United States Court of Appeals for the Federal Circuit

MCRO, INC., DBA PLANET BLUE,
Plaintiff-Appellant

v.

BANDAI NAMCO GAMES AMERICA INC., TREYARCH CORPORATION,
Defendants

SONY COMPUTER ENTERTAINMENT AMERICA LLC, SUCKER PUNCH PRODUCTIONS, LLC, INFINITY WARD, INC., LUCASARTS, A DIVISION OF LUCASFILM ENTERTAINMENT COMPANY LTD. LLC, ACTIVISION PUBLISHING, INC., BLIZZARD ENTERTAINMENT, INC., NAUGHTY DOG, INC., ELECTRONIC ARTS, INC., DISNEY INTERACTIVE STUDIOS, INC., SQUARE ENIX, INC.,
Defendants-Appellees

2019-1557

Appeal from the United States District Court for the Central District of California in Nos. 2:12-cv-10322-GW-FFM, 2:12-cv-10329-GW-FFM, 2:12-cv-10333-GW-FFM, 2:12-cv-10335-GW-FFM, 2:12-cv-10338-GW-FFM, 2:14-cv-00332-GW-FFM, 2:14-cv-00336-GW-FFM, 2:14-cv-00352-GW-FFM, 2:14-cv-00358-GW-FFM, 2:14-cv-00383-GW-FFM, Judge George H. Wu.

Decided: May 20, 2020

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Before REYNA, MAYER, and TARANTO, Circuit Judges.

TARANTO, *Circuit Judge*.

McRO, Inc., d/b/a Planet Blue (McRO) brought this case against more than a dozen video game developers (the Developers), alleging that the Developers infringed three

method claims of U.S. Patent No. 6,611,278, owned by McRO. The district court held the claims invalid for ineligibility under 35 U.S.C. § 101, but we reversed that holding in *McRO, Inc. v. Bandai Namco Games America Inc.*, 837 F.3d 1299 (Fed. Cir. 2016) (*McRO I*). On remand, the district court ultimately held that the Developers were entitled to summary judgment of noninfringement because the accused products do not practice the claimed methods and to summary judgment of invalidity because the specification fails to enable the full scope of the claims.

McRO appeals. We affirm the judgment of noninfringement. We vacate the judgment of invalidity and remand for the district court to consider any appropriate further proceedings in light of, among other things, the Developers' offer to withdraw their counterclaims without prejudice. *See* ECF No. 86.

I

A

McRO owns U.S. Patent No. 6,611,278, which describes and claims a method for automatically generating animations, with a three-dimensional appearance, depicting lip movements and facial expressions. The method uses two basic building blocks: "phonemes" and "morph targets." A "phoneme," the patent explains, is "the smallest unit of speech, and corresponds to a single sound." '278 patent, col. 1, lines 38–40. A "morph target" is a model of a mouth position—one "reference model" displays a "neutral mouth position," while other models display "other mouth positions, each corresponding to a different phoneme or set of phonemes." *Id.*, col. 1, lines 48–53.

The patent describes specifying a model by identifying groups of vertices placed in particular positions. In a "typical case," "[e]ach morph target has the same topology as the neutral model, the same number of vertices, and each vertex on each model logically corresponds to a vertex on

each other model." *Id.*, col. 1, lines 54–59. Because of that precise correspondence, each morph target can be defined as a set of "deltas," each delta a vertex-specific vector: there is a "vector from each vertex *n* on the reference to each vertex *n* on each morph target," and that vector is the "delta" for that vertex. *Id.*, col. 1, lines 60–63.

To animate a particular facial expression, an artist defines a plurality of morph targets (with corresponding delta sets) and assigns a scalar "morph weight"—"a value usually from 0 to 1"—to each target. *Id.*, col. 1, lines 65–67. Next, the artist chooses a vertex on the reference model and adds the "corresponding delta set's vertex multiplied by the scalar morph weight." *Id.*, col. 2, lines 1–3. Repeating this vertex-specific process for each morph target being used to create the desired animation, the artist sums the resulting vectors and proceeds to the next reference-model vertex. *See id.*, col. 2, lines 4–5. The specification summarizes this process with a formula, stating that for "each vertex v in the neutral model":

$$|\text{result}| = |\text{neutral}| + \sum_{x=1}^{n} |\text{delta set}_x| * \text{morph weight}_x$$

J.A. 15 (cleaning up '278 patent, col. 2, line 6).[1]

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[1] In the sigma (summation) term of the formula, there are *n* morph targets ($x = 1$ through n) that contribute to the ultimate result. For each morph target *x*, its delta (a vector) for the chosen vertex—*i.e.*, the particular vertex's vector within $|\text{delta set}_x|$—is multiplied by the scalar morph weight for that morph target. The *n* resulting vectors (for $x = 1$ through n) are added in the ordinary way for vectors, *i.e.*, term by term in the ordered-sequence representation. Then the sum, in its ordered-sequence representation, is added to the ordered-sequence representation of the corresponding vertex of the neutral model.

Although prior-art methods used morph weight sets, the patent asserts, artists using those methods had to "set all of these weights at each frame to an appropriate value." '278 patent, col. 2, lines 26–27. Accordingly, those methods were time-consuming and laborious, and artists therefore sought to reduce the required work with a "'keyframe' approach, where the artist [would] set[] the appropriate weights at certain important times ('keyframes') and a program [would] interpolate[] each of the channels at each frame." *Id.*, col. 2, lines 28–31. But the keyframe approach itself was "very tedious and time consuming, as well as inaccurate." *Id.*, col. 2, lines 31–34.

By contrast, the '278 patent teaches a method of "automatically" generating animations using morph weight sets. In particular, it describes a method in which a time-marked transcript of recorded text denoting each phoneme—a "time aligned phonetic transcription" (TAPT)—is received by a computer system. *Id.*, col. 2, line 64, through col. 3, line 5. The system takes this input and applies "a set of rules that determine the system[']s output comprising a stream or streams of morph weight sets." *Id.*, col. 3, lines 2–5. The specification describes an exemplary set of rules, with six distinct morph targets, for animating the word "hello." *See id.*, col. 7, line 33, through col. 8, line 55. It further provides several "illustrative examples of other rules which may be used." *See id.*, col. 9, line 32, through col. 11, line 11.

McRO asserts claims 1, 4, and 13 of its patent. Claim 1 is representative for purposes of the issues on appeal:

> 1. A method for automatically animating lip synchronization and facial expression of three-dimensional characters comprising:
>
> obtaining a first set of rules that defines a morph weight set stream as a function of phoneme sequence and times associated with said phoneme sequence;

> obtaining a plurality of sub-sequences of timed phonemes corresponding to a desired audio sequence for said three-dimensional characters;
>
> generating an output morph weight set stream by applying said first set of rules to each sub-sequence of said plurality of sub-sequences of timed phonemes; and
>
> applying said output morph weight set stream to an input sequence of animated characters to generate an output sequence of animated characters with lip and facial expression synchronized to said audio sequence.

Id., col. 11, lines 44–59.

B

In 2012, McRO sued the Developers for patent infringement based on the Developers' production and sale of video games that used one of two third-party software applications—FaceFX or Annosoft—to model facial animations. Both FaceFX and Annosoft use a technique called "bones animation," which attaches "special control objects (called 'bones')" to multiple vertices on a three-dimensional image (*i.e.*, an image that looks three-dimensional). J.A. 4649. Each bone stores information, whether as a 4x4 matrix or as an equivalent 16-term vector, that acts as a "transform" to direct the attached vertices to move to certain positions. J.A. 4650. This movement, which can be complex, generally combines "simpler linear transformations such as rotations, translations, [or] scales." *Id.* Because a vertex can attach to multiple bones, each bone is assigned a weight and the "resulting position of a vertex is determined by blending the transforms that it is attached to according to the weights." J.A. 4649.

After claim construction, the Developers filed a motion for judgment on the pleadings, arguing that each asserted

claim is invalid under 35 U.S.C. § 101. In 2014, the district court granted the Developers judgment on the pleadings and terminated the case. *McRO, Inc. v. Sony Computer Entertainment America, LLC*, 55 F. Supp. 3d 1214 (C.D. Cal. 2014). Although the claims "are tangible, each covering an approach to automated three-dimensional computer animation," the court noted, the claims "preempt the field of lip synchronization using a rules-based morph target approach." *Id.* at 1224, 1227.

We reversed the district court's determination. *McRO I*, 837 F.3d at 1302–03. Holding that the patent does not preempt the field of rules-based animation, we stated that the claims "are limited to rules with certain common characteristics, i.e., a genus." *Id.* at 1313. Specifically, the "rules are limiting in that they define morph weight sets as a function of the timing of phoneme sub-sequences." *Id.* Although "[p]atent law has evolved to place additional requirements on patentees seeking to claim a genus," we explained, "these limits have . . . principally been in terms of whether the patentee has satisfied the tradeoff of broad disclosure for broad claim scope implicit in 35 U.S.C. § 112." *Id.* at 1313–14.

The case returned to the district court, and in July 2018, the court tentatively granted the Developers' motion for summary judgment of noninfringement. The court concluded that the bones animation technique, because it does not use three-dimensional vectors for its movement of vertices, does not practice the "morph weight set" limitation. But, the court stated, it would "not issue a final ruling" until it determined whether the asserted claims of the '278 patent are enabled, as required by 35 U.S.C. § 112.

In November 2018, the district court granted the Developers' motion for summary judgment of invalidity (asserted by most of the Developers through counterclaims). The district court noted that the Developers had identified two animation techniques—bones animation and the

"BALDI system"—that are not enabled by the specification. *McRO, Inc. v. Namco Bandai Games America, Inc.*, No. CV 12-10322-GW(FFMx), 2018 WL 9410401, at *12 (C.D. Cal. Nov. 13, 2018) (*Enablement Opinion*). The court concluded that the Developers had provided clear and convincing evidence that "at the time of the invention, a person of skill in the art would not have the tools to practice the full scope of the 'first set of rules' limitation." *Id*.

The district court entered a final judgment of noninfringement and invalidity on January 9, 2019. McRO timely appealed to this court. We have jurisdiction pursuant to 28 U.S.C. § 1295(a)(1).

II

We review the grant of summary judgment de novo and ask whether there is a "genuine dispute of material fact, after viewing the evidence in the light most favorable to the nonmoving party." *Weber v. Allergan, Inc.*, 940 F.3d 1106, 1110 (9th Cir. 2019); *Eli Lilly & Co. v. Hospira, Inc.*, 933 F.3d 1320, 1327 (Fed. Cir. 2019) (applying regional circuit law). Claim construction is a legal question that may involve underlying factual findings. *Teva Pharms. USA, Inc. v. Sandoz, Inc.*, 574 U.S. 318, 331–32 (2015). Similarly, whether a patent satisfies the enablement requirement is a question of law based on underlying factual findings. *Wyeth & Cordis Corp. v. Abbott Labs.*, 720 F.3d 1380, 1384 (Fed. Cir. 2013). The party challenging the validity of the patent must provide clear and convincing evidence to support such factual findings. *Cephalon, Inc. v. Watson Pharms., Inc.*, 707 F.3d 1330, 1336 (Fed. Cir. 2013).

A

We begin with McRO's appeal of the judgment of noninfringement. We agree with the Developers that the claim term "morph weight set" requires three-dimensional vectors. That is, we conclude that the district court was correct as a matter of law in ruling that a "vector," in the

context of the '278 patent, must have "3-D magnitude and direction computed by pure subtraction/addition between the neutral and target models, with one vector corresponding to each set of two vertices." J.A. 16–17. Because the parties agree that there is no infringement under this construction, we affirm the district court's grant to the Developers of summary judgment of noninfringement.

The district court construed the term "morph weight set" as "[a] set of values, one for each delta set, that, when applied, transform the neutral model to some desired state, wherein each delta set is the set of vectors from each vertex on the neutral (reference) model to each vertex on a model of another mouth position." J.A. 902. This construction combines two express definitions from the specification—"morph weight set" is defined in terms of a "delta set," which, in turn, is defined in terms of "vectors." '278 patent, col. 4, lines 35–37; *id.*, col. 1, lines 60–62. The parties do not dispute this construction of "morph weight set."

The parties do dispute the meaning of "vector" within that construction. The district court construed "vector" as "a vector with direction and magnitude in three-dimensional space." J.A. 21. This construction accords with the Developers' argument that "the vectors constituting the 'delta set' must be vectors in three-dimensional space." J.A. 7302. The construction rejects McRO's proposal that the term should be construed as, simply, "an ordered set of numbers." J.A. 6138. The court noted that it had already "rejected [McRO's] request to construe 'delta set' in the context of 'morph weight set' as 'wherein each delta set is the *mathematical representation* of the difference between the neutral model and another model,'" and the court concluded that McRO was "effectively urging the same impermissibly broad meaning." J.A. 17.

The difference matters for assessing the accused bones system for infringement. The bones system, in its relevant aspect, uses vectors as that term is used in one general

mathematical sense, *i.e.*, any ordered collection of individual terms such as $(a_1, a_2, a_3, \ldots, a_n)$. But there is no dispute that the relevant aspect of the bones system does *not* come within the meaning of "vector" if that word is limited, in the '278 patent, to the ordinary three-dimensional geometric vector, which can be represented by a three-term sequence (a_x, a_y, a_z), each term for one of the three spatial dimensions. The district court adopted the latter construction, rejecting infringement on that basis.

We agree with the district court. The proper claim construction is based "not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1313–16 (Fed. Cir. 2005); *see Ruckus Wireless, Inc. v. Innovative Wireless Solutions, LLC*, 824 F.3d 999, 1003 (Fed. Cir. 2018) ("Ultimately, '[t]he only meaning that matters in claim construction is the meaning in the context of the patent.'" (quoting *Trustees of Columbia Univ. v. Symantec Corp.*, 811 F.3d 1359, 1365 (Fed. Cir. 2016))). Here, the specification compels the three-dimensional geometric construction of "vector" adopted by the district court.

Vertices in the neutral model (points on a face) are locations in three-dimensional space, and the specification's express definition of "delta set" requires a one-to-one correspondence between the vertices of the neutral model and the vertices of each morph target, with a "vector" connecting these corresponding vertices in three-dimensional space. According to the specification, a "delta" is "computed as *a* vector *from each vertex* n on the reference *to each vertex* n on each morph target." '278 patent, col. 1, lines 60–62 (emphasis added). The term "vertex" naturally carries a spatial meaning, as do the words "from" and "to," and they imply that a delta is a *direct path* from the vertex (a spatial point) on the reference to the vertex (a spatial point) on the morph target, *i.e.*, a three-dimensional vector. The conclusion is reinforced by the specification's statement, in

the paragraph preceding the definitional sentence, that "[e]ach morph target has the *same topology* as the neutral model . . . ." *Id.*, col. 1, lines 53–56 (emphasis added). All these terms strongly favor the narrow geometric meaning of "vector"—especially in the spatial context of the invention, reflected in claim 1's stated object of creating visually recognizable "three-dimensional characters." *Id.*, col. 11, line 44.

The equation in the specification confirms the requirement of three-dimensional vectors that can be added and subtracted. Each delta set (a set of vectors) is assigned a "scalar" morph weight, "usually from 0 to 1," and each vector is multiplied by that scalar value. *See id.*, col. 1, line 65, through col. 2, line 3. Then, the corresponding scalar-multiplied vectors from each set are added together—these summations are, finally, added to the corresponding neutral vertices. *Id.*, col. 2, lines 5–9. The specification provides an equation that summarizes this process:

$$|\text{result}| = |\text{neutral}| + \sum_{x=1}^{n} |\text{delta set}_x| * \text{morph weight}_x$$

J.A. 15 (cleaning up '278 patent, col. 2, line 6).

The specification's surrounding discussion confirms that this equation is naturally understood as referring to three-dimensional vectors. The "symbol |xxx| is used to indicate the corresponding vector in each referenced set," the specification explains, and, specifically, |neutral| represents "vertex v in the neutral model." *See* '278 patent, col. 2, lines 5–13. The vertex in the neutral model (a point on a face) is a location in three-dimensional space, which is represented by a three-dimensional vector from the Cartesian origin. Accordingly, to add |neutral| to the result of the summation, the result of the summation must be a three-dimensional vector. And to get that result, $|\text{delta set}_x|$ must also be a three-dimensional vector. Thus, the equation strongly supports the district court's

construction: a "vector" must have "3-D magnitude and direction computed by pure subtraction/addition between the neutral and target models, with one vector corresponding to each set of two vertices." J.A. 16–17.

McRO offers two arguments that this specification evidence should be interpreted differently. The first argument, which relies on the key definitional sentence, misreads our precedent and ignores most of the language in that sentence. According to McRO, the phrase "*a* vector from each vertex n on the reference" implies that each vertex on the reference can have multiple corresponding vectors because "it is a well settled rule that the article 'a' means one or more and not 'a single.'" Brief for Appellant at 24 (citing *KCJ Corp. v. Kinetic Concepts, Inc.*, 223 F.3d 1351, 1356 (Fed. Cir. 2000)). The patent would have used the phrase "a single vector," McRO argues, if it had meant to require one-to-one correspondence. *Id.* But McRO misreads *KCJ Corp.*, which explains that "an indefinite article 'a' or 'an' in patent parlance carries the meaning of 'one or more' in *open-ended claims* containing the *transitional phrase 'comprising*.'" 223 F.3d at 1356 (emphasis added). This specific canon of claim construction has no bearing here. And as discussed, the word "a" is hardly the only relevant textual evidence of meaning.

McRO's second argument, which relies on the paragraph in the specification that precedes the key definitional sentence, gives too much weight to an ambiguous phrase that does not clearly refer to the relevant term. After discussing the topological correspondence between the neutral model and each morph target, the passage states that "such rigid correspondence may not be necessary." *Id.*, col. 1, lines 58–59. This language, McRO contends, overrides the natural understanding of all the specification evidence we have discussed and renders the specification's guidance optional. But the statement that "such rigid correspondence *may* not be necessary" is too equivocal and uncertain to alter the clear teaching of the specification. Indeed, it

does not even refer specifically to the claim term, "morph weight set"; it might be referring to some notion independent of that claim limitation, which, by the specification, is defined to include the "vector" requirement. Nothing in the specification shows a use of "vector," or representation of "delta sets" (sets of vectors), other than the ordinary, geometric, three-dimensional one.

What remains is McRO's brief argument, relying on extrinsic evidence, that one ordinary meaning of "vector" is broader than the district court's construction. Citing a computer graphics textbook called "Real Time Rendering," Dr. Gleicher (McRO's expert) stated that "[t]he term 'vector' in mathematics, computer science and computer graphics is a general concept that roughly means an ordered list of numbers." J.A. 2289 (citing J.A. 2068–69). It is, in fact, not disputed that one broad meaning of "vector" in mathematics and other fields is an "ordered list of numbers." But the existence of one broader meaning in the field is not controlling. What matters is the meaning most appropriate in the context of the particular patent. Here, it is clear, based on the intrinsic evidence, that the term "vector" has the narrower geometric meaning in this patent. That construction, as is undisputed, compels the judgment of noninfringement, which we therefore affirm.

B

We now address McRO's appeal of the judgment of invalidity based on the specification's failure to enable the full scope of claim 1's required "first set of rules." We agree with McRO that the Developers failed to identify with particularity any method of animation that falls within the scope of claim 1 and is not enabled. Without any specific examples, the district court's reasoning is too abstract, too conclusory, to support summary judgment. We do not go so far as to hold that there is a triable issue of fact on enablement—instead, we vacate the judgment and remand for the district court to consider how to proceed.

1

The requirement of enablement, stated in 35 U.S.C. § 112, enforces the essential "*quid pro quo* of the patent bargain" by requiring a patentee to teach the public how "to practice the full scope of the claimed invention." *AK Steel Corp. v. Sollac*, 344 F.3d 1234, 1244 (Fed. Cir. 2003). "The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same . . . ." 35 U.S.C. § 112 ¶ 1 (2006) (now § 112(a)). Although a patent's specification need not "describe how to make and use every possible variant of the claimed invention," "when a range is claimed, there must be reasonable enablement of the scope of the range." *AK Steel*, 344 F.3d at 1244. To qualify as "reasonable," "the specification . . . must teach those skilled in the art how to make and use the full scope of the claimed invention without 'undue experimentation.'" *ALZA Corp. v. Andrx Pharm., LLC*, 603 F.3d 935, 940 (Fed. Cir. 2010) (citing *Genentech Inc. v. Novo Nordisk A/S*, 108 F.3d 1361, 1365 (Fed. Cir. 1997)).

This statutory requirement is limited to what is claimed. Section 112 requires enablement of "only the claimed invention," not matter outside the claims. *Union Carbide Chemicals & Plastics Tech. Corp. v. Shell Oil Co.*, 308 F.3d 1167, 1186 (Fed. Cir. 2002) (citing *Durel Corp. v. Osram Sylvania Inc.*, 256 F.3d 1298, 1306–07 (Fed. Cir. 2001)); *Liquid Dynamics Corp. v. Vaughan Co.*, 449 F.3d 1209, 1224 & n.2 (Fed. Cir. 2006); *In re Vaeck*, 947 F.2d 488, 495 (Fed. Cir. 1991) (all that must be enabled is "the claimed invention"). For that reason, the "enablement inquiry necessarily depends on an interpretation of the claims." *Liquid Dynamics*, 449 F.3d at 1224 & n.2.

Once the precise scope of the claimed invention is defined, the question is whether undue experimentation is

required to make and use the full scope of embodiments of the invention claimed. *See Union Carbide*, 308 F.3d at 1186 n.9 ("Evidence of unsuccessful experimentation without any link to the claims at issue is not evidence of a lack of enablement."). Whether undue experimentation is required "is not a single, simple factual determination, but rather is a conclusion reached by weighing many factual considerations." *ALZA*, 603 F.3d at 940 (citing *In re Wands*, 858 F.2d 731, 737 (Fed. Cir. 1988)). Conducting the *Wands* analysis has routinely involved concrete identification of at least some embodiment or embodiments asserted not to be enabled—including what particular products or processes are or may be within the claim, so that breadth is shown concretely and not just as an abstract possibility, and how much experimentation a skilled artisan would have to undertake to make and use those products or processes. *See*, *e.g.*, *id.* at 939–43 (conducting *Wands* analysis in terms of the specifically identified claim embodiments—tablets and capsules for oral medication dosages).[2]

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[2] In cases involving claims that state certain structural requirements and also require performance of some function (*e.g.*, efficacy for a certain purpose), we have explained that undue experimentation can include undue experimentation in identifying, from among the many concretely identified compounds that meet the structural requirements, the compounds that satisfy the functional requirement. *See*, *e.g.*, *Idenix Pharms. LLC v. Gilead Scis. Inc.*, 941 F.3d 1149, 1155–56 (Fed. Cir. 2019); *Enzo Life Scis., Inc. v. Roche Molecular Systems, Inc.*, 928 F.3d 1340, 1346–47, 1349 (Fed. Cir. 2019); *Wyeth & Cordis Corp. v. Abbott Labs.*, 720 F.3d 1380, 1384, 1387 (Fed. Cir. 2013); *Enzo Biochem, Inc. v. Calgene, Inc.*, 188 F.3d 1362, 1372 (Fed. Cir. 1999); *ALZA*, 603 F.3d at 939.

All the enablement cases on which the district court relied, and on which the Developers rely in this court, involved specific identification of products or processes that were or may be within the scope of the claims and were allegedly not enabled. In *Automotive Technologies International, Inc. v. BMW of North America*, for example, we considered whether a claimed "side impact crash sensor for a vehicle having front and rear wheels" was enabled. 501 F.3d 1274, 1277 (Fed. Cir. 2007). We observed that, under the governing claim construction (not disputed by the parties), the claim term embraced "electronic side impact sensors." *Id.* at 1282. The enablement question, then, was a concrete one: whether the "specification did not enable the full scope of the invention because it did not enable electronic side impact sensors." *Id.*

In *Genentech, Inc. v. Novo Nordisk, A/S*, 108 F.3d 1361, 1367–68 (Fed. Cir. 1997), a case involving a functional cleaving property, the court noted the wide range of enzyme-protein combinations that were not enabled; indeed, it concluded that the specification omitted crucial details (*e.g.*, starting materials, process conditions) for teaching even a single way of producing the claimed result for the identified matter. In *MagSil Corp. v. Hitachi Global Storage Technologies, Inc.*, 687 F.3d 1377, 1381–83 (Fed. Cir. 2012), the claim covered all changes in resistance of 10% or more (*e.g.*, 100% or 1000%) in a particular process, and it was the lack of any teaching of how to achieve the resistance change even a little bit above 10% that was not enabled (and was concededly unknown at the time). In *Sitrick v. Dreamworks, LLC*, 516 F.3d 993, 999–1001 (Fed. Cir. 2008), the claim covered both video games and movies, and it was movies that the court held to be not enabled. In *In re Vaeck*, 947 F.2d at 495, the claims covered use of any of the many known species of cyanobacteria, but there was no enabling of the required gene expression in any but a small subset (and such expression in cyanobacteria was unpredictable). In *Trustees of Boston University v. Everlight*

Electronics Co. Ltd., 896 F.3d 1357, 1360, 1362 (Fed. Cir. 2018), the parties agreed that the claim covered six permutations for the relationship between a growth layer and a buffer layer, and it was one of those permutations that the court concluded was not enabled.[3]

In short, none of the cases invoked by the district court and by the Developers have involved an abstract assertion of breadth, without concrete identification of matter that is not enabled but is or may be within the claim scope. As next explained, this case, in its current posture, involves such an abstract assertion of breadth. Under our claim construction, the bones and BALDI techniques are noninfringing and so cannot support a nonenablement determination. And no other concretely identified animation techniques have been advanced to support the district court's and Developers' enablement analyses.

2

The district court in this case determined that the specification of the '278 patent fails to enable claim 1's "first set of rules" limitation. *Enablement Opinion* at *10. Specifically, claim 1 requires "obtaining a first set of rules that defines a morph weight set stream as a function of phoneme sequence and times associated with said phoneme

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[3] *See also Idenix*, 941 F.3d at 1157 (vast number of substituents at positions on ring other than 2′-up); *Enzo Life Scis.*, 928 F.3d at 1346–67, 1349 (all phosphate-labeled polynucleotides that are hybridizable and detectable, including any type of labels and linkages and any location of labels); *Wyeth*, 720 F.3d at 1384, 1387 (large number of compounds varying substituent groups outside a sirolimus ring and of potential rapamycin compounds); *ALZA*, 603 F.3d at 939 (non-osmotic oral dosage forms—tablets and capsules); *Enzo Biochem*, 188 F.3d at 1372 (all eukaryotic and prokaryotic cell types).

sequence." '278 patent, col. 11, lines 43–48. This claim, the specification reveals, requires at least two operations.

First, the specification makes clear that obtaining the set of rules presupposes identifying which mouth shapes (morph targets) should be used for representing a particular phoneme (or phoneme sequence) appearing on the "time aligned phonetic transcription" that is being synched to an animation. *See id.*, col. 4, lines 31–45 ("The method preferably comprises a set of rules that determine what the output morph weight set stream will be when any sequence o[f] phonemes and their associated times is encountered."); *id.*, col. 1, lines 49–53 ("morph targets" are models of mouth positions—one "reference model" corresponds to a "neutral mouth position," while other models display "other mouth positions, each corresponding to a different phoneme or set of phonemes"). For example, the specification explains, an artist would have to know that "the 'l' in 'hello'" requires a wider mouth shape than the "'l' in 'burly.'" '278 patent, col. 10, lines 22–25.

But on the record before us, this aspect of the claimed rules need not have been taught in the specification, and the district court did not rule otherwise. An "artisan's knowledge of the prior art and routine experimentation can often fill gaps, interpolate between embodiments, and perhaps even extrapolate beyond the disclosed embodiments, depending upon the predictability of the art," *AK Steel*, 344 F.3d at 1244, and a "patent need not teach, and preferably omits, what is well known in the art," *Spectra-Physics, Inc. v. Coherent, Inc.*, 827 F.2d 1524, 1534 (Fed. Cir. 1987). Here, the district court explained that "both experts apparently agree that the state of computer animation overall and the development of rules for animation was well-developed in other contexts." *Enablement Opinion* at *17; *see* J.A. 4945 (McRO's expert); J.A. 5772 (the Developers' expert). The specification itself indicates that animators knew how to match mouth positions to phonemes—doing so just took a significant amount of time because the

process was manual. *See* '278 patent, col. 2, lines 26–42. The inventors here do not purport to have discovered that the "l" in "hello" requires a wider mouth shape than the "l" in "burly."

The second, and assertedly novel, aspect of the invention, is a set of rules that tells the system how to automatically output the chosen mouth shapes in a format that can create an animation—as a continuous stream of morph weight sets that can transform a neutral model. *See id.*, col. 4, lines 46–60 ("The primary function of the rules is to determine[] 1) the appropriate morph weight set correspondence with each TAPT sub-sequence; and 2) the time parameters of the morph weight set transitions between the representation of the prior TAPT sub-sequence or other timed data and the current one."). Because this process is the novel aspect of the claimed invention, the specification must reasonably teach how to make and use this aspect of the invention. *See Auto. Techs.*, 501 F.3d at 1283; *Genentech*, 108 F.3d at 1366.

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The Developers have not, at this point in the case, met their burden of identifying a set of rules, for automatically outputting chosen mouth shapes, that is or may be within the scope of claim 1. *See MagSil*, 687 F.3d at 1380 ("A party must prove invalidity based on nonenablement by clear and convincing evidence.").

The district court identified, and relied on for the "more important[]" part of its analysis, two specific examples offered by Dr. Wyvill (the Developers' expert): bones animation (the accused product) and the BALDI system. *Enablement Opinion* at *12. As discussed above, bones animation uses 4x4 matrices or vectors of length sixteen to perform a combination of linear transformations on multiple vertices. J.A. 4649–50. Similarly, as the district court recognized, the BALDI system uses an "'interlocking set of mathematical equations . . . that balance the influence of

different proximate phonemes on various aspects of the model's facial expression.'" *Enablement Opinion* at *12 (citing J.A. 5891–92). Dr. Wyvill stated that the specification of the '278 patent does not "even remotely suggest that the inventor had possession of the species of rule sets that defines a morph weight set stream as a function of phoneme sequence and time for bone animation," J.A. 5893, and that the "BALDI system provides a good example of a system that uses 'rules' that are far more complex and intricate than anything the '278 Patent describes," J.A. 5891. The district court concluded that those statements "suggest that at the time of the invention, a person of skill in the art would not have the tools to practice the full scope of the 'first set of rules' limitation." *Enablement Opinion* at *12.

Given our construction of the term "morph weight sets," however, both bones animation and the BALDI system are clearly "outside the scope of the claims" and are thus "irrelevant to enablement." *See Durel*, 256 F.3d at 1307. With respect to bones animation, our noninfringement decision compels this conclusion—"bones" are not, and do not use, three-dimensional geometric vectors to move vertices. *See supra* pp. 10–13; *see also* Brief for Appellee at 15 ("Bone transform values . . . do not specify, or even contain enough information to derive, the position or the displacement of any vertex on any facial model."). Record evidence compels the same conclusion with respect to the BALDI process, at least in the context of a summary-judgment motion. Dr. Wyvill, in the context of an expert opinion regarding obviousness, conceded that BALDI's "parameter target values corresponding to each phoneme do not represent delta sets as construed" and that BALDI's equations "do not represent the displacements of each vertex in terms of a simple *xyz* displacement vector." J.A. 5839.

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Without bones animation and the BALDI process available as claim-covered techniques that must be enabled, the district court's reasoning is too abstract and too conclusory to support summary judgment.

Apart from its discussion of bones and BALDI, the district court made two basic observations. First, the court noted, the "first set of rules" limitation "is broad, encompassing more than simply a rule scheme that involves rules applied at keyframes or rules in the form of 'if . . . then . . . else' constructs." *Enablement Opinion* at *8. Second, the court stated, a "review of the specification supports the conclusion that the patent disclosure only provides working examples of rules related to a keyframe approach using an 'if . . . then . . . else' construct." *Id.* at *10. Tying these two observations together, the court concluded that McRO had failed to "provide . . . any exemplary metric that might allow the [c]ourt to understand the exact bounds of what is claimed in the '278 Patent as a first set of rules." *Id.* at *11. Accordingly, McRO could not "avoid an enablement challenge by simply arguing that [the Appellees] ha[d] failed to identify an operative alternative embodiment." *Id.*

But these observations merely state the conclusion that the claims are too broad and the specification's discussion is too narrow. The observations do not justify the conclusion with any concrete support. To say that the "first set of rules" limitation is broader than "if . . . then . . . else" statements based on keyframes is not to say what else is or may be within the phrase—and it was the burden of the Developers, not McRO, to prove that such specific content exists and that it is not enabled. Where, as here, there is at least some expert testimony supporting enablement, even if at a high level of generality, *see*, *e.g.*, J.A. 4893–94, J.A. 4944–47, the district court's reasoning and the support offered by the Developers are not enough to justify summary judgment of nonenablement for the Developers.

We see no reason in this case to depart from our usual requirement that the challenger identify specifics that are or may be within the claim but are not enabled. Specifics have always mattered. *See supra* pp. 16–17. Here, a "fuller set of fact-findings [about what is] within the scope of the claims" is necessary "to decide the enablement issue." *Durel*, 256 F.3d at 1307.

III

We affirm the district court's judgment that the Developers did not infringe the '278 patent. We vacate the district court's judgment that the Developers were entitled to summary judgment that the '278 patent is invalid for lack of enablement. Without holding that the Developers could not make such a showing, we remand the case for such further proceedings as are appropriate, considering the Developers' offer to withdraw their invalidity counterclaims.[4]

The parties shall bear their own costs.

AFFIRMED IN PART, VACATED IN PART, AND REMANDED

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[4] We deny McRO's request to direct that the case be assigned to a different district judge on remand. *See Juicy Whip, Inc. v. Orange Bang, Inc.*, 382 F.3d 1367, 1371, 1373–74 (Fed. Cir. 2004).