. Petitioner relies on Grotmol to teach the claimed "correlations" and "circumstance representations" and "generally applies Hickman's teachings of facilitating knowledge sharing among different robots through a cloud computing system." Pet. Reply 21; Pet. 58–61. Similarly, Patent Owner's argument that Hickman discloses "storing images and instructions separately in separate knowledgebases" is not persuasive because Petitioner does not rely on "the specific organization of knowledgebases in Hickman" in the proposed combination for this claim. PO Resp. 42–43; Pet. Reply 21.

Additionally, as discussed above with respect to motivation to combine, we do not agree with Patent Owner's assertion that Hickman only discloses "a single object information that is not a circumstance representation," because Hickman discloses robot interactions with multiple objects, and is not limited to interactions with only one object. *See* Pet. Reply 24–25; PO Resp. 43–44; Ex. 1005, 2:53–57. Finally, we have reviewed Dr. Janet's deposition testimony cited by Patent Owner, and find that it does not overcome the showing of obviousness made by Petitioner in this proceeding.

Consequently, after consideration of the contentions and the evidence of record, we find that Petitioner has not established by a preponderance of the evidence that claim 4 would have been obvious over the combination of Grotmol and Hickman.

4. Dependent Claim 11

Dependent Claim 11 recites as follows:

> 11. The method of claim 1, wherein the knowledgebase further includes a fourth correlation including a fourth circumstance representation correlated with a fourth one or more instruction

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

Ex. 1001, 171:44–53.

Petitioner argues that Grotmol discloses:

> (i) training a robot wherein images (circumstance representations) detected by a camera during operation of the robot are correlated with motor commands (instructions); (ii) multiple training (learning) processes can be done to train multiple behaviors; and (iii) a robot can be loaded with a first trained configuration learned during a training process involving operation of that robot by a user, and can also be loaded with another trained configuration from a training process involving operation of a different robot by a user.

Pet. 64 (citing Ex. 1004, 33:24–35; Ex. 1002 ¶ 156).

Petitioner argues that "Hickman discloses 'a shared robot knowledge bases for use with cloud computing systems'" that "'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[,] . . . sends instructions for interacting with an object to a robot[,] . . . [and] sends instructions to a robot for executing an application based on information stored in the shared robot knowledge base.'" Pet. 64–65 (citing Ex. 1005, code (57)) (ellipses in original). Petitioner asserts that, as noted in Hickman, the "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." *Id.* at 65 (citing Ex. 1005, code (57)). Additionally, according to Patent Owner, Hickman discloses that "robot experiences" may include "'coaching' from *humans*'" like "the training

described in Grotmol." *Id.* (citing Ex. 1005, 23:36–48; Ex. 1002 ¶ 156). "For example," Petitioner asserts, "similar to the 'fetch' behavior described in Grotmol, Hickman describes a human coach training a robot how to properly grasp objects such as a cup, uploading and storing this information on a shared knowledge base (memory), then having another robot obtain these instructions from the memory and executing the instructions." *Id.* (citing Ex. 1005, 26:21–27:21).

"As explained above," Petitioner argues, "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." Pet. 65 (citing Ex. 1002 ¶ 157). "The combination," according to Petitioner, "discloses and renders obvious a knowledgebase that includes circumstance representations correlated with instructions for operating a first device (i.e., claimed first and second circumstance representations correlated with first and second instruction set for operating the first device) learned during a training using the first device," and "also includes a circumstance representation correlated with instructions for operating a different device (i.e., claimed fourth circumstance representation correlated with fourth instruction set for operating a second device) learned during a training using the different device." *Id.* at 65–66 (citing Ex. 1002 ¶¶ 156–157).

Relying on substantially similar arguments as those advance for claim 4, Patent Owner asserts that the Grotmol-Hickman combination fails to disclose: (1) "a fourth correlation including a fourth circumstance representation correlated with a fourth one or more instruction sets for operating the second device"; (2) "wherein the fourth circumstance

representation represents a fourth circumstance detected at least in part by the one or more sensors of the second device." PO Resp. 50–52. For example, Patent Owner argues that Grotmol "discloses one user operating one device in one learning process," that Hickman does not disclose correlations or circumstance representations and stores images and instructions separately in separate knowledgebases, and that Hickman discloses only the use of single object information that is not a circumstance representation. *Id.*

Patent Owner also argues that Grotmol and Hickman fail to disclose "at least a portion of the fourth correlation is learned in another learning process that includes operating the second device at least partially by another user." PO Resp. 52 (citing Ex. 2007 ¶¶ 125–129). Patent Owner asserts that Grotmol does not disclose another learning process "involving a second device operated by another user " and Hickman also fails to disclose a fourth correlation that "is specifically learned in another learning process that includes operating a second device by another user." *Id.* at 52–54 (citing Ex. 2007 ¶¶ 125–129).

Finally, Patent Owner argues that Dr. Janet's deposition testimony shows that he failed to perform a proper obviousness analysis for essentially the same reasons as discussed above in connection with claim 4. PO Resp. 55–56.

Based on the full trial record, Petitioner has sufficiently shown that claim 11 would have been obvious over the combination of Grotmol and Hickman. *See* Pet. 64–66; Ex. 1002 ¶¶ 156–157. Claim 11 adds to claim 4 the limitation that the fourth correlation is learned in another learning process that includes operating the second device at least partially "by

another user." Ex. 1001, 171:50–53. Hickman teaches this limitation by disclosing that "information in the shared robot knowledge bases is updated based on robot experiences so that any particular robot may benefit from prior experience of other robots," and that "robot experiences" may include "'coaching' from humans" like the training described in Grotmol. Pet. 64–65; Ex. 1002 ¶ 156. For example, Hickman describes a human coach training a robot how to properly grasp objects such as a cup, uploading and storing this information on a shared knowledge base (memory), and then having another robot obtain these instructions from the memory and execute them. Ex. 1005, 26:21–27:21. We agree with and find credible Dr. Janet's testimony that one of ordinary skill would understand that, in the Grotmol-Hickman combination, "the shared knowledgebase would include training sets learned during operation of a first robot by a user (i.e., first and second circumstance representations correlated with first and second instruction sets for operating a first device) as well as training sets learned during operation of another robot by another user (i.e., fourth circumstance representation correlated with instruction set for operating a second device)." Ex. 1002 ¶ 157.

Patent Owner's remaining arguments, which are substantially similar to its arguments for claim 4, do not overcome Petitioner's showing, as discussed above with respect to claim 4. *See* § II.E.2, *supra*.

Consequently, after consideration of the contentions and the evidence of record, we find that Petitioner has not established by a preponderance of the evidence that claim 11 would have been obvious over the combination of Grotmol and Hickman.

III. ANALYSIS OF PROPOSED SUBSTITUTE CLAIMS

Patent Owner's Motion to Amend requests that, "[i]n the event the Board finds any of original claims 4, 5, 7, or 11 unpatentable . . . the Board grant this motion to amend and issue the corresponding substitute claims" 21–24. MTA 1. The Motion to Amend also submits that "[c]laims 14 and 15 are hereby cancelled" and requests that "the Board issue claims 25 and 26 as substitutes for claims 14 and 15, respectively," noting that Patent Owner "does not condition its request regarding claims 25 and 26 on any condition." *Id.* at 1, 2 n.1. For the reasons discussed above, we have determined that Petitioner has proved, by a preponderance of evidence, that claims 4 and 11 '974 patent are unpatentable. We, therefore, proceed to address proposed substitute claims 21 and 24–26 in Patent Owner's Motion to Amend. Because Petitioner has not sufficiently proven that claims 5 and 7 are unpatentable, we do not address proposed substitute claims 22 and 23.

A. Illustrative Proposed Amended Claim

Proposed substitute claim 21 is illustrative[5] 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.[21.1[6]] A method implemented using a computing system that includes one or more processor circuits, the method comprising:

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[5] The parties agree that proposed substitute claims 22–26 were amended to recite the same amended features recited in claim 21. *See* MTA 22–23; Opp. MTA 18–25.

[6] We use Petitioner's designations for the elements of claim 21. *See* Opp. MTA App. A.

[21.2] accessing a memory that stores at least a knowledgebase that includes: a first correlation including a first circumstance representation correlated with a first one or more instruction sets for operating a first device and a second correlation including a second circumstance representation correlated with a second one or more instruction sets for operating the 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 the second circumstance representation represents a second circumstance detected at least in part by the one or more sensors of the first device,

[21.3] and wherein at least a portion of the first correlation and at least a portion of the second correlation are learned in a learning process that includes operating the first device at least partially by a user;

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

[21.5] anticipating the first one or more instruction sets for operating the first device learned in the learning process based on at least partial match between the third circumstance representation and the first circumstance representation; and

[21.6] at least in response to the anticipating, executing the first one or more instruction sets for operating the first device learned in the learning process, 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 learned in the learning process;

[21.7] wherein the learning process includes: generating or receiving the first circumstance representation, and

generating or receiving the second circumstance representation; and,

[21.8] obtaining or receiving the first one or more instruction sets for operating the first device, and obtaining or receiving the second one or more instruction sets for operating the first device,

[21.9] and wherein the knowledgebase further includes a fourth correlation including a fourth circumstance representation correlated with a fourth one or more instruction sets for operating the second device, and wherein the fourth circumstance representation represents a fourth circumstance detected at least in part by the one or more sensors of the second device, and wherein at least a portion of the fourth correlation is learned in another learning process that includes: generating or receiving the fourth circumstance representation; and obtaining or receiving the fourth one or more instruction sets for operating the second device;

[Sub-1] <u>wherein the first circumstance representation includes a first collection of object representations, and the second circumstance representation includes a second collection of object representations;</u>

[Sub-2] <u>wherein the first collection of object representations represents multiple objects detected at a first time or during a first time period, and comprises a first data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects;</u>

[Sub-3] <u>wherein the second collection of object representations represents the multiple objects detected at a second time or during a second time period, and comprises a second data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects;</u>

[Sub-4] <u>wherein the first data structure is correlated with the first one or more instruction sets for operating the first device; and</u>

> [Sub-5] <u>wherein the second data structure is correlated with the second one or more instruction sets for operating the first device.</u>

MTA App. A 1–3.

B. 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.

C. 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 1–16. Petitioner does not argue otherwise. *See generally* Pet. MTA Opp.; Pet. MTA Sur-reply. We determine that Patent Owner meets this requirement.

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, 24, 25, and 26 recite new limitations, and new combinations of limitations, that directly respond to the grounds of unpatentability involved in the trial. *See* MTA 3, 18–23, App. A 1–16. Petitioner does not argue otherwise. *See generally* Pet. MTA Opp.; Pet. MTA Sur-reply. We determine that Patent Owner meets this requirement.

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, 24, 25, and 26 (i) retain all limitations of their original corresponding claims 4, 11, 14, and 15 (including the original dependent and independent claims from which claims 4, 11, 14, and 15 depend), and (ii) further include additional limitations as compared to respective claims 4, 11, 14, and 15. Proposed substitute claims 21 and 24–26 do not enlarge the scope of the claims of the challenged patent. *See* MTA 4–5, App. A 1–16. Petitioner does not argue otherwise. *See generally* Pet. MTA Opp.; Pet. MTA Sur-reply. We determine that Patent Owner meets this requirement.

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 and 24–26. *See* MTA 5–16. Petitioner does not argue otherwise. *See generally* Pet. MTA Opp.; Pet. MTA Sur-reply. We determine that each proposed substitute claim is supported by the

original disclosure of the '974 patent and does not seek to add new matter. Accordingly, Patent Owner has met this requirement.

D. 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. Motivation to Combine Grotmol and Hickman

Petitioner relies on its reasons to combine Grotmol and Hickman presented in the Petition. Pet. MTA Opp. 12–13. 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 13 (citing Ex. 1010 ¶¶ 67–68; Ex. 1005, 10:57–11:7, 11:47–20:20, Fig. 3). Petitioner also argues that "[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 that was well-within the capabilities of a" person of ordinary skill. *Id.* (citing Ex. 1010 ¶ 68; Ex. 1005, 10:57–11:7). Petitioner further argues that "[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 and such a person would have had a reasonable expectation of success in implementing the combination. *Id.* at 13–14 (citing Ex. 1010 ¶¶ 68–69).

In its MTA Reply, Patent Owner argues that, "[f]or the limitations discussed in Sections III.A.1-2 and III.B.1-2 (and indeed, all the other added

limitations of the substitute claims), Petitioner has utterly failed to present 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***." PO MTA Reply 11. Patent Owner acknowledges that Petitioner's MTA Opposition brief "includes sections regarding motivation to combine Grotmol and Hickman," but argues that those sections present arguments "only at an abstract, high level of generality, completely divorced from the specific limitations added to the substitute claims." *Id.* (citing Pet. MTA Opp. 12–18).

We find Petitioner's arguments in its Opposition to be supported by the evidence of record and not undermined by Patent Owner's arguments. To begin with, we agree with Petitioner that Hickman discloses that it is not limited to the specific knowledge base design shown in Figure 3, but instead explains that different arrangements of data in knowledge bases can be used:

> 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. Pet. MTA Opp. 12–15 (citing, *e.g.*, Ex. 1004, 33:13–35, 38:33–41, Fig. 8; Ex. 1005, 10:57–11:7, Fig. 3); Ex. 1010 ¶¶ 66–71. 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 13 (citing Ex. 1010 ¶ 68).

Specifically, we agree with and find credible Dr. Janet's testimony that the use of Hickman's data structures for objects in Grotmol's images "would better allow for robot queries in the cloud system to be received and processed, and for relevant data to be retrieved from the shared knowledge base." Ex. 1010 ¶ 70 (citing Ex. 1005, 10:41–56, 11:9–30). Dr. Janet provides the example of receiving information from an image including a specific car model, and then using the information stored in data structure 313 to identify that car model. *Id.* Thus, as Dr. Janet explains, using Hickman's data structures to store information about objects in Grotmol's images "would have improved knowledge sharing and object matching capabilities, thereby improving performance of Grotmol's system." *Id.* We also agree with and find credible Dr. Janet's testimony that one of ordinary skill would have had a reasonable expectation of success in implementing

the proposed Grotmol-Hickman combination because "the use of various types of data structures to store data would have been entirely predictable particularly when extending Grotmol's system to a cloud system with various types of robots and devices connected to the cloud system," and "[a]pplying Hickman's data structures in Grotmol's system would not have required extraordinary skill and would have been within the ordinary capabilities of a" person of ordinary skill. *Id.* ¶ 69.

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. PO MTA Reply 11. Petitioner's reasoning is sufficiently articulated with rational underpinning and supports Petitioner's modification of Grotmol and Hickman.

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 Patent Owner's proposed substitute claims. We also find that Petitioner has sufficiently 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.

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

Proposed substitute claim 21 includes amendments to original claim 4. As discussed above, Petitioner has proven by a preponderance of the

evidence that original claim 4 would have been obvious over the Grotmol-Hickman combination. *See* § II.E.3, *supra*.

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

a) Element [Sub-1]

Element [Sub-1] recites "wherein the first circumstance representation includes a first collection of object representations, and the second circumstance representation includes a second collection of object representations." MTA App. A 3.

Petitioner argues that, in Grotmol, "the 'circumstance representation' includes various types of data including, but not limited to, a collection of object representations, such as images of objects in a training set detected by one or more robot sensors, and data structures related to the objects and images." Pet. MTA Opp 18 (citing Ex. 1004, Figs. 20A, 20B, 38:43–39:12) (emphasis omitted). "For example," Petitioner asserts, "as illustrated in Grotmol's FIGS. 20A, 20B, image 200 is an example part of a '***first circumstance representation***' and 'may comprise representations [of] one or more objects, e.g., a tree 2002, a rectangle, a ball 2008, and/or other objects." *Id.* (citing Ex. 1004, Fig. 20A, 38:43–39:12). "A subsequent image 2010," according to Petitioner, "is an example part of a '***second circumstance representation***,' and may comprise representations of objects from image 2010." *Id.* at 19 (citing Ex. 1004, Fig. 20B, 38:43–39:12). "Thus," Petitioner contends, "images 2000 and 2010 respectively include first and second collections of object representations." *Id.* (citing Ex. 1010 ¶ 78).

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [Sub-1]. *See generally* PO MTA Reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [Sub-1].

b) Element [Sub-2]

Element [Sub-2] recites "wherein the first collection of object representations represents multiple objects detected at a first time or during a first time period, and comprises a first data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects." MTA App. A 3.

Petitioner argues that "Grotmol's FIGS. 20A and 20B illustrate how images 2000 and 2010 may be shifted 'based on relative motion between the images (e.g., motion speed and time interval t2-tl between the images).'" Pet. MTA Opp. 19 (citing Ex. 1004, Figs. 20A, 20B, 38:43–39:12). According to Petitioner, one of ordinary skill "would have understood that time t1 corresponds to the time at which the first image (e.g., image 2000) was taken." *Id.* "Accordingly," Petitioner contends, Grotmol teaches that "the first collection of object representations represents multiple objects detected at a first time or during a first time period." *Id.* (citing Ex. 1010, ¶ 80) (emphasis omitted).

Petitioner argues that "Hickman discloses that data associated with a particular object that is stored in a knowledge base can include one or more of the object's physical dimensions, weight, material composition, object identifier, serial number, image data, and location of the object (LOC)." Pet. MTA Opp. 19–20 (citing Ex. 1005, 2:65–3:7, 12:5–18; Fig. 3). Petitioner also points to Hickman's disclosure that "[t]he location data (LOC) may

include GPS coordinates and/or other location-based information, e.g., an association with (or a link to) one or more maps stored in the map knowledge base 310." *Id.* at 20 (citing Ex. 1005, 14:3–29). "In some cases," according to Petitioner, "when a general object knowledge base is being used, the stored data associated with an object may include 'data about different "types" of objects that a robot may encounter or interact with in its environment, including different "types" of "unique" and "non-unique" objects.'" *Id.* (citing Ex. 1005, 14:61–19:22). "Such object data," Petitioner contends, "is stored in data structures, e.g., data structures 313, 314, or 315, which along with object image data corresponds to the '***first collection of object representations***' in '***the first circumstance representation***.'" *Id.* "Accordingly," Petitioner argues, the Grotmol-Hickman combination "renders obvious '***a first data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects***. "' *Id.* (citing Ex. 1010 ¶ 81).

Patent Owner does not contest Petitioner's arguments that Grotmol discloses element [Sub-2]. *See generally* PO MTA Reply; PO MTA Sur-sur-reply. Based on the arguments and evidence of record, we find that Grotmol discloses element [Sub-2].

c) Element [Sub-3]

Element [Sub-3] recites "<u>wherein the second collection of object representations represents the multiple objects detected at a second time or during a second time period, and comprises a second data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects</u>." MTA App. A 3.

Petitioner argues that, in the example of FIGS. 20A and 20B, Grotmol teaches that "images 2000 and 2010 may be shifted 'based on relative motion between the images (e.g., motion speed and **time interval t2-tl between the images**).'" Pet. MTA Opp. 22 (citing Ex. 1004, Figs. 20A, 20B, 38:43–39:12). According to Petitioner, one of ordinary skill "would have understood that time t2 corresponds to the time at which the second image (e.g., image 2010) was taken." *Id.* (citing Ex. 1010 ¶ 86). "Accordingly," Petitioner contends, "Grotmol teaches at least '***wherein the second collection of object representations represents multiple objects detected at a second time or during a second time period***.'" *Id.* (emphasis omitted).

Petitioner argues that, "[f]or the reasons explained above with respect to feature 2, Hickman discloses data structures ('***second data structure***') that store '***labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects***.'" Pet. MTA Opp. 22. According to Petitioner, it would have been obvious to a person of skill that, in the Grotmol-Hickman combination, "a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2000 and objects therein may correspond to the 'first data structure,' and a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2010 and objects therein may correspond to the 'second data structure.'" *Id.* "The depiction of objects in the images," Petitioner contends, "together with the first and second data structures provide the claimed '***first collection of object representations***' and '***second collection of object representations***,' respectively." *Id.* at 22–23 (citing Ex. 1010 ¶ 87).

In our Preliminary Guidance, we preliminarily determined that Hickman teaches or at least suggests a "first data structure that includes: labels indicating *types* of the multiple objects" by disclosing "data structure 313 in which multiple rows indicate *types* of multiple unique objects, or data structure 314 in which multiple rows indicate *types* of multiple non-unique objects." Prelim. Guid. 10. However, we preliminarily determined that Petitioner had not sufficiently explained how the teachings of Grotmol and Hickman would render obvious the claimed "second data structure." *Id.* at 11. More specifically, we preliminarily determined that Petitioner had not sufficiently explained where or how Hickman discloses or renders obvious multiple data structures that each include information (types and locations) for the same multiple objects (as detected at different times or time periods). *Id.* We noted that claim 21 appears to require that the first and second data structures each store information about the ***same*** objects by reciting that "the first collection of object representations represents multiple objects . . .," the "*first data structure* . . . includes: labels indicating types *of* ***the*** *multiple objects*, and coordinates indicating locations *of* ***the*** *multiple objects*," and the "second data structure . . . includes: labels indicating types *of* ***the*** *multiple objects*, and coordinates indicating locations *of* ***the*** *multiple objects*." *Id.* We further explained that the use of the term "the" before "multiple objects" in the "second data structure" limitation appears to indicate that the objects in the second data structure are the same objects as those in the first data structure. *Id.* We noted that Petitioner references various data structures in Hickman, but did not identify two data structures that each include information (such as locations)

for the same multiple objects (as detected at different times or time periods). *Id.* at 11–12.

Following the Preliminary Guidance, Patent Owner filed a Reply, arguing that the Grotmol-Hickman combination does not disclose "a second data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects." PO MTA Reply 4. Patent Owner argues that "[c]laim 21 requires that the first and second data structures each store information about the ***same*** objects, by reciting 'the multiple objects' (note the antecedent basis is recited at 'the first collection of object representations represents multiple objects'—i.e., the same multiple objects referred to for the first data structure)." *Id.* at 5. "For this limitation," Patent Owner asserts, "Petitioner provides a single paragraph, with only three sentences of analysis that entirely evade the foregoing aspect of this limitation." *Id.* (citing Pet. MTA Opp. 22). "And," according to Patent Owner, "the first sentence of that paragraph cites "the reasons explained above with respect to feature 2"—which shows that Petitioner has simply relied on its analysis for an earlier limitation regarding 'first data structure,' which does not suffice here." *Id.* (citation omitted). Indeed, Patent Owner contends, "Petitioner does not even clearly identify which data structure of Hickman is being mapped for this limitation, instead vaguely mentioning that 'Hickman discloses data structure***s***' (i.e., plural) and repeatedly citing 'Hickman's structure 314 (or 313).'" *Id.* (citing Pet. MTA Opp. 22). Thus, Patent Owner argues, "Petitioner has not identified ***two*** data structures that ***each*** include information (types and locations) for the ***same*** multiple objects (as detected at different times or time periods)." *Id.*

Petitioner responds that our Preliminary Guidance erred by "focusing on Hickman alone and not fully accounting for Grotmol's role in the combination." Pet. MTA Sur-reply 2. "Indeed," Petitioner argues, "***Grotmol itself discloses and renders obvious a knowledgebase having multiple data structures (e.g., training sets) that each include images representing the same set of multiple objects correlated with respective motor commands (e.g., first and instruction sets)***," and "Hickman does not disturb this basic aspect of Grotmol's teachings" in the combination. *Id.* at 2–3. Petitioner notes that its Opposition to the Motion to Amend "referred to image 2000 in Grotmol's FIG. 20A as 'an example part of' the claimed 'first circumstance representation' and image 2010 as 'an example part of' the claimed 'second circumstance representation.'" *Id.* at 3 (citing Pet. MTA Opp. 18–19; Ex. 1004, 38:43–40:63, 42:37–45). Petitioner argues that image 2000 and image 2010 each depict the same objects, as shown in Petitioner's annotated version of Grotmol's Figure 20A reproduced below.

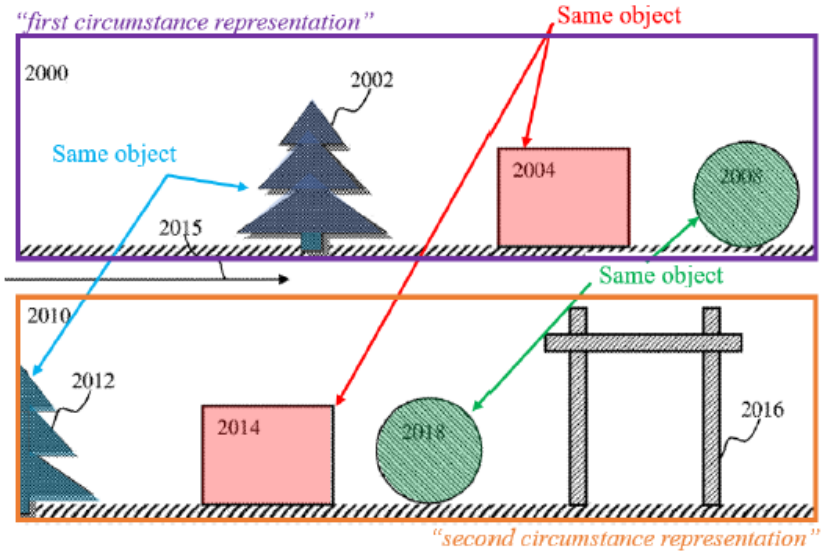


FIG. 20A

Referring to its annotated figure above, Petitioner argues that "[i]mage 2000 and image 2010 each depict the ***same objects***—including a tree (highlighted

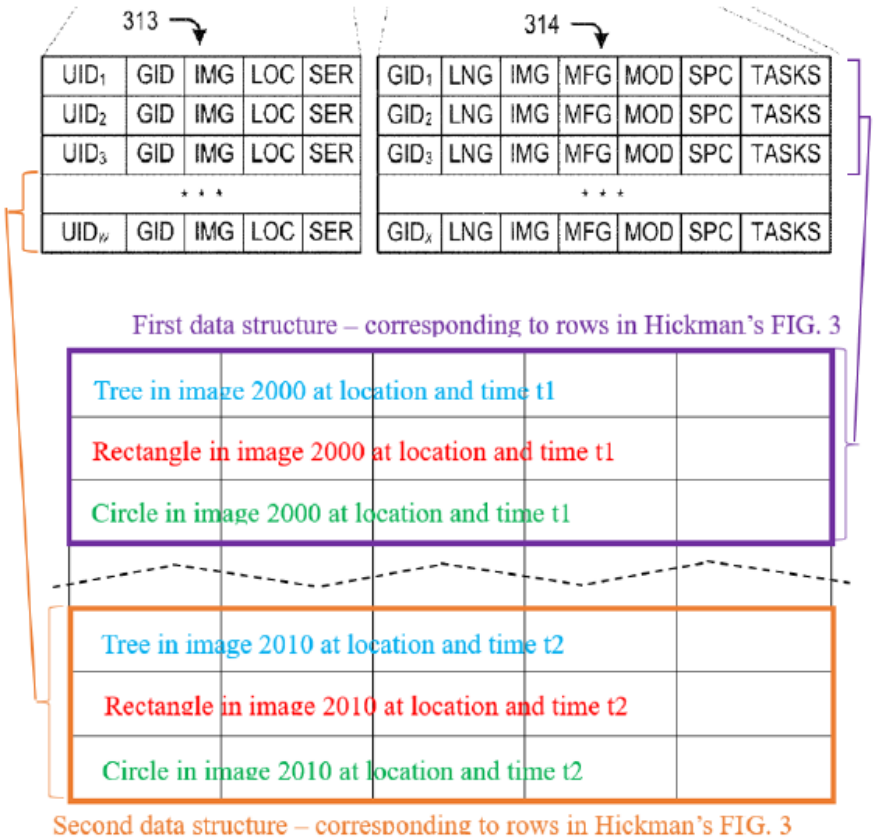
in blue), a circle (highlighted in green), and a rectangle (highlighted in red)—shifted, in part, because these images were taken by a camera on a moving robot at different times. *Id.*

"During training," Petitioner argues, "Grotmol's robot creates and stores distinct 'training sets' for each image in a sequence of acquired images, e.g., images 2000 and 2010." Pet. MTA Reply 3–4 (citing Ex. 1004, code (57), 39:64–40:4, 3:35–39, 38:38–42, 39:13–19, 43:5–9, Fig. 15). "A training set," according to Petitioner, "correlates a given image with motor control commands." *Id.* at 4 (citing Ex. 1004, 3:35–39).

Petitioner also argues that its Opposition "explained how it would have been obvious to apply Hickman's teachings to Grotmol, thereby implementing a knowledgebase in the cloud that would 'facilitate the sharing of knowledge between[] various client devices' and further modifying 'Grotmol's storage structure to include one or more knowledge bases with Hickman's data structures.'" Pet. MTA Sur-reply 4 (citing Pet. MTA Opp. 12–13). "The relevant differences between Grotmol's solution and the [Grotmol-Hickman combination]," Petitioner asserts, "are simply that Grotmol's training sets in the [Grotmol-Hickman combination] are accessible to multiple devices by the cloud and are stored in data structures like those described in Hickman." *Id.* (citing Pet. 63–64). "In this context," according to Petitioner, "it would have been obvious that the first data structure in the [Grotmol-Hickman combination] would predictably store[] information about the multiple objects in image 2000 at time t1 and would have included ***at least some objects***, such as the tree, rectangle, and circle, ***that are the same*** as objects in image 2010 (at time t2) for which

information is stored in the second data structure, consistent with Grotmol's teachings." *Id.* (citing Pet. MTA Opp. 24–25).

Relatedly, Petitioner argues, the Opposition cited Dr. Janet's explanation that it would have been obvious to a person of ordinary skill that, in the Grotmol-Hickman combination, "a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2000 and objects therein may correspond to the 'first data structure,' and a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2010 and the same objects therein may correspond to the 'second data structure.'" Pet. MTA Sur-reply 5 (citing Ex. 1010 ¶ 87; Pet. MTA Opp. 22). Petitioner provides an annotated version of the data structures from Hickman's Figure 3, which is reproduced below.



Id.

In its authorized Sur-sur-reply, Patent Owner responds that Petitioner's Sur-reply includes impermissible new arguments, including that Grotmol teaches "a knowledgebase having multiple data structures (e.g., training sets) that each include images representing the same set of multiple objects correlated with respective motor commands (e.g., first and second instruction sets)" and that the Preliminary Guidance "did not fully account[] for Grotmol's role in the combination." PO MTA Sur-sur Reply 3–4 (citing Pet. MTA Sur-reply 2–3). Patent Owner argues that Petitioner's Opposition, "when addressing the above portion of [Sub-3], did not make this argument about Grotmol," but instead "used Hickman for this limitation, effectively admitting that Grotmol does not disclose it." *Id.* at 4 (emphasis omitted). According to Patent Owner, "the substitute claims recite first and second data structures that each includes labels indicating types of the multiple objects and coordinates indicating locations of the multiple objects specifically to distinguish Grotmol's images." *Id.* Object depictions in Grotmol's images, Patent Owner argues, "are collections of pixels, not the recited first/second data structures including labels and coordinates," and "pixels don't involve any labels and coordinates." *Id.* "Further," Patent Owner contends, "the last sentence of page 4 of the MTA Sur-Reply ('In this context, it would have been obvious . . .') is a new argument" because "[p]ages 12–13 of the Opposition about motivation to combine are completely divorced from the new limitations." *Id.* (citing PO MTA Reply 11). "Petitioner's attempt to tie that back to [Sub-3]," according to Patent Owner "is an impermissible new argument." *Id.*

Patent Owner also argues that the annotated version of Hickman's Figure 3 found at page 5 of Petitioner's MTA Sur-reply, and the associated

discussion, is both new and incorrect. PO MTA Sur-sur-reply 4. First, Patent Owner asserts, "there is not even a hint in Grotmol or Hickman that portions of Grotmol's image depicting objects can be replaced by rows containing object data in Hickman, which is technically and logically unfeasible." *Id.* at 4–5. Second, according to Patent Owner, "Petitioner places two separate tables 313/314 next to each other incorrectly implying a single table, and wrongly cherry-picks some rows to represent a tree, rectangle, and circle in Grotmol's image 2000 and other rows to represent the tree, rectangle, and circle in Grotmol's image 2010." *Id.* at 5. However, Patent Owner contends, "random groupings of rows from a table are not data structures" because "a data structure *is data that is actually disclosed as structured, not a random grouping of rows or other data* that Petitioner retrospectively attempts to structure to fit its purpose." *Id.* Third, Patent Owner argues, "if tables 313/314 are considered as separate data structures in Petitioner's annotated figure 3, then *table 314 does not include the claimed coordinates* recited in both the first and second claimed data structures." *Id.*

Fourth, according to Patent Owner, Petitioner argues that "Grotmol's images show the same objects, but replaces each of Grotmol's images with multiple rows from Hickman that represent different objects in its annotated figure 3." PO MTA Sur-sur Reply 5. Specifically, Patent Owner asserts, "[t]he rows in purple (that Petitioner maps to the multiple objects in the first data structure) and the rows in orange (that Petitioner maps to the *same* multiple objects in the second data structure) *do not represent the same objects since the rows in Hickman's tables all represent different objects*." *Id.* "In other words," Patent Owner contends, "no row in Hickman's tables

represents the same object as any other row (i.e., since Hickman always operates on a single object, duplicate rows representing the same object would confuse the system)." *Id.* at 5–6. According to Patent Owner, "Hickman never meant multiple rows to be structured in a first data structure that represents a first multi-object circumstance, let alone a second such data structure as recited." *Id.* at 6. "In fact," Patent Owner argues, "there is no concept of a multi-object circumstance in Hickman." *Id.* (emphasis omitted).

Fifth, Patent Owner argues that "Petitioner is attempting to replace Grotmol's time series of images with Hickman's rows in a table that have nothing to do with (and even teach away from) any time series." PO MTA Sur-sur-reply 6. Because "Hickman always operates on a single object at a time," Patent Owner asserts, "rows in Hickman's tables represent objects each at a different time." *Id.* (emphasis omitted). Thus, according to Patent Owner, "[a]n image, in a time series of images in Grotmol, depicting multiple objects at a particular time cannot be replaced by multiple object rows in Hickman that represent objects at different times." *Id.* "Hickman," Patent Owner contends, "never meant multiple rows to be structured in a first data structure that represents a first multi-object circumstance at a particular first time in a time series, let alone a second such data structure at a second time in the time series as recited. *Id.* "In fact," Patent Owner argues, "Hickman has no concept of rows being in a time series as recited in the amendment." *Id.* (emphasis omitted).

Based on the full trial record, Petitioner has sufficiently shown that limitation [Sub-3] would have been obvious over the Grotmol-Hickman combination. Petitioner has presented sufficient evidence that Grotmol's

Figures 20A and 20B and the accompanying description teach a first time at which a first image (image 2000) was taken and a second time t2 at which a second image (image 2010) was taken. Pet. MTA Opp. 19, 22. The image 2000 taken at time t1 teaches "the first collection of object representations" that "represents multiple objects detected at a first time" and the image 2010 taken at time t2 teaches "the second collection of object representations" that "represents the multiple objects detected at a second time." *Id.* We also agree with Petitioner that, because images 2000 and 2010 both include the same tree (2002, 2012), rectangle (2004, 2014), and ball (2008, 2018), the second collection of object representations (image 2010) represents the same multiple objects as the first collection of object representations (image 2010) but detected at a second (later) time. Thus, "the second collection of object representations" represents ***the*** (i.e., the same) multiple objects detected at a second time, as limitation [Sub-3] requires.

We also find that Petitioner has sufficiently proven that the Grotmol-Hickman combination discloses "a second data structure that includes: labels indicating types of the multiple objects, and coordinates indicating locations of the multiple objects." In this regard, we agree with and find credible Dr. Janet's testimony that "[i]t would have been obvious to a [person of ordinary skill in the art] that, in the [Grotmol-Hickman combination], a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2010 and objects therein may correspond to the 'second data structure.'" Ex. 1010 ¶ 87. We also find that rows in tables 313 and 314 can be considered a single data structure because table 313 specifically includes a "GID," row, which references the GIDs in the first row of table 314. Ex. 1005, Fig. 3. In this regard, the '974 patent defines "data structure"

broadly to include "any variety of data structures" such as an "array, list, linked list, doubly linked list, queue, tree, heap, graph, map, grid, matrix, multi-dimensional matrix, table, database, database management system (DBMS), file, neural network, and/or any other type or form of a data structure including a custom one." Ex. 1001, 65:45–51). In light of this broad definition, we agree with Petitioner that one or more rows of tables 313 combined with 314 can be considered a "data structure" as recited by this limitation. Additionally, we agree with Petitioner that Hickman does not limit itself to the particular arrangement in Figure 3, explaining that "the distribution across the various component knowledge bases shown in FIG. 3 is merely one example of one embodiment" and "[t]he 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." Ex. 1005, 10:61–66. Given this understanding, we agree with Petitioner that one obvious and straightforward modification would have been to combine tables 313 and 314 into a single table, such that each UID would have a corresponding GID (type) field, a location (LOC) field, and a TASKS field. Pet. MTA Sur-reply 7–8.

We also agree with and find credible Dr. Janet's testimony that Hickman teaches that these "data structures" (rows or sets of rows in Hickman's structures 313/314) include labels indicating "types" of multiple objects. Ex. 1010 ¶ 81. This testimony is supported by the following disclosure from Hickman:

> In the example conceptual data structure 313 shown in FIG. 3, an individual unique object identifier (UID) may have a corresponding general object identifier (GID). The general object identifier (GID) defines a ***"type"*** of object. In the unique object knowledge base 307, the general object identifier (GID)

> defines the ***"type"*** of "unique" object that corresponds to the unique object identifier (UID).

Ex. 1005, 12:52–58 (emphasis added); *see id.* 12:59–13:24 (providing examples of identifying "types" objects in data structures 313/314). Hickman further discloses that

> Some embodiments of the shared robot knowledge base 306 may include a general object knowledge base 308. The general object knowledge base 308 is configured to store data about different ***"types"*** of objects that a robot may encounter or interact with in its environment, including different ***"types"*** of "unique" and "non-unique" objects.

Id. at 14:62–67 (emphasis added); *see id.* at 15:1–18:33 (additional disclosure of the use of "types" in Hickman's data structures).

We also agree with and find credible Dr. Janet's testimony that Hickman teaches that its "data structures" (rows or set of rows in Hickman's structures 313/314) include information concerning the "location of the object (LOC)." Ex. 1010 ¶ 81. This testimony is supported by Hickman's disclosure that:

> An individual unique object identifier (UID) in the example conceptual data structure 313 of the unique object knowledge base 307 shown in FIG. 3 may also have corresponding location data (LOC). The location data (LOC) corresponding to a particular unique object identifier (UID) in the unique object knowledge base 307 corresponds to a location of the unique object. The location data (LOC) may include GPS coordinates and/or other location-based information, e.g., an association with (or a link to) one or more maps stored in the map knowledge base 310.

Ex. 1005, 13:63–14:6; *see id.* at 2:65–3:5 ("[t]he data associated with a particular object . . . may include . . . location of the object"), 12:5–9 (explaining that data structure 313 in Figure 3 can include "location data (LOC),"), Fig. 3 (showing "LOC" as a column of data in data structure 313).

Additionally, we find that Petitioner has sufficiently shown that the Grotmol-Hickman combination renders obvious first and second data structures that include labels indicating types and locations of the same multiple objects. As discussed above, Hickman discloses first and second data structures including labels indicating types and locations of multiple data objects, but does not specifically disclose that data structures include types and locations of ***the same*** multiple objects. Grotmol discloses a receiving first and second images (2000 and 2010 in Figure 20A) including the same objects (tree 2002/2012, rectangle 2004/2014, and ball 2008, 2018) different time periods. We agree with Petitioner and Dr. Janet that it would have been obvious to use Hickman's data structures including types and locations of objects with Grotmol's system that receives first and second images including the same objects at different time periods, resulting in a combined system that uses Hickman's data structures to store types and locations of the same objects received at different times.[7] *See* Pet. MTA Opp. 13–15; Ex. 1010 ¶¶ 68–70.

Patent Owner's arguments to the contrary do not overcome Petitioner's showing. First, we disagree with Patent Owner's argument that Petitioner fails to "clearly identify which data structure of Hickman is being

[7] We recognize that our conclusion here differs from the preliminary determination made in our Preliminary Guidance. After considering the full trial record, including Patent Owner's MTA Reply, Petitioner's MTA Sur-reply, Patent Owner's Sur-sur-reply, and the arguments made at the oral hearing, we find that Petitioner has satisfied its burden of showing that this claim limitation would have been obvious over the Grotmol-Hickman combination. When issuing our Preliminary Guidance, we emphasized that the views expressed therein were "preliminary," "subject to change upon consideration of the complete record," and "not binding on the Board when reaching a final written decision." *See* Prelim. Guid. 3.

mapped for this limitation" and "has not identified ***two*** data structures that ***each*** include information (types and locations) for the ***same*** multiple objects (as detected at different times or periods)." *See* PO MTA Reply 4. As discussed above, Dr. Janet explains that, in the Grotmol-Hickman combination, "[i]t would have been obvious to a [person of ordinary skill in the art] that, in the [Grotmol-Hickman combination], ***a row or set of rows in Hickman's structure 314 (or 313)*** that include Grotmol's image 2010 and objects therein may correspond to the 'second data structure.'" Ex. 1010 ¶ 87 (emphasis added). Therefore, Petitioner has sufficiently explained that each of the claimed first and second data structures can be met by one or more rows of Hickman's structures 313 and 314.

We also disagree with Patent Owner's argument that Petitioner's Sur-reply includes the impermissible new argument that Grotmol teaches "a knowledgebase having multiple data structures (e.g., training sets) that each include images representing the same set of multiple objects correlated with respective motor commands (e.g., first and second instruction sets)" and that the Preliminary Guidance "did not fully account[] for Grotmol's role in the combination." PO MTA Sur-sur Reply 3–4 (citing Pet. MTA Sur-reply 2–3). Petitioner's MTA Sur-reply makes it clear that the "multiple data structures . . .that each include images representing the same set of multiple objects" that it is referring to include images 2000 and 2010 in Grotmol's Figure 20A which each include the same objects. Pet. MTA Sur-reply 2–3. Petitioner's MTA Opposition points to images 2000 and 2010 in Grotmol's Figure 20A for the "second collection of object representations," and combines this with the more detailed data structures disclosed in Hickman particular. Pet. MTA Opp. 22–23. We find that Petitioner's arguments in its

MTA Sur-reply are a permissible further explanation of the argument made in its MTA Opposition, and are a permissible response to the points made about Grotmol in the Preliminary Guidance and Patent Owner's MTA Reply. We also allowed Patent Owner to file a further brief responding to the arguments in Petitioner's MTA Sur-reply to ensure that Patent Owner had an adequate opportunity to respond to any arguments presented therein. *See* Paper 43 (Order allowing Patent Owner to file a Sur-sur-reply); Paper 44 (Patent Owner's Sur-sur-reply).

We also are not persuaded by Patent Owner's argument that the "[o]bject depictions in Grotmol's images are collections of pixels, not the recited first/second data structures including labels and coordinates" because "pixels don't involve any labels and coordinates." PO MTA Sur-sur-reply 4. Petitioner does not rely on Grotmol's images 2000 and 2010 (or Grotmol's structures for storing those images) for the first and second data structures including labels and coordinates, but instead relies on Hickman for these specific aspects of the claimed data structures. *See* Pet. MTA Opp. 22–23; Pet. MTA Sur-reply 4–5.

Additionally, we disagree with Patent Owner's argument that the last sentence of page 4 of the MTA Sur-reply is a new argument because the arguments about motivation to combine on pages 12–13 of the MTA Opposition "are completely divorced from the new limitations." PO MTA Sur-sur-reply 4. The argument made by Petitioner in the Sur-reply that Patent Owner objects to states as follows:

> In this context, it would have been obvious that the first data structure in the [Grotmol-Hickman combination] would predictably store[] information about the multiple objects in image 2000 at time t1 and would have included at least some objects, such as the tree, rectangle, and circle, that are the same

> as objects in image 2010 (at time t2) for which information is stored in the second data structure, consistent with Grotmol's teachings.

Pet. MTA Sur-reply 4 (citing Pet. MTA Opp. 24–25). In its MTA Opposition, however, when discussing limitation [Sub-3], Petitioner specifically asserted that, in the combination, Grotmol's image 2000 corresponds to the first data structure and Grotmol's image 2010 corresponds to the second data structure, stating that:

> It would have been obvious to a [person of ordinary skill in the art] that, in the [Grotmol-Hickman combination], a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2000 and objects therein may correspond to the "first data structure," and a row or set of rows in Hickman's structure 314 (or 313) that include Grotmol's image 2010 and objects therein may correspond to the "second data structure."

Pet. MTA Opp. 22. Petitioner also argues in its MTA Opposition that Grotmol teaches receiving image 2000 at a first time t1 and image 2010 at a second time t2. *Id.* We find that Petitioner's argument in the MTA Sur-reply is a permissible further explanation of these statements in the MTA Opposition. Additionally, as noted above, we allowed Patent Owner to file a further brief responding to the arguments in Petitioner's MTA Sur-reply to ensure that Patent Owner had an adequate opportunity to respond to any arguments presented therein. *See* Paper 43; Paper 44.

We also disagree with Patent Owner's remaining arguments. First, we disagree with the argument that "there is not even a hint in Grotmol or Hickman that portions of Grotmol's image depicting objects can be replaced by rows containing object data in Hickman, which is technically and logically unfeasible." *See* PO Sur-sur-reply 4–5. As explained above, Petitioner and Dr. Janet have sufficiently explained why it would have been

obvious to combine Grotmol's images 2000 and 2010 with Hickman's data structures, and it is not necessary that the references themselves provide the suggestion to make the combination. Additionally, Patent Owner does not sufficiently explain why using Hickman's data structures for Grotmol's images 2000 and 2010 would be "technically and logically unfeasible," and we do not find persuasive evidence in the record supporting that assertion.

Second, we disagree with Patent Owner's argument that "Petitioner places two separate tables 313/314 next to each other incorrectly implying a single table, and wrongly cherry-picks some rows to represent a tree, rectangle, and circle in Grotmol's image 2000 and other rows to represent the tree, rectangle, and circle in Grotmol's image 2010." PO MTA Sur-sur Reply 5. To the contrary, as discussed above, we find that rows in tables 313 and 314 can be considered a single data structure because table 313 specifically includes a "GID," row, which references the GIDs in the first row of table 314. Ex. 1005, Fig. 3. We also are not persuaded by Patent Owner's assertion that "random groupings of rows from a table are not data structures" because "a data structure *is data that is actually disclosed as structured, not a random grouping of rows or other data* that Petitioner retrospectively attempts to structure to fit its purpose." PO MTA Sur-sur-reply 5. As discussed above, the '974 patent provides a broad definition of the term "data structure," and we find that this definition is broad enough to encompass one or more rows of tables 313/314. *See* Ex. 1001, 65:45–51. Moreover, as discussed above, we agree with Petitioner that it would have been obvious to combine tables 313 and 314 into a single table.

Third, we disagree with Patent Owner's argument that "if tables 313/314 are considered as separate data structures in Petitioner's annotated

figure 3, then *table 314 does not include the claimed coordinates* recited in both the first and second claimed data structures." *See* PO MTA Sur-sur-reply 5. As discussed above, we find that tables 313 and 314 can be considered a single data structure and, in any event, it would have been obvious to combine tables 313 and 314 into a single table. Ex. 1005, Fig. 3. This combined data structure would include the location coordinates required by the claim.

Fourth, we disagree with Patent Owner's argument that "Grotmol's images show the same objects, but replaces each of Grotmol's images with multiple rows from Hickman that represent different objects in its annotated figure 3," and that "Hickman never meant multiple rows to be structured in a first data structure that represents a first multi-object circumstance, let alone a second such data structure as recited." PO MTA Sur-sur Reply 5–6. This argument from Patent Owner does not sufficiently address Petitioner's proposed combination and the motivation to combine provided by Dr. Janet. In this regard, we agree with and find credible Dr. Janet's testimony that the use of Hickman's data structures for objects in Grotmol's images "would better allow for robot queries in the cloud system to be received and processed, and for relevant data to be retrieved from the shared knowledge base." Ex. 1010 ¶ 70 (citing Ex. 1005, 10:41–56, 11:9–30). Dr. Janet provides the example of receiving information from an image including a specific car model, and then using the information stored in data structure 313 to identify that car model. *Id.* Thus, as Dr. Janet explains, using Hickman's data structures to store information about objects in Grotmol's images "would have improved knowledge sharing and object matching capabilities, thereby improving performance of Grotmol's system," and it

would have been obvious to combine these data structures with Grotmol's system. *Id.*

For similar reasons, we disagree with Patent Owner's argument that "Petitioner is attempting to replace Grotmol's time series of images with Hickman's rows in a table that have nothing to do with (and even teach away from) any time series." *See* PO MTA Sur-sur-reply 6. Petitioner does not rely on Hickman to teach receiving different images at different times, but rather relies on Grotmol for that disclosure. As discussed above, Petitioner and Dr. Janet have presented sufficient evidence that one of ordinary skill would have been motivated to use a modified version of Hickman's data structures in Grotmol in order to improve knowledge sharing and object matching capabilities. Ex. 1010 ¶ 70

Consequently, based on the full trial record, we find that element [Sub-3] would have been obvious over the Grotmol-Hickman combination.

d) Elements [Sub-4] and [Sub-5]

Element [Sub-4] recites "<u>wherein the first data structure is correlated with the first one or more instruction sets for operating the first device</u>," and element [Sub-5] recites "<u>wherein the second data structure is correlated with the second one or more instruction sets for operating the first device</u>."

Petitioner argues that "Hickman teaches that for each detected object, the knowledge base may store 'relevant tasks that a robot may perform with the object' in the task data (TASK) field." Pet. MTA Opp. 24 (citing Ex. 1005, 2:65–3:8, 15:28–43, 18:34–20:20, Fig. 3). "Accordingly," Petitioner asserts, one of ordinary skill "would have understood that because the tasks for the robot ('***the first one or more instruction sets for operating the first device***') are part of the first data structure and provide instructions

for the robot, "***the first data structure is correlated with the first one or more instruction sets***." *Id.* (citing Ex. 1010 ¶ 90). Petitioner also argues that, for similar reasons, it would have been obvious to one of ordinary skill that, in the Grotmol-Hickman combination, "tasks ('***second one or more instruction sets for operating the first device***') for operating the robot when objects in image 2010 are detected, are stored in a second data structure." *Id.* at 25 (citing Ex. 1010 ¶ 93).

In our Preliminary Guidance, we preliminarily determined that Hickman discloses that data structure 314 is correlated with instruction sets (TASKS for operating an object) because each row in data structure 314 includes "an individual general object identifier (GID) [that] may have the following corresponding data: . . . task data (TASKS)." Prelim. Guid. 12 (citing Ex. 1005, 15:28–35, Fig. 3). However, we preliminarily determined that Petitioner had not sufficiently explained where or how Hickman discloses or renders obvious multiple data structures that (i) each include information (type and locations) for the same multiple objects (as detected at different times or time periods) and (ii) are each correlated with instruction sets for operating a device, as recited in proposed substitute claim 21. *Id.* (citing MTA App. A 1–3). Specifically, we noted that data structure 313 includes locations for multiple objects but does not include a TASKS field, and data structure 314 includes a TASKS field but does not include location information. *Id.* at 13. We also preliminarily determined that Petitioner had not sufficiently explained why it would have been obvious in the combination to include both location information and a TASKS field in a single data structure. *Id.* at 13–14.

Following the Preliminary Guidance, Patent Owner filed a Reply, arguing that the Grotmol-Hickman combination does not disclose that "the first data structure is correlated with the first one or more instruction sets." PO MTA Reply 5–6. Echoing the Preliminary Guidance, Patent Owner argues that "Hickman's data structure 313 does not include the tasks field (which Petitioner relies upon for a data structure correlated with instruction sets); data structure 314 includes the tasks field but does not include the LOC field (which Petitioner relies upon for a data structure including coordinates indicating objects' locations); and data structure 315 does not include types and locations for multiple objects." *Id.* at 6 (citing Prelim. Guid. 13). "Thus," Patent Owner asserts, "Petitioner vaguely identifies one data structure (313) for types and locations but has not established that it is 'correlated with . . . instruction sets'; identifies a second data structure (314) that has a tasks field but does not even contemplate locations information; and identifies a third data structure (315) without even explaining how it would include types and coordinates." *Id.* Patent Owner also argues that "since Grotmol-Hickman does not disclose the second data structure," it "does not disclose or suggest 'the second data structure is correlated with the second one or more instruction sets." *Id.* at 7.

Petitioner responds that, in the Grotmol-Hickman combination, a first training set corresponds to the "first data structure" and a second training set corresponds to the "second data structure." Pet MTA Sur-reply 5–6 (citing Pet. 58–64; Pet. MTA Opp. 12–22). Petitioner argues that "Grotmol's training sets themselves correlate circumstance representations (e.g., images of a robot's environment) with instruction sets (e.g., motor commands)." *Id.* (citing Pet. 12–15; Ex. 1004, 3:35–39, 39:13–19, code (57)). "Thus,"

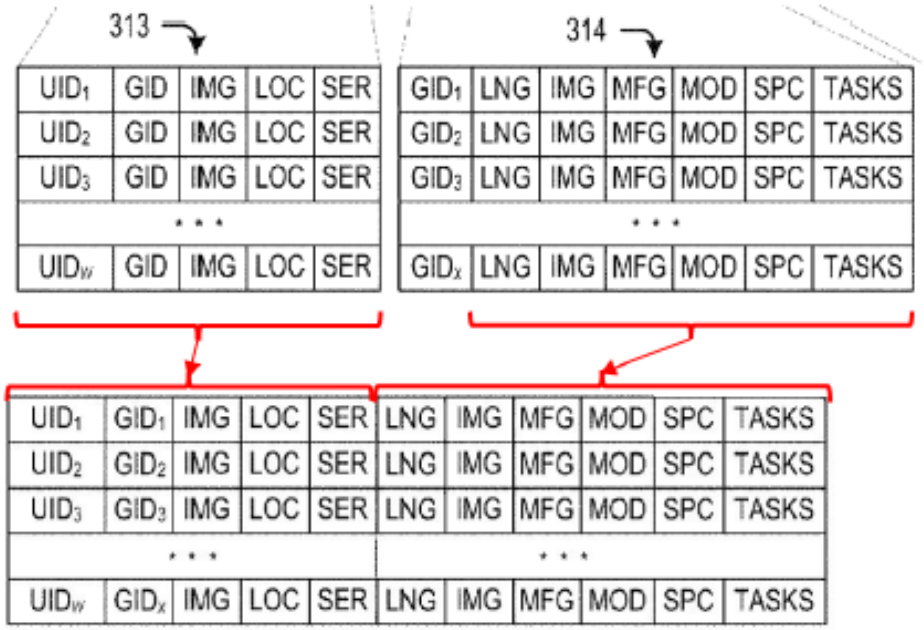
according to Petitioner, "the images 2000 and 2010 as depicted in FIG. 20A, including the representations of objections depicted therein, are correlated in different training sets with respective motor control commands (i.e., first and second instruction sets). *Id.* "Even when Hickman's data structures are applied to Grotmol's training sets," Petitioner asserts, "the correlations remain and therefore meet the limitations of the substitute claims." *Id.*

Petitioner also argues that Hickman's data structure 313 correlates the object location (e.g. LOC) and type (e.g., GID) data provided in that data structure with the TASKS data in data structure 314 where instruction sets are stored. Pet. MTA Sur-reply 6. More specifically, Petitioner asserts that "[d]ata structure 313 specifically links each unique object to a corresponding general object in data structure 314 via the general object identifier (GID), and each general object entry in data structure 314 includes corresponding TASKS data." *Id.* (citing Ex. 1005, 12:54–55, 14:61–15:56, 18:44–20:20, Fig. 3). "Each row in data structure 313," according to Petitioner, "is therefore correlated with TASKS data from data structure 314." *Id.*

"Further," Petitioner argues, "Hickman provides that TASKS data can be included in the same data structure as data from other fields in *both* data structures 313 and 314 that characterize the location and type of objects." Pet. MTA Sur-reply 6 (citing Pet. MTA Opp. 24–25). "In some implementations," Petitioner asserts, "the TASKS data is correlated with the data structure of which it is a part (which is not disputed in either [Patent Owner's] Reply or the [Preliminary Guidance])." *Id.* at 6–7 (citing Ex. 1010 ¶ 90). "Even though Hickman's FIG. 3 illustrates one example where the TASKS data in structure 314 is stored apart from data structure 313," according to Petitioner, "Hickman contemplates other configurations that

provide a merged data structure including object location, type, ***and*** task fields." *Id.* at 7 (citing Ex. 1005, 10:57–11:7; Ex. 1010 ¶ 67; Pet. MTA Opp. 13, 15).

Petitioner provides an annotated version of a portion of Hickman's Figure 5, illustrated below, to illustrate an example of a "single common knowledge base."



Pet. MTA Sur-reply 7. Petitioner explains that, in the above figure, "data structures 313 and 314 are combined by directly linking each entry in data structure 313 with the corresponding fields in data structure 314 associated with the same GID." *Id.* "In this straightforward implementation," Petitioner contends, "Hickman's consolidated data structure provides an entry for each object that includes a unique identification (UID), an image, a label indicating a type of the object (e.g., GID or other 'type' information[)], a label indicating coordinates for a location of the object (e.g., LOC), and additional information." *Id.* at 7–8 (citing Ex. 1005, 14:63–67) (citation omitted). "This arrangement of data," Petitioner contends, "is not only

expressly within the scope of Hickman's teaching of 'a single common knowledgebase,' but is also a simple matter of design choice well within the skill of" a person of ordinary skill. *Id.* at 8 (citing Ex. 1005, 10:57–11:7; Ex. 1010 ¶ 68).

Patent Owner responds that, for limitations [Sub-4] and [Sub-5], "the Opposition relied entirely on Hickman effectively admitting that Grotmol does not disclose these limitations." PO MTA Sur-sur-reply 6 (citing Pet. MTA Opp. 23–25). Patent Owner also argues that Petitioner's MTA Sur-reply "makes impermissible new arguments regarding Grotmol, stating that 'Grotmol's training sets themselves correlate circumstance representations (e.g., images of a robot's environment) with instruction sets (e.g., motor commands).'" *Id.* at 6–7 (citing Pet. MTA Sur-reply 6). Patent Owner further contends that Grotmol's correlations are being improperly matched to these limitations because the MTA Sur-reply also argued that "[e]ven when Hickman's data structures are applied to Grotmol's training sets, the correlations ***remain*** and ***therefore meet*** the limitations of the substitute claims." *Id.* at 7 (citing Pet. MTA Sur-reply 6).

Patent Owner also argues that the Petitioner's MTA Sur-reply "wrongly argues that '[d]ata structure 313 specifically links each unique object to a corresponding general object in data structure 314 via the general object identifier (GID), and each general object entry in data structure 314 includes corresponding TASKS data," for two reasons. PO MTA Sur-sur-reply 7 (citing Pet. MTA Sur-reply 6). First, Patent Owner asserts, "in Petitioner's figure 5 at page 7 of [the] MTA Sur-Reply, two separate tables 313 and 314 are not a single data structure since they need to be linked using an extra process step of linking." *Id.* According to Patent Owner, "[a]s its

name dictates, a data structure is data that is actually disclosed as structured, not something that requires an extra process step to be structured after the fact to fit Petitioner's purpose." *Id.* Second, Patent Owner contends that, "even if the two linked tables are considered as a single data structure (which they cannot be), the single data structure only allegedly discloses the first recited data structure, and cannot then disclose the second recited data structure." *Id.* Third, Patent Owner argues, "Petitioner cannot just carve up random groupings of rows from Hickman's tables as desired in hindsight, to form recited data structures to fit Petitioner's purpose, as discussed in more detail above." *Id.* (emphasis omitted).

Finally, Patent Owner argues that "[t]he MTA Sur-Reply's argument that 'Hickman contemplates other configurations that provide a merged data structure including object location, type, and task fields,' citing Hickman 10:57-11:7, is an impermissible new argument for [Sub-4]/[Sub-5]." PO MTA Sur-sur-reply 7–8 (citing Pet. MTA Sur-Reply 7). "Even if Petitioner may have cited that portion for another limitation," Patent Owner asserts, "it didn't for [Sub-4]/[Sub-5], and [Patent Owner] replied to what the Opposition actually asserted." *Id.* at 8 (citing Pet. MTA Opp. 24–25). Additionally, according to Patent Owner, "that portion of Hickman has extremely broad, essentially meaningless, language without any explanation of the unspecified configurations proposed by Petitioner." Finally, Patent Owner argues that "Figure 5 at page 7 of the MTA Sur-Reply and associated text are another impermissible new argument, and references its previous arguments as to why it is unpersuasive. *Id.*

Based on the full trial record, we find that Petitioner has made a sufficient showing as to this limitation.[8] As discussed above, we agree with Petitioner that Grotmol discloses correlating images of a robot's environment (circumstance representations) with instruction sets (motor commands). Pet. MTA Surreply 6; Ex. 1004, 3:35–39, 39:13–19, code (57). For example Grotmol states that "[a] given training set may comprise an instance of the video frame, an instance of the binary signal, and an instance of a motor control indication configured to cause the robot to execute an action." Ex. 1004, 3:35–39; *see id.* at 39:13–19 ("During training, images . . may be stored in a memory buffer" and "[m]otor commands issued by a trainer corresponding to time instances when the images are acquired may be stored."), code (57) ("A robotic vehicle . . . stores the sequence of images of a visual scene seen when following a trajectory during training in an ordered buffer" and "[m]otor commands associated with a given image may be stored."). Thus, Grotmol discloses that images 2000 and 2010 in Figure 20A, including the representations of objects depicted in those images, are correlated in different training sets with motor control commands (first and second instruction sets). *Id.*

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[8] As with element [Sub-3], we recognize that our conclusion here differs from the preliminary determination made in our Preliminary Guidance. After considering the full trial record, including Patent Owner's MTA Reply, Petitioner's MTA Sur-reply, Patent Owner's Sur-sur-reply, and the arguments made at the oral hearing, we find that Petitioner has satisfied its burden of showing that elements [Sub-4] and [Sub-5] would have been obvious over the Grotmol-Hickman combination. As noted above, we emphasized in our Preliminary Guidance that the views expressed therein were "preliminary," "subject to change upon consideration of the complete record," and "not binding on the Board when reaching a final written decision." *See* Prelim. Guid. 3.

We also agree with Petitioner that Hickman's data structure 313 correlates each unique object to a corresponding general object in data structure 314 via the general object identifier (GID), and that each general object entry in data structure 314 includes corresponding TASKS data. Ex. 1005, 12:52–58 (explaining that each "individual unique object identifier (UID) may have a corresponding general object identifier (GID)"); *see id.* at 14:61–15:56, 18:44–20:20, Fig. 3). We further agree that the TASKS field may store relevant tasks that a robot may perform with the object. Pet. MTA Opp. 24; Ex. 1005, 2:65–38, 15:28–43, 18:43–20:20, Fig. 3).

As discussed above with respect to element [Sub-3], we also find that rows in tables 313 and 314 can be considered a single data structure because table 313 specifically includes a "GID," row, which references the GIDs in the first row of table 314. Ex. 1005, Fig. 3. The '974 patent defines "data structure" broadly to include "any variety of data structures" such as an "array, list, linked list, doubly linked list, queue, tree, heap, graph, map, grid, matrix, multi-dimensional matrix, table, database, database management system (DBMS), file, neural network, and/or any other type or form of a data structure including a custom one." Ex. 1001, 65:45–51). In light of this broad definition, we find that one or more rows of tables 313 and 314 can be considered a "data structure" as recited by this limitation. Additionally, we agree with Petitioner that Hickman does not limit itself to the particular arrangement in Figure 3, explaining that "the distribution across the various component knowledge bases shown in FIG. 3 is merely one example of one embodiment" and "[t]he 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."

Ex. 1005, 10:61–66. Given this understanding, we agree with Petitioner that one obvious and straightforward modification would have been to combine tables 313 and 314 into a single table, as set forth in Petitioner's annotated version of a portion of Hickman's Figure 5, such that each UID would have a corresponding GID (type) field, a location (LOC) field, and a TASKS field. Pet. MTA Sur-reply 7–8.

Finally, we agree with Petitioner and Dr. Janet that one of ordinary skill would have found it obvious to combine Hickman's data structures with Grotmol. As discussed above, Grotmol discloses correlating images with motor commands, but does not provide the details of how to carry this out. We agree with and find credible Dr. Janet's testimony that the use of Hickman's data structures for objects in Grotmol's images "would better allow for robot queries in the cloud system to be received and processed, and for relevant data to be retrieved from the shared knowledge base." Ex. 1010 ¶ 70 (citing Ex. 1005, 10:41–56, 11:9–30). Dr. Janet provides the example of receiving information from an image including a specific car model, and then using the information stored in data structure 313 to identify that car model. *Id.* Thus, as Dr. Janet explains, using Hickman's data structures to store information about objects in Grotmol's images "would have improved knowledge sharing and object matching capabilities, thereby improving performance of Grotmol's system. *Id.*

Patent Owner's arguments to the contrary do not overcome Petitioner's showing. First, we are not persuaded by Patent Owner's argument that Hickman's data structure 313 does not include the TASKS field, and data structure 314 does not include the LOC field. *See* PO MTA Reply 6. As discussed above, we find that structures 313 and 314 can be

considered to be a single "data structure" under the broad definition of "data structure" in the '974 patent and, in any event, it would have been obvious to combine structures 313 and 314 into a single table due to table 313's reference to the GID indicator in table 314 and Hickman's disclosure that the knowledgebases can be combined. *See* Ex. 1005, 10:61–66.

We also disagree with Patent Owner's argument that Petitioner's MTA Sur-reply makes impermissible new arguments that Grotmol's training sets correlate circumstance representations (e.g., images of a robot's environment) with instruction sets (e.g., motor commands), and erroneously attempts to apply Hickman's data structures to Grotmol's training sets. PO MTA Sur-sur-reply 6–7. As to the first point, the Petition and Dr. Janet's declaration specifically asserted that Grotmol "discloses a memory circumstance representations (images of scenes from a robot vehicle's operation) correlated with an 'instruction set[] for operating a first device' (motor control indication configured to cause the robot to execute an action)." Pet. 12–13; Ex. 1002 ¶ 68. And, as discussed previously, we allowed Patent Owner to file a Sur-sur-reply responding to the arguments made in Petitioner's MTA Sur-reply. Papers 43, 44. Therefore, we do not find that Petitioner's argument is improper, and we find that Patent Owner has had an adequate opportunity to respond to the arguments in Petitioner's MTA Sur-reply. As to the second point, as discussed above with respect to element [Sub-3], we find that Petitioner had sufficiently shown that it would have been obvious to apply Hickman's data structures to Grotmol's training sets.

Additionally, we disagree with Patent Owner's arguments that Hickman's tables 313 and 314 are "separate" and "not a single data structure

since they need to be linked using an extra process of linking." PO MTA Sur-sur-reply 7. As discussed above, given the broad definition of "data structure" in the '974 patent, we find that Hickman's tables 313 and 314 can be considered a "data structure" and, in any event, it would have been obvious to combine tables 313 and 314 into a single table as Petitioner proposes. We also disagree with Patent Owner's argument that "even if the two linked tables are considered as a single data structure," the "single data structure only allegedly discloses the first recited data structure, and cannot then disclose the second recited data structure." *Id.* As discussed above, we agree with Petitioner that one or more rows of tables 313/314 can be considered the "first data structure" and one or more other rows of table 313/314 can be considered the "second data structure," particularly given the broad definition of "data structure" in the '974 patent. We further disagree with Patent Owner's argument that "Petitioner cannot just carve up random groupings of rows from Hickman's tables as desired in hindsight, to form recited data structures to fit Petitioner's purpose." *Id.* (emphasis omitted). Patent Owner does not sufficiently explain why groups of rows of Hickman's tables cannot be a "data structure" under the '974 patent's broad definition of that term.

Furthermore, we disagree with Patent Owner's argument that Petitioner's MTA Sur-reply presents an impermissible new argument when it asserts that "Hickman contemplates other configurations that provide a merged data structure including object location, type, and task fields." PO MTA Sur-sur-reply 7–8 (citing Ex. 1005, 10:57–11:7). Petitioner's MTA Opposition includes the argument that one or more rows in Hickman's data tables 313/314 correspond to the first and second data structures, and we

find that Petitioner's argument in its MTA Sur-reply is a permissible further explanation of that argument. *See* Pet. MTA Opp. 22–23. And, as previously discussed, Patent Owner had the opportunity to submit further briefing responding to Petitioner's MTA Sur-reply. For similar reasons, we also disagree with Patent Owner's assertion that Petitioner's annotated version of Hickman's Figure 5 on page 7 of the MTA Sur-reply is "another impermissible new argument." PO MTA Sur-sur-reply 8. Finally, we disagree with Patent Owner's argument that the referenced portion of Hickman "has extremely broad, essentially meaningless, language without any explanation of the unspecified configurations proposed by Petitioner," because we agree with Petitioner and Dr. Janet that this language would have suggested to one of ordinary skill that other configurations of Hickman's tables would have been obvious, including the straightforward approach of combining tables 313 and 314 as Petitioner proposes. *See* PO MTA Sur-sur-reply 8.

Consequently, based on the full trial record, we find that elements [Sub-4] and [Sub-5] would have been obvious over the Grotmol-Hickman combination.

3. Obviousness of Proposed Substitute Claims 24–26

We turn to Petitioner's argument that proposed substitute claims 24–26 would have been obvious over Grotmol and Hickman and proposed substitute claim 24 would have been obvious over Grotmol, the knowledge of a person of ordinary skill in the art, and Hickman. *See* Pet. MTA Opp. 11–12.

Proposed substitute claim 24 include amendments to original claim 11. As discussed above, we have found that Petitioner has proven by a

preponderance of the evidence that original claim 11 would have been obvious over the Grotmol-Hickman combination. *See* § II.F.4, *supra*.

Proposed substitute claims 25 and 26 include amendments to original claims 14 and 15, respectively, which Patent Owner has cancelled. We find that Petitioner has supported its arguments that claims 14 and 15 are anticipated by Grotmol with specific citations to Grotmol and Dr. Janet's declaration. Pet. 41–45 (citing, e.g., Ex. 1002 ¶¶ 67–73, 75–77, 117–123). Petitioner's argument and Dr. Janet's testimony are supported by the evidence cited therein. Patent Owner does not offer arguments for dependent claims 14 or 15 or contest Petitioner's analysis and, instead, Patent Owner states that claims 14 and 15 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 14 and 15 are unpatentable as anticipated by Grotmol.

Patent Owner's amendments to claims 24–26 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 24–26 would have been obvious over Grotmol and Hickman and proposed substitute claim 24 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 4 and 11 of the '974 patent are unpatentable. Petitioner has not proven by a preponderance of the evidence that claims 5 and 7 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
4, 5, 7[10]	102(a)(2)	Grotmol		5, 7[11]
11[12]	103	Grotmol		
4, 11	103	Grotmol,	4, 11	

[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 1–3, 6, 8–10, 12–13, and 16–20 of the '974 patent. *See* Prelim. Resp. 1 (citing Ex. 2004; 37 C.F.R. § 42.107(e)).

[11] We do not determine whether Petitioner has shown that claim 4 would have been obvious over Grotmol alone in light of our determination that Petitioner has shown by a preponderance of the evidence that claim 4 would have been obvious over Grotmol and Hickman.

[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.

Claims Challenged	35 U.S.C. §	Reference(s)	Claims Shown Unpatentable	Claims Not shown Unpatentable
		Hickman		
Overall Outcome			4, 11	5, 7

Motion to Amend Outcome	Claims
Original Claims Cancelled by Amendment	14, 15
Substitute Claims Proposed in Amendment	21–26
Substitute Claims: Motion to Amend Granted	
Substitute Claims: Motion to Amend Denied	21, 24–26
Substitute Claims: Not Reached	22, 23

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that Petitioner has shown by a preponderance of the evidence that claims 4 and 11 of the ’974 patent are unpatentable;

FURTHER ORDERED that Petitioner has not shown by a preponderance of the evidence that claims 5 and 7 of the ’974 patent are unpatentable;

FURTHER ORDERED that Patent Owner’s request to cancel claims 14 and 15 in its Motion to Amend is *granted*;

FURTHER ORDERED that Petitioner has shown by a preponderance of the evidence that proposed substitute claims 21 and 24–26 are

unpatentable and Patent Owner's request to issue substitute claims 21 and 24–26 is *denied*;

FURTHER ORDERED that Patent Owner's request to substitute claims 22 and 23 for claims 5 and 7 is denied as moot because we have found that Petitioner has not proven that claims 5 and 7 are unpatentable; and

FURTHER ORDERED that, because this is a Final Written Decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

FOR PETITIONER:

W. Karl Renner
Nicholas Stephens
Usman Khan
Matthew Colvin
FISH & RICHARDSON P.C.
axf-ptab@fr.com
nstephens@fr.com
khan@fr.com
colvin@fr.com

FOR PATENT OWNER:

Arvind Jairam
Christina Ondrick
John Holley
George Fishback
McKOOL SMITH, P.C.
ajairam@mckoolsmith.com
condrick@mckoolsmith.com
jholley@mckoolsmith.com
gfishback@mckoolsmith.com