

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

LULULEMON ATHLETICA CANADA INC. and LULULEMON USA INC.

Petitioners,

v.

NIKE, INC.,

Patent Owner

Case IPR2023-00438

Patent No. 8,620,413

DECLARATION OF DR. BRYAN BERGERON, M.D.

lululemon v. NIKE, Inc. IPR2023-00438 Patent No. 8,620,413 Ex. 2001
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I, Bryan Bergeron, M.D, declare as follows:

I. INTRODUCTION

1. I have been retained by the Patent Owner Nike, Inc. (“Nike”) to provide certain opinions in the *inter partes* review proceeding (IPR2023-00438) regarding U.S. Patent No. 8,620,413 (“the ’413 Patent”).

2. I have been asked to assess how a person of ordinary skill in the art (a “POSITA”) would have understood the ’413 Patent at the time of invention, as well as the state of the art and prior art at that time. I have also been asked to analyze the prior art references used in the asserted grounds of the Petition to determine whether they disclose elements of the Challenged Claims, and would have been combined in the manner suggested by Petitioner. Further, I have been asked to compare the prior art references used in the asserted grounds of the Petition with the prior art that was disclosed to and considered by the Examiner during prosecution of the ’413 Patent, to determine whether such references disclose substantially the same subject matter.

3. I am being compensated for my time working on this matter at my standard rate of \$425/hour. I am also being reimbursed for reasonable expenses incurred during my work. My opinions and understanding herein are my own, and my compensation does not depend in any way on the substance of my opinions, or on the outcome of any proceedings or actions involving the ’413 Patent. I also have no known financial interests in any of the parties involved in this proceeding.

II. QUALIFICATIONS

4. My *curriculum vitae*, attached as Exhibit A, includes my detailed education and employment background, professional experience, and a list of technical publications and patents. A high-level summary of my relevant experience is provided herein below.

5. Currently, I am the President of Archetype Technologies, Inc., which specializes in the development and evaluation of new technologies and intellectual property. Specifically, Archetype Technologies designs and develops custom hardware and software solutions for medical device and medical information system companies. We are currently developing software and hardware systems for commercialization in the field of translational reality.

6. In 1980, I obtained my Bachelor of Science (B.S.) degree in Psychology, with honors, in the Tulane University Scholar's Program, with minors in physics and chemistry. I obtained my Doctor of Medicine (M.D.) degree from Louisiana State University Medical Center in 1984. From 1985 through 1987, I was a post-doctoral research fellow in medical informatics at Brigham & Women's Hospital, a Harvard Medical School teaching hospital located in Boston, Massachusetts. As part of my post-doctoral fellowship, I studied computer science at Harvard University.

7. In 1984, I founded Home Health Software in New Orleans, Louisiana, where I was the sole employee and worked as both the president and chief programmer. Home Health Software focused on the development of software for various types of medical analyses and planning, including one of the first commercial nutritional analysis and planning applications that could be utilized by a lay-person on a home microcomputer.

8. In late 1984, I began working at Apple Inc. as a Certified Developer of its new Macintosh Computer.

9. In 1987, I worked as an Application Specialist at Children's Hospital in Boston, Massachusetts. In this role, I managed the first HL7 installation on the East Coast, defined the hospital's data dictionary, and designed the clinical workstation. This clinical workstation combined a particular patient or group of patient's clinical data under one intuitive interface, which allowed a patient's current labs, radiology, and physiological data to be present in one centralized location.

10. In 1989, I began working as an Instructor at Harvard Medical School. During this time, I was also an Assistant Director of the post-doctoral fellowship program in Medical Informatics and Brigham & Women's Hospital and Harvard University. In this role, my primary responsibility involved facilitating the

development of innovative, graphical, computer-based teachings, such as patient simulation software, to train medical students.

11. Starting in 1989, I managed a team of post-doctoral fellows in medical informatics, medical students and visiting fellows, students, and faculty in developing over a dozen commercial-grade simulators as well as back-end infrastructures and databases for monitoring and documenting learner progress in the various medical educational systems.

12. In 1996, I founded Archetype Technologies to offer consulting services to industry and to compete for government funding. In addition to serving as the Head of Archetype, I also serve as Chief Scientist for various clients. Many of Archetypes clients are generally startup companies or other small companies.

13. In 1999, I served as Principal Investigator on a Small Business Innovation Research grant after being award this grant on behalf of Kurzweil Applied Intelligence. During this time, I co-developed a rule-based medical record quality assurance system for automatically reviewing and evaluating reports in EMR system. This system was immediately commercialized and sold by Lernout & Hauspie Speech Products.

14. I have approximately thirty years of teaching experience. From 1986 to 2015, I taught in the Harvard-MIT Program in Health Sciences and Technology (HST) in Cambridge, Massachusetts. This program is a collaboration between the

Massachusetts Institute of Technology (MIT), Harvard Medical School, Harvard University, and Boston area teaching hospitals that integrates science, medicine, and engineering to solve problems in human health. I taught clinical medicine, including cardiac pathophysiology and pulmonary pathophysiology, to medical students in the HST program, as well as medical informatics to these same students, faculty at MIT and Harvard Medical School, graduate students at the Harvard Law School, Harvard School of Public Health, and Harvard Business School.

15. I competed for and won a First Independent Research Support and Transition Award by the National Library of Medicine in 1988. This award provided six years of support and funding for me to develop new technologies. For the past decade, I have served as the Principal Investigator on a series of research grants south by Accella Learning Company related to the development of electronic simulator hardware and software for intelligent tutoring systems that train medical first responders for nuclear, chemical, and biological warfare events. Most recently, I served as the chief medical consultant on the United States Department of Defense's funded grants to design and develop the software infrastructure for a national physiology research platform called BioGears. This platform is designed to build lifelike mannequins, realistic online military games, and a variety of medically-accurate scenarios for training and testing.

16. Throughout my career I have invented a number of devices, systems, and software in the medical field. For example, during my post-doctoral fellowship at Brigham & Women's Hospital and Harvard Medical School, I developed HeartLab. HeartLab was the first commercial multimedia patient simulator for a microcomputer. I sold HeartLab to Williams and Wilkins Publishers in Baltimore, Maryland, and to virtually all medical schools in the United States and to major medical schools in Canada and Europe. I also developed a bedside heart monitoring system that acquired and digitized heart sounds in patients with various disease states, e.g., aortic stenosis. I also developed a program called EKGLab to stimulate the range of EKG tracings possible with a variety of disease states. Finally, I created a pulmonary monitoring system to acquire auscultatory data for LungLab, a program that I co-developed to teach pulmonary pathophysiology.

17. I am a named inventor on eleven (11) U.S. patents. Four (4) of the patents on which I am listed as a co-inventor relate to virtual, web-based, and processor-enabled training for medical personnel. My other patents involve intelligent tutoring systems and translational reality interfaces using embedded processors.

18. Throughout my career, I have held a variety of posts in organizations that focus on the application of computing to the practice and teaching of medicine. For example, I have served as Chairman of the Mathematical Modeling &

Simulation Committee for the Symposium on Computer Applications in Medical Care (SCAMC), Chairman of the SCAMC Human-Computer Interfacing Committee, and Chairman of the Healthcare Information and Management Systems Society (HIMSS) Conference on Innovative Informatics for Reducing Medical Errors.

19. I am a frequent contributor to the field of medical informatics and I have also served on fourteen (14) editorial boards for various publications related to medical informatics. I have written numerous articles for various journals and publications, including Computer Methods and Programs in Biomedicine, the Journal of Medical Education Technology, the Journal of Educational Multimedia and Hypermedia, the Journal of Instructional Delivery Systems, Perspectives in Biology and Medicine, the British Journal of Knowledge Management, and the International Journal of Mechanical Engineering and Robotics Research. Many of those articles are in the field of robotics (including telerobotics) and telemedicine. I have also given hundreds of lectures and courses on topics regarding computer technology, computer-assisted training, medical informatics, data dictionary design issues, emerging technologies in healthcare, and robotics. A more detailed description of my publications and lecturing experience can be found in my *curriculum vitae*, attached as Exhibit A.

20. From 2007 to present, I have served as an expert witness and technical consultant in litigation over one hundred (100) times. This total includes both district court cases and *inter partes* review proceedings before the Patent Trial and Appeal Board. I have been deposed thirty-three (33) times and I have testified twelve (12) times. I have also presented at a Markman Hearing three (3) different times. I have equally served both Plaintiffs/Petitioners and Defendants almost as I have served as an expert witness for Plaintiffs/Petitioners fifty-three (53) times and for Defendants fifty-two (52) times.

21. In forming my opinions, I have relied on my education and experience, as well as the materials described below. My CV provides additional details on my qualifications and experience.

III. MATERIALS REVIEWED AND CONSIDERED

22. In performing my analysis and preparing this declaration, I reviewed the Petition for *inter partes* review of the '413 Patent (the "Petition") and the cited exhibits (Exs. 1001-1015), the '413 Patent and its prosecution history, and references disclosed to and cited by the Patent Office during prosecution (including those discussed herein). I also reviewed the declaration of Dr. Kevin Lynch (Ex. 1009) submitted in conjunction with the Petition.

IV. RELEVANT LEGAL STANDARDS

23. I am not an attorney, but for the purposes of preparing this declaration, I have been informed about certain legal concepts that are relevant to forming my opinions. My understanding of those concepts is provided in this section.

24. I understand that in order for the Board to institute trial in this IPR, Petitioner must show a reasonable likelihood of prevailing as to the unpatentability of at least one Challenged Claim.

25. I understand that a patent claim may be invalid as anticipated if each element of that claim is present either expressly or inherently in a single prior art reference.

26. I also understand that a patent claim may be invalid if it would have been obvious to a POSITA at the time the application was filed. I understand this means that all the elements of the patent claim must be found in the teachings of one or more references, and that there must have been a rationale for a POSITA to combine and/or modify the teachings of the references at the time of invention to arrive at the claimed invention, along with a reasonable expectation of success in doing so. I understand that a proper analysis of whether a patent claim is obvious includes consideration of the scope and content of the prior art, the differences between the patent claims at issue and the prior art, the level of ordinary skill in the field of the invention at the time of the invention, and other objective considerations.

I also understand that in considering obviousness, it is important not to rely on the benefit of hindsight derived from the patent being considered.

27. I understand that in evaluating whether a patent claim would have been obvious, it is appropriate to consider, among other factors:

- whether the teachings of the prior art references disclose known concepts that may be combined in familiar ways, and that when combined, would yield predictable results;
- whether substituting one known element for another would yield predictable results;
- whether applying a known technique would improve similar devices in the same way;
- whether the claimed elements represent one of a limited number of known design choices, which would have a reasonable expectation of success to a POSITA;
- whether known work in one field would prompt variations of the same work in others, leading to predictable results;
- whether there is some teaching, suggestion, or motivation in the prior art references that would have led a POSITA to combine or modify their teachings to arrive at the claimed invention.

28. I understand that in evaluating an IPR petition, the Board considers whether the same or substantially the same prior art had been previously presented to the Patent Office, and if so, whether or not the Petitioner has demonstrated that the Patent Office erred in its previous evaluation of that art in a manner material to patentability. I understand that the Board uses the so-called *Becton, Dickinson* factors in considering this issue, which are as follows:

- (a) the similarities and material differences between the asserted art and the prior art involved during examination;
- (b) the cumulative nature of the asserted art and the prior art evaluated during examination;
- (c) the extent to which the asserted art was evaluated during examination, including whether the prior art was the basis for rejection;
- (d) the extent of the overlap between the arguments made during examination and the manner in which Petitioner relies on the prior art or Patent Owner distinguishes the prior art;
- (e) whether Petitioner has pointed out sufficiently how the Examiner erred in its evaluation of the asserted prior art; and
- (f) the extent to which additional evidence and facts presented in the Petition warrant reconsideration of the prior art or arguments.

V. OVERVIEW OF THE '413 PATENT

29. The '413 Patent is titled "Adaptive Watch," and generally discloses a "watch or other type of portable electronic console" for monitoring athletic performance. Ex. 1001, 3:3-7. Embodiments of the invention allow connection to and display of information from "any desired combination of athletic performance sensors, including one or more of a remote heart rate monitor, a speed/distance monitor, a blood pressure monitor, a bike pedometer, a volumetric expansion monitor, or a global positioning device," or even a "music player." *Id.*, 3:7-53. One aspect of the invention is a device that can "automatically calculate various data values to be used by an athlete, such as heart rate zones." *Id.*, 3:53-57.

30. The patent explains that certain prior devices calculated heart rate zones by "employ[ing] a mathematical formula incorporating the athlete's sitting heart rate, the athlete's age, and a general estimate of the athlete's fitness condition," which "are typically difficult for an athlete to calculate." *Id.*, 15:7-11. Or in some cases, prior devices asked the user to "shoot for a number" taken from a standardized "heart rate chart," which includes values that may only "be appropriate for a few individuals." *Id.*, 15:11-15. These previous methods often produced inaccurate results for many users because they could not "take into account an individual's particular exercise ability." *Id.*, 15:11-17.

31. The patent explains that a key feature of the invention is providing a method for determining heart rate zones “for an individual athlete.” *Id.*, 15:18-20. The patent also explains that “an athlete can obtain different performance gains by maintaining his or her heart rate within” different zones. *Id.*, 14:53-61. For example, when an athlete maintains his or her heart rate within a zone that is 40% to 60% of the athlete’s maximum heart rate, the athlete may burn fat most efficiently in this “fat-burning” zone. *Id.*, 14:59-63. On the other hand, when the athlete increases his or her exercise intensity to reach 60% to 80% of his or her maximum heart rate, “an athlete may improve his or her maximum possible rate of oxygen consumption by maintaining his or her heart rate” in that zone. *Id.*, 14:64-67. However, these zones will be different for each individual, and to account for that fact the patent describes embodiments that “allow a user to calculate an individualized heart rate by associating the heart rate with how a user is physically feeling when determining the heart rate.” *Id.*, 15:21-24. For example, the heart rate zones can be determined based on a specific user’s heart rate measurements received by a sensor while the user is exercising at levels that subjectively feel “easy,” “medium,” and “hard.” *Id.*, 15:44-16:55. This process accounts for the athlete’s unique “fitness condition,” and therefore allow for the determination of “appropriate” heart rate zones that “take into account an individual’s particular exercise ability.” *Id.*, 15:7-26. This aspect of the

invention ultimately allows an athlete “to exercise more efficiently and to avoid over-training.” *Id.*

32. I note from my review of the prosecution history that after considering nearly two dozen references and evaluating the applicant’s responses to two office action rejections, the Examiner allowed the Challenged Claims and granted the ’413 Patent. Notably, the Examiner considered both Lubell and Flach during the prosecution of the ’413 Patent, but allowed the claims over those references.

33. Originally, the Examiner rejected the independent claims as anticipated by Lubell, and certain dependent claims as rendered obvious by the combination of Lubell, Flach, and another reference. Ex. 1011, at 2–3, 4–5; Ex. 1013, at 3–4, 6. After the applicant explained that Lubell was “directed to a prescribed exercise test” and that it “executes a predefined exercise test protocol that is not based on a level of physical fitness of a user,” the Examiner withdrew the rejections and allowed the claims. Ex. 1015, at 2–3. The Examiner explained that she allowed the claims over all the disclosed prior art because the ’413 Patent’s claimed “exertion levels are based on a level of physical fitness of the user and are specifically chosen by the user,” and because unlike the disclosed prior art, “there is no external device which is choosing the exertion level” for the user. *Id.* The Examiner also noted that the claimed exertion levels are “chosen and maintained exclusively by the user and not in any way acted upon by the device.” *Id.*

VI. LEVEL OF ORDINARY SKILL IN THE ART

34. I understand that the '413 Patent, the prior art, and any other evidence is to be evaluated from the perspective of the hypothetical person of ordinary skill in the art (POSITA) at the time of the claimed invention. My opinions in this declaration are based on such perspective.

35. In Petitioner's view, a POSITA for the subject matter of the '413 Patent would have had (1) a bachelor's degree in engineering, computer science, industrial design, biomechanics, or a related field, and (2) at least two years of experience researching, developing, designing, and/or testing fitness or physiological sensors, wearable devices, physiological or biomechanical devices, remotely controlled systems or interfaces, wired and wireless communication, network-based applications and/or equipment, or the equivalent experience or education. Petition, at 18.

36. For this declaration, I have accepted Petitioner's definition of a POSITA. However, I reserve the right to address the level of ordinary skill in the art at a later date if the Board institutes trial.

37. Under Petitioner's definition, I qualify as a POSITA because I have significantly more than the minimum qualifications in education or equivalents (including an M.D. and post-doctoral work in computer science), and in experience

(including over 30 years of teaching, and decades of experience in inventing and contributing to a number of devices, systems, and software in the medical field).

VII. CLAIM CONSTRUCTION

38. I understand that Petitioner has not proposed that any claim terms in the '413 Patent require construction for purposes of its IPR petition. Petition, at 17. Thus, I have not offered any opinions on claim construction in this declaration, although I reserve the right to do so at a later date if I am asked.

39. I understand that the claim terms of the '413 Patent are to receive their ordinary and customary meanings, which I have applied in forming my opinions in this declaration.

VIII. SUMMARY OF OPINIONS

40. The subject matter of Amano and Matsumoto is substantially the same as the subject matter of Lubell, which was extensively considered by the Examiner during prosecution of the '413 Patent. Similarly, the subject matter of Ceci is substantially the same as the subject matter of Henry and Fabrizio, which were also considered by the Examiner during prosecution of the '413 Patent.

41. Amano and Matsumoto do not disclose multiple limitations of the independent Challenged Claims 1, 12, and 17, including [C] “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user,” [D] “determin[ing] a plurality of heart

rate zones based on first heart rate measurements received from a sensor while the user exercises at the plurality of successive exertion levels,” and [E] “generat[ing] a prompt instructing a user to exercise while maintaining heart rate within a particular one of the plurality of heart rate zones.” Lubell also does not disclose multiple limitations of the independent Challenged Claims 1, 12, and 17, including [E] “generat[ing] a prompt instructing a user to exercise while maintaining heart rate within a particular one of the plurality of heart rate zones,” and [G] “determin[ing] whether the second heart rate measurements are within the particular heart rate zone”

42. A POSITA would not have been motivated to combine Lubell with Ceci, including because Lubell discloses standardized workout routines that are selected by the device, and disparages the type of self-selected workout routines taught by Ceci.

IX. OVERVIEW OF ASSERTED PRIOR ART REFERENCES

A. Lubell

43. U.S. Patent No. 4,566,461 (“Lubell,” Ex. 1004) is titled “Health Fitness Monitor,” and generally discloses a “device suitable for use in monitoring aerobic exercise training,” including by “monitoring the subject’s heart rate and pacing the subject through a submaximal exercise stress test protocol.” Ex. 1004, Abstract. Lubell discloses a portable, programmable device that can be worn while running or cycling, which includes a heart rate monitor and a heart beat sensor, along with audio

and/or visual display capabilities for providing information to the user. *Id.*, 2:45-3:17.

44. Lubell was cited extensively by the Examiner during prosecution of the '413 Patent, which is acknowledged by the Petitioner, but does not appear to have been acknowledged or addressed by Dr. Lynch. Petition, at 7-8. Dr. Lynch stated that he reviewed the prosecution history, but “did not see anything in the prosecution history of the '413 patent that affected” his opinions. Ex. 1009, ¶ 40. I also reviewed the prosecution history, and in contrast to Dr. Lynch, that history has informed my opinions. For example, the Examiner originally rejected claims under Lubell (Ex. 1011, at 3; Ex. 1013, at 3-4), which prompted the applicant to amend the claims. Those changes involved additions to elements in the independent claims, including “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user,” with the added material underlined. Ex. 1014, at 3. After these amendments, the Examiner retracted its rejection under Lubell and allowed the claims. The Examiner’s reasons for allowing the claims are instructive. Specifically, the Examiner stated that the '413 Patent’s claims require “exertion levels [that] are based on a level of physical fitness of the user and are specifically chosen by the user there is no external device which is choosing the exercise level.” Ex. 1015, at 8. The Examiner also found that under the claims, a “user is given a prompt to exercise at a first level,” which is “chosen

by the user.” *Id.*, at 9. The Examiner contrasted the ’413 Patent’s claims to the prior art that was considered (which included Lubell), finding that unlike the prior art, under the claims “the exertion level is chosen and maintained exclusively by the user and not in any way acted upon by the device.” *Id.* The Examiner’s findings are informative in understanding Lubell, because I agree with the Examiner that Lubell only discloses a training protocol that is chosen by the device, not by the user.

45. Specifically, Lubell discloses monitoring aerobic exercise training by estimating the subject’s maximal oxygen uptake, or VO_{2max} . As Lubell describes, VO_{2max} is a measure of the cardiovascular system’s capacity for delivering oxygen through the blood stream to the body tissues, and is “usually expressed in terms of the volume of oxygen taken up by the cardiovascular system, per kilogram of body weight, per minute.” Ex. 1004, 1:42-49. Generally speaking, a higher VO_{2max} correlates with a greater level of physical fitness. As Lubell explains, a “sedentary thirty year old male” may have a VO_{2max} of “30-35 milliliters of oxygen per kilogram of body weight per minute,” while a “well-trained thirty-year-old male distance runner” may have a VO_{2max} of 70. *Id.*, 1:51-57. According to Lubell, a subject’s “ VO_{2max} can be estimated” from his or her oxygen consumption measured at submaximal work loads. *Id.*, 1:65-68.

46. Importantly, in order to determine these estimated VO_{2max} levels for a subject by measuring oxygen consumption at submaximal work loads, Lubell

teaches “automatically pacing the subject through a straightforward training protocol.” *Id.*, 2:50-51. This is because Lubell’s disclosed method for estimating VO_{2max} involves the so-called Van der Walt relationship, which uses experimentally derived coefficients to calculate a subject’s VO_{2max} based upon the amount of time that it takes a subject to reach his or her “maximum heart rate” while running in a specially designed “exercise tolerance test.” *Id.*, 3:47-53. The Van der Walt relationship is defined as “ $VO_{2max} = aT + b$,” where T equals time, such that, for example, if a male subject requires 7 minutes to reach his maximum heart rate while running in the exercise tolerance test, the specific coefficients used are “ $VO_{2max} = 3.83 \times 7 + 13$,” for a VO_{2max} of 39.8 milliliters of oxygen per kilogram of body weight per minute. *Id.*, 4:7-19. If the subject requires a different range of time to reach maximum heart rate, then different coefficients are used in the equation. *Id.*

47. In order for the equation taking advantage of the Van der Walt relationship to be applicable, Lubell discloses a standardized “submaximal exercise test protocol” that users are subjected to. First, a subject enters his or her height, weight, and sex information, which is used to select the appropriate equation coefficients. *Id.*, 3:19-26. Next, the device measures the subject’s resting heart rate. *Id.*, 3:27-29. Then, the device uses “pacing tones to establish an exercise cadence,” so that the subject exercises “at a predetermined pacing rate” in accordance with the “graded submaximal exercise tolerance test.” *Id.*, 3:30-34. In this “predetermined”

test, the subject exercises in three minute intervals “at progressively faster cadences,” while the device measures the subject’s heart rate. *Id.*, 3:36-43. Lubell teaches that its “preferred” test starts at “four miles per hour,” and then increases to 6, 8, 10, 12, and 14 miles per hour “for the successive three minute intervals.” *Id.*, 3:58-68. Lubell teaches that its protocol requires the subject to run, even if certain speeds “can be walked,” and that the test proceeds until the subject “reaches his or her maximum heart rate,” or “reaches the point of exhaustion.” *Id.*, 3:64-4:13. The device then estimates VO_{2max} using the Van der Walt equation, with the appropriate coefficients. *Id.*

48. Lubell only discloses a “submaximal exercise tolerance test” whereby a subject is directed to exercise “at a predetermined pacing rate.” *Id.*, 3:30-34. One reason for this is that an object of Lubell is to provide a “universally applicable” system. *Id.*, 2:9-10. In discussing prior approaches to estimating VO_{2max} , Lubell describes a “previously-proposed fitness monitoring system” where maximum oxygen uptake “was calculated by having the subject exercise, at whatever speed he or she desired, for a period of twelve minutes.” *Id.*, at 2:1-4. Lubell criticizes that test as “not accurate for subjects of a range of ages or fitness levels,” because it was “based only on the performance of a homogeneous group of male U.S. Air Force recruits who were already in reasonably good physical shape.” *Id.*, at 2:9-15. Lubell also criticizes another test, where runners were allowed “to pace themselves at

various speeds,” because it failed to account for variability between subjects, including in their “stride length.” *Id.*, 2:35-44. For at least these reasons, Lubell states that “an object of this invention” is to “automatically” pace the user “through a straightforward training protocol,” which is a “submaximal exercise tolerance test” using “predetermined” pacing rates. *Id.*, 2:45-51, 3:30-34. Lubell’s “preferred fitness index submaximal exercise test protocol” is designed so that VO_{2max} “is calculated according to the Van der Walt relationship used for the running test.” *Id.*, 3:58-4:13. Thus, Lubell explains that “an exemplary embodiment” of its device is “intended for use with a human subject using running as the preferred training exercise.” *Id.*, 5:6-8. But Lubell mentions that its device “could be suitably adapted for use when cycling, swimming” or performing “some other exercise,” in which case “a suitable submaximal exercise test protocol could be used, in a controlled exercise environment.” *Id.*, 5:9-14. Lubell also mentions that its device could be “adapted for monitoring the training of non-human subjects, such as race horses or dogs.” *Id.*, 5:15-17.

49. Apart from the “submaximal exercise test protocol” used to estimate a subject’s VO_{2max} , the device in Lubell also has a “pacer mode.” *Id.*, 9:58-60. Relevant to this pacer mode, Lubell also discusses that a given “fraction of maximal oxygen uptake” can be calculated using the following equation, which takes as its

inputs a subject's heart rate while exercising (HR or HR_E), resting heart rate (HR_R), and maximal heart rate (HR_M):

$$(\% VO_{2max}) = \frac{HR - HR_R + 10}{HR_M - HR_R}$$

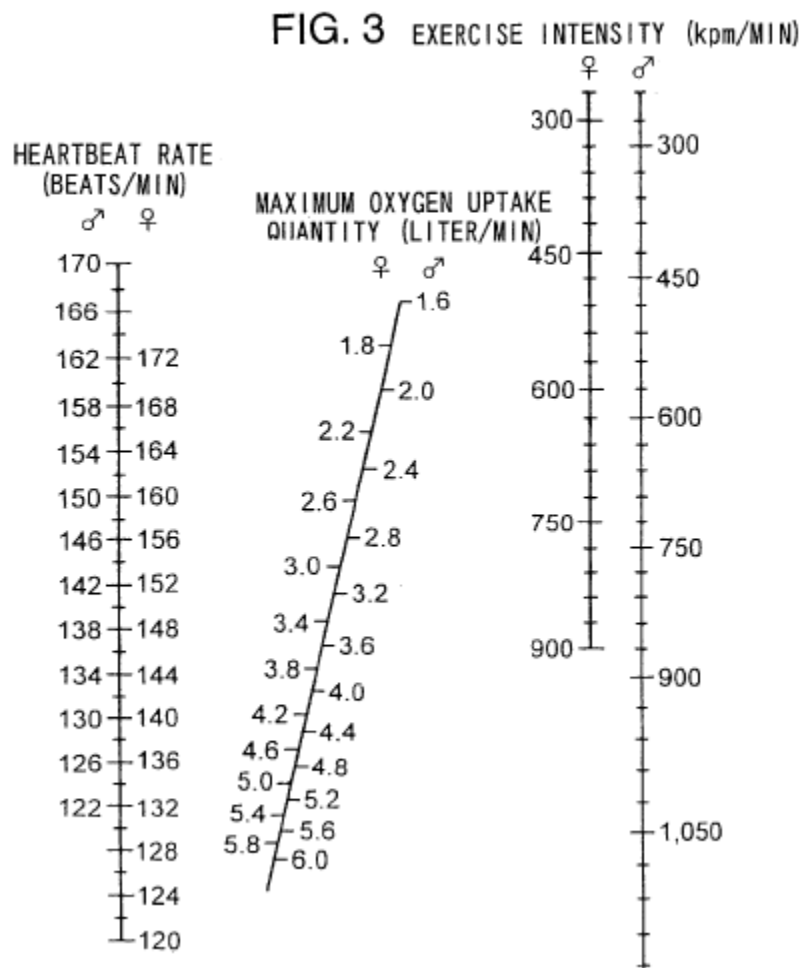
Id., 4:39-52. For example, once a subject's maximum and resting heart rates have been measured, then the exercise heart rate corresponding to, for example, 60% of VO_{2max} , can be easily calculated. Lubell explains that a "generally accepted principle of aerobic training" is that exercise should be maintained within the range of 60-80% of one's maximum heart rate, and that "fitness monitors are often provided with alarms" to help "the subject keep his exercise stress level within what is regarded as the fitness training range." *Id.*, 1:19-29. Thus, Lubell teaches that its device can emit "pacer tones" that prompt a user to maintain a "running velocity" that keeps the person's "exercise stress level" within the fitness training "range" corresponding to 60%-80% of VO_{2max} . *Id.*, 9:65-10:7. To do so, the device emits "higher" and "lower" pitch "pacer tones," which alert the subject to speed up or slow down, if their VO_{2max} is not within the fitness training "range." *Id.*, 10:1-43.

B. Amano

50. U.S. Patent No. 6,241,684 ("Amano," Ex. 1002) is titled "Exercise Workout Support Device," and generally discloses a portable device that can

estimate a user's maximum oxygen uptake quantity, *i.e.* VO_{2max} , and display upper and lower heart rate limits corresponding to an "appropriate exercise intensity" range. Ex. 1002, 1:8-20. Amano features a lengthy specification and dozens of figures, but these two aspects are the primary focus of Petitioner and Dr. Lynch.

51. Beginning with the aspect of the device that estimates VO_{2max} , Amano teaches the use of a so-called Astrand-Ryhming nomogram (Figure 3, excerpt shown below), which is a standardized chart that plots known relationships between heart rate, exercise intensity, and VO_{2max} . Ex. 1002, 6:25-38.



In Amano, “the exercise carried out by the test subject is assumed to be running,” and exercise intensity is therefore measured “as the product of the distance run per unit time and the test subject’s body weight,” which in part is simply the speed or pace of running (*i.e.*, distance run per unit time). *Id.*, 7:30-37. Amano explains that there are different nomograms for men and women, so that “by indicating the sex of the subject,” the VO_{2max} can be estimated from the chart by plotting a subject’s heart rate and exercise intensity levels on the left and right axes, respectively. *Id.* In order for this method to work, Amano teaches that “it is necessary to establish a straight line relationship between the test subject’s exercise intensity and heartbeat rate.” *Id.*, 6:59-67. And to determine whether a straight line relationship exists for a given subject, “it is necessary to measure exercise intensity at at least three or more stages, and determine the heart beat rate at each stage.” *Id.*

52. Amano describes an embodiment for estimating VO_{2max} according to the above method using a portable, programmable device “having the structure of a wristwatch.” *Id.*, 8:55-65. The device carries out a series of programmed steps, which I will describe in somewhat simplified and abbreviated form. First, in what is described as a “prerequisite,” the user inputs sex, body weight, and stride length information. *Id.*, 10:1-20. Then, once the subject begins running, the device starts detecting “the pitch of running,” and emits a “sound synchronized to the exercise.” *Id.*, 10:63-11:4. Next, the device initiates an “exercise intensity increase notifying”

process, in which the user is directed to increase exercise intensity in fixed time intervals (*e.g.*, 120 second intervals), with the “subject being notified” by the device “to increase exercise intensity by 10% each time.” *Id.*, 13:27-55. To accomplish this, for each increase the device emits a new sound corresponding to the “10% increase over the previous pitch,” and the subject “tries to maintain running” at the new speed until another increase occurs. *Id.*, 14:52-65. At that point, another “alarm sound is generated at an interval corresponding to a further 10% increase in pitch,” and the subject is again supposed to try “to maintain running at” the higher speed. *Id.*, 14:66-15:5. In each case, the sound provided by the device is synchronized to the running pace that the subject is directed to achieve. *Id.*; *id.* at 11:2-4. Because the Astrand-Ryhming nomogram method requires measuring heart rates for at least three different exercise intensity stages, the process continues until three “exercise intensity-beat rate” pairs are obtained. *Id.*, 15:6-18. Once three such measurement pairs are obtained, the device determines if a straight line relationship exists, and if it does, the device estimates the subject’s VO_{2max} , and shows it on the device display. *Id.*, 15:10-26.

53. Amano explains that the device-set 10% increases in exercise speed/intensity are “merely a target” that the subject is supposed to attempt to achieve, such that when the device notifies the user to increase speed, the subject may stay at the same pace, or even reduce speed “to some extent,” or vary the level

“according to his own preferences.” *Id.*, 13:56-67. However, if “exercise intensity-beat rate” pairs cannot be measured for at least three different intensity levels, then it is not possible to determine if a straight line relationship exists, as required for using the Astrand-Ryhming nomogram method in order to estimate VO_{2max} . *Id.*, 15:9-18. In such cases, “operation of the maximum oxygen uptake quantity estimating mode is terminated.” *Id.*, 15:40-41.

54. In another embodiment, Amano describes using a subject’s estimated VO_{2max} to select a target pulse rate and calculate upper and lower pulse rate limits, which are shown on the device display. *Id.*, 19:10-26. To accomplish this, Amano teaches the use of a standardized pulse rate table (there are separate tables for women and men, with the male version shown in Figure 14, below) that correlates VO_{2max} values with the pulse rate of an “average person” when exercising at an intensity level corresponding to 50% of that VO_{2max} . *Id.*, 19:40-46.

FIG. 14

VO_{2max}	36	37	38	39	40	41	42
PULSE RATE	105	110	115	120	125	130	135

A subject enters his or her sex and estimated VO_{2max} (including by using the estimate obtained through the Amano procedure described above), and the device reads out

the appropriate pulse rate from the table. *Id.*, 19:65-20:18. Next, the device calculates upper and lower pulse rate limits by multiplying the target pulse by 0.8 and 1.2. *Id.*, 20:19-28. As an example, if a male subject's estimated VO_{2max} is 40, the device reads out a pulse rate of 125 from the table, and calculates an upper pulse rate limit of 150 (*i.e.*, 125×1.2) and a lower pulse rate limit of 100 (*i.e.*, 125×0.8). *Id.*, 20:16-28.

55. Amano also teaches a “pitch maker” that prompts the subject to exercise within the “appropriate exercise intensity” range bounded by the upper and lower pulse rate limits. *Id.*, 3:35-38, 20:38-65. The “pitch maker” operates by detecting the pulse rate of the subject during exercise, and emitting a pitch signal (*i.e.*, a sound) prompting the subject to increase speed if, for example, the device detects a pulse rate “below the lower limit,” which continues “until the user’s pulse rate is again above the lower limit.” *Id.*, 21:4-16. The device operates in the same manner if the detected heart rate is “found to be above the upper limit,” in that the device emits a sound prompting the subject to reduce speed that continues until the “pulse rate is again below the upper limit.” *Id.*, 21:17-23.

C. Matsumoto

56. U.S. Patent No. 4,911,427 (“Matsumoto,” Ex. 1003) is titled “Exercise And Training Machine With Microcomputer-Assisted Training Guide,” and generally discloses an exercise bicycle that uses information provided by a user,

including sex, age, and weight, to select a “suitable” “prescribed program” for exercising that “instruct[s] the individual on the appropriate training from warm up to all out training, with detection means to constantly determine the progress,” including a “pulse sensor to determine the pulse of the user.” Ex. 1003, Abstract, 1:39-55, 2:31-35.

57. In one embodiment, Matsumoto teaches an “exercise management” training program, where the bicycle selects prescribed exercise programs from an “exercise standard” table (with an excerpt shown below), which is programmed into the electronics of the device. *Id.*, 3:1-55.

Age	Exercise Prog. No.	Target Pulse	Exercise Time	Exercise Standard	
				Men	Women
-29	1	120	5	M1	W1
	2	130	5	M2	W2
	3	140	5	M3	W3
	4	145	5	M4	W4
	5	150	5	M5	W5
	6	155	5	M6	W6
	7	155	6	M7	W7
	8	155	7	M8	W8
	9	155	8	M9	W9
	10	155	9	M10	W10
	11	155	10	M11	W11
	12	155	11	M12	W12
	13	155	12	M13	W13
	14	155	13	M14	W14
	15	155	14	M15	W15

Matsumoto teaches that the “exercise standard” programs in the table correspond to “specific standard amounts of exercise,” for example “exercising at xxx pulses/min. for xx mins,” with the specific values filled based on the selected program. *Id.*, 3:53-

64. When a user initiates a training program, the device chooses an exercise program “from the table,” based on the user’s “age, sex, weight,” and any previous use of the bicycle. *Id.* For example, if the device selects program No. 5, then the user is directed to exercise until he or she reaches the target pulse of 150, and exercise while maintaining that pulse for 5 minutes. As Matsumoto explains, the user “starts peddling the bicycle,” and increases “speed until he or she arrives at the target pulse.” *Id.*, 3:66-68. The user’s pulse is monitored, and once the user reaches the target pulse, a timer is started that displays the remaining time for the exercise program selected by the device. *Id.*, 4:1-10. The device records the results, which are “used to determine the user’s exercise program for the next session.” *Id.*, 4:10-14. Matsumoto explains that its exercise standard programs only go up to a certain maximum level for a given age group, so for example, after a user in the “under 29” age group reaches the maximum program No. 16, the device instructs the person to continue future workouts at the same level. *Id.*, 4:15-18.

58. Matsumoto explains that the purpose of “providing an exercise program” from the “exercise standard” table is selecting one “suited to the individual user’s physical fitness.” *Id.*, 4:33-60. Matsumoto teaches that a similar device, with a pulse sensor, could also be used for jogging training programs, whereby similar standardized exercise routines could be used. *Id.*, 4:54-58.

59. Matsumoto describes another, similar bicycle-based embodiment, where a warm-up exercise program is again selected by the device from a standardized table. *Id.*, 5:1-3. In this version, the user also enters sex, age, and weight information, and the device uses that information to select a target heart rate “for warming up” from the table shown below. *Id.*, at 5:16-38.

TABLE 2							
N	0	1	2	3	4	5	6
PN	80	100	120	130	140	150	160

For example, if the device selects program No. 1 for a user, then the target pulse rate for warming up is set to 100. *Id.* Once the user starts peddling the bicycle, he or she is instructed to speed up or slow down until the target pulse selected by the machine is reached, at which point the user is instructed to maintain that pulse rate for one minute. *Id.*, 5:39-61. Then, the device resets the target pulse rate to the next value in the table, for instance 120 for program No. 2, and the user is again instructed to reach the new target. *Id.* This process continues in one minute increments. *Id.* Then, once the user enters “full fledged training,” the device selects pre-programmed routines that instruct the user to exercise at a certain target pulse rate, for a certain amount of time (*i.e.*, “Continue for xx min at a Pulse of xxx p/m”). *Id.* During this process, the device is measuring the user’s pulse rate, and instructs the user to speed or slow down as necessary, so that the use can exercise at the target pulse rate selected by the device. *Id.*

60. In another embodiment, Matsumoto discloses a display that can be used in a “manual training mode” or an “auto training mode.” *Id.*, 7:36-10:68. In this embodiment, Matsumoto teaches that a “target pulse” is calculated by the machine using formulas, which in part are based on the user’s age and pulse at rest (*e.g.*, $200 - \text{the user's age} - \text{the user's pulse at rest}$). *Id.* In both modes, while the user is exercising the display shows the “target pulse,” and uses green indicator lights to show whether the user’s measured pulse rate is within the range of ± 5 beats per minute of the single “target pulse” rate. *Id.* The display can also show whether the user’s measured pulse rate is above (red) or below (yellow) that single “target pulse” rate range. *Id.* In this embodiment, a “buzzer sounds if the user’s pulse rate” exceeds the “target pulse” by 10. *Id.*

D. Ceci

61. Ceci (Ex. 1005) is an scientific article titled “Self-monitored exercise at three different RPE intensities in treadmill vs field running,” that was published in the journal *Medicine and Science in Sports in Exercise* in 1991, and authored by Ruggero Ceci and Peter Hassmen. Petitioner does not appear to rely on the results of Ceci’s scientific study, or most of its details, but instead focuses on its use of “self-regulation” in exercise, whereby subjects adjusted their “exercise intensity” according to subjective metrics, such as “perceived exertion.” Ex. 1005, at 1 (p. 732

in the journal's pagination). I will likewise focus on the narrow aspects of Ceci relied upon by Petitioner, and discussed by Dr. Lynch.

62. Ceci set out to study how closely subjects' actual heart rates measured while exercising compared to the subjective levels of exertion at which they were directed to exercise. To do this, Ceci used the so-called "Ratings of Perceived Exertion" scale, or "RPE," which it describes as a "generally accepted subjective method in estimation studies, that is, studies in which subjects are asked to rate the degree of exertion they perceive as related to a certain physical intensity." *Id.*, at 1. Specifically, the subjects were directed to exercise in successive intervals at the RPE scale levels 11, 13, and 15, which correspond to subjectively perceived "light exertion," "somewhat hard" exertion, and "hard" exertion, respectively. *Id.*, at 3. Both before initiating the training protocols for the study, and after the study was completed, the subjects performed a "standardized cycle ergometer test for the determination of" baseline heart rate responses. *Id.*, at 2. In these tests, the subjects exercised on the ergometer machine in 5 minute intervals, with prescribed power (*i.e.*, intensity) levels corresponding to either 150 Watts or 200 Watts. *Id.*

63. During the exercise intervals, the subjects' heart rates and running velocity were tracked and measured, as were the subjects' resting heart rates. *Id.*, at 2. One of the aims of Ceci was to study any differences in perceived intensity levels between running on an outdoor track, and on an indoor treadmill, so the subjects

completed the procedure in both settings. *Id.* Among other findings, the results showed increasingly higher “mean” heart rates for the three subjective exertion levels (Figure 2, below). *Id.*, at 4.

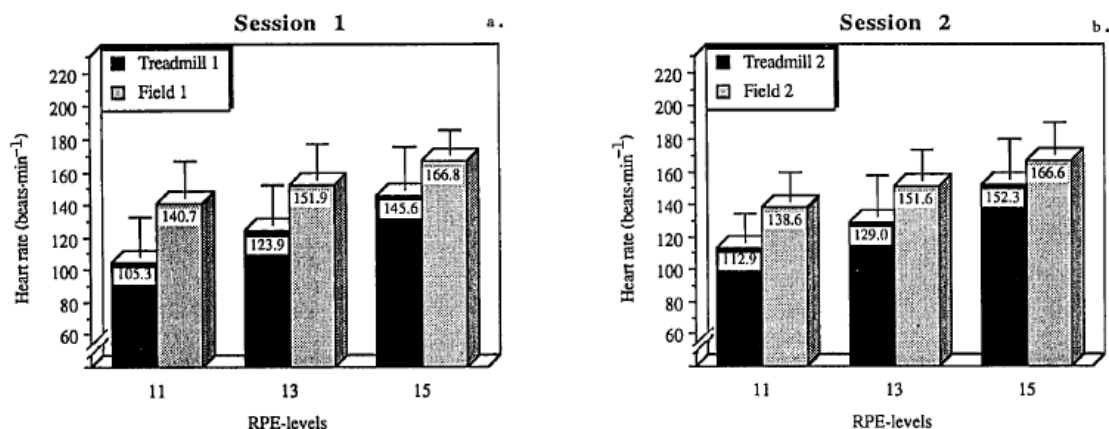


Figure 2—The obtained heart rates (in beats·min⁻¹) from sessions 1 (a) and 2 (b) are shown at the three RPE levels for both treadmill and field running. Mean values are shown and standard deviations indicated for each bar; *N* = 11.

64. Ceci also teaches how “self-monitoring” of exercise levels “leads to self-regulation,” in that a user may be able to adjust his or her own “exercise intensity” levels in order to “reach a level that is best suited to their state of health, fitness,” etc. *Id.*, at 1. Such adjustments of “exercise intensity can be seen as a continuous” process that occurs throughout a workout, and across different workout sessions. *Id.*

E. Henry

65. U.S. Patent No. 5,769,744 (“Henry,” Ex. 2002) is titled “Workout Level Indicator,” and generally discloses an “exercise display system for aiding a user in maintaining a desired exercise intensity level.” Ex. 2002, Abstract. Henry was

disclosed to the Patent Office during prosecution of the '413 Patent, and was considered by the Examiner. Ex. 2004, at 2; Ex. 2005, at 2.

66. According to Henry, there were certain drawbacks in existing heart rate and fitness monitors, including that “none are particularly useful in helping the exerciser easily understand where he or she is in terms of their own fitness training range during a workout.” Ex. 2002, 2:6-8. For instance, Henry specifically refers to Lubell, which according to Henry “only helps the person to keep his or her exercise intensity level from going above or below the fitness training range.” *Id.*, 2:6-13. Henry also specifically refers to Matsumoto, which “suggest[s] a target heart rate,” but does not provide an indication of where the user’s own “exercise intensity falls.” *Id.*, 2:15-20. Henry explains that while the standardized “fitness training range” of exercising “within a range of about 60% to 85% of the subject’s maximum heart rate” is a “good general guide in gauging workout intensity,” it is not tailored to individuals, whose intensity ranges “will vary according to a number of factors.” *Id.*, 1:27-60. For instance, a “fragile 80-year-old female will have a fitness training range that requires much less exertion than a 20-year-old male athlete.” *Id.*, 1:61-63. Thus, Henry teaches that it is “important for an individual to be able to monitor their exercise intensity level within a fitness training range tailored according to their individual circumstances.” *Id.*, 1:67-2:3.

67. To accomplish these goals, Henry discloses a “display system that allows a user to see a spectrum of exercise intensity levels that have been created specifically for that individual.” *Id.*, 2:21-23. To prepare these individualized exercise intensity levels, the system allows a user to input his or her own physiological information, including “weight, age, sex, build, resting heart rate,” and information about the “exerciser’s perceived or actual fitness capacity.” *Id.*, 3:52-63. For example, the user can “input that he or she is a frequent exerciser,” an “occasional exerciser,” or a “non-exerciser.” *Id.* Using this information, the system provides a “spectrum of exercise intensity levels unique to the exerciser.” *Id.*, 4:13-15.

68. Henry discloses a device that displays multiple types of intensity levels for the user during a workout, all of which are tailored to the individual. One type includes training scale subdivisions (*e.g.*, “Below Training Zone,” “Weight Loss Training Zone,” “Cardiovascular Training Zone,” and “Above Training Zone”) which are shown on the display using lights, with a different color for each subdivision. *Id.*, 4:28-65. The subdivisions are “divided amongst the intensity levels” according to the an individual user’s specific characteristics. *Id.* Another type of intensity level shown on the display is maximum heart rate percentages, which are also shown by lights, and are allocated into specific subdivisions that “vary depending on the individual characteristics of the user.” *Id.*, 4:66-5:9. During

a workout, the user wears a sensor that detects his or her heart rate, so that the user can see “their current level of exercise intensity.” *Id.*, 4:18-46. In this manner, Henry teaches a system in which a user can track exercise intensity “depending on the intent of the exerciser,” so that, for example, a person “wish[ing] to exercise” at intensities that feel “high-intensity” or “low-intensity” to them individually is able to do so. *Id.*, 1:50-56.

F. Fabrizio

69. U.S. Patent No. 6,163,718 (“Fabrizio,” Ex. 2003) is titled “Age-Based Heart Rate Target Zone Method and Apparatus,” and generally discloses a wearable “heart rate monitor” that allows a user to “set upper and lower heart rate” limits, including limits that “can be selectively changed” by the user based upon his or her unique “physical conditioning.” Ex. 2003, Abstract. Fabrizio was disclosed to the Patent Office during prosecution of the ’413 Patent, and was considered by the Examiner. Ex. 2004, at 2; Ex. 2005, at 2.

70. Specifically, Fabrizio discloses a wearable “wristwatch” style heart rate monitor that can display the user’s current heart rate, and can also emit beeps or flashes to signal to the user if the current heart rate falls below a set lower heart rate limit, or rises above a set upper heart rate limit. Ex. 2003, 2:49-3:3, 3:64-4:12. Fabrizio teaches two approaches for setting the upper and lower heart rate limits. First, the device has “data” programmed into its circuitry and uses preset formulas

to calculate heart rate limits “automatically” based on the age of the exerciser, which is entered into the device by the user. *Id.*, 1:59-67, 3:4-31. For example, the device can use the basic formula “200 - Age” to set an upper heart rate limit, and multiply that upper limit by 0.65 to obtain a lower limit. *Id.*

71. However, Fabrizio also explains that the “appropriate heart rate level” for a user to achieve beneficial “aerobic conditioning” varies between individuals, because those levels are based “on a person’s general conditioning.” *Id.*, 1:13-25. Therefore, Fabrizio also teaches a second approach, where heart rate limits can be “set by the user,” such that the user has “the option to raise or lower” the heart rate limits based on that individual’s own “physical condition.” *Id.*, 3:4-63. In this manner, Fabrizio explains that an “advantage” of its device is the ability to track a user’s heart rate during exercise by comparing it to a range that is chosen by the user, which “take[s] into account” his or her individual “physical conditioning.” *Id.*, 2:1-5, 4:13-14, Abstract. The Fabrizio device also teaches that the “upper and lower limits can be selectively modified” to account for the “progress of the person wearing the monitor,” if for example, the user desired to “permit[] higher limits” based on her or her own conditioning level. *Id.*, 3:12-16. Fabrizio also teaches that the user can choose his or her own “desired or target ‘Time Accumulation Goal’ so that the user can predetermine how much time he or she desires for obtaining a heart rate within the target zone.” *Id.*, 4:20-24. In other words, the user is also able to select

how long the workout will last for achieving the heart rates that are also selected by the user, which is another manner in which the user (not the device) is in control of the workout intensity levels.

G. Flach

72. U.S. Patent App. Pub. No. 2001/0023315 (“Flach,” Ex. 1008) is titled “Cellular Architecture And Data Transfer Methods For Real Time Patient Monitoring Within Medical Facilities,” and generally discloses a communication system and protocols for the radiofrequency transmission of patients’ physiological data from a portable sensor device to a centralized monitoring station for displaying the data. Ex. 1008, Abstract, [0003]. Flach includes a lengthy disclosure covering numerous details, but I will focus on the same narrow aspect of the reference as Petitioner and Dr. Lynch. *E.g.*, Petition at 16-17; Ex. 1009, ¶¶ 86-88.

73. Flach discusses that in a hospital setting, there may be a large number of patients with portable sensors in communication with a monitoring station at the same time, over a large physical area. Ex. 1008, [0008]. Flach specifically discloses a wireless transfer protocol using time slots (*i.e.*, a TDMA or time division multiple access protocol), which allows for the signals of a given portable sensor to be encoded for radiofrequency transmission during a specific timeslot, so that the monitoring station knows which sensor (and therefore which patient) corresponds to the data received in a given timeslot. Ex. 1008, [0094] – [0106]. Flach also teaches

that in addition to the patient data, the data packets sent by a sensor device also include “ID codes which identify” them, to further enable the monitoring device to locate a given sensor device, and confirm which sensor device it is communicating with. *Id.*, [0017], [0065]. Finally, Flach also teaches that another purpose for the timeslot protocol and use of identification data is to facilitate reliable data transmissions and reduce errors. *Id.*, [0003], [0018].

74. Flach was cited and relied upon by the Examiner for rejections during prosecution of the '413 Patent, which is acknowledged by the Petitioner, but does not appear to have been acknowledged or addressed by Dr. Lynch. Petition, at 20. Specifically, the Examiner found that Flach “teaches of a time division multiple access protocol, in which data from specific sensors is sent during designated timeslots.” Ex. 1011, at 5; Ex. 1013, at 7.

H. Gorman

75. U.S. Patent No. 5,400,794 (“Gorman,” Ex. 1007) is titled “Biomedical Response Monitor and Technique Using Error Correction,” and generally discloses a monitor for measuring and displaying biomedical data, such as heartbeat rates, with a transmitting unit that encodes the data with an identification part, so that a receiving unit can determine that the received data is from a specific transmitting unit. Ex. 1007, Abstract. In other words, Gorman describes a monitor that “includes unique identification between a transmitted and an associated receiver.” *Id.*, 4:27-

29. The monitor can be portable, or it can be incorporated into exercise equipment. *Id.*, 4:34-36. Gorman includes a lengthy disclosure covering numerous details, but I will focus on the same narrow aspect of the reference as Petitioner and Dr. Lynch. *E.g.*, Petition at 15-16; Ex. 1009, ¶¶ 82-85.

76. Specifically, Gorman teaches a heartbeat sensor worn by a subject, which encodes data for wireless transmission to a receiving display unit, where the encoded data includes a data portion and an identification portion. *Id.*, 4:41-5:2. The identification portion is different for each sensor, such that the receiver is able to accept an incoming signal only if it matches to the proper sensor, which “prevents two heart monitors working in close proximity to each other and transmitting on the same frequency from receiving and displaying signals from the wrong person.” *Id.* The encoding protocol also provides “error detection and correction” capabilities. *Id.*, 5:3-11. Gorman also teaches that a “synchronization” signal can be used, to facilitate the correct timing of transmission and reception between the transmitter and receiver. *Id.*, 8:1-25. To that end, Gorman states that an object of its device is to “provide an improved wireless heartbeat monitor wherein signal encoding is utilized to provide unique identification between a sensor-transmitter unit and a receiver-display unit.” *Id.*, 3:54-58.

X. Amano and Matsumoto Disclose Substantially The Same Subject Matter As Lubell

77. I have been asked to evaluate the subject matter of Lubell, with a particular focus on the aspects that the Examiner found during prosecution not to disclose the independent claims of the '413 Patent, and compare those aspects to the portions of Amano and Matsumoto that Petitioner now contends disclose the independent claims. Because it is what the Examiner focused on, my focus in this section will be on limitation [C] of the independent claims, which recites “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user.” Ex. 1001, 18:5-23.

78. Based upon my review of the prosecution history, I understand that the Examiner focused on limitation [C], explaining that the claimed “exertion levels are based on a level of physical fitness of the user and are specifically chosen by the user there is no external device which is choosing the exercise level.” Ex. 1015, at 8 (p. 2 in the pagination of the Notice of Allowability). While the Examiner had previously rejected the independent claims under Lubell (Ex. 1011, at 3-4; Ex. 1013, at 4-5), in allowing the claims the Examiner found that the “prior art fails to disclose or render obvious all of the limitations of the independent claims in combination with prompting the user to exercise at a plurality of exertion levels, wherein an exertion level is based on a level of fitness of the user and determining a plurality of

heart rate zones based on heart rate measurements received from the sensors while the user exercises at the plurality of exertion levels.” Ex. 1015, at 9. Further, the Examiner reasoned that while the ’413 Patent claimed invention “guides the user, the exertion level is chosen and maintained exclusively by the user and not in any way acted upon by the device.” *Id.*

79. Petitioner acknowledges that the device in Lubell “automatically pac[es] the subject through a straightforward training protocol.” Petition, at 13. In other words, in Lubell the device chooses the exercise level for the user, just as the Examiner found. Dr. Lynch agrees, as he explains that the Lubell device “prompts a user through a submaximal exercise test,” by “prompting a user to exercise at increasingly faster cadences” at “predetermined speeds.” Ex. 1009, at ¶¶ 48-51. Again, this is in agreement with the Examiner’s findings.

80. Petitioner contends that Amano and Matsumoto anticipate the independent claims (Petition, at 19), and I understand that means Petitioner must show that these references disclose every element of those claims. In other words, in addition to all the other elements, Petitioner must show that limitation [C] is disclosed by Amano and Matsumoto, which in the words of the Examiner, would mean showing that those references disclose “exertion levels [that] are based on a level of physical fitness of the user and are specifically chosen by the user there is no external device which is choosing the exercise level.” Ex. 1015, at 8. For the

reasons discussed below, Amano and Matsumoto also fail to disclose limitation [C] because, in relevant part, their disclosures are substantially the same as the disclosures in Lubell.

A. Comparing Amano and Lubell

81. Starting with Amano, in my opinion the portions of Amano that Petitioner relies upon for limitation [C] of the independent claims disclose substantially the same subject matter as the teachings of Lubell that the Examiner found did not disclose limitation [C].

82. Petitioner acknowledges that the Amano “device notifies an exerciser to increase their exercise intensity after a certain amount of time at a particular intensity.” Petition, at 10 (citing Ex. 1002, 13:30-34). Petitioner further admits that “Amano describes beeps that indicate to the subject the pace they should run.” *Id.* (citing Ex. 1002, 13:46-50). Dr. Lynch agrees. First, he explains that “the device prompts a user to increase their workout intensity in order to get the appropriate intensity/heart rate data,” which is necessary because the device needs “heart rate measurements that correspond with particular exercise intensities” in order to “estimate[] VO_{2max} from these pairs.” Ex. 1009, ¶ 74. Indeed, the intensities are chosen by the device, because “the device beeps at users to notify them of the pace to run to obtain difference exercise intensities.” *Id.*

83. These aspects of Amano are substantially the same as the subject matter disclosed in Lubell. First, Lubell discloses a standardized “submaximal exercise test protocol” that uses “pacing tones to establish an exercise cadence,” so that the subject exercises “at a predetermined pacing rate” in accordance with the “graded submaximal exercise tolerance test.” Ex. 1004, 3:30-34. Amano also discloses a standardized protocol, in which the device prompts the user to increase exercise intensity in fixed time intervals (*e.g.*, 120 second intervals), with the “subject being notified” by the device “to increase exercise intensity by 10% each time,” by emitting sounds that correspond to the “10% increase over the previous pitch.” Ex. 1002, 13:27-55, 14:52-65.

84. Second, Lubell discloses a protocol with multiple exertion levels chosen by the device, such that the subject exercises in three minute intervals “at progressively faster cadences,” which preferably start at “four miles per hour,” and then increase to 6, 8, 10, 12, and 14 miles per hour “for the successive three minute intervals.” Ex. 1004, 3:36-68. Amano also discloses a protocol that requires at least three different exercise intensity stages chosen by the device, as its testing process continues until three “exercise intensity-beat rate” pairs are obtained. Ex. 1002, 15:6-18.

85. Third, Lubell discloses that its prescribed protocol is necessary because of the method it uses to estimate VO_{2max} , which involves the Van der Walt

relationship, and uses a formula that requires a subject to reach his or her “maximum heart rate” while running in a specially designed “exercise tolerance test.” Ex. 1004, 3:47-53. The same is true for Amano, which discloses using an Astrand-Ryhming nomogram to estimate VO_{2max} , which only works if “a straight line relationship between the test subject’s exercise intensity and heartbeat rate” can be established, which in turn requires measuring heart rates in “at least three or more stages” of exercise intensity.” Ex. 1002, 6:59-67.

86. Fourth, because the method in Lubell requires that the user reach his or her maximum heart rate in order for it to be possible to estimate VO_{2max} , Lubell teaches that its protocol requires the subject to run, even if certain speeds “can be walked,” and that the test proceeds until the subject “reaches his or her maximum heart rate,” or “reaches the point of exhaustion.” Ex. 1004, 3:64-4:13. In other words, if the user does not follow the prescribed protocol, the purpose of the test is defeated, because it would not be possible to estimate VO_{2max} . Again, the same is true for Amano. While Amano explains that the device-set 10% increases in exercise speed/intensity are “merely a target,” the test does not work unless “exercise intensity-beat rate” pairs are measured for at least three different intensity levels. Ex. 1002, 13:56-67, 15:9-18. Therefore, subjects are prompted to try “to maintain running” at the device-set speeds, because if it is not possible to determine whether

a straight line relationship exists “operation of the maximum oxygen uptake quantity estimating mode is terminated.” *Id.*, 15:2-5, 15:40-41.

87. Finally, Petitioner references one aspect of Amano that is supposedly different than Lubell, namely the sentence in Amano stating that “it is also acceptable for the test subject to vary exercise intensity according to his own preferences.” Petition, at 22 (citing Ex. 1002, 13:66-67). Dr. Lynch also quotes the same sentence from Amano. Ex. 1009, ¶ 74. However, other than quoting Amano, Dr. Lynch does not offer any opinions regarding this aspect of its disclosures. *Id.* I also note that Petitioner does not rely upon Dr. Lynch in its Amano-based contentions for limitation [C] of the independent claims, or for any other aspect of Ground 1 (anticipation by Amano).

88. For at least two reasons, it is my opinion that this sentence in Amano does not change the fact that it discloses substantially the same subject matter as Lubell (in the relevant respects that I have addressed). First, Petitioner does not contend that Amano “prompts” a user to exercise at self-selected intensity levels, and in my review of Amano I did not find any such disclosure. I also note that Dr. Lynch does not offer the opinion that Amano “prompts” a user to exercise at self-selected intensity levels, and in that respect it appears we are in agreement: just like Lubell, Amano only “prompts” subjects to exercise at intensity levels chosen by the device.

89. Second, the reason why Amano chooses the intensity levels for the subject is substantially the same as in Lubell. Namely, Amano's Astrand-Ryhming nomogram requires measuring at least three exercise intensity-heart beat rate pairs, in order to determine if a straight line relationship exists for estimating VO_{2max} . Thus, while Amano explains that a "subject may maintain exercise intensity at a constant level," or "reduce exercise intensity to some extent," or "vary exercise intensity according to his own preferences," such intensities are not prompted by the device, and are likely described only in recognition of the reality that a given subject may not be able to keep pace with the prescribed training protocol. However, in such cases the protocol would not be successful. For instance, Amano teaches that if "exercise intensity is constant," then only "one exercise intensity-beat rate pair" can be obtained. Ex. 1002, 14:47-48. And Amano explains that if the protocol does not provide data from which a straight line relationship is established, then the mode for estimating VO_{2max} is terminated. Lubell chooses the intensity levels for the subject for substantially the same reason. In order for the equations applying the Van der Walt relationship to accurately estimate VO_{2max} , it is necessary for the subject to reach his or her maximum heart rate, or the point of exhaustion. Ex. 1004, 4:4-30. But if a subject were allowed to exercise at his or her own pace, there would be no way to ensure that the maximum heart rate was attained within the time periods used in the standardize equations, which incorporate "experimentally derived

coefficients.” *Id.*, 3:44-54, 4:14-28. The necessity of Lubell’s device-selected intensity levels is confirmed by other applications described in the reference, specifically that its protocol can be used in training non-human subjects, including race horses and dogs. *Id.*, 5:14-17. It would certainly not be feasible (if even possible) for an animal to choose its own exertion levels in a protocol seeking to estimate VO_{2max} .

B. Comparing Matsumoto and Lubell

90. It is also my opinion that the portions of Matsumoto that Petitioner relies upon for limitation [C] of the independent claims disclose substantially the same subject matter as the teachings of Lubell that the Examiner already found did not disclose limitation [C].

91. Petitioner acknowledges that in Matsumoto, “the machine chooses a workout with several target pulses, from warm-up to full-fledged training.” Petition, at 12 (citing Ex. 1003, 5:25-61). Petitioner further admits that the Matsumoto device displays information that directs the user how to exercise, such as “Continue for xx min at a Pulse of xxx p/m.” *Id.* (citing Ex. 1003, 5:39-61). Dr. Lynch agrees. First, he explains that the Matsumoto device uses information input by the user (*e.g.*, age, weight, and sex) “to choose a workout with several target pulses, as it works a user from warm-up to full-fledged training.” Ex. 1009, ¶ 79. Second, Dr. Lynch also refers to the same sample workout chosen by the Matsumoto device, as he explains

that “the machine displays ‘Continue for xx min at a Pulse of xxx p/m.’” *Id.* Indeed, Dr. Lynch acknowledges that the workout intensities are chosen by the device, because the results of the initial device-chosen workouts are also “used to calculate the exercise program for the next session.” *Id.*, ¶ 80.

92. These aspects of Matsumoto are substantially the same as the subject matter disclosed in Lubell. First, Lubell discloses a standardized “submaximal exercise test protocol” that uses “pacing tones to establish an exercise cadence,” so that the subject exercises “at a predetermined pacing rate” in accordance with the “graded submaximal exercise tolerance test.” Ex. 1004, 3:30-34. Matsumoto also discloses standardized protocols, in which the device prompts the user to workout according to a program selected by the machine from an “exercise standard” table—for example “exercising at xxx pulses/min. for xx mins,” with the specific values filled based on the program selected by the device, based on the user’s “age, sex, weight,” and any previous use of the bicycle. Ex. 1003, 3:15-64. For instance, the device may choose program No. 5 to begin, which initiates a standardized protocol in which the user is directed to exercise until he or she reaches the target pulse of 150, and exercise while maintaining that pulse for 5 minutes. *Id.* The Matsumoto device also discloses standardized protocols for warm-up routines, in which the device chooses a target pulse from another table, and directs the user to exercise at

that target pulse rate for a set amount of time, *i.e.*, “until the one minute timer expires.” *Id.*, 5:25-50.

93. Second, Lubell discloses a protocol with multiple exertion levels chosen by the device, such that the subject exercises in three minute intervals “at progressively faster cadences,” which preferably start at “four miles per hour,” and then increase to 6, 8, 10, 12, and 14 miles per hour “for the successive three minute intervals.” Ex. 1004, 3:36-68. Matsumoto also discloses multiple exercise stages with increasing intensity and times, which are chosen by the device from the “exercise standard” table. Ex. 1003, 3:15-4:24. For example, Matsumoto discloses a series of exercise standard programs for a given age group, such as for the “under 29” age group, where the stages begin at program No. 1 (with a target pulse of 120, and an exercise time of 5 minutes), and continue to program No. 16 (with a target pulse of 155, and an exercise time of 15 minutes). *Id.* When a user exercises at one program chosen by the device, he or she continues until the timer “reaches the specified time.” *Id.* Then, the device records the results, which are “used to determine the user’s exercise program for the next session.” *Id.*, 4:10-14. Once a user reaches the “highest level,” the device instructs the person to continue future workouts at the same highest level. *Id.*, 4:15-18. The same is true for Matsumoto’s standardized protocols for warm-up routines, in which the device chooses a target pulse from another table that includes multiple levels of target pulse rates. *Id.*, 5:25-

50. Matsumoto directs the user to exercise at the first target pulse rate selected by the device for a set amount of time, *i.e.*, “until the one minute timer expires,” at which point the device calculates the next target pulse from the protocols in the table, and the user continues exercising at that intensity level chosen by the device. *Id.*, 5:39-61.

94. Petitioner references one aspect of Matsumoto that is supposedly different than Lubell, namely the sentence in Matsumoto stating that an “objective of this invention” is “providing an exercise program that is suited to the individual user’s physical fitness.” Petition, at 31 (citing Ex. 1003, 4:33-35). Dr. Lynch also quotes the same sentence from Lubell. Ex. 1009, ¶ 77. However, and just as with Amano, other than quoting Matsumoto, Dr. Lynch does not offer any opinions regarding this aspect of its disclosures. *Id.* I also note that Petitioner does not rely upon Dr. Lynch in its Matsumoto-based contentions for element [C] of the independent claims, or for any other aspect of Ground 2 (anticipation by Matsumoto).

95. For at least two reasons, it is my opinion that this sentence in Matsumoto does not change the fact that it discloses substantially the same subject matter as Lubell (in the relevant respects that I have addressed). First, Lubell also discloses the goal of exercise programs that are suited to a user’s fitness level, because that is at least one of the reasons why Lubell estimates a user’s VO_{2max} in

the first place. Specifically, Lubell explains that the estimated “VO_{2max} is used in monitoring a program for the subject’s fitness training.” Ex. 1004, 4:31-32. Second, even if an “objective” of Matsumoto is to provide a program “*suited to* the individual user’s physical fitness,” Matsumoto does so by selecting programs for the user from an exercise standard table (Ex. 1003, 3:15-4:24), just as Lubell uses standardized workout routines. Petitioner admits that “the machine sets the initial exertion level targets,” but also contends that such “levels *must be based on* the physical fitness of the user.” Petition, at 31 (emphasis added). I do not find any disclosure in Matsumoto to support such a conclusion. Matsumoto teaches that a user enters a minimal amount of personal information, including their age, sex, and weight, and the machine selects a starting program from the “exercise standard” table based on that information. Ex. 1003, 1:39-43. Two people of the same age, sex, and weight may have different levels of physical fitness. Indeed, Petitioner also acknowledges that the input information “is compared to typical fitness tables to *estimate* the physical fitness of the user” (Petition, at 31), not determine a program *based on* the user’s actual level of physical fitness. Similarly, Petitioner acknowledges that the Matsumoto exercise programs are “not subjective” (Petition, at 32), but an exertion level that is “based on a level of physical fitness of a user” would have to be subjective, in at least some respects. Because the exercise programs in Matsumoto are also selected by the machine from standardized tables that do not account for any

different fitness levels among users with the same age, sex, and weight characteristics, Matsumoto discloses substantially the same subject matter as Lubell.

96. Finally, Petitioner does not contend that Matsumoto prompts a user to exercise at his or her own chosen intensity levels, and I did not find any such teachings in Matsumoto. Nor did I find any such opinion from Dr. Lynch. Indeed, even if it were accurate to equate an exertion level “based on a level of physical fitness of a user” with an exertion level that is merely *suited to* a user (and for the reasons above, I do not find the two concepts to be equivalent) Petitioner acknowledges that it is still the “machine set[ting] the initial exertion level targets” in Matsumoto (Petition, at 31), just like the device in Lubell.

XI. Henry and Fabrizio Disclose Substantially The Same Subject Matter As Ceci

97. I have been asked to evaluate the subject matter of Ceci, with a particular focus on the aspects that Petitioner relies upon, and compare those aspects to Henry and Fabrizio. Petitioner primarily relies upon Ceci for limitation [C] in the grounds asserting Ceci in combination with Lubell. *E.g.*, Petition, at 40-44. Therefore, my focus in this section again will be on limitation [C] of the independent claims, which recites “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user.” Ex. 1001, 18:5-23.

98. Petitioner contends that Lubell in combination with Ceci renders obvious the independent claims. Petition, at 19, 39-47. Specifically, for limitation [C] Petitioner contends that to the extent Lubell does not disclose “wherein an exertion level is based on a level of physical fitness of a user,” that aspect is taught by Ceci. *Id.*, at 42-44. Petitioner also relies upon Ceci for limitation [D], and contends that it would have been obvious “to use the heart rate zones found in an RPE test as described by Ceci.” *Id.*, at 45.

99. Based upon my review of the prosecution history, I understand that both Henry and Fabrizio were disclosed to the Patent Office, and were considered by the Examiner. Ex. 2004, at 2; Ex. 2005, at 2. I also understand that in allowing the claims over references including Lubell, the Examiner found that the “prior art fails to disclose or render obvious all of the limitations of the independent claims in combination with prompting the user to exercise at a plurality of exertion levels, wherein an exertion level is based on a level of fitness of the user and determining a plurality of heart rate zones based on heart rate measurements received from the sensors while the user exercises at the plurality of exertion levels.” Ex. 1015, at 9 (p. 3 in the pagination of the Notice of Allowability).

100. Petitioner’s reliance on Ceci is limited to the reference’s disclosure of “self-determined exercise intensities,” and the concept of “determining heart rate zones from subjective instruction.” Petition, at 14-15. Specifically as it relates to

the claim language, Petitioner contends Ceci teaches that a “test protocol could be a self-regulated exercise chosen by a user,” which allegedly satisfies the “wherein an exertion level is based on a level of physical fitness of a user” portion of limitation [C]. *Id.* at 41-44.

A. Comparing Ceci and Henry

101. Starting with Henry, in my opinion the portions of Ceci that Petitioner relies upon for limitation [C] of the independent claims disclose substantially the same subject matter as the teachings of Henry, which was already considered by the Examiner. Ceci discloses the “Ratings of Perceived Exertion” scale, or “RPE,” which uses subjective ratings such that subjects “are asked to rate the degree of exertion they perceive as related to a certain physical intensity.” Ex. 1005, at 1. For example, the RPE levels 11, 13, and 15 correspond to subjectively perceived “light exertion,” “somewhat hard” exertion, and “hard” exertion, respectively. *Id.*, at 3. In Ceci, subjects were asked to exercise at RPE levels 11, 13, and 15, and their heart rates and running velocity were tracked and measured during exercise. *Id.*, at 2. Petitioner relies on these teaches from Ceci to contend that the reference “describe[s] a test where subjects choose how hard to exercise,” and where heart rates are associated with “level[s] of perceived exertion.” Petition, at 43. Dr. Lynch refers to the same aspects of Ceci. Ex. 1009, ¶¶ 65-69. Dr. Lynch specifically opines that

the Ceci protocol teaches that the “actual running speed chosen by each subject for each perceived exertion level depends on the subject’s fitness level.” *Id.*, ¶ 60.

102. Henry discloses substantially the same subject matter. Specifically, Henry teaches that individualized exercise intensity levels can be set based on information about the “exerciser’s perceived or actual fitness capacity” (Ex. 2002, 3:52-63), just like the “perceived” exertion levels based on the RPE scale in Ceci. Based on that information about a specific user, the system in Henry provides a “spectrum of exercise intensity levels unique to the exerciser” (*id.*, 4:13-15), such that the user can exercise however hard they so choose without being prompted to exercise at an exertion level set by a machine, just like the protocol in Ceci where subjects were asked to exercise at different exertion levels that subjectively felt light, somewhat hard, and hard. Finally, the display in Henry uses lights to show subdivisions that are “divided amongst the intensity levels” for an individual user’s specific characteristics, and can also show maximum heart rate percentages that are allocated “based on the individual characteristics of the user.” *Id.*, 4:18-5:9. During a workout, the display in Henry also shows the current heart rate so that the user can see “their current level of exercise intensity.” *Id.*, 4:18-46. These teachings are just like the protocol in Ceci, which tracked the subjects’ heart rates during exercise at the various RPE workout intensity levels, which were levels chosen by each individual subject and based on each subject’s own physical fitness.

B. Comparing Ceci and Fabrizio

103. Turning to Fabrizio, in my opinion the portions of Ceci that Petitioner relies upon for limitation [C] of the independent claims disclose substantially the same subject matter as the teachings of Fabrizio, which was already considered by the Examiner. Above I described the disclosures in Ceci, and how Petitioner relies upon the reference in combination with Lubell and the related opinions offered by Dr. Lynch.

104. Fabrizio also discloses substantially the same subject matter as Ceci. Specifically, Fabrizio discloses a device where upper and lower heart rate limits for exercising can be “set by the user,” such that the user has “the option to raise or lower” the workout intensity based on that “person’s general conditioning” level (Ex. 2003, 1:13-25), which is analogous to the “self-regulation” provided by the RPE scale in Ceci, whereby the subjects were able to “subjectively” “adjust[] the exercise intensity” of their workouts based on their feelings of perceived exertion. Fabrizio also teaches that heart rate limits can be “selectively modified” by the user according to the “progress” he or she makes in different workouts, instead of such limits being “programmed” by the device (*id.*, 3:4-16), which is just like the protocol in Ceci where the subjective workout intensity levels could be part of a “continuous” process, such that perceived exertion levels can change as the subject completes more training. Fabrizio also teaches that the device tracks a user’s heart rate during

exercise and compares it to a range that is chosen by the user, which “take[s] into account” his or her individual “physical conditioning” (*id.*, 2:1-5, 4:13-14, Abstract), in the same manner that Ceci tracked its subjects’ heart rates during exercise at the various subjective RPE intensity levels. Finally, Fabrizio teaches that users can set their own “desired or target ‘Time Accumulation Goal,’” such that each individual can choose for themselves “how much time he or she desires for obtaining a heart rate within the target zone” for aerobic conditioning (*id.*, 4:20-24), which is substantively the same as the teachings in Ceci that describe the RPE scale “as a method of self-regulation” in exercise, whereby an individual can establish personalized guidelines for aerobic exercise based on their own state of health and fitness. In this way, Fabrizio discloses substantially the same subject matter as Ceci regarding the user’s ability to choose their own routine, as opposed to a device selecting a standardized protocol for the user.

XII. Gorman Discloses Substantially The Same Subject Matter As Flach

105. I have been asked to evaluate the subject matter of Gorman, with a particular focus on the aspects that Petitioner relies upon, and compare those aspects to Flach. Petitioner relies upon Gorman for teachings regarding “communication between the sensor and a display device,” and in particular the use of “an encoded signal that can include identification data unique to the sensor so the receiver knows the source of the message.” Petition, at 15-16; Ex. 1007, 4:27-5:2. As Dr. Lynch

describes the reference, Gorman teaches that “[e]ach monitor has its own identification that is different from other monitors,” so that the receiver can determine whether it is receiving data from the correct monitor. Ex. 1009, ¶ 85.

106. In these aspects, Gorman discloses substantially the same subject matter as Flach, which was already considered by the Examiner during prosecution. Flach teaches a radiofrequency transmission protocol for transmitting biomedical data between a portable sensor and a monitoring and display unit, which in addition to the patient data (such as heartbeat data), also includes unique “ID codes which identify” the specific sensor, so that the receiver can confirm which sensor device it is communicating with. Ex. 1008, [0017], [0065], [0094] – [0106]. This is substantively the same disclosure as Gorman’s teaching of a “an encoded signal that can include identification data unique to the sensor so the receiver knows the source of the message.” Petition, at 15-16; Ex. 1007, 4:27-5:2.

XIII. Ground 1: Amano Does Not Disclose Every Limitation Of The Independent Claims

107. Petitioner contends that Claims 1, 5, 7, 12 and 17 are anticipated by Amano. Petition, at 20-28. For at least the following reasons, it is my opinion that Amano does not disclose, teach, or suggest each and every limitation of independent Claims 1, 12, and 17. While I only address certain limitations in the independent claims, because dependent Claims 5 and 7 depend from Claim 1, my opinions that Amano does not anticipate also apply to those claims. The fact that I do not address

certain claims and claim limitations here does not mean that I agree with Petitioner, or its expert Dr. Lynch.

108. Specifically, I will address why Amano does not disclose limitations [C], [D], and [E], which are substantively the same for each independent claim.

A. Limitation [C]: “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user”

109. This limitation includes two distinct elements, neither of which is disclosed by Amano.

110. First, Amano does not disclose “exertions levels” that are “*based on a level of physical fitness* of a user,” because the process for estimating VO_{2max} in Amano uses standardized workout levels that are selected by the machine, without regard to an individual user’s physical fitness. Amano uses an “exercise intensity increase notifying” process, in which the user is directed to increase exercise intensity in fixed time intervals (*e.g.*, 120 seconds), at a series of intensity levels that are pre-set by the device “to increase exercise intensity by 10% each time.” Ex. 1002, 13:27-55. Amano also describes these pre-set levels as “increas[ing] the *pitch* by 10%” each time, where “pitch” refers to “the number of steps per unit time,” which is similar to a running speed. Ex. 1002, 14:57, 7:24-26. To notify the user of the pre-set intensity levels, the device emits a sound corresponding to a “10% increase over the previous pitch,” and the user runs at that speed until another

increase occurs. *Id.*, 14:52-65. In each case, the sound provided by the device is synchronized to the new pre-set running pace. *Id.*, 11:2-4. Thus, these pre-set “exertion levels” in Amano are the same regardless of a given user’s physical fitness level. In other words, under Amano’s protocol, a world-class Olympian and an elderly grandmother would be paced through the same intensity levels.

111. Petitioner also argues that Amano discloses this element of limitation [C] because its pre-set levels of “intensity” are “based on a user’s stride length and weight,” which Petitioner contends are “aspects of a user’s physical fitness.” Petition, at 22, citing Ex. 1002, 12:15-20. I disagree, and I also note that Dr. Lynch does not provide any opinions in support of Petitioner’s contention. First, the “intensity” that Petitioner cites in Amano for this argument refers to an entirely different aspect of that reference, where the device calculates a measured variable “[W],” which represents the user’s “exercise intensity.” Ex. 1002, 12:15-20. Calculating “exercise intensity” involves multiplying a subject’s “stride” length by the “pitch”¹ at which the subject is running to determine the “distance run by the test subject per unit time” (*i.e.*, a more familiar speed metric, such as miles per hour), and then multiplying that result by the subject’s “body weight” to obtain “exercise intensity [W].” *Id.* While the same word “intensity” is used in both aspects, it is

¹ Amano defines “pitch during running” as “the number of steps per unit time,” which is similar to speed. *Id.*, 7:24-26.

clear that in describing the workout protocol that Amano directs users to follow, “intensity” refers to the pre-set increasing “exercise intensity by 10% each time.” *Id.*, 13:27-55. The reason why this is clear is because Amano interchangeably describes this protocol as increasing the subject’s “pitch” in pre-set 10% increments, and “pitch” is plainly defined as “number of steps per unit time.” Moreover, “pitch” is one of the inputs used to calculate “exercise intensity [W]” as I described above, so when Amano refers to increasing “pitch” by 10%, it cannot be referring to the different concept of “intensity” in “exercise intensity [W].” And, Petitioner does not point to any teaching in Amano that the pre-set 10% increases in “pitch” are based on a user’s “stride length” or “weight,” and I found no such teachings.

112. Second, even if Petitioner had referred to the relevant usage of “intensity” in Amano, I would still disagree, because a POSITA would not understand “stride length” or “weight” to be aspects of “a level of physical fitness of a user” within the plain and ordinary meaning of that term as used in the ’413 Patent. The patent explains that in determining “appropriate heart rate” zones, an individual “athlete’s fitness condition” should be considered, which is another way of describing what is often colloquially referred to as athletic “shape.” Ex. 1001, 15:7-26. A POSITA would understand the claim language “a level of physical fitness of a user” to refer to the same concept, *i.e.*, a user’s “fitness condition” or shape. But in this respect, a POSITA would not consider “stride length” and

“weight” to be “aspects of a user’s physical fitness” as Petitioner contends, because two people with the same stride length or the same weight can have totally different “physical fitness” levels. For instance, one person could be a professional athlete, while the other could be a non-exerciser. Thus, even under this hypothetical scenario, I still disagree that Amano discloses this element of limitation [C].

113. Turning to the second element, Amano also fails to disclose “***prompting*** a user to exercise at a plurality of successive exertion levels” that are “based on a level of physical fitness of a user,” because Amano only notifies the subject to increase exercise intensity (or “pitch”) by 10% at each stage, and never “prompts” a user to exercise at subjective levels chosen by the user. Amano discloses an “exercise intensity increase ***notifying***” process, with the “subject being ***notified***” (*i.e.*, prompted) by the device “to increase exercise intensity by 10% each time” in a series of fixed time intervals (*e.g.*, of 120 seconds each). *Id.*, 13:27-55.

114. Petitioner also argues that in Amano, “a user can choose subjective exertion levels.” Petitioner, at 22. I disagree for reasons I will explain, but in the first instance, even if a user could “choose” different exertion levels, that would not satisfy this limitation’s requirement of an apparatus that “***prompts***” a user to exercise at exertion levels “based on a level of physical fitness of a user.” In fact, I did not find that Petitioner contends Amano disclosing such “prompting,” and Dr. Lynch does not offer such an opinion either. In any case, Petitioner is also incorrect.

Petitioner relies on one sentence from Amano, which states that “it is also acceptable for the test subject to vary exercise intensity according to his own preferences.” Petition, at 22, citing Ex. 1002, 13:66-67. In my opinion, Petitioner takes this sentence out of context. Amano explains that the device-set 10% increases in exercise speed/intensity are “merely a target” that the subject is supposed to attempt to achieve, such that when the device notifies the user to increase speed, the subject may stay at the same pace, or even reduce speed “to some extent,” or vary the level “according to his own preferences.” Ex. 1002, 13:56-67. However, Amano is clear that the subject is supposed to try “to maintain running at” the higher speeds that are selected by the device. *Id.*, 14:66-15:5. One reason for this has to do with the method that Amano discloses for estimating VO_{2max} . Specifically, Amano uses the Astrand-Ryhming nomogram method, which requires measuring a user’s heart rate for at least three different exercise intensity stages, in order to obtain three “exercise intensity-beat rate” pairs so that the device can determine if a straight line relationship exists. *Id.*, 15:6-26. If at least three such pairs are not obtained, then the device cannot estimate VO_{2max} , and “operation of the maximum oxygen uptake quantity estimating mode is terminated.” *Id.*, 15:9-18, 40-41. Therefore, where Amano briefly mentions that it is “acceptable” for the subject to vary the pace somewhat from the speeds prompted by the device, this is only in recognition of common sense, as no device can force a subject to run at a pace that the user is unable

to maintain. However, under Amano's protocol the variance cannot be fully based on the user's own preferences, because Amano requires obtaining at least three "exercise intensity-beat rate" pairs, which would not be accomplished if the subject chooses not to exercise at multiple levels of increasing intensity.

B. Limitation [D]: "determin[ing] a plurality of heart rate zones based on first heart rate measurements received from a sensor while the user exercises at the plurality of successive exertion levels"

115. For at least two reasons, Amano does not disclose this limitation.

116. First, Amano does not disclose "determin[ing] a *plurality of heart rate zones* based on first heart rate measurements," because at most Amano only discloses a single "appropriate exercise intensity" range. Petitioner contends that Amano discloses three "heart rate zones" corresponding to "below 40% VO_{2max} ," "from 40 to 60%" of VO_{2max} , and "greater than 60%" VO_{2max} . Petition, at 23. Setting aside that Petitioner defines these zones by VO_{2max} percentages, and not by "heart rate" as claimed (a separate deficiency that I will address below), I also disagree that Amano discloses these three "zones."

117. In fact, Amano only discloses the single heart rate range that Petitioner refers to as "from 40 to 60%" of VO_{2max} . Amano determines the upper and lower pulse rates for that single range by taking a user's estimated VO_{2max} , reading out from a standardized pulse rate table (the male version is shown in Figure 14 of Amano) the pulse rate that corresponds to the pulse of an "average person" when

exercising at an intensity level corresponding to 50% of that VO_{2max} , and then setting the upper and lower heart rate values at 20% above, and 20% below, that average pulse rate. Ex. 1002, 19:40-46, 20:19-28. In other words, because 20% below 50% is 40%, and 20% above 50% is 60%, Petitioner arrived at the range of “from 40 to 60%” of VO_{2max} . But that is the only heart rate range described in Amano. Petitioner annotated Figure 27 of Amano with additional lower and higher heart rate ranges (colored in yellow and red), but neither Petitioner nor Dr. Lynch cites any portion of Amano that describes such additional ranges, and I have found no such descriptions myself. In fact, Figure 27 relates to an entirely different portion of Amano that describes a “timing chart” for the device’s “pitch maker,” which compares a user’s current “pulse rate” and current “pitch” at the given point in time. *Id.*, 25:18-34 (for instance, “160 steps/min” in the example depicted in Figure 27). Amano explains that the device uses this comparison to determine the “pitch sound” generated by the “sound releaser” to notify the user of the speed at which to exercise. *Id.* In fact, there are two different vertical axes in Figure 27, with the left axis corresponding to heart rate, and the right axis corresponding to pitch rate (*i.e.*, steps per unit time). *Id.*, 25:18-26:34. This section of Amano does not mention anything about multiple heart rate ranges, and I did not find any basis in Amano for Petitioner’s annotations of Figure 27.

118. Second, Amano does not disclose “determin[ing] a plurality of *heart rate zones based on first heart rate measurements*,” because the single “appropriate exercise intensity” range is set based on the user’s estimated VO_{2max} and standardized heart rates, not the *user’s* “heart rate measurements” as claimed. As I already explained in part above, Amano discloses only a single heart rate range, and the device sets the upper and lower limits of that range by taking the user’s estimated VO_{2max} , and reading off the corresponding “target” “pulse rate” from a standardized table, such as the “male” table shown in Figure 14 (Amano explains that there is a different table for females, but does not show it). *Id.*, 19:40-20:28. Amano then sets the range by multiplying that “target” rate by 0.8 (for the lower limit) and by 1.2 (for the upper limit). *Id.* But, Amano plainly explains that the target “pulse rates” in the tables are for an “*average* person” exercising at “50%” of the corresponding VO_{2max} . *Id.* Therefore, upper and lower pulse rate limits that are calculated by multiplying an “average” person’s target rate by 0.8 and 1.2 are not “based on” an individual user’s “heart rate measurements,” as required by this limitation. And in any case, Amano calculates the upper and lower limits based on a user’s estimated VO_{2max} , which is also not a user’s “heart rate measurements,” as required by this limitation. In both respects, even if the Amano device measures an individual’s heart rates at an earlier point in the protocol, those measurements are discarded for purposes of calculating the single “appropriate exercise intensity” range. In other words, no

matter what a specific user's actual "appropriate" lower and upper heart rate limits may be, Amano sets those limits based on an "average" person. Using a similar example as above, two people with similar VO_{2max} levels may nevertheless have different appropriate lower and upper heart rate limits, but because Amano uses a standardized table, the same limits would be set for both.

C. Limitation [E]: "generat[ing] a prompt instructing a user to exercise while maintaining heart rate within a particular one of the plurality of heart rate zones"

119. Amano does not disclose "a prompt *instructing a user to exercise* while maintaining heart rate within *a particular one of the plurality* of heart rate zones," because at most Amano only discloses prompting a user to exercise within a single range, not one of a "plurality" of zones. First, I have already explained above why Amano only discloses (at most) one heart rate range, referred to as an "appropriate exercise intensity" range, and I will not repeat those details here. Amano also only generates "a prompt instructing a user to exercise" within that single range.

120. In the portion of Amano relied upon by Petitioner, the reference explains the following process. When a user starts to warm up during an exercise, the device "does not generate a pitch sound." Ex. 1002, 25:13-14. Then, once the user reaches the lower pulse rate limit of the "appropriate exercise intensity" range, the device emits a "sound . . . for the first time." *Id.*, 25:30-34. Importantly, once the user has entered this range, the device checks to see if the user has "entered a

steady state in running,” at which point the sound is turned off because the user is exercising at a “stable” rate within the “appropriate” range. *Id.*, 25:44-51. However, if the user’s pulse rises above the upper limit, then the device again emits a sound at a lower pitch which informs the user to slow down, and that sound continues “until the user’s pulse falls below the upper limit.” *Id.*, 25:52-62. The device does the same if the user’s pulse falls below the lower limit, by emitting a sound informing the user to speed up “so that the pitch increases at a fixed rate until the user’s pulse exceeds the lower limit.” *Id.*, 26:7-18. In other words, Amano only “***instructs a user to exercise***” within the single heart rate range, because the devices employs sound notifications to move a user ***out of*** heart rates below the lower limit, or above the upper limit, by notifying the user to change speed until their heart rate is again back in the single “appropriate exercise intensity” range. In fact, Dr. Lynch agrees with me, because he opines that Amano prompts a user “to exercise while maintaining their heart rate within the ***calculated zone***,” singular. Ex. 1009, ¶ 76 (emphasis added).

121. Petitioner also argues that Figure 51 in Amano discloses this limitation, because it supposedly shows LED lights corresponding to different exercise intensities.” Petition, at 25. I disagree. First, Figure 51 does not show “heart rate zones” as required by this limitation. Instead, Amano explains that the device display shown in Figure 51 includes an “exercise intensity meter” (element 605,

which Petitioner annotates in blue), that includes LED lights spaced at intervals of 10%, within a full intensity range of 0%-200%. Ex. 1002, 39:7-17. Amano teaches that the device can illuminate a portion of the LEDs corresponding to a desired “exercise intensity target value” (*id.*), which is not a single “heart rate zone,” let alone multiple zones. In fact, Amano further explains that the meter displays the “exercise intensity current value” for a user during exercise, so that the user can understand how hard he or she is working out, and therefore “is able to know that the intensity of exercise is too great by looking at the display.” *Id.*, 39:27-32. But if the device shows the user that the workout intensity is too high, the user would be prompted to *change* pace accordingly, not “maintain[] heart rate within a particular one of the plurality of heart rate zones” as required by this limitation. Therefore, for these additional reasons, Amano does not disclose this limitation.

XIV. Ground 2: Matsumoto Does Not Disclose Every Limitation Of The Independent Claims

122. Petitioner contends Claims 1, 5, 7, 12 and 17 are anticipated by Matsumoto. Petition, at 29. For at least the following reasons, it is my opinion that Matsumoto does not disclose, teach, or suggest each and every limitation of independent claims 1, 12, and 17. While I only address certain limitations in the independent claims, because dependent Claims 5 and 7 depend from Claim 1, my opinions that Matsumoto does not anticipate also apply to those claims. The fact

that I do not address certain claims and claim limitations here does not mean that I agree with Petitioner, or its expert Dr. Lynch.

123. Specifically, I will address why Matsumoto does not disclose limitations [C], [D], and [E], which are substantively the same for each independent claims.

A. Limitation [C]: “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user”

124. This limitation includes two distinct elements, neither of which is disclosed by Matsumoto.

125. First, Matsumoto does not disclose “exertion levels” that are “*based on a level of physical fitness of a user*,” because Matsumoto teaches a series of pre-set exercise routines selected by the device from an “exercise standard” table, with “specific time” and “target pulse” parameters that increase in standardized increments, without regard to a user’s “level of physical fitness.” Ex. 1003, at 3:1-4:24. Petitioner acknowledges that in Matsumoto “the *machine sets* the initial exertion level targets.” Petition, at 30–31. Dr. Lynch agrees, opining that the “machine . . . choose[s] a workout” for the user, although I note that Petitioner does not cite or rely upon Dr. Lynch for this asserted ground. Ex. 1009, ¶ 79. More specifically, Matsumoto teaches that the “exercise standard” programs in the table correspond to “specific standard amounts of exercise,” for example “exercising at

xxx pulses/min. for xx mins,” with the specific values filled based on the program selected by the machine. Ex. 1003, 3:53-64. When a user initiates a training program, the device chooses an exercise program “from the table,” based on the user’s “age, sex, weight,” and any previous use of the bicycle. *Id.* For example, if the device selects program No. 5, then the user is directed to exercise until he or she reaches the target pulse of 150, and exercise while maintaining that pulse for 5 minutes. As Matsumoto explains, the user “starts peddling the bicycle,” and increases “speed until he or she arrives at the target pulse.” *Id.*, 3:66-68. In other words, the exercise programs selected by the machine from the table are standardized, and do not change “based on a level of physical fitness of a user.”

126. The same is true for another embodiment in Matsumoto describing warm-up routines. Here, Matsumoto again teaches that the user enters sex, age, and weight information, and the device uses that information to select a target heart rate “for warming up” from another standardized table (Table 2 in Matsumoto). *Id.*, at 5:16-38. For example, if the device selects program No. 1, then the target pulse rate for warming up is set to 100. *Id.* Once the user starts peddling the bicycle, he or she is instructed to speed up or slow down until the target pulse selected by the machine is reached. *Id.*, 5:45-48. Then, the user is then instructed to “[c]ontinue exercising at xx p/m for 1 minute.” *Id.*, 5:24-25. Next, the machine increases the target pulse rate to the next value in the standardized table, for instance 120 for program No. 2,

and the user is again instructed to reach the new target. *Id.*, 5:39-61. This process continues in one minute increments, until the user enters “full fledged training.” In other words, Matsumoto again teaches intensity levels that increase based on standardized values in a table, not based on “a level of physical fitness of a user.” The warm-up routine progresses regardless of the user’s subjective fitness ability, which Petitioner acknowledges in stating that Matsumoto’s “exertion levels” are “not subjective.” Petition, at 32 (emphasis added).

127. Petitioner contends that Matsumoto nevertheless discloses this limitation because it supposedly teaches “an exercise program that is *suited to* the individual user’s physical fitness.” Petition, at 32, citing Ex. 1003, 4:33-35. I disagree that a program “suited to” an individual is equivalent to “exertion levels” that are “*based on* a level of physical fitness of a user,” and I also note that Dr. Lynch does not provide any opinions in support of Petitioner’s contention. Petitioner admits that Matsumoto selects workouts from the “exercise standard” table based on a user’s “sex, age, and weight” information (Ex. 1003, 5:8-15), which Petitioner contends “*estimate* the physical fitness of the user.” Petition, at 31, citing Ex. 1003, 3:23-50, 5:17-18. But I did not find any reference to estimating a user’s physical fitness in the portions of Matsumoto cited by Petitioner. And in any case, I disagree that a POSITA would understand “sex, age, and weight” information standing alone to server as estimates of a user’s physical fitness, at least because persons of the

same age and weight can have vastly different fitness levels, depending on how often they exercise, lung capacity, muscle development, and other factors. As an example of how a POSITA would understand these concepts, the '413 Patent describes an “athlete’s fitness condition” as a variable that is distinct from an “athlete’s age” (Ex. 1001, 15:7-10), which makes logical sense because people of the same age can have drastically different fitness levels. Petitioner further contends that in Matsumoto the “levels *must be* based on the physical fitness of the user” (Petition, at 31), but no portion of Matsumoto is cited in support, and I did not find any such disclosure in the reference. At most, Matsumoto discloses a device that selects workouts for a user from a standardized table, and while those workouts may be tailored based on sex, age, and weight, there is no disclosure of “exertion levels” that are “based on a level of physical fitness” for an individual user, as required by this limitation.

Turning to the second element, Matsumoto also fails to disclose “*prompting* a user to exercise at a plurality of successive exertion levels” that are “based on a level of physical fitness of a user,” because Matsumoto only directs a user to continue “exercising at xxx pulses/min. for xx mins,” using standardized values selected by the machine. Ex. 1003, 3:53-64. In fact, Petitioner acknowledges that Matsumoto “prompt[s] the user to do a *certain type of workout* with a *certain increasing intensity*” (Petition, at 30), which are pre-set “exertion levels” selected by the machine, not based on an individual user’s physical fitness. Petitioner further

contends that Matsumoto's standardized levels "are analogous" to an embodiment in the '413 Patent that discloses prompting a user to exercise at "EASY," "MEDIUM," and "HARD" levels. Petition, at 30, citing Ex. 1001, 15:44-16:55. I disagree. Intensity levels such as easy, medium, and hard are subjective, because each individual user would associate those prompts with intensity levels that feel a certain way to them personally, without reference to a standard. Matsumoto, on the other hand, discloses an "exercise standard" table with pre-set target pulse and exercise time values (Ex. 1003, 3:20-55), which do not vary based on an individual user's subjective feelings of how difficult a given workout may feel.

B. Limitation [D]: "determin[ing] a plurality of heart rate zones based on first heart rate measurements received from a sensor while the user exercises at the plurality of successive exertion levels"

128. Matsumoto does not disclose this limitation for at least two reasons. First, Matsumoto discloses at most a single heart rate range, set around a single heart rate "target pulse," not a "plurality." Second, even for that single range, Matsumoto calculates the target pulse using a formula that considers a user's *resting* heart rate, not "heart rate measurements received" while the user exercises at a "plurality of successive exertion levels."

129. First, Matsumoto discloses a single heart rate range, which is set at " ± 5 " beats around a "target pulse" value." Ex. 1003, 7:50-51. Petitioner contends there are multiple "zones," but in the portions of Matsumoto that Petitioner cites, the

reference only discloses a single “target pulse zone”: “[i]f the user’s pulse is within *the target pulse zone*, the LED emits green light, yellow light if it is below *the target pulse zone*, and red if it is above *the target pulse zone*.” Petition, at 33, citing Ex. 1003, 9:36-40. In other words, whether the device uses LED lights to inform the user that he or she is exercising within, above, or below the “target pulse” range, it is always in reference to that single range, not to multiple ranges.

130. Next, and in reference to Table 2 (which I discussed above), Petitioner contends that because “there are numerous pulse targets in an exercise program, the device is calculating a plurality of these heart rate zones.” Petition, at 33. I disagree, at least because Petitioner is referring to a different portion of Matsumoto that has nothing to do with *calculating* a “target pulse” and LED lights showing “ ± 5 ” pulses above and below the target. Table 2 relates to warm-up routines, where the user is directed to reach a pre-set “target pulse” selected by the machine from the table. Ex. 1003, 5:25-61. There is no teaching of a range or “zone” for these warm-ups, and in fact the user is instructed to “maintain” their “pulse at as close a value to [the target pulse] as possible.” *Id.* But as indicated by the different columns of the reference that Petitioner cites (Petition, at 32-33), the single “target pulse” range teaching appears in a different portion of Matsumoto describing “another embodiment” with a “manual training mode” and an “auto training mode.” *Id.*, 7:36-9:51. And in that portion of the reference, Matsumoto teaches calculating a “target

pulse” using a formula (rather than using pre-set target pulses appearing in a table) which, in part, takes as an input the user’s “pulse at rest.” *Id.* I did not find a disclosure of “numerous pulse targets in an exercise program” for this embodiment of Matsumoto, as Petitioner incorrectly contends. Petition, at 33. Instead, Matsumoto explains that during a given exercise routine, the device sets one “target pulse,” and the user is directed to pedal “the bicycle at an appropriate speed to arrive at *the prescribed target pulse*,” singular. Ex. 1003, 9:20-22. Then, once the workout timer “counts down to zero, the user is informed on the display that the training timing has ended and is instructed to start pedaling slower to cool down.” *Id.*, 9:43-46. Other than for one “ ± 5 ” range set about the single “target pulse” for a given workout routine, I did not find any support in Matsumoto for Petitioner’s contention that “[t]here is a *plurality of zones* calculated each time a new program is determined for a user.” Petition, at 33.

131. Turning to the second reason this limitation is not disclosed, as I discussed above Matsumoto at most *calculates* (*i.e.*, “determines”) the single “target pulse” range using a formula that inputs *resting* heart rate, not “heart rate measurements received” while the user exercises at a “plurality of successive exertion levels.” For example, Matsumoto teaches that a “target pulse” is calculated using a formula based at least in part on the user’s age and pulse at rest (*e.g.*, $200 - \text{the user's age} - \text{the user's pulse at rest}$). Ex. 1003, 8:24-9:22. While Matsumoto

suggests that a “target pulse” can take account of parameters including a user’s “exercise rating,” which in turn relates to the user’s “pulse while [sic] exerciseing,” Matsumoto does not disclose that the single calculated “target pulse” range is based on multiple “heart rate measurements” that were taken while the user exercised “at a plurality of successive exertion levels.” Indeed, in the “manual training mode” Matsumoto teaches that the “exercise rating” is set to “30,” without regard to a user’s pulse rate (*id.*, at 9:59), and if the “user is not feeling that well or wants to exercise a little harder than usual,” he or she can change the “step No..” *i.e.* the exercise program, which also changes the “target pulse.” *Id.*, 8:48-52. In each case, Matsumoto is not determining a “heart rate zone,” let alone a “plurality” of zones, “based on first heart rate measurements received from a sensor while the user exercises at the plurality of successive exertion levels.”

C. Limitation [E]: “generat[ing] a prompt instructing a user to exercise while maintaining heart rate within a particular one of the plurality of heart rate zones”

132. Matsumoto does not disclose this limitation, because at most Matsumoto only discloses informing a user that he or she is exercising within a single “heart rate” range, not “*a particular one of the plurality* of heart rate zones.”

133. As an initial matter, I have already explained above why Matsumoto only discloses (at most) one heart rate range, and I will not repeat those details in this section. First, Petitioner contends that Matsumoto’s disclosure “[c]ontinue for

xx min at a Pulse for xxx p/m” is a “prompt” for the user “to exercise while maintaining heart rate within *one of the plurality of heart rate zones.*” Petition, at 34, citing Ex. 1003, 5:61. I disagree, because as I discussed above, this portion of Matsumoto discussing warm-up routines does not disclose a heart rate range in the first place, and instead teaches that a user is to “maintain” their “pulse at as close a value to [the target pulse] as possible,” not exercise within a “zone.” Ex. 1003, 5:25-61. And as I also discussed above, this portion of Matsumoto does not teach one “±5” range set about a single “target pulse.”

134. Second, Petitioner contends that this limitation is disclosed by Matsumoto’s “graphical representation and flashing LEDs.” Petition, at 34. I disagree, including because (as I discussed above) in this section Matsumoto also does not disclose a “plurality of heart rate zones.” Furthermore, Matsumoto teaches that the user pedals the bicycle at an “appropriate speed to arrive at the prescribed target pulse.” Ex. 1003, 9:15-22. Then, the LED lights change color (to yellow or red) to indicate to the user that he or she is outside of the single target pulse range. *Id.*, 9:36-40. To the extent that Matsumoto “instructs” the user, it is only informing the user with respect to the status of exercising withing the single “target pulse” range, because the device timer on the display starts once the user reaches the target pulse to inform he user “that he has started training,” and if the user exceeds the target pulse by too much, the device emits a “buzzer” to warn the user to slow down.

Id., 9:31-42. In both respects, there is no “*plurality* of heart rate zones” or “prompting” the user to exercise, and therefore Matsumoto does not disclose prompting a user to exercise within “a particular *one of the plurality* of heart rate zones.”

XV. Ground 3: Lubell and Ceci Do Not Disclose Every Limitation Of The Independent Claims

135. Petitioner contends that Claims 1, 12 and 17 are rendered obvious by the combination of Lubell and Ceci. Petition, at 39-47. For at least the reasons detailed below, it is my opinion that Lubell and Ceci (whether considered separately or together) do not teach or suggest each and every limitation of the independent claims. In a separate section, I will also address why a POSITA also would not have been motivated to combine Lubell and Ceci to reach the independent claims. Again, the fact that I do not address certain claims and claim limitations here does not mean that I agree with Petitioner, or its expert Dr. Lynch.

136. Specifically, I will address why this combination does not disclose limitations [E] and [G] of the independent claims, for which Petitioner exclusively relies on Lubell, and not on Ceci.

A. Limitation [E]: “generat[ing] a prompt instructing a user to exercise while maintaining heart rate within a particular one of the plurality of heart rate zones”

137. Lubell does not disclose this limitation. First, Lubell does not disclose a “a particular one of the plurality of heart rate zones” in limitation [E], because

limitation [D] requires that those “zones” be “*based on first heart rate measurements*” received from a sensor while the user exercises at the plurality of successive exertion levels.” But to the extent that Lubell discloses any heart rate “zone,” it is a single range that is determined by estimating a user’s VO_{2max} , not by heart rate measurements. Specifically, Lubell teaches that its device can be programmed to emit an alarm sound so that the subject’s heart rate “stays within” the single fitness training “range” corresponding to 60%-80% of VO_{2max} . Ex. 1004, 9:65-10:7. The device can also emit an alarm sound with the subject’s heart rate is not within that fitness training “range,” which again is based on VO_{2max} (*id.*, 10:32-37), which Lubell estimates using the Van der Walt relationship, which uses experimentally derived coefficients to calculate a subject’s VO_{2max} based upon the amount of time that it takes a subject to reach his or her “maximum heart rate” while running in a specially designed “exercise tolerance test.” *Id.*, 3:47-53. For limitation [D], Petitioner acknowledges that Lubell only calculates a workout range “in terms of percentage of oxygen uptake, VO_{2max} ,” and relies on Ceci for the missing “claimed heart rate zones” (which I separately address below). Petition, at 44-45. Therefore, Lubell also cannot disclose limitation [E].

138. Lubell also cannot disclose limitation [E] because, as Petitioner admits, Lubell “prompt[s] a user to run at a particular *velocity*,” rather than prompting a user to exercise while maintaining a particular heart rate. Petition, at 45-46. Lubell

teaches that its device can be programmed to emit “pacer tones” so that the subject “stays within” the fitness training “range” corresponding to 60%-80% of VO_{2max} . *Id.*, 9:65-10:7. This includes emitting “higher” and “lower” “pacer tones” if the subject is not within the fitness training “range.” *Id.*, 10:32-37. Indeed, if the user’s VO_{2max} rises “above 80%,” Lubell sounds a “higher pitch pacer tone” instructing the user to “*slow down*, as necessary, to maintain his *speed* within the training range of 60 to 80 percent.” Ex. 1004, 10:33–38 (emphases added). In other words, Lubell only prompts a user to maintain a particular running speed in the first place (not a heart rate), but even to the extent Lubell discusses a heart rate “range,” it is only the single fitness training range, and Lubell does not disclose “prompting” with respect to a “plurality” of zones as required by this limitation.

B. Limitation [G]: “determin[ing] whether the second heart rate measurements are within the particular heart rate zone”

139. For the same reasons as for limitation [E], Lubell also does not disclose this limitation. Namely, because Lubell does not disclose “heart rate zones” that are “*based on first heart rate measurements*,” and at most discloses a single range that is based on estimates of VO_{2max} , Lubell cannot disclose determining whether “second heart rate measurements are within *the particular heart rate zone*.”

XVI. Ground 3: A POSITA Would Not Have Been Motivated To Combine Lubell With Ceci

140. For the reasons I explained above, the Lubell and Ceci references (whether considered separately or in combination) do not disclose at least limitations [E] and [G] of independent Claims 1, 12, and 17. In addition, a POSITA would not have been motivated to combine Lubell with Ceci, in the manner suggested by Petitioner and Dr. Lynch.² Below I will only address limitations [C] and [D] of the independent claims, but I reserve the right to address other limitations and claim at a later date, if necessary.

A. Limitation [C]: “prompt[ing] a user to exercise at a plurality of successive exertion levels, wherein an exertion level is based on a level of physical fitness of a user”

141. Petitioner contends that if Lubell does not disclose an exercise protocol where “exertion levels” are “based on a level of physical fitness of a user,” that gap is filled by Ceci’s teachings of “self-regulated exercise chosen by a user.” Petition, at 42. Petitioner argues that the motivation to combine the references in this manner comes from the following statement in Lubell: “it is to be understood that a device

² I also note that Dr. Lynch’s declaration includes opinions relating to what he terms “obvious modifications” to Lubell by itself, separate from opinions relating to the combination of Lubell and Ceci. *E.g.*, Ex. 1009, ¶¶ 56-64. I understand that Petitioner did not include an invalidity Ground based on Lubell by itself, and does not cite to or rely upon Dr. Lynch’s opinions on that topic, so I also will not respond to them in my declaration (although I reserve the right to do so at a later date, if necessary). The one exception is ¶ 60 of Dr. Lynch’s declaration, which in part discusses Lubell and Ceci, and is cited in the Petition (*e.g.*, at p. 42). I will address those opinions of Dr. Lynch in this section of my declaration.

embodying this invention could be suitably adapted for use when cycling, swimming, or some other exercise. . . In such a case, a *suitable submaximal exercise test protocol could be used.*” *Id.*, citing Ex. 1004, 5:8-13 (emphasis added). Petitioner contends that this reference in Lubell to a “suitable” protocol would have led a POSITA to consider that “other tests” could be used “in other circumstances,” and specifically would have motivated a POSITA to use the “self-regulated” protocol of Ceci. Petition, at 42-43. Petitioner describes three supposed rationales for making this combination: (a) each reference includes disclosures that would have motivated a POSITA to look to and combine with the other reference, (b) the combination is a “simple substitution of one test for another,” and (c) the combination is “applying a known technique (RPE test protocol) to a known device (Lubell health fitness monitor).” *Id.*, at 43-44. Dr. Lynch also opines regarding the same three supposed rationales. Ex. 1009, ¶¶ 60, 89-93. I disagree with Petitioner and Dr. Lynch for at least the following reasons.

142. Starting with the supposed motivation to combine in Lubell, Petitioner and Dr. Lynch misinterpret the paragraph of Lubell referring to a “suitable submaximal exercise test protocol.” Ex. 1004, 5:12-13. The full paragraph discloses the following:

While the description given below is of an exemplary embodiment intended for use with a human subject using running as the preferred training exercise, it is to be understood that a device embodying this invention could be suitably adapted for use when cycling, swimming,

or some other exercise is the preferred training exercise. In such case, a suitable submaximal exercise test protocol could be used, in a controlled exercise environment. Furthermore, devices embodying this invention could be adapted for monitoring the training of non-human subjects, such as race horses or dogs.

Id., 5:6-16. This paragraph does not teach that a “suitable submaximal exercise test protocol” could refer to “self-regulated” exercise protocols. Instead, Lubell is merely pointing out that while the embodiment described in its specification is for a “human subject” that is “running,” a similar and “suitable” protocol could be adapted for *different* scenarios. For example, it could be adapted for different types of exercise, such as “cycling” or “swimming.” *Id.* Or, it could be adapted for non-human subjects, such as “race horses” or “dogs.” *Id.* But in both cases, Lubell explains that another “*submaximal exercise test* protocol” would be used. And every description of a “submaximal exercise test” in Lubell refers to a protocol where the subject is “paced” by the device to exercise at pre-determined speeds. Ex. 1004, Abstract (“monitoring the subject’s heart rate and *pacing the subject through a submaximal exercise stress test protocol*”), 3:30-34 (the “indicator then provides indications, such as pacing tones, *to establish an exercise cadence* (such as a running stride frequency) *for the subject at a predetermined pacing rate* so that the subject can follow a graded *submaximal exercise tolerance test*”), 3:58-60 (“In a preferred fitness index *submaximal exercise test protocol*, the subject, wearing the device, *is paced to run at speeds . . .*”), 8:32-34 (“This *protocol paces the subject*

through a prescribed submaximal exercise program for calculating his fitness index”). Indeed, a POSITA would not understand that Lubell’s “suitable submaximal exercise test protocol,” which can be adapted for use by “race horses” or “dogs,” could encompass a “self-regulated” exercise protocol as Petitioner contends, because it does not make logical sense that a horse or a dog could choose its own exercise protocol.

143. The fact that Petitioner and Dr. Lynch misinterpreted Lubell is confirmed by other sections of Lubell that explicitly criticize “self-regulated” exercise protocols. In discussing prior approaches for health and fitness monitors, Lubell states that “one previously-proposed fitness monitoring system” directed a subject to exercise “at whatever speed he or she desired.” *Id.*, 2:1-4. And in others, Lubell explains that “previously proposed fitness monitors” allowed “runners to pace themselves at various speeds.” *Id.*, 2:35-37. But in both cases, Lubell describes these prior systems as having drawbacks and disadvantages. For instance, Lubell explains that these systems were not “universally applicable.” *Id.*, 2:10. To “avoid the drawbacks of the previously proposed devices,” Lubell states that “an object of this invention” is to provide a system that “automatically pac[es] the subject through a straightforward training protocol.” *Id.*, 2:45-51. In other words, Lubell explicitly teaches a POSITA to use protocols where the device selects the exercise protocol and puts the subject through it, *instead of* using a protocol where subjects pace

themselves. A POSITA would thus understand that Lubell's reference to a "suitable" protocol in other scenarios does not refer to a "self-regulated" protocol, like the one in Ceci, because Lubell is in fact teaching a POSITA *not to use* such protocols.

144. Another reason that Lubell actually teaches a POSITA away from using a "self-regulated" protocol is that its method for estimating VO_{2max} uses the Van der Walt equation with the appropriate coefficients (as I explained in more detail above, and will not repeat here). That approach requires that the subject reach his or her maximum heart rate (or point of exhaustion) during the test, in order for it to be possible to estimate VO_{2max} . *Id.*, 3:64-4:13. In other words, if the user does not follow the prescribed protocol, the purpose of the test is defeated, because it would not be possible to estimate VO_{2max} . But if subjects were allowed to choose their own pace of exercise, as opposed to being paced through the Lubell protocol (which in one example starts at four miles per hour, and increases up to fourteen miles per hour, *id.*, 3:58-68), there would be no way to guarantee that a subject reached his or her maximum heart rate or point of exhaustion. This is yet another reason why Lubell would not have motivated a POSITA to consider a "self-regulated" exercise protocol, such as the one in Ceci.

145. Finally, while the above focused on the supposedly motivating disclosures in Lubell, Petitioner also argues that Ceci includes motivating

disclosures. Specifically, Petitioner contends motivation is provided because Ceci “acknowledges that the RPE scale could be used to track exercise intensity with heart rate zones, and that ‘exercise intensity should vary between 65% and 90% of maximal heart rate reserve to reach optimal effectiveness.’” Petition, at 44, citing Ex. 1005, at 6. But even if it is accurate to describe Ceci as tracking exercise intensity using the Ratings of Perceived Exertion (RPE) scale, Petitioner does not point to any aspect of Ceci that would have led a POSITA to consider combining its self-regulated exercise approach with the prescribed approach of Lubell, and I did not find any such teachings in Ceci. For at least that reason, I disagree that the disclosures in Ceci would have motivated a POSITA to combine with Lubell.

146. Turning to the second rationale, I disagree that using the “self-regulated” exercise protocol of Ceci in the Lubell system would have been a “simple substitution of one test for another.” Petition, at 43. Before discussing the details, I note that while Petitioner contends that this is a distinct rationale, in support it only refers to the same portion of Lubell that I discussed above regarding a “suitable” protocol for scenarios other than human subjects running. *Id.* Petitioner also cites Dr. Lynch, but he does not refer to a “simple substitution” for this combination either. *E.g.*, Ex. 1009, ¶¶ 89-93. Thus, I have not found any supporting explanation for this argument. In any case, Dr. Lynch does opine that the “architecture already exists in the device of Lubell to support a test protocol” like the one in Ceci (*id.*, at

¶ 93), but even if Dr. Lynch intended for this opinion to apply to a “simple substitution” rationale, I disagree with him. First, Dr. Lynch does not describe any details of the “architecture” he refers to. But more importantly, Dr. Lynch ignores that Lubell’s method for estimating VO_{2max} uses the Van der Walt relationship, which requires that the subject reach his or her maximum heart rate (or point of exhaustion) during the test, in order for it to be possible to estimate VO_{2max} . *Id.*, 3:64-4:13. The device in Lubell is pre-programmed with equations that use standardized coefficients based upon the Van der Walt relationship, which require as inputs a subject’s maximum heart rate, as measured during set time periods of exercise that essentially “force” the subject to attain that maximum rate (or reach a point of exhaustion). *Id.*, 9:13-10:25. In this section, Lubell explains that the device is able to estimate VO_{2max} using the “fitness test protocol described hereinabove,” which as Lubell explains, is not the type of self-directed protocol used in “previously proposed fitness monitors.” *Id.*, 9:17-18, 2:35-37. Dr. Lynch does not provide any explanation for how a POSITA could have simply substituted an entirely different type of protocol, like the “self-regulated” protocol Ceci, into the Lubell system, which is specifically designed to be used with a series of “predetermined pacing rate[s].” *Id.*, 3:32-33. Finally, Dr. Lynch also opines that it “would be a simple implementation in software to include an RPE test as another method of determining fitness parameters such as heart rate zones” (Ex. 1009, ¶ 93), but he does not explain

how the Lubell system, which is premised on a different type of protocol, could have been so modified in the first place, let alone that it would have been a “simple implementation.” In addition, Dr. Lynch ignores that an “object” of Lubell’s invention was to estimate “maximal oxygen uptake level or VO_{2max} ,” not “heart rate zones” (which are not even mentioned in Lubell). And as I already explained, Lubell’s built-in approach for estimating VO_{2max} requires a different type of protocol, and there is no indication that it would work with something like the Ceci protocol. Therefore, I disagree that a POSITA would have found the combination of the Ceci protocol with Lubell to be a simple substitution, or would have had a reasonable expectation of success with such a combination.

147. Finally, for the third rationale, I disagree that applying a “known technique” to a “known device” would have been a reason for a POSITA to make the combination of Ceci and Lubell (Petition, at 43), primarily for the same reasons that I have already discussed. That is, even if the RPE scale in Ceci was a “known technique,” and the system in Lubell was a “known device,” the fact that Lubell teaches not to use a “self-regulated” exercise protocol would have led a POSITA away from applying the technique of Ceci to the device of Lubell. Dr. Lynch states that a POSITA “would have been aware of the existence of the RPE scale and its effectiveness at prompting exercise at various levels,” and opines that awareness would have motivated a POSITA “to add another test to Lubell, since Lubell

explicitly mentions the possibility.” Ex. 1009, ¶ 92. I disagree on both counts. First, Lubell does not mention adding tests of the type in Ceci. As I have discussed at length, Lubell only teaches that its prescribed protocol can be adapted for different scenarios, such as different activities (cycling, swimming) and different subjects (horses, dogs). Ex. 1004, 5:6-17. And in any case, the protocol in Lubell already prompts its subjects to exercise at various prescribed levels, so it would not have been necessary for a POSITA to consider a different protocol that also “prompt[ed] exercise at various levels.” Second, I disagree that mere “awareness” of the RPE scale would have motivated a POSITA to combine Ceci with Lubell, since Lubell specifically criticizes self-directed exercise protocols and claims as an “object” of its invention the use of a prescribed protocol. Dr. Lynch mentions the supposed “flexibility” advantage of adding a different type of exercise protocol, but does not explain why a POSITA would have been concerned with “flexibility” in the first place, when Lubell does not contain any disclosure that would have led a POSITA to “self-regulated” exercise protocols (and in fact directs a POSITA away from them). Similarly, Petitioner argues that “[c]ombining a known fitness test with Lubell would be desirable and feasible.” Petition, at 44, citing Ex. 1009, ¶ 93. But neither Petitioner or Dr. Lynch explain why it would have been “desirable,” and for feasibility, Petitioner cites the same opinion of Dr. Lynch that I discussed above, regarding the “architecture” of Lubell supposedly supporting the Ceci test protocol.

As I explained, Lubell's built-in approach for estimating VO_{2max} requires a prescribed test protocol, and neither Petitioner nor Dr. Lynch provided any details supporting how the Lubell "architecture" could have been modified or adapted to use Ceci's "self-regulated" protocol.

B. Limitation [D]: "determin[ing] a plurality of heart rate zones based on first heart rate measurements received from a sensor while the user exercises at the plurality of successive exertion levels"

148. Petitioner acknowledges that to the extent Lubell determines a "heart rate" range, it "does so in terms of percentage of maximal oxygen uptake, VO_{2max} ," not "*based on first heart rate measurements* received from a sensor while the user exercises." Petition, at 44. To fill the gap, Petitioner contends that it "would also be obvious to use the heart rate zones found in an RPE test as described by Ceci." *Id.*, at 45. To support this argument, Petitioner cites to one sentence from Dr. Lynch's declaration, where he opines that a POSITA "would thus be motivated to use the heart rates measured at different RPE levels, as described in Ceci, as the basis for the heart rate zones in Lubell (heart rates that correlate to less than 60%, 60-80%, and greater than 80% VO_{2max})." Ex. 1009, ¶ 92. I disagree, and I do not see any supporting explanation for why a POSITA would have been motivated to look for teachings about heart rates measured at different levels of perceived exertion in the first place, let alone why a POSITA would have specifically looked to a reference describing a "self-regulated" exercise protocol, when Lubell criticizes precisely that

type of protocol. Lubell already discloses a process for pacing a subject to maintain an “exercise stress level” corresponding to the range “between 60% and 80%” of VO_{2max} , using “pacer tones” that are programmed to alarm based on estimated VO_{2max} levels calculated during exercise. Ex. 1004, 9:65-10:49. Other than mentioning the generic concept of “flexibility,” neither Petitioner nor Dr. Lynch explains what would have motivated a POSITA to change Lubell’s approach when the system already had a working method for pacing a subject within a certain exercise range. In other words, even if the “measured heart rates” in Ceci could have been used “to directly determine heart rate zones” in Lubell as Petitioner contends (Petition, at 45), I see no reason why a POSITA would have been motivated to do so where no missing or inferior functionality has been identified in Lubell. Particularly when considered in addition to all of the reasons I discussed above for how Lubell teaches a POSITA away from a combination with Ceci, I disagree that a POSITA would have been motivated to make the combination for limitation [D].

I reserve the right to supplement my opinions in the future to respond to any arguments that Petitioner raises. This declaration represents only those opinions that I have formed to date. I reserve the right to revise, supplement, and/or amend my opinions stated herein based on new information that becomes available to me and on my continuing analysis of the materials already provided.

I recognize that this declaration will be filed as evidence in a contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I also recognize that I may be subject to cross examination in the case and that cross examination will take place within the United States. If cross examination is required of me, I will appear at the appropriate time as mutually agreed between the parties.

I declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

April 20, 2023
Date

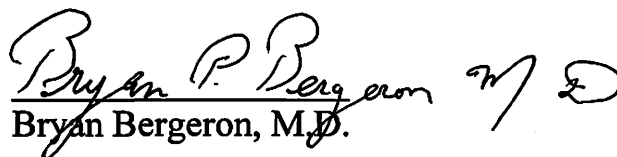

Bryan Bergeron, M.D.

EXHIBIT A

Bryan P. Bergeron, MD, FACMI

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Major Education

1975 Drafting, Morgan City Vocational and Technical School
1975–77 Electrical Engineering, LSU Baton Rouge, LA
1979 Neurobiology Research, Marine Biology Laboratory, Woods Hole, MA and Brigham & Women's Hospital, Boston, MA
1980 B.S, cum laude, Experimental Psychology, minors in Chemistry and Physics, Tulane Scholar Program, Tulane University, New Orleans, LA
1984 M.D., Louisiana State University Medical Center, New Orleans, LA
1985–87 Computer Science, Harvard University, Cambridge, MA
1985–87 Medical Informatics, National Library of Medicine (NLM) Post-Doctoral Fellowship at Brigham & Women's Hospital, Boston, and Harvard University, Cambridge, MA

Major Certifications

1971 General Radiotelephone License, FCC
1973 Extra Class License, FCC
1974 Radar Endorsement, FCC
1984 License to Practice Medicine and Surgery
1990 Elected Fellow, American College of Medical Informatics (ACMI)

Major Professional Positions

1971–84 Offshore Communications Technician/Engineer, DataComm, the Offshore Telephone Company, Morgan City, LA
1980–84 Phlebotomist, Pathology Department, Touro Infirmary, New Orleans, LA
1985 Admitting/Pre-Surgical Workup, Chalmette General Hospital, Chalmette, LA
1985 High-Risk OB Triage, Ochsner Clinic, New Orleans, LA
1987–89 Application Specialist, Children's Hospital, Boston, MA
1989–94 Assistant Director, Decision Systems Group (DSG), Brigham and Women's Hospital, Boston, MA
1996–06 Director, Medical Informatics Laboratory, Massachusetts General Hospital (MGH) Dept. Anesthesia and Critical Care, Boston, MA
1996– President, Archetype Technologies, Inc., Brookline, MA
1998–99 Chief Scientist, Kurzweil Technologies, Inc., Waltham, MA
1998–00 Chief Scientist, Kurzweil Applied Intelligence, Inc., Waltham, MA
1999–03 Chief Scientist, Medical Learning Company, Inc., Wellesley, MA
2007–09 Acting Director, Clinical Investigation, MGH Institute for Healthcare Professions (MGH-IHP), Charlestown, MA
2004–20 Chief Scientist, Accella Learning Company/Boardpoint, LLC, Louisville, KY

Major Committee Chairs

- 1987 Mathematical Modeling & Simulation. Symposium on Computer Applications in Medical Care (SCAMC), Washington, DC
- 1990 Human-Computer Interfacing. SCAMC, Washington, DC
- 1996–98 McGraw-Hill Healthcare Symposium Series
- 2003 Healthcare Information Management Systems Society (HIMSS) Conference: Innovative Informatics for Reducing Medical Errors, Cambridge, MA
- 2019– Board of Directors, International Morse Preservation Society

Major Editorial Boards

- 1988–93 MD Computing, Springer-Verlag
- 1988–98 Medical Devices and Software, Waverly Press
- 1989–07 ARRL Handbook, American Radio Relay League
- 1995–03 Founding Editor-in-Chief, e.MD, McGraw-Hill
- 1995–00 Physicians Home Page, Silver Platter Publishers
- 1997–08 Postgraduate Med, McGraw-Hill
- 1998–00 Advance for Health Information Executives, Merion Publishers
- 1999–10 Healthcare Informatics, McGraw-Hill
- 2000–04 Perspectives in Biology & Medicine, Johns Hopkins University Publications
- 2001–05 Medical Software Reviews
- 2003–05 WebMD/Medscape Tech Med
- 2012–13 Robotics Business Review
- 2007– Editor in Chief, Servo Magazine (www.servomagazine.com), T&L Publications
- 2007– Editor in Chief, Nuts & Volts Magazine (www.nutsvolts.com), T&L Publications
- 2019– Editor, Keynote, Newsletter of the International Morse Preservation Society

Major Grant Support

- 1988–94 Principal Investigator (PI), "Computer simulation in clinical medicine", National Library of Medicine/Department of Health and Human Services (DHHS). Desktop based graphical patient cases for physician.
- 1991–93 Co-investigator, "Knowledge management in medicine", NLM. Hypertext engine development, language parsers, novel user interfaces.
- 1993–94 PI, Radiology self-evaluation workstation, American Board of Radiology. Multimedia, machine learning, and physician teaching.
- 1993–94 PI, Recertification workstation, American Board of Family Practitioners. Multimedia, simulation, and machine learning.
- 1997 PI, Medical record quality assurance system, Small Business Innovation Research (SBIR)/Agency for Healthcare Research & Quality (AHRQ). AI and pattern matching, integration with HL7.
- 2005–06 PI, Adaptive Nuclear, Biological and Chemical Multimedia Collaboratory. Telemedicine & Advanced Technology Research Center (TATRC)/US Army Medical Research and Materiel Command (USAMRMC). Content author, AI system development, networked streaming media.
- 2007–08 PI, Knowledge Warehouse Infrastructure for Standards-Based Intelligent Tutoring, TATRC.
- 2007–09 Consultant, Simulation-based Planning and Training Tool for Infectious Disease Outbreak, National Institutes of Health (NIH).
- 2008–09 Consultant, Cyber Insider Threat Reduction, SBIR.
- 2010–13 PI, Standards-Based Intelligent Tutoring, TATRC/USAMRMC Phase III.

- 2011–13 PI, Development of HeartLander as an Epicardial Injection Delivery System. NIH/National Institute of Biomedical Imaging and Bioengineering (NIBIB) SBIR Phase I.
- 2012–13 Senior Medical Consultant, Precise Minimally Invasive Treatment of VT Using Non-invasive Mapping. NIH/NIBIB SBIR Phase I.
- 2013–16 PI, Standards-Based Intelligent Tutoring: Electronic Competency Record Build-Out and Evaluation, USAMRMC.
- 2014–16 Program Advisor, Advanced Modular Manikin (Anthropomorphic Robot), USAMRMC/MGH/Center for Integration of Medicine and Innovative Technology (CIMIT).
- 2013–20 Senior Medical Consultant, Physiologically Accurate Community-Based Platform for Training Systems (PhACTS/BioGears), USAMRMC/Applied Research Associates, Inc.

Non-Provisional Patents

- 6,747,672 Haakon Sen K, Bergeron BP, Tarschansky S, Kurzweil R. Virtual Patient Hot Spots. *Medical Simulation*. (Issued 6/8/2004)
- 6,692,258 Kurzweil K, Bergeron BP, Haakonsen K. Patient Simulator. *Medical Simulation*. (Issued 2/17/20204)
- 7,386,432 Haakonsen K, Tarschansky S, Bergeron BP, Kurzweil R. Web Simulator. *Medical Simulation*. (Issued 6/10/2008)
- 7,777,763 Haakonsen K, Bergeron BP, Tarschansky S, Kurzweil R. Morphing Patient Features. *Media for Medical Simulation*. (Issued 8/17/2010)
- 8,239,047** Bergeron BP. Indirect Control of Processor Enabled Devices. *Augmented Reality*. (Application 12503471, Filed 07/15/2009, Issued 8/7/12, Maintenance 8/7/2023)
- 8,356,997 Bergeron BP. Intelligent Tutoring System. *Intelligent tutoring*. (Issued 1/22/2013)
- 8,666,519** Bergeron BP. Indirect Control of Processor Enabled Devices, Continuation. *Augmented Reality*. (Application 13540660, Filed 7/3/2021, Issued 3/14/2014, Maintenance 9/5/2025)
- 8,684,747** Bergeron BP. Intelligent Tutoring System, Continuation (Issued 4/1/14)
- 9,067,132** Bergeron BP. Indirect Control of Processor Enabled Devices, Continuation. *Augmented Reality*. (Application 139127711, Filed 6/7/2013, Issued 6/30/15, Maintenance 6/30/2022)
- 9,230,450 Bergeron BP. Distributed Adaptive Simulator. *Augmented Reality*. (Issued 1/5/2016)
- 9,542,853 Bergeron BP. Instruction Based on Competency Assessment and Prediction. *Intelligent Tutoring*. (Issued 1/10/2017)

Teaching Experience: Tutorials and Invited Lectures

- 1987 Simulation and clinical skills acquisition. Beth Israel Hospital, Boston, MA
Education through computer-assisted experiences. MacWorld Expo, Boston, MA
Simulated patient encounters: process vs. outcomes. Center for Clinical Computing, Boston, MA
- 1988 Simulation techniques for medical educators. SCAMC, Washington, DC
The clinical workstation. Children's Hospital, Boston, MA
Simulated learning environments in medical education. MacWorld Expo, San Francisco, CA
- 1989 Mathematical modeling of complex biological systems. American Association for Medical Systems and Informatics Congress. San Francisco, CA
Data dictionary design issues. Children's Hospital, Boston, MA
Managing courseware development. SCAMC, Washington, DC
Computer-assisted competency assessment: computer-based tools. National Board of Medical Examiners, Philadelphia, PA

- 1990 Interactive multimodal courseware design. American Association for Medical Systems and Informatics Congress, Salt Lake City, UT
 Data visualization techniques. Harvard University, Cambridge, MA
 Simulation techniques for medical educators. SCAMC, Washington, DC
 Clinical database design issues. Boston University, Boston, MA
 Courseware development for medical educators. Harvard Medical School (HMS), Boston, MA
- 1991 Medical informatics: an overview. Harvard University, Cambridge, MA
 The clinical workstation. SCAMC, Washington DC
 Medical informatics: data analysis. Boston University, Boston, MA
 Courseware options for course directors. Harvard - MIT Health Sciences and Technology, Boston, MA
- 1992 Medical informatics. Boston University, Boston, MA
 Networking and data sharing. Harvard - MIT Health Sciences and Technology, Boston, MA
- 1993 Medical informatics. Boston University, Boston, MA
 Managing software development. Harvard - MIT Health Sciences and Technology, Boston, MA
- 1994 Computer-based knowledge resources for CAI. Soc Acad Emergency Med, Washington, DC
 Integrating and managing sound in multimedia courseware for problem-based teaching. Workshop on Interactive Multimedia Technology, Salt Lake City, UT
 Courseware development and design. Harvard - MIT Health Sciences and Technology, Boston, MA
- 1995 Biomedical imaging. SCAMC, Washington, DC
 Physician competency assessment. Harvard Business School (HBS), Cambridge, MA
- 1996 Marketing medical software. American Medical Informatics Association (AMIA), Washington, DC
- 1997 Intellectual property and electronic publishing. Ed-Media & Ed-Telecom 97, Calgary, Canada
 Voice recognition. Interstate Postgraduate Medical Association, Minneapolis, MN
 Software marketing. AMIA, Nashville, TN
 Practical informatics for primary care physicians. Core Curriculum Committee, Dedham, MA
- 1998 Intellectual property and Electronic Media. American Society of Anesthesiologists (ASA), Orlando, FL
 Voice recognition for clinicians. Winchester Hospital, Winchester, MA
 The web and medical record systems. Winchester Hospital, Winchester, MA
- 1999 Leveraging the Web for practical anesthesia practice, HMS Anesthesia Review, Boston, MA
 Innovation in medical technology. Harvard - MIT Health Sciences and Technology, Boston, MA
- 2000 Chairman, Tutorial session. Health Care Informatics Expo and Conference, Chicago, IL

- Keynote: Current Computer Technology in Primary Care. 21st Annual Primary Care Review, University of Louisville, Louisville, KY
- Technology trends in the healthcare industry. Harvard - MIT Health Sciences and Technology, Boston, MA
- Self-health tools in 1, 5, 10 and 50 years. Future of Health Technology Summit 2000, MIT Media Lab, Cambridge, MA
- 2001
- Keynote: Technology Developments in Health Care. Association of Departments of Family Medicine. Palm Springs, CA
- The Economics of Healthcare. Harvard - MIT Health Sciences and Technology, Boston, MA
- E-Loyalty: Business Week Boardroom Briefings Club. Singapore
- The Eternal E-Customer: Building Customer Loyalty in the Digital Era. Business Week Asia CEO Forum. Kuala Lumpur, Singapore, Seoul, South Korea and Hong Kong
- Keynote: Winning customer's loyalty in today's economy. Customer Contact World Asia. Singapore
- CRM-International Experts Debate Asia's Future. Customer Contact World Asia, Singapore
- Tools: Voice Recognition, Handhelds – The Works. Health Care Informatics Expo and Conference, Chicago, IL
- Keynote: Customer Contact World Africa, Johannesburg, South Africa
- The Wireless Web. Business Week North Asia. Taipei, Taiwan, Shanghai and Seoul
- The Eternal E-Customer. Business Week and Pacific Century Cyberworks. Hong Kong
- Keynote: Winning customer loyalty in today's economy: The basics of relationship building. Customer Contact World Mexico 2001. Mexico City
- 2002
- Wireless and the Future of Healthcare. Health Care Informatics Expo and Conf, Chicago, IL
- Medical Simulation in Psychiatry. GSK National Advisory Board Meeting, Aspen, CO
- Process, People and Enabling Technologies: Cornerstones of Modern Healthcare. Harvard - MIT Health Sciences and Technology, Boston, MA
- Untethered Medicine. Harvard - MIT Health Sciences and Technology, Boston, MA
- Business Expectations: Leveraging Technology to the Bottom Line. Business Week. Taipei, Taiwan, Singapore, Bangkok, Thailand, Hong Kong, Mumbai and Kuala Lumpur
- Work Your Marriage: Developing an Enterprise Strategy for Business Intelligence. The Third Annual Customer Relationship Management Asian Executive Summit. Singapore
- Keynote: CRM Outlook 2002. The Third Annual Customer Relationship Management Asian Executive Summit. Singapore
- 2003
- Biopharmaceuticals. Harvard - MIT Health Sciences and Technology, Boston, MA
- Emerging Technologies. Harvard - MIT Health Sciences and Technology, Boston, MA
- Innovative Informatics for Reducing Medical Errors. Keynote, HIMSS Conference. Boston, MA
- Physician Quality of Life: The Role of Technology. American College of Obstetrics and Gynecologists. New Orleans, LA
- Using Technology to Improve Your Quality of Clinical Life. American Academy of Physician Assistants. New Orleans, LA
- Knowledge Management: Maintaining Corporate Competitiveness and Synergy. Business Week. Hong Kong
- Training teachers, teaching and technology. Multidisciplinary Academy of Clinical Education. Boston, MA
- Knowledge Management. Business Week. Bangkok, Thailand

- On the Horizon: Unleashing the Transformative Power of Technology. Business Week. Singapore
- 2004 The Biotech Boom: Has it Passed the U.S. By? Massachusetts Biotechnology Council Annual Meeting. Cambridge, MA
 The Future of Medical Practice. American College of Physicians Annual Meeting. New Orleans, LA
 Military Biotech. Harvard - MIT Health Sciences and Technology, Boston, MA
 Application of Wireless in Healthcare. Harvard - MIT Health Sciences and Technology, Boston, MA
 Business Ethics. Harvard - MIT Health Sciences and Technology, Boston, MA
 Life Sciences Sector in Asia: Current Landscape and Possible Futures, Brookings Institution. Washington, DC
 Biosecurity in a Regional Context: South and East Asia, Brookings Institution. Washington, DC
 Performance Management. KFSH&RC, Riyadh, Saudi Arabia
- 2005 Statistics for Performance Management. KFSH&RC, Riyadh, Saudi Arabia
 Chemical, Biological and Nuclear Multimedia Collaboratory. The White House, Washington, DC
 Performance Management. Harvard - MIT Health Sciences and Technology, Boston, MA
 Game Design for Knowledge, Skills and Attitude Transfer. Workshop on Designing Compelling Medical Games. Stanford University, Stanford, CA
 Authoring Tools for Game Design. Workshop on Designing Compelling Medical Games. Stanford University, Stanford, CA
 Career Options in Healthcare Informatics. National Guard Hospital, Riyadh, Saudi Arabia
- 2006 Augmented Assessment for Augmented Reality. Medicine Meets Virtual Reality. Long Beach, CA
 Developing Serious Medical Games Workshop. Medicine Meets Virtual Reality. Long Beach, CA
 Data Warehousing & Business Intelligence for Health Care. Webinar. KFSH&RC, Riyadh, Saudi Arabia
 Emerging Technologies in Healthcare. Saudi eHealth Conference. Riyadh, Saudi Arabia
 Interdependent Man-Machine Problem Solving in Serious Games. International Conference on Complex Systems. Quincy, MA
 Entertainment Technologies & Medical Education. Medical Modeling & Simulation Program, 2006 Advanced Technology Applications for Combat Casualty Care, St. Pete, FL
- 2007 Biomimetics, Robotics and Embedded Systems. Harvard - MIT Health Sciences and Technology, Boston, MA
 Robotics Workshop. Medicine Meets Virtual Reality. Long Beach, CA
 Fitness functions and innovation. Harvard - MIT Health Sciences and Technology, Boston, MA
 Virtual Interactive Environments: Real-World Interfaces. 7th Annual International Meeting on Simulation in Healthcare. Orlando, FL
 Neural Network Co-Chair, IEEE International Symposium on Computational Intelligence in Robotics and Automation (CIRA). Jacksonville, FL
- 2008 Intellectual Property Protection. Harvard - MIT Health Sciences and Technology, Boston, MA
 Emerging technologies in healthcare. Saudi eHealth Conference, Riyadh, Saudi Arabia
 Educational Effectiveness of Serious Games, Medicine Meets Virtual Reality, Long Beach, CA
 Future of Simulation. CIMIT Forum, Boston, MA

- Serious Games and Health Improvement Panel. Summit on Behavioral Telehealth, Boston, MA
 Gaming, Simulation & Social Media in Behavioral Health & Disease Management Workshop.
 Summit on Behavioral Telehealth, HMS, Boston, MA
- 2009 Future of Medical Practice. Harvard - MIT Health Sciences and Technology, Boston, MA
 Projection of Medical Domain Requirements in 2045 and Beyond and What We Need to Get There. Air Force Medical Services Advanced Research Futures Conference. Stinson Airfield, San Antonio, TX
 Innovation Simulation. China Institute and Center for Medical Simulation, Cambridge, MA
 Pay for Performance: The Physician's Perspective. HIMSS Middle East '09. Muscat, Oman
- 2010 Medical Technology Startup Business Simulation. Harvard - MIT Health Sciences and Technology, Boston, MA
 Innovation in Healthcare. Saudi eHealth Conference, Riyadh, Saudi Arabia
 Innovation, IP and Capitalization. Harvard - MIT Health Sciences and Technology, Boston, MA
- 2011 Medical Technology Startup Business Simulation. Harvard - MIT Health Sciences and Technology, Boston, MA
 Composite Databases: Opportunities and Challenges. Div Clinical Informatics, BI-Deaconess Medical Center, Boston, MA
 An Adaptive Signal Processing Approach to Online Adaptive Tutoring, Medicine Meets Virtual Reality, Long Beach, CA
 Technology Adoption. Saudi eHealth Conference, Riyadh, Saudi Arabia
 Technology in Medical Education: Present and Future, Georgia Health Sciences University (two day solo seminar), Augusta, GA
- 2012 Distributed Adaptive Simulation Through Standards-Based Integration of Simulators and Adaptive Learning Systems, Medicine Meets Virtual Reality, Long Beach, CA
 Technical and Organizational Requirements for the Implementation of Adaptive Learning: A Case Study In Collaboration. With Graham, T, and R Dworkin, Medicine Meets Virtual Reality, Long Beach, CA
 Medical Technology Startup Business Simulation. Harvard - MIT Health Sciences and Technology, Boston, MA
 Public Health Informatics and Translational Informatics: From Molecules to Populations, Saudi eHealth Conference, Riyadh, Saudi Arabia
 On-Demand Adaptive First Responder Training: Value Assessment, ATACCC/Military Health System Research Symposium (MHSRS), Ft. Lauderdale, FL
- 2013 Microcontrollers and Medical Simulation: How to Use Affordable, Readily Available Microcontroller Hardware and Software to Create Medical Simulators. With Talbot, T and Gracey, K. Medicine Meets Virtual Reality, San Diego, CA
- 2014 Modular Simulator Building Blocks: Physiologic Signaling Requirements. Medicine Meets Virtual Reality, Manhattan Beach, CA
 Application of Learning Record Stores and Other Forms of Electronic Competency Records in Modeling Competency Degradation. Medicine Meets Virtual Reality, Manhattan Beach, CA
 The Confluence of Experiential Databases, MOOCs and The Internet of Things: Promise for Medical Simulation Developers. Medicine Meets Virtual Reality, Manhattan Beach, CA

- 3D Printing for Rapid Prototyping. Medicine Meets Virtual Reality, Manhattan Beach, CA
Top Healthcare Industry Challenges and How Technology Can Help. MIT-Sloan, Cambridge, MA
- 2015 Medical technology startup business simulation. MIT-Sloan, Cambridge, MA
Self-learning medical simulation. BioGears Conference. North Carolina Biotechnology Center, Research Triangle Park, Raleigh/Durham, NC
Integrating BioGears real time physiology with an advanced modular mannequin. BioGears Conference. North Carolina Biotechnology Center, Research Triangle Park, Raleigh/Durham, NC
- 2017 Comparison of Augmented Reality, Intelligent Tutoring Systems, Computer Based Training and Didactic Training and Evaluation of Retinopathy-Based Diagnosis. 2017 ATACCC/Military Health System Research Symposium (MHSRS), Kissimmee, FL
- 2018 Medical Technology: A Historical Perspective. Harvard Medical School STEM Program, Boston, MA

Teaching Experience: Courses

- 1986-89 Cardiovascular Pathophysiology (HST 090), Pulmonary Pathophysiology (HST 100) and numerous workshops on Courseware Development for Medical Faculty. HMS/MIT, Boston and Cambridge, MA
- 1998-15 Enabling Technology Innovation in Healthcare and the Life Sciences (HST 921/923). HMS/MIT-Sloan, Boston and Cambridge, MA

Bibliography: Original Reports

- 1988 HeartLab: a multi-mode simulation for teaching cardiac auscultation. Simulation. 1988; 50(2); 50-60.
Toward more effective learning environments: strategies for computer simulation design. Collegiate Microcomputer. 1988; 6(2); 289-309.
Physician meets computer: a graphic format is easier to use. Computer News for Physicians. 1988; 78(11); 24-32.
- 1989 Providing clinical experience through computer simulation. Journal of Medical Practice Management. 1989; 4(4); 288-93.
Bergeron BP, Greenes RA. Skill-building simulations in cardiology: HeartLab and EKGLab. Computer Methods and Programs in Biomedicine. 1989; 30 (2/3); 111-26.
- 1990 Microcomputer-based DSP. Collegiate Microcomputer. 1990; 7(4); 339-64.
Program instrumentation: a technique for evaluating educational software. Collegiate Microcomputer. 1990; 8(1); 34-46.
Using a spreadsheet metaphor to visualize neural network behavior. Collegiate Microcomputer. 1990; 8(2); 81-92.
Using an integrated induction system to detect student misconceptions in computer-based tutoring systems. Collegiate Microcomputer. 1990; 8(3); 161-70.
Using an intra-aural microphone for improved speech recognition. Collegiate Microcomputer. 1990; 8(3); 231-9.
Bergeron BP, Fallon JT, Morse AN, Rouse RL. Using a gaming approach to maximize student interaction in computer-based instruction. Collegiate Microcomputer. 1990; 8(4); 293-300.

- Locke S, Bergeron BP. The Soviet-American Exchange Program. MD Computing. 1990;7(4):198-9.
- 1991 The effects of stereophonic priming on the development of auscultatory pattern recognition skills. Collegiate Microcomputer. 1991; 9(1); 25-35.
Challenges associated with providing speech recognition user interfaces for computer-based educational systems. Collegiate Microcomputer. 1991; 9(3); 129-43.
Bergeron BP, McClure RC, Dichter MS, Rouse RL. Repurposing: a fundamental factor in the development of multimedia applications. Collegiate Microcomputer. 1991; 9(2); 123-8.
A computer-based signal monitoring system for the physiology laboratory. Collegiate Microcomputer. 1991; 9(2); 82-92.
- 1993 Pulmonary Pathophysiology: A Multimedia Case-Based Approach. Journal of Medical Education Technology. 1993; 4(2); 4-10.
- 1994 Bergeron BP, Sato L, Rouse RG. Morphing as a means of generating variability in visual medical teaching materials. Computers in Biology and Medicine 1994; 24:11-8.
Bergeron BP. Personalized data representation: Supporting the individual needs of knowledge workers. Journal of Educational Multimedia and Hypermedia. 1994; 3(1); 93-109.
Bergeron BP, Shiffman RS, Rouse RL. Data qualification: logic analysis applied toward neural network training. Comput Biol Med; 1994; 24(2); 157-64.
Bergeron BP, Rouse RL. ImageView: a high-level authoring tool for repurposing multimedia content. Journal of Education Computer Research. 1994; 11(4); 385-96.
- 1995 A guide to blister management. Physician & Sportsmedicine 1995; 23(2); 37-46.
Voice recognition and the technical writer. Intercom; 1996; 43(4); 9-11.
- 1996 Competency as a Paradigm for Technology-Enabled Instruction and Evaluation. Journal of Instructional Delivery Systems; 1996; 10(2); 22-4.
Bergeron BP, Obeid J, Sato L, Rouse RL. Temporal issues in the design of virtual learning environments. Journal of Educational Multimedia and Hypermedia; 1996; 4(2/3); 127-46.
Bergeron BP, Sato L, Obeid J, Rouse RL. Connectionist modeling as the basis for multimedia clinical patient simulations with diagnostic capabilities. Journal of Educational Multimedia and Hypermedia; 1996; 4(2/3); 257-70.
Bergeron BP, Bailin MT. Collaborative hypermedia development: considerations for academic publishing. Journal of Educational Multimedia and Hypermedia; 1996; 5(2); 101-12.
Bergeron BP, McClay J. Voice recognition: Current status as an enabling tool for clinical data capture. Journal of Healthcare Information Management; 1996; 10(3); 67-72.
Voice recognition and the practice of clinical medicine. eMD; 1996; 1(1); 40-1.
- 1997 Bergeron BP, Bailin MT. The Contribution of HyperMedia Link Authoring and Editing. Technical Communications; 1997; 44(2); 121-8.
Bergeron BP, Bailin MT, Bergeron RA. The electronic medical record: a potential to increase patient participation in the healthcare process. Journal of Medical Practice Management. 1997; 13(1); 38-44.
Bergeron BP, Bailin MT. Managing the complexities of hypermedia development: challenges for online digital publishing. Journal of Educational Multimedia and Hypermedia; 1997; 6(3/4), 413-24.

- Using the Web to improve patient care. *Advance for Health Information Executives*. 1997; Sept; 35.
- A physician's perspective on technology-based medical education. *Advance for Health Information Executives*. 1997; 1(3); 35.
- Voice recognition – it's finally arrived! *Postgraduate Medicine*. 1997; 102(5); 39-45.
- 1998
- Bergeron BP, Bailin MT, Staneck K, Bergeron RA. Electronic medical records: information technology as a change agent. *Journal of Medical Practice Management*. 1998; 13(5); 247-51.
- Medical information technology: what can we expect in the next millennium? *Postgraduate Medicine*. 1998; 103(1); 13-5.
- Taming time with technology. *Postgraduate Medicine*. 1998; 103(1); 33-40.
- The digital camera. *Postgraduate Medicine*. 1998; 103(2); 31-4.
- Electronic publishing can bring your work to life: augmenting content with multimedia highlights and links. *Postgraduate Medicine*. 1998; 104(3); 27-30.
- Optical character recognition. *Postgraduate Medicine*. 1998; 103(3); 37-9.
- Technology-enabled education. *Postgraduate Medicine*. 1998; 103(5); 31-4.
- Can electronic medical records really achieve information sharing? *Postgraduate Medicine*. 1998; 104(1); 25-7.
- Personal digital assistants: another step toward ubiquitous computing. *Postgraduate Medicine*. 1998; 103(6); 29-31.
- Enterprises using 'smart cards' might have a winning hand. *Postgraduate Medicine*. 1998; 104(4); 31-3.
- Remember your office at gift-giving time: it won't hurt if selections are tax-deductible. *Postgraduate Medicine*. 1998; 104(8); 15-21.
- The effects of technology on the oral and written traditions of Medicine. *Perspectives in Biology and Medicine*. 1998; 41(4); 572-8.
- Continuous voice recognition. *Intercom*; 1998; 45(5); 30-2.
- Optical mark recognition: tallying information from filled-in 'bubbles'. *Postgraduate Medicine*. 1998; 104(2); 23-5.
- Telepresence and the practice of medicine. *Postgraduate Medicine*. 1998; 103(4); 37-42.
- Physician productivity evaluated. *Advance for Health Information Executives*. 1998; 2(5); 51-4.
- Serving physician information needs. *Advance for Health Information Executives*. 1998; 2(7); 20-8.
- Bergeron BP, Bergeron RA. The return on investment for information technology. *Journal of Medical Practice Management*. 1998; 14(1); 43-50.
- The technological underpinnings of a modern clinical practice. *Journal of Medical Practice Management*. 1998; 14(2); 51-8.
- Bergeron BP. Guarding your intellectual property: how to protect your rights in a digital age. *Physicians & Computers*. 1998; Oct; 30-5.
- The case for physician input: physicians have simple goals when it comes to technology. *Healthcare Informatics*. 1998; 15(5); 144.
- Pilot studies: what information and at what cost? *Physicians & Computers*. 1998; 15(10); 22-8.
- Is it time to learn more about wireless computing? *Postgraduate Medicine*. 1998; 104(5); 39-43.
- CME: the killer application for medical computing? *e.MD*. 1998; 2(4); 28.
- The evolving role of knowledge management in medicine. *British Journal of Knowledge Management*. 1998; 1(6).
- Standardizing the desktop environment. *Advance for Health Information Executives*. 1998; (2)11; 74-8.

- Alger R, Berkowitz LL, Bergeron BP, Buskett D. Computer networking in an ambulatory health care setting. *Journal of Medical Practice Management*. 1999; (May-June); 303-7.
- The future of the web in health care. *Advance for Health Information Executives*. 1998; (2)12; 30-8.
- 1999
- How to safeguard your clinical data: security systems against crashes, thieves and hackers. *Postgraduate Medicine*. 1999; 105(1); 27-9.
- Are the hinges on your 'electronic closet' ready to burst? *Postgraduate Medicine*. 1999; 105(2); 21-2.
- The cost of being first. *Postgraduate Medicine*. 1999; 105(3);23-4.
- Bergeron BP, Bailin MT. Medical information technology: a vehicle for change. *International Journal of Technology Management, Special Issue*. 1999; 1(1/2); 29-45.
- How to detect vaporware. *Advance for Health Information Executives*. 1999; 3(5); 34-8.
- You and your vendor. *Postgraduate Medicine*. 1999; 105(4); 31-4.
- Creating a computer network in your small practice. *Postgraduate Medicine*. 1999; 106(3); 43-6.
- Creating your own medical web site. *Postgraduate Medicine*. 1999; 106(1); 17-21.
- The RFP: a keystone in your change agent strategy. *Advance for Health Information Executives*. 1999; 3(3); 64-70.
- Ten things you can do now to safeguard patient information. *Advance for Health Information Executives*. 1999; 3(4); 67-72.
- Considering a digital video camera? *Postgraduate Medicine*. 1999; 106(5); 33-4.
- What you'll need to give all-electronic presentations. *Postgraduate Medicine*. 1999; 106(2); 21-8.
- TimeSlicing: Executive time management. *Advance for Health Information Executives*. 1999; 3(8);14.
- Don't get buried under email. *Advance for Health Information Executives*. 1999; 3(10); 16.
- Avoiding personal data loss. *Journal of Medical Practice Management*. 1999; 15(3); 157-9.
- Reclaiming your desktop space. *Postgraduate Medicine*. 1999; 105(5); 29-30.
- Is Y2K really such a big problem? *Postgraduate Medicine*. 1999; 105(6); 29-30.
- What technology has brought to the telephone. *Postgraduate Medicine*. 1999; 106(4);29-32.
- CME online: access and bandwidth pay off big. *Healthcare Informatics*. 1999; 16(9);46.
- Tele-Proctoring: an automated approach to secure tele-testing. *International Journal of Educational Telecommunications*. 1999.
- E-prescribing: coming of age. *e.MD*. 1999; Fall; 36-7.
- Where to find practical patient education materials. *Postgraduate Medicine*. 1999; 106(6);35-8.
- 2000
- Email: a realistic conduit for doctor-patient communications? *Journal of Medical Practice Management*. 2000; 15(4); 208-10.
- Need more power in your communication technology? *Postgraduate Medicine*. 2000; 107(2);35-8
- Weaving your own medical web site. *MD Net Guide*. 2000; 2(7); 22-5.
- It my be fast but is it safe?: Ways to protect your DSL system from hackers. *Postgraduate Medicine*. 2000; 108(1); 31-2.
- Voice recognition: Process versus technology. *Journal of Medical Practice Management*. 2001; (16)4; 213-6.
- High-speed connectivity. *Journal of Medical Practice Management*. 2000; 15(6); 299-303.
- Pen Computing. *Journal of Medical Practice Management*. 2000; 16(3); 148-50.
- Hot technologies for 2000 and beyond. *Advance for Health Information Executives*. 2000; 4(2); 28-32.

- Get in with the e-crowd: e-mail can serve your practice if kept in check. *Postgraduate Medicine*. 2000; 107(7); 31-4.
- To err is inevitable – human or otherwise. *E.M.D.* 2000; Spring; 5.
- Hoping to educate you about their products, pharmaceutical giants are willing to pay handsomely for web site banner ads. *E.M.D.* 2000; Spring; 50.
- Getting your hands on decision-support tools. *Postgraduate Medicine*. 2000; 107(1); 27-30.
- Medical implications of non-lethal electronic prisoner control devices. *Correctional Health Care Report*. 2000; 1(5); 65-77.
- Fast-forward 2020. *E.M.D.* 2000; Summer; 2.
- Touch points. *E.M.D.* 2000; Summer; 46.
- Could your practice use a waiting room kiosk?: how to turn waiting time into learning time. *Postgraduate Medicine*. 2000; 107(4); 41-3.
- What price for your data? *Postgraduate Medicine*. 2000.
- The dark side of the digital revolution. *Postgraduate Medicine*. 2000; 108(3); 23-5.
- Wireless communication is all around: It's gone way beyond cellular phones. *Postgraduate Medicine*. 2000; 108(5); 27-30.
- The B2B connection. *E.M.D.* 2000; Fall; 2.
- Wireless. *E.M.D.* 2000; Winter; 21.
- Physician databases. *E.M.D.* 2000; Winter; 2.
- Your defense line against hackers. *E.M.D.* 2000; Winter; 44.
- Thin is in: LCD technology offers a lot in a flat package. *Postgraduate Medicine*. 2000; 108(7); 29-32.
- Office automation. *E.M.D.* 2000; Spring; 2.
- The form factor. *E.M.D.* 2000; Spring; 18.
- 2001 Put a scanner in your pocket: handheld OCR technology saves time and typing. *Postgraduate Medicine*. 2001; 109(1); 21-3.
- Patient education: redefining the patient-physician relationship. *Healthcare Informatics*. 2001.
- Is it safe? – Security speed bumps on the information highway. *Journal of Medical Practice Management*. 2001; 16(6); 297-300.
- The wireless web: redefining how we interact. *Journal of Medical Practice Management*. 2001; 17(1); 39-43.
- Let's have a meeting – at your place and mine: Videoconferencing can keep you out of those crowded airports. *Postgraduate Medicine*. 2001; (109); 23-7.
- Reducing clip-on clutter: the pros and cons of multipurpose communications tools. *Postgraduate Medicine*. 2001; 109(5); 35-9.
- Ether business: evolution or revolution? *Catalyst*. 2001; Spring; 64-6.
- 2002 Application service providers: The ultimate electronic medical record system? *Postgraduate Medicine Online*. 2002; Jan.
- Memory matters. *Postgraduate Medicine*. 2002.
- Image libraries. *Postgraduate Medicine*. 2002.
- In league with your patients: properly implemented customer relationship management systems can be mutually beneficial. *Healthcare Informatics*. 2002; 19(1); 77-80; *Healthcare Informatics Online*, Jan 2002.
- Enterprise digital assistants: The progression of wireless clinical computing. *Journal of Medical Practice Management*. 2002; 17(5); 229-33.
- Essentials of CRM. *SmartPros*. Mar 2002.

- CRM: The customer isn't always right. *Journal of Corporate Accounting and Finance*. 2002; 14(1); 53-8.
- Cutting the cord: The wireless web and healthcare. *IHealthBeat*, California HealthCare Foundation. 2002; Sept.
- Essentials of shared services. *SmartPros*. 2002; Oct 22.
- Bioinformatics data mining. *InformIT*. 2002; Nov.
- Applied bioinformatics computing: An introduction. *InformIT*. 2002; Dec.
- Postgenomic medicine: The evolution of clinical medicine – and the clinician. *WebMD*. 2002; 2(4).
- 2003
- Virtual Reality Applications in Clinical Medicine. *Journal of Medical Practice Management*. 2003; 18(4); 211-5.
- Biotechnology Applications in Clinical Medicine. *Journal of Medical Practice Management*. 2003.
- Bioterrorism: The Role of IT in Preparing for a Rational Response. *Healthcare Informatics*. 2003; 20(2); 41-2.
- Achieving clinician buy-in to technology. *WebMD*. 2003; 2(4).
- RF Interference and Wireless Devices. *Healthcare Informatics*. 2003.
- XBRL. *SmartPros*. 2003; Feb.
- Pervasive Clinical Computing: Handheld Wireless Computing. *WebMD*. 2003; 3(1).
- Countering digital data loss. *Medical Software Reviews*. 2003; 12(2); 1-9.
- Handheld Technology. *Hospital Pharmacy Europe*. 2003; 8(Apr/May); 15-6.
- Pervasive Clinical Computing: Online Medical Databases. *WebMD*. 2003; 3(2).
- Medication Errors and e-Prescribing: Solutions and limitations. *Medical Software Reviews*. 2003; 12(4); 6.
- Telemedicine in the Practice Setting: Infrastructure, not technology, limits practical application. *Postgraduate Medicine*. 2003;114(1); 9-12.
- Pervasive Clinical Computing: Telemedicine. *WebMD*. 2003; 3(2).
- Pervasive Clinical Computing: Hardware. *WebMD*. 2003; 5(3).
- Pervasive Clinical Computing: Clinical Data Visualization. *WebMD*. 2003; 5(3).
- Finding Medical Information on the Net. *Postgraduate Medicine*. 2003; 114(3); 79-80.
- Pervasive Clinical Computing: Data Acquisition. *WebMD*. 2003;5(4).
- Medicine: A Balancing Act of Complex Interfaces. *Health-IT World*. 2003; Aug 19.
- Understanding Networking in Bioinformatics Computing. *InformIT* 2003; June.
- 2004
- Online Collaboration. *Journal of Medical Practice Management*. 2004.
- 64-bit Processors. *WebMD*. 2004; 6(4).
- The Hidden Cost of Upgrading. *WebMD*. 2004; 6(1).
- Small Practice EMRs. *WebMD*. 2004; 6(1).
- Creating a Digital Library. *WebMD*. 2004; 6(1).
- Online CME Options. *WebMD*. 2004; 6(2).
- Online Patient Education. *WebMD*. 2004; 6(2).
- HIPPA and Beyond. *WebMD*. 2004.
- Voice Recognition and Transcription. *WebMD*. 2004; 6(3).
- Computerized Physician Order Entry Systems. *WebMD*. 2004.
- Grid Computing. *WebMD*. 2004.
- Teleconferencing. *WebMD*. 2004.

- Clinical Data Capture: OMR and OCR. WebMD. 2004.
- HIPAA, Security, the Internet and Innovation. Journal of Medical Practice Management. 2004.
- Wireless interference with telemetry equipment. Postgraduate Medicine. 2004; 115(3); 80.
- Wireless local area network security. Journal of Medical Practice Management. 2004; 20(3):138-42.
- 2005 Performance management in small practices. Journal of Medical Practice Management. 2005; 20(5):237-41.
- Medical errors: computers are no panacea. Journal of Medical Practice Management. 2005; 21(1); 31-4.
- 2006 RSS Feeds. Journal of Medical Practice Management. 2006; May: 345-7.
- Online CME Options: An Update. Journal of Medical Practice Management. 2006; 22(1): 55-7.
- So you have an EMR – Now What? Journal of Medical Practice Management. 2006.
- 2007 The Case for Competency-Based Education of Clinical Research Professionals. Monitor. 2007.
- 2017 Meglan D, Bergeron B, Bardsley R, Galeotti J, Riviere C. Techniques for Avoidance of Coronary Vasculature during Epicardial Needle Insertions with a Miniature Robotic Walker. International Journal of Mechanical Engineering and Robotics Research. 2017.
- Staffing for IT: What a Medical Group Practice Needs to Know. Journal of Medical Practice Management. 2017. Sept/Oct: 1-4.
- 2018 Best Practices for Patient Portals: Convincing patients to embrace practice portals. Journal of Medical Practice Management. 2018. Jan/Feb: 254-5.
- Best Practices for Patient Portals: The key is convincing patients to embrace practice portals. Podiatry Management Magazine. 2018. Sept:167-8.
- 2019 Bergeron B, Hagen M, Peterson L, Dworkin R, Bono C, Graham T, Williams M. Comparison of AR, ITS, CBT, and Didactic Training and Evaluation of Retinopathy-Based Diagnosis. Military Medicine. (184):Sup 1, 2019. March/April: 579-83, <https://doi.org/10.1093/milmed/usy372>

Proceedings of Meetings

- 1986 Bergeron BP, Greenes RA. A computer simulation for teaching clinical cardiology. Proceedings 5th Conference on Medical Informatics. Washington, DC. Oct, 1986; 933-5.
- Clinical skill building through computer simulation. Proceedings Medical Simulation Foundation Conference. Williamstown, MA. Oct, 1986; 115-20.
- 1987 Simulated learning environments in medicine. Proceedings 2nd Symposium on Biomedical Information Management Systems. Tuskegee University, AL. Sept, 1987; 171-90.
- Engineering the man-machine interface for the physician workstation. Proceedings 2nd Symposium on Biomedical Information Management Systems. Tuskegee University, AL. Sept, 1987; 21-36.
- Bergeron BP, Greenes RA. Skill-building simulations in cardiology: the HeartLab and EKGLab experience. Proceedings SCAMC. Washington, DC. Nov, 1987; 481-5.
- Bergeron BP, Greenes RA. HeartLab and EKGLab: skill-building simulations in cardiology. Demonstration Digest SCAMC. Washington, DC. Nov, 1987; 29-30.

- Bergeron BP, Greenes RA. Intelligent visual input: a graphical method for rapid entry of patient-specific data. Proceedings SCAMC. Washington, DC. Nov, 1987; 281-6.
Issues relevant to the design and implementation of skill-building simulations in clinical medicine. Proceedings 1987 Summer Computer Simulation Conference. Montreal, Canada. June, 1987; 437-41.
- 1988 Bergeron BP, Greenes RA. Modeling and simulation in medicine: the state of the art. Proceedings SCAMC. Washington, DC. Nov, 1988; 282-6.
- 1989 Courseware options for medical educators. Proceedings 1989 American Association for Medical Systems and Informatics Congress. San Francisco, CA. May, 1989; 180-4.
Challenges associated with providing simulation-based medical education. Proceedings 2nd IEEE Symposium on Computer-Based Medical Systems. University Minnesota. June, 1989; 134-9.
- 1990 Bergeron BP, Morse AN, Greenes RA. A generic neural network-based tutorial supervisor for computer-aided instruction. Proceedings SCAMC. Washington, DC. Nov, 1990; 435-9.
Dichter MS, Greenes RA, Bergeron BP. The clinical problem-solving exercise: an orthogonal approach to organizing medical knowledge. Proceedings SCAMC. Washington, DC. Nov, 1990; 473-7.
McClure RC, Greenes RA, Bergeron BP. MEDBase: a tool for managing multimedia content. Proceedings SCAMC. Washington, DC. Nov, 1990; 420-4.
McCallie D, Margulies DM, Kohane, I, Stahlhut, R, Bergeron BP, Ribitzky, R. The Children's Hospital clinician's workstation. Proceedings SCAMC. Washington, DC. Nov, 1990; 755-9.
Dichter MS, Greenes RA, Bergeron BP. Use of multimedia clinical problem-solving exercises to access a medical knowledge base. Proceedings SCAMC. Washington, DC. Nov, 1990; 1026-7.
- 1991 Bergeron BP, Shiffman RN, Rouse RL, Greenes RA. Composing user models through logic analysis. Proceedings SCAMC. Washington, DC. Nov, 1991; 681-5.
Dichter MS, Bergeron BP, Greenes RA. Authoring multimedia clinical problem-solving exercises with CaseBase. Proceedings SCAMC. Washington, DC. Nov, 1991; 911-2.
- 1994 Greenes RA, Bergeron B, Maynard CD. The American Board of Radiology's self-evaluation workstation project. Proceedings SCAR. 1994; 424-9.
- 1996 Academia, privacy and modern information technology: partnering with industry in the modern economy. Proceedings 14th annual International Conference on Marshaling New Technological Forces. Research Triangle Park, NC. Oct, 1996; 243-45.
Voice recognition: an enabling technology for medical care? Proceedings 1996 AMIA. Bethesda, MD. Oct, 1996; 802-6.
- 1997 Multimedia asset management: the cornerstone of cost-effective institutional WWW development. Proceedings Orlando Multimedia '97. Orlando, FL. Feb, 1997; 58-62.
Tele-Medicine and Tele-Training. Proceedings of Ed-Media & Ed-Telecom 97, Calgary. Apr, 1997; 188-204.
- 2001 Creating a 360-Degree Image of the Customer. Proceedings Customer Service World Africa 2001, Johannesburg, South Africa. July, 2001.

- 2006 Augmented Assessment for Augmented Reality. Proceedings Medicine Meets Virtual Reality. Long Beach, CA. Jan, 2006; 49-51.
- 2007 Physics-Based Animation for Qualitative Assessment of Biomimetic Subterranean Burrowing Behaviors. Proceedings 2007 IEEE CIRA. Jacksonville, FL. June, 2007.
- 2008 Learning and retention in adaptive serious games. Proceedings Medicine Meets Virtual Reality. Long Beach, CA. Jan, 2008; 26-30.
Bergeron BP, Al-Daig H, AlBawardi F, Hoque E, Alswailem O. Developing a data warehouse for the healthcare enterprise. Proceedings HIMSS, Orlando, FL. Feb, 2008.
- 2011 Bergeron BP, Cline A. An adaptive signal processing approach to online adaptive tutoring. Proceedings Medicine Meets Virtual Reality. Long Beach, CA. Jan, 2011; 60-64.
- 2012 Bergeron BP, Cline A, Shipley J. Distributed Adaptive Simulation Through Standards-Based Integration of Simulators and Adaptive Learning Systems. Stud Health Technol Inform. 2012; 173:48-52.
- 2014 Bergeron BP. Modular Simulator Building Blocks: Physiologic Signaling Requirements. Stud Health Technol Inform. 2014; 17-22.
Application of Learning Record Stores and Other Forms of Electronic Competency Records in Modeling Competency Degradation. Stud Health Technol Inform. 2014; 23-28.
- 2016 Metoyer R, Carter J, Bergeron B, et. al. Modular A Framework for Multiscale Physiology: Towards Individualized Computer Simulation. Proceedings Virtual Physiological Human Conference 2016. Amsterdam.
- 2017 Meglan D, Bergeron B, Bardsley R, Galeotti J, Riviere C. Techniques for Avoidance of Coronary Vasculature during Epicardial Needle Insertions with a Miniature Robotic Walker. ICMRE 2017: Proceedings 3rd International Conference on Mechatronics and Robotics Engineering. 2017; 1-5. Paris.

Reviews

- 1987 HeartLab: teaching heart sounds by computer. Technology Window. 1987; 1(6);1.
Medical area HyperCard applications. Technology Window 1987; 2(5); 1-2.
- 1988 Bergeron BP, Abdella T, Catanzarite VA. Selecting software for your Macintosh computer. Contemporary OB-GYN. 1988; 32(10); 71-82.
- 1989 Bergeron BP, Locke S. The Macintosh in medicine. MD Computing. 1989; 6(1); 3.
Bergeron BP, Locke S. Courseware options for the Macintosh. MD Computing. 1989; 6(1); 44-9.
Bergeron BP, Locke S. Expert systems, medicine and the Macintosh. MD Computing. 1989;6(2);100-11.
MedCalc. Computer News for Physicians. 1989; Sept: C6.
Bergeron BP, Locke S. Dynamic algorithm generation. MD Computing. 1989; 6(5); 290.
- 1990 Bergeron BP, Locke S. Medical Informatics at the crossroads. MD Computing. 1990; 7(2); 118-27.
Bergeron BP, Locke S. Micro-based instrumentation systems. MD Computing. 1990; 7(3);178-84.

- Bergeron BP, Locke S. Speech recognition as a user interface. MD Computing. 1990; 7(5); 329-34.
- 1991 ILIAD: a diagnostic consultant and patient simulator. MD Computing. 1991. 8(1); 46-53.
- 1995 Collaborative anesthesiology project. Technology Window. 1995; 9(2); 1.
- 1996 Pocket Doc mobile patient record system. Clinical Software Reviews. 1996; 5(3); 6-7.
Stat*Pack computerized patient record system. Clinical Software Reviews. 1996; 5(5); 4-5.
Voice recognition technology. E.MD. 1996; 1(1); 40-1.
- 1997 Technology meets process. E.MD. 1997; 1(2); 40.
Agents for change: IT is medicine's new change agent. E.MD. 1997; 1(3); 20.
Five ways to spot a skunk: screening for real-world use. E.MD. 1997; 1(4); 5-6.
The physician-computer connection. Ann Intern Medicine. 1997; 127(2); 175-6.
Healthcare software sourcebook. Ann Intern Medicine. 1997; 127(5); 416.
Continuous speech recognition dictation. Medical Software Reviews. 1997; 6(10); 1-12.
Consider operating in a structured environment. E.MD. 1997; 1(5); 24.
- 1998 Berkowitz L, Bergeron BP. Spending wisely. Physicians & Computers. 1998; 15(7); 10-5.
Optical character recognition. Medical Software Reviews. 1998; 7(3); 1-12.
Electronic form generators. Medical Software Reviews. 1998; 7(6); 1-12.
Medical images. Medical Software Reviews. 1998; 7(9); 1-13.
Medical images II – image manipulation. Medical Software Reviews. 1998; 7(10); 1-12.
Specialty image processing. Medical Software Reviews. 1998; 7(11); 1-12.
- 1999 Physician Scheduling. Medical Software Reviews. 1999; 8(1); 1-12.
Managing Your Time. Medical Software Reviews. 1999; 8(3); 1-12.
3B Scientific Anatomy Trainer. Medical Software Reviews. 1999; 8(7); 6-7.
Authoring Tools. Medical Software Reviews. 1999; 8(11); 1-12.
Olympus/IBM Portable Voice Recognition System. Medical Software Reviews. 1999; 8(10); 6-7.
- 2000 NMS USMLE Step 2. Doody's Health Sciences Book Review Journal. 2000; 7(6); 10-1.
Authoring Tools, Part II. Medical Software Reviews. 2000; 8(12); 1-6.
NMS USMLE Step 1. Doody's Health Sciences Book Review Journal. 2000; 7(6); 9-10.
Medical home page services. Medical Software Reviews. 2000; 9(1); 1-12.
RC. Medical Software Reviews. 2000; 9(4)6-7.
Web-based EMR Systems. Medical Software Reviews. 2000; 9(5); 1-12.
Web-based EMR Systems, Part II. Medical Software Reviews. 2000; 9(6); 1-12.
- 2001 PracticePoint Chart. Medical Software Reviews. 2001; 10(2); 6-9.
- 2002 Voice-Enabled Documentation. Medical Software Reviews. 2002; 11(1); 1-5.
- 2003 ABC's of Interpretive Laboratory Data. Journal of the American Medical Association. 2003; 290(16); 2197.

Books, Monographs and Chapters

- 1984 The Triathalog: scientific training and performance. Book to accompany software. Home Health Software, New Orleans, LA. 1984.
- Know Your Body: automated obstetrical planning. Book to accompany software. Home Health Software, New Orleans, LA. 1984.
- The Lean Machine: nutritional analysis and planning. Book to accompany software. Home Health Software, New Orleans, LA. 1984.
- 1988 A simulation handbook for biomedical educators. SCAMC. Washington, DC. 1988.
- HeartLab: clinical cardiology auscultatory simulation. Williams and Wilkins Publishers, Baltimore, MD. 1988.
- Bergeron BP, Stahlhut R, Margulies DM, Nguyen L, Ribitzky R. The role of a common data dictionary/directory in a hospital Information system, in Creating an Integrated Hospital Information System. SCAMC. Washington, DC. 1988; 15-26.
- Bergeron BP, Margulies DM, Ribitzky R, McCallie DP. Designing a user interface for a physician's workstation, in Creating an Integrated Hospital Information System. SCAMC. Washington, DC. 1988; 37-46.
- Merola JL, Margulies DM, Bergeron BP. Selecting expert systems software for a health care environment, in Creating an Integrated Hospital Information System. SCAMC. Washington, DC. 1988; 47-75.
- 1991 Greenes RA, Bergeron BP, Dichter MS, Fallon JT. Clinical problem solving as an educational paradigm in teaching pre-clinical cardiac pathophysiology, in Meester GT and Pinciroli F, eds., Databases In Cardiology. The Netherlands: Kluwer Academic Publishers. 1991; 113-40.
- 1992 Electromagnetic Interference, in Radio Frequency Interference: How to find it and fix it. ARRL, Newington, CT. 1992.
- Bergeron BP, Rouse RL. Cognitive aspects of modeling and simulating complex biological systems, in Iyengar SS, ed., Structuring Biological Systems: a computer modeling approach. Boca Raton: CRC Press. 1992; 125-66.
- 1993 Medical Education Software, in Student Computing at HMS. Boston: HMS. 1993; 99-111.
- 1994 Double duty for your transceiver power supply, in The ARRL Handbook. ARRL, Newington, CT. 1994, chapter 27, 13-6.
- 1995 Bergeron BP, Sato L, Rouse RL. Morphing as a means of generating variation in visual medical teaching materials, in van Bemmelen JH and McCray AT, eds., Yearbook of Medical Informatics '95. Stuttgart, Germany: Schattauer. 1995; 590-7.
- Biomedical imaging: Practical tools and techniques. SCAMC. Washington, DC. 1995.
- 1996 Bergeron BP, Bergeron RA. Getting your software to market. AMIA. Washington, DC. Oct, 1996.
- 1998 Bergeron BP, Hare E. EMC Fundamentals, in The ARRL RFI Book: Practical cures for radio frequency interference. ARRL, Newington, CT. 1998.

- 2001 Data repositories, data marts and data warehouses in a nutshell, in *Electronic medical records: A guide for clinicians and administrators*. Philadelphia: American College of Physicians. 2001; 73-102.
- The eternal e-customer: How emotionally intelligent interfaces can create long-lasting customer relationships. New York; McGraw-Hill. 2001. *Recommended reading, Harvard Business School (HBS) Working Knowledge*.
- The wireless web: How to develop and execute a winning wireless strategy. New York; McGraw-Hill. 2001. *First McGraw-Hill business book in Amazon print catalog; A Wall Street Journal Top Business Book of the Summer, 2001*.
- The hitchhiker's guide to the wireless web. New York; McGraw-Hill. 2001. *First full-length electronic book transmitted over the Internet and processed for copyright approval entirely in digital format and included in the Library of Congress; Top e-book in business/technology on PeanutPress; Nominated Frankfurt Award by McGraw-Hill*.
- 2002 Dark ages II: When the digital data die. New York; Prentice Hall. 2002. *Recommended reading, HBS Working Knowledge*.
- Essentials of CRM: A guide to customer relationship management. New York; J. Wiley & Sons. 2002. *Simplified and Orthodox Chinese translations*.
- Bergeron BP, Blander J. Business expectations: Are you using technology to its fullest? New York; J. Wiley & Sons. 2002. *AudioTech Summaries translation; Recommended reading, HBS Working Knowledge*.
- The wireless web in healthcare. Chicago; HIMSS. 2002.
- Essentials of shared services: A handbook for CEOs. New York; J. Wiley & Sons. 2002. *Recommended reading, HBS Working Knowledge; Korean Translation*.
- Bioinformatics computing. New York; Prentice Hall. 2002. *Indian, Japanese and Chinese translations*.
- 2003 Essentials of knowledge management: A handbook for CEOs. New York; J. Wiley & Sons. 2003.
- Essentials of XBRL: Financial reporting in the 21st century. New York; J. Wiley & Sons. 2003. *Recommended reading, HBS Working Knowledge; SmartPros Top 10; Official reference, XBRL Australia, LTD; Japanese, Simplified Chinese and Russian translations*.
- 2004 Blander J, Bergeron BP. Clinical management systems: A guide for systems deployment. Chicago; HIMSS. 2004.
- Bergeron BP, Chan P. Biotech industry: A global, economic, and financial overview. New York; J. Wiley & Sons. 2004.
- Case studies in genes and disease: A primer for clinicians. Philadelphia; American College of Physicians-American Society of Internal Medicine. 2004.
- Adamson H, Bergeron BP. A day in the life of a doctor. North Mankato, MN; Capstone Press. 2004.
- 2006 Performance management in healthcare. Chicago; HIMSS. 2006. *HIMSS 2006 Bestseller*.
- Developing serious games. Boston; Thomson. 2006.
- 2007 Bergeron BP (ed.). Developing a data warehouse for the healthcare enterprise: Lessons from the trenches. Chicago, HIMSS. 2007. *HIMSS Book of the Year*.
- Bergeron BP, Garrett J, Smith J. So, you wanna be a doctor? Roswell Institute. 2007.
- Overview and Epilog, in *Developing a data warehouse for the healthcare enterprise: Lessons from the trenches*. Chicago, HIMSS. 2007.

- 2010 Teardowns: Learn how electronics work by taking them apart. New York; McGraw-Hill. 2010.
- 2013 Bergeron BP (ed.). Developing a data warehouse for the healthcare enterprise: Lessons from the trenches, 2nd Ed. Chicago, HIMSS. 2013.
Benefits, Drivers and Challenges of Data Warehouse Implementation, in Developing a data warehouse for the healthcare enterprise: Lessons from the trenches, 2nd Ed. Chicago, HIMSS. 2013. *HIMSS 2013 Bestseller*.
Bergeron BP, Talbot T. Androids: Build your own lifelike robots. New York; McGraw-Hill. 2013. *Chinese translation*.
- 2017 Performance management in healthcare, 2nd Ed. Chicago; CRC Press. 2017. Chinese translation, 2022.
- 2018 Developing a data warehouse for the healthcare enterprise: Lessons from the trenches, 3rd Ed. Chicago; CRC Press. 2018.
Here, there be monsters, in Developing a data warehouse for the healthcare enterprise: Lessons from the trenches, 3rd Ed. Chicago; CRC Press. 2018.
The data warehouse as feeder to data analytics and business intelligence: The good, the bad and the ugly, in Developing a data warehouse for the healthcare enterprise: Lessons from the trenches, 3rd Ed. Chicago; CRC Press. 2018.
- 2023 Restoring Vintage Audio Electronics: From tabletop receivers and component stereo systems to turntables and reel-to-reel tape decks. Corona, CA; T&L Publications. (In press).

Software – Commercially Published/Distributed

- 1984 Know your body: automated obstetrical planning. Home Health Software, New Orleans, LA. 1984. *First commercial patient simulation on a microcomputer; First commercial program for family planning on a microcomputer*.
The lean machine: nutritional analysis and planning. Home Health Software, New Orleans, LA. 1984. *First commercial diet, nutrition and weight loss program on a microcomputer*.
The triathalog: scientific training and performance. Home Health Software, New Orleans, LA. 1984. *First commercial personal fitness program on a microcomputer*.
- 1988 HeartLab: clinical cardiology auscultatory simulation. Williams and Wilkins Publishers, Baltimore, MD. 1988. *First commercial multimedia patient simulator on a microcomputer; Integrated, rule-based intelligent tutor; Used as part of the HMS and Harvard - MIT Health Sciences and Technology curriculum, most medical schools in the U.S. and Europe*.
- 1989 Catanzarite V, Bergeron BP. Fetal monitor interpretation. Williams and Wilkins Publishers, Baltimore, MD. 1989. *First commercial interactive clinical diagnosis rule-based expert system on a microcomputer*.
- 1993 Dichter M, Bergeron BP, Greenes RA. CaseBase: synthetic multimedia patient cases. Keyboard Publishing, Blue Bell, PA. 1993. *First commercial, multimedia, knowledgebase-driven patient simulator*.

- 1999 Bergeron BP (PI), Rosenthal D. Medical record quality assurance system. Developed for Kurzweil Applied Intelligence, Inc. 1999. *Rule-based expert system for reviewing electronic medical records; Fully funded by SBIR; Commercialized after Phase I by Lernout & Hauspie, Inc.*
- 2000 HeartLab online. Medical Learning Company. 2000.
- 2002 Bergeron BP, et al. SynPatient. Quantitative patient simulation with models for diabetes. For Medical Learning Company, Wellesley MA. 2002.
- Bergeron BP, et al. BioPRN. Simulation-based bioterrorism resource for healthcare workers. For Medical Learning Company, Wellesley MA. 2002.

Software – Academic/Government/Privately Funded/Distributed

- 1987 NeuroLab. HMS and MIT, Cambridge, MA. 1987. *First clinical role-playing game to use neural networks to drive real-time morphing of clinical images; Harvard - MIT Health Sciences and Technology curriculum.*
- EKGLab. HMS and MIT, Cambridge, MA. 1987. *Role playing game format; Knowledgebase-driven waveform synthesizer that responds to patient physiology and pharmacological intervention; Real-time morphing of cardiac depolarization keyed to cardiac condition; Harvard - MIT Health Sciences and Technology curriculum.*
- 1989 Locke S, Bergeron BP. HIV patient interview. Beth Israel Hospital, Boston, MA. 1989. *First program to show computers are more effective than clinicians in screening patients.*
- 1990 Bergeron BP, Fallon JT. PathGame. HMS and MIT, Cambridge, MA. 1990. *First image-based program to use a neural network to automatically vary the complexity of the gameplay based on models of student performance; Harvard - MIT Health Sciences and Technology curriculum.*
- McClure RC, Greenes RA, Bergeron BP. MEDBase. HMS and MIT, Cambridge, MA. 1990. Multimedia knowledgebase for decision support and clinical simulations.
- McClure RC, Mark R, Hahn S, Bergeron BP. EKG trainer. HMS and MIT, Cambridge, MA. 1990. *First knowledgebase-driven intelligent tutoring game and adaptive testing system for EKG interpretation; Large vocabulary NLP interface; Harvard - MIT Health Sciences and Technology curriculum.*
- 1991 Shannon D, Bergeron BP, Rouse R. Pulmonary pathophysiology simulator. HMS and MIT, Cambridge, MA. 1991. *Integrated multimedia system of role-playing patient cases, pathophysiology simulations, reference guides and context-specific didactic support; Harvard - MIT Health Sciences and Technology curriculum.*
- Bergeron BP, Shannon D. LungLab. HMS and MIT, Cambridge, MA. 1991. *Knowledgebase-driven auscultation simulator and intelligent tutorial system for pulmonary medicine; Harvard - MIT Health Sciences and Technology curriculum.*
- 1992 Sato L, Pierce S, Bergeron BP, Rouse R, Greenes RA. PEXNET knowledgebase for medical decision support. HMS and MIT, Cambridge, MA. 1992.
- 1994 Bergeron BP, Obeid J, Rouse R, Greenes RA. Patient simulator for electronic recertification of family practitioners. American Board of Family Practice. 1994.
- Deibel S, Bergeron BP, Rouse R, Greenes RA. Radiology recertification workstation. American Board of Radiology. 1994.
- Rouse RL, Bergeron BP. ImageView. HMS and MIT, Cambridge, MA. 1994.

- 1995 Microbe Hunter. First-person shooter 3D arcade game for Bristol Myers Squibb. 1995.
USMLE Preparation. Waverly Press. 1995.
- 1997 Goodman M, Fleisher G, Burrows J, Bergeron BP. Photo story book. Cambridge Public Library, Cambridge, MA. 1997.
Web site, MGH Department of Anesthesia and Critical Care, Boston, MA 1997.
- 2004 HeartLab iPod. For HMS, Boston, MA. 2004.
- 2005 Mixed reality auscultation trainer. 2005. *Handheld, laptop, and wireless, instructor-directed augmented reality wireless vest for standard patient cardiac, pulmonary, and abdominal auscultation; For Duke University School of Medicine study.*
Mannequin-based cardiac and pulmonary auscultation Challenge. For HMS, Boston, MA. 2005.
- 2006 SCORM-compliant serious games nuclear collaboratory. For Accella Learning, LLC. 2006.
- 2008 Explosion and blast injuries: Medical aspects of mass casualty events. Online Intelligent Tutoring System. National Center for Deterrence of Biowarfare and Bioterrorism, Louisville, KY. 2008.
Burns and burn management: Post-radiation response. Online Intelligent Tutoring System. National Center for Deterrence of Biowarfare and Bioterrorism, Louisville, KY. 2008.
- 2012 Adaptive survey meter skill trainer. Augmented reality system for the National Center for Deterrence of Biowarfare and Bioterrorism, Louisville, KY. 2012.
- 2014 Adaptive retinopathy assessment trainer for diabetes and hypertension. Augmented reality system for TATRC at the University of Louisville, KY. 2014.

Abstracts

- 1986 HeartLab, a computer simulation for teaching clinical cardiology. 5th Conference on Medical Informatics. Washington, DC. Oct,1986; 1152.
- 1987 HeartLab & EKGLab. Symposium on Medical Computing. Memphis, TN. May,1987; 37-8.
- 1988 Sharing data through networks: past, present, and future. Symposium on Technology Pathways to the Future. Boston, MA. Jan,1988; 5-6.
Strategies for implementing the clinical workstation. Symposium on Technology Pathways to the Future. Boston, MA. Jan,1988; 18-9.
The Macintosh as a platform for skill-building simulations in medicine. European Apple University Consortium Conference. Heidelberg University, Germany. Apr,1988; 49-50.
- 1989 Computer simulation in medical education. 6th National Symposium on Computers in Medical Education. Omaha, NE. Mar,1989; 28-9.
Using a graphic modeling and simulation environment to teach medical physiology. 3rd International Conference on Human-Computer Interaction. Boston, MA. Sept,1989; 140.
Computer-based learning environments in medicine. International Symposium on Computers in Medicine. Munich, Germany. Nov,1989.

- 1990 Dichter MS, Greenes RA, Bergeron BP. A medical case presentation shell for directed hypermedia. AMIA First Educational and Research Conference. Salt Lake City, UT. June,1990;15.
- 1991 McClure RC, Dichter MS, Fallon JT, Greenes RA, Bergeron BP. Multimedia knowledge management applications for cardiovascular education. Journal of the American Colleges. 1991; 17(2); 10A.
- 1992 Sato L, Pierce S, Bergeron B, Rouse R, Greenes RA. PExNet: a neural network-based browsing and authoring environment for physical examination findings. AMIA Spring Conference. 1992; 63.
- 1994 Obeid J, Bergeron BP, Sato L, Rouse RL. The representation of time in clinical patient simulations. SCAMC. Washington, DC. Nov,1994; 228.
- 1996 Bergeron BP, Bailin MT. Guarding your intellectual property rights in the era of electronic publishing. International Journal of Clinical Monitoring and Computing. 1996; 13(3); 195-6.
Bailin MT, Bergeron BP. Collaborative multimedia as a paradigm for academic communications. International Journal of Clinical Monitoring and Computing. 1996; 13(3); 194.
- 1997 Voice recognition applications in medicine. e.MD Conference. Minneapolis, MN. Apr,1997; 72.
How you slice it: the hypermedia authoring and editing conundrum. Slice of Life Workshop. Chicago, IL. June,1997; 38.
Information technology as a vehicle for change in medical practice. 2nd INFORMS Meeting on Medical Management Technology. Dallas, TX. Oct,1997; 34.
- 1998 Bailin, MT, Bergeron BP. A hypermedia approach to anesthesia education: the challenges associated with harnessing modern information technology to improve teaching and learning. American Society of Anesthesia. Orlando, FL, 1998; 187.
- 2005 Nuclear, Biological, and Chemical Multimedia Collaboratory. DOD Baseline Review of Medical Training Research, Advanced Technology Applications for Combat Casualty Care Conference. St. Pete Beach, FL. 2005. CD-ROM.
- 2013 Medical Modeling and Simulation, Simulators and Intelligent Tutoring Systems: Future or Evolutionary Dead End? Medicine Meets Virtual Reality, San Diego, CA.

Technical Articles

- 1989 Easy antenna access for urban apartment dwellers. Ham Radio. 1989; 22(4); 18-21. *Best article of the year award.*
A computer-controlled digitized speech system for SSB. QST. 1989; 73(10); 19-24.
Computer-aided design of printed circuit boards. Ham Radio. 1989; 23(1); 10-3.
- 1990 Understanding over-the-horizon RADAR. Ham Radio. 1990; 23(2); 9-14.
Understanding computer-generated RFI. Ham Radio. 1990; 23(3); 75-81.
DSP fundamentals. Ham Radio. 1990; 23(4); 24-35.
A folding dipole for 2 meters. QST. 1990; 74(6); 26-7.
A primer on laser communications: part 1. QST. 1990; 74(9); 19-24
A primer on laser communications: part 2. QST. 1990; 74(10); 22-6.

- DSP: working in the frequency domain. *Communications Quarterly*. 1990; Fall: 45-54.
- An intra-aural microphone for mobile operation. *QST*. 1990; 74(11); 22-4.
- A surface mount technology primer—part 1. *QST*. 1990. 74(12); 48-51.
- 1991 DSP: artificial intelligence techniques. *Communications Quarterly*. 1991; 1(1);77-87.
- DSP: image processing. *Communications Quarterly*. 1991; 1(2); 23-36.
- An audio imaging system for enhanced cw reception. *Communications Quarterly*. 1991; 1(3); 76-83.
- A computer-based signal monitoring system. *Communications Quarterly*. 1991; 1(4); 99-108.
- A surface mount technology primer—part 2. *QST*. 1991. 75(1); 27-30.
- Making soldering safer. *QST*. 1991. 75(3); 28-30.
- Electrostatic discharge part 1. *QST*. 1991; 75(4);19-21.
- Electrostatic discharge part 2. *QST*. 1991; 75(5);28-33.
- Hand-held digital multimeters. *QST*. 1991; 75(6); 19-22.
- Cholette, M. Souledez en toute securite. *RAQI*. 1991; 15(1); 34-6.
- 1992 An inexpensive, easy-to-build ESD Probe. *QST*. 1992; 76(5); 31-4.
- Control your transceiver by voice. *QST*. 1992; 76(8); 35-8.
- Double duty your transceiver's power supply. *QST*. 1992; 76(10); 50-3.
- Choosing a digital frequency counter. *QST*. 1992; 76(12); 42-80.
- Microcomputer-based instrumentation systems. *Communications Quarterly*. 1992; 2(1); 36-45.
- 1993 Direct digital synthesis. *Communications Quarterly*. 1993; 3(3); 13-28.
- Under the hood: resistors. *QST*. 1993; 77(11); 41-4.
- Spread spectrum communications. *Communications Quarterly*. 1993; 3(4) 13-29.
- 1994 Multimedia communications. *Communications Quarterly*. 1994; 4(1); 13-9.
- Surface acoustic wave devices. *Communications Quarterly*. 1994; 4(2); 83-93.
- Under the hood: capacitors. *QST*. 1994; 78(1); 45-8.
- Under the hood: inductors. *QST*. 1994; 78(3); 37-40.
- Under the hood: semiconductor devices. *QST*. 1994; 78(4); 46-8.
- Under the hood: lamps, indicators, and displays. *QST*. 1994; 78(9); 34-7.
- Under the hood: connectors. *QST*. 1994; 78(10); 36-9.
- Under the hood: enclosures. *QST*. 1994; 78(11); 12-7.
- 1995 Amateur radio: the next 50 years. *Communications Quarterly*. 1995; 51(1); 136.
- Electrochemical storage Cells. *Communications Quarterly*. 1995; 5(1);40-52.
- 1996 Boundary scan technology. *Communications Quarterly*. 1996; 6(4);9-17.
- 2002 The doctor is in: Circuit analysis. *QST*. 2002. May, June and July.
- 2006 Robotic learning: Closing the loop. *Servo*. 2006. Aug. 36-42.
- Voice recognition for robotics control. *Servo*. 2006. May.
- Sensor fusion fundamentals. *Servo*. 2006. June.

Advanced sensor fusion. Servo. 2006. July.

Autonomous robots and energy management. Servo. 2006. Aug.

Tele-autonomous robotics. Servo. 2006. Sept.

Video processing for robotic vision. Servo. 2006. Oct.

Collaborative robotics. Servo. 2006.

MindIron. Servo. 2006.

Robot safety. Servo. 2006.

Robot simulation: AI behavior. Servo. 2006.

Robot simulation: Physics. Servo. 2006.

Robot simulation: Systems level simulation. Servo. 2006.

2007

Haptics for robot tele-operation. Servo. 2007.

Exergames with the Hydra. Nuts & Volts. 2007.

Personality and autonomous robots. Servo. 2007.

Developing perspectives. Servo. 2007.

Web-based telerobotics. Servo. 2007.

Inventing the future. Servo. 2007.

Fostering innovation. Nuts & Volts. 2007.

RFID localization. Servo. 2007.

Ubiquitous robotics. Servo. 2007.

Green innovation. Nuts & Volts. 2007.

Standards. Nuts & Volts. 2007.

Academic versus commercial robotics. Servo. 2007. Sept.

Military robotics. Servo. 2007. Oct.

Magnetic inchworm. Nuts & Volts. 2007. Oct.

Wearable computing. Nuts & Volts. 2007. Nov.

The technology hype cycle. Servo. 2007. Nov.

Computational and energetic autonomy. Servo. 2007. Dec.

Electronic music innovation. Nuts & Volts. 2007. Dec.

2008

The importance of infrastructure. Servo. 2008. Jan.

Sensory transformation. Nuts & Volts. 2008. Jan.

The circuit development process. Nuts & Volts. 2008. Jan.

Biomimetic reflex control. Servo. 2008. Feb.

What price for perfection? Nuts & Volts. 2008. Feb.

Consumer robotics. Servo, 2008. Mar.

Modularization. Nuts & Volts. 2008. Mar.

Tough enough. Servo, 2008. Apr.

Going green with LEDs. Nuts & Volts. 2008. Apr.

Machine pains. Servo, 2008. May.

Finding your tone. Nuts & Volts. 2008. May.

Precision headphone preamplifier. Nuts & Volts. 2008. May.

Tear down: iRobot looj semiautonomous gutter cleaner. Servo. 2008. June.

Next level robotics. Servo. 2008. June.

- Memristors. Nuts & Volts. 2008. June.
- Economical electronics. Nuts & Volts. 2008.
- Wanted in surgery. Servo. 2008.
- 2009
- Unintended consequences. Servo. 2009.
- Size matters. Servo. 2009.
- Robots in business school. Servo. 2009.
- Kit building. Nuts & Volts. 2009.
- Stimulus package for robotics. Servo. 2009. Apr.
- The art of diagnosis. Nuts & Volts. 2009. Apr.
- MIDI Integration. Nuts & Volts. 2009.
- Value packs. Nuts & Volts. 2009.
- Robotics as your vocation. Servo. 2009.
- Affordable robotic platforms. Servo. 2009.
- The end of the wristwatch. Nuts & Volts. 2009.
- Virtual instruments. Nuts & Volts. 2009.
- Designing for efficiency. Nuts & Volts. 2009.
- Sensory overload. Servo. 2009.
- Developing hands-on mechanical skills. Servo. 2009.
- Integrating video games and robotics. Servo. 2009.
- Integrating power in your robot design. Servo. 2009.
- The human-robot server-servant relationship. Servo. 2009.
- Micro-tracker position sensors. Servo. 2009.
- Mathematics and physics in robotics. Servo. 2009.
- Digital audio workstation software. Nuts & Volts. 2009.
- SMT components and standards. Nuts & Volts. 2009.
- Speaker break-in: Electronic mythology. Nuts & Volts. 2009.
- Truth in specifications. Nuts & Volts. 2009.
- The golden age of electronics. Nuts & Volts. 2009.
- 2010
- Going, going, gone... Nuts & Volts. 2010.
- Bots and intelligent agents. Servo. 2010.
- Robotic pet teardown. Nuts & Volts. 2010.
- Robotics horizon. Servo. 2010.
- Basic requirements for experimentalists. Nuts & Volts. 2010.
- Mechatronic prosthetics. Servo. 2010.
- Microcontroller debate. Nuts & Volts. 2010.
- Mechatronic music. Servo. 2010.
- Wearable computing. Nuts & Volts. 2010.
- Robotic chia pet. Servo. 2010.
- Harvesting Power. Nuts & Volts. 2010.
- When to move on. Servo. 2010.
- Going, going, gone...components. Nuts & Volts. 2010.
- Bots and intelligent agents. Servo. 2010.

- Designing for the best-case scenario. Nuts & Volts. 2010.
- Dull, dirty and dangerous. Servo. 2010.
- When water and electronics mix. Nuts & Volts. 2010.
- Motor doping. Servo. 2010.
- Electronics enthusiast. Nuts & Volts. 2010.
- Newly discovered method of locomotion. Servo. 2010.
- The 'Best' components for your project. Nuts & Volts. 2010.
- Practical service robotics. Servo. 2010.
- Semiconductor Shortage. Nuts & Volts. 2010.
- Robot Control Options: Don't Forget Your Feet. Servo. 2010.
- 2011
- Modding. Nuts & Volts. 2011.
- Government Push for Robotics. Servo. 2011.
- Sound Control. Nuts & Volts. 2011.
- Electronics Explorer. Nuts & Volts. 2011.
- Building With Repurposing in Mind. Nuts & Volts. 2011.
- 3D Printers. Servo. 2011.
- Voice Recognition. Servo. 2011.
- Designing for Others. Nuts & Volts. 2011.
- Building with Repurposing in Mind. Servo. 2011.
- Maintaining Momentum. Servo. 2011.
- Putting a Pretty Face on Your Next Project. Nuts & Volts. 2011.
- Virtual Portable Instruments. Nuts & Volts. 2011.
- Mobile Platforms. Servo. 2011.
- Embedded Linux Development Platforms. Servo. 2011.
- Spectrum Microprocessors. Nuts & Volts. 2011.
- There's An App for That. Nuts & Volts. 2011.
- Anthropomorphic Computing. Servo. 2011.
- The Long Arm of the Space Shuttle. Servo. 2011.
- Biology and Electronics. Nuts & Volts. 2011.
- Reinventing the Wheel. Servo. 2011.
- Moongel, Drum Dials and Aurora Strings. Servo. 2011.
- Thoughtful Repurposing. Nuts & Volts. 2011. Nov.
- Li-Fi. Nuts & Volts. 2011. Dec.
- 2012
- How Old is Old Enough? Nuts & Volts. 2012. Jan.
- Neurosynaptic Chips. Servo. 2012. Jan.
- How Do They Do That? Nuts & Volts. 2012. Feb.
- When to Move On. Servo. 2012. Feb.
- Don't Cut the Blue Wire –Nuts & Volts. 2012. Mar.
- Building With Repurposing in Mind. Servo. 2012. Mar.
- 3D Printers and Self-Replicating Machines. Servo. 2012. Apr.
- A Matter of Time. Nuts & Volts. 2012. Apr.
- Medicine Meets Virtual Reality. Servo. 2012. May.

Infant Mortality. Nuts & Volts. 2012. May.
 Nuts & Bolts. Nuts & Volts. 2012. June.
 Embedded Linux Development Platform. Servo. 2012. June.
 Voice Recognition Options. Servo. 2012. July.
 Designing for Minimum Mass. Nuts & Volts. 2012. July.
 Mobile Platforms. Servo. 2012. Aug.
 How Much to Invest? Nuts & Volts. 2012. Aug.
 Danger, Will Robinson! Servo. 2012. Sept.
 Parallax Quadcopter – Mechanical Build. Servo. 2012. Sept.
 Traveling Light. Nuts & Volts. 2012. Sept.
 Parallax Quadcopter –Electronics. Servo. 2012. Oct.
 Autonomous Robots: End of Life Dilemma. Servo. 2012. Dec.
 The Lost World of Tubes. Nuts & Volts. 2012. Dec.

2013 Cutting Corners. Servo. 2013. Jan.
 The Stuff Dreams Are Made Of. Nuts & Volts. 2013. Jan.
 The Joy of Prototyping. Servo. 2013. Feb.
 Component Specifications. Nuts & Volts. 2013. Feb.
 The MicroMedic Kit. Nuts & Volts. 2013. Feb.
 MicroMedic. Servo. 2013. Mar.
 There’s a Chip for That. Servo. 2013. Mar.
 Ticklish Robots. Servo. 2013. Apr.
 Vulnerabilities of Networked, Embedded Systems. Nuts & Volts. 2013. Apr.
 Kickstart Your Project. Nuts & Volts. 2013. May.
 The Internet of Things. Servo. 2013. May.
 The Duality of Technology. Nuts & Volts. 2013. June.
 Li-Ion Battery Technology. Nuts & Volts. 2013. June.
 Telemedicine Robot Cleared for Launch. Servo. 2013. June.
 Starting from SCRATCH. Servo. 2013. July.
 Dedicated Chip vs Microcontroller. Nuts & Volts. 2013. July.
 Getting Out of Your Comfort Zone. Nuts & Volts. 2013. Aug.
 Revenge of the (Robot) Nerds. Servo. 2013. Aug.
 Nostalgia and the Amnesia of Time. Nuts & Volts. 2013. Sept.
 The Benefits of Flexibility. Servo. 2013. Sept.
 Sound Off. Nuts & Volts. 2013. Oct.
 Biomimetics and Perception. Servo. 2013. Oct.
 Not Your Father’s LEDs. Nuts & Volts. 2013. Nov.
 Self-Replicating Robots. Servo. 2013. Nov.
 Up Close and Personal. Nuts & Volts. 2013. Dec.
 Predicting the Future. Servo. 2013. Dec.

2014 A Ton of Bricks vs a Ton of Feathers: Practical Kinematics. Servo. 2014. Jan.
 Toast. Nuts & Volts. 2014. Jan.
 The “Drone Click” Button. Servo. 2014. Feb.

Night Meeting. Nuts & Volts. 2014. Feb.
 Designing from Experience. Servo. 2014. Mar.
 Know Your Basics. Nuts & Volts. 2014. Mar.
 Self-Driving Cars: An Incremental Approach. Servo. 2014. Apr.
 A Maker's Dozen: Designing Around Failure. Nuts & Volts. 2014. Apr.
 The Samantha AI: Just Another Pretty Voice? Servo. 2014. May.
 When Additive and Subtractive Technologies Don't Add Up. Nuts & Volts. 2014. May.
 Sensing Sensibly. Servo. 2014. June.
 The Art of Prototyping. Nuts & Volts. 2014. June.
 How Sleeping Ducks Can Teach Us a Thing or Two. Servo. 2014. July.
 The Internet of Things. Nuts & Volts. 2014. July.
 Just Because You Can. Servo. 2014. Aug.
 Can't Get There From Here. Nuts & Volts. 2014. Aug.
 Working Assumptions. Servo. 2014. Sep.
 Getting Away From the Bench. Nuts & Volts. 2014. Sep.
 The Problem With Too Much Experience. Servo. 2014. Oct.
 Don't Get Stung By a Wall Wart. Nuts & Volts. 2014. Oct.
 Machine Morality. Servo. 2014. Nov.
 The DIY Differentia. Nuts & Volts. 2014. Nov.
 Passing the Turing Test – But Not the Sniff Test. Servo. 2014. Dec.
 Just-In-Time Parts. Nuts & Volts. 2014. Dec.

2015

Back to Basics: The Universal, All-Digital Device isn't Necessarily Nirvana. Servo. 2015. Jan.
 Amateur Radio: Not Just for the Nostalgic. Nuts & Volts. 2015. Jan.
 Failing Forward: Robot Designs That Minimize Negative Outcomes. Servo. 2015. Feb.
 One-Upmanship: A Method of Systematic Incremental Improvement. Nuts & Volts. 2015. Feb.
 Mapping Kinetic Art to Robotic Science. Servo. 2015. Mar.
 Starting Out: Avoiding the Equipment Acquisition Disorder. Nuts & Volts. 2015. Mar.
 Anthropomorphic Interfaces - So Misunderstood. Servo. 2015. Apr.
 The EBay Treasure Chest. Nuts & Volts. 2015. Apr.
 Time Machines. Servo. 2015. May.
 Building Sandcastles in the Digital Sandbox. Nuts & Volts. 2015. May.
 Disposable Drones. Servo. 2015. June.
 Going Beyond Shallow Understanding. Nuts & Volts. 2015. June.
 Can Your Robot Handle the Heat? Servo. 2015. July.
 Change the World. Nuts & Volts. 2015. July.
 Not Your Grandmother's Singer. Servo. 2015. Aug.
 Vintage Repair. Nuts & Volts. 2015. Aug.
 Workshop Air Quality Sensors. Servo. 2015. Sep.
 Home Automation: Are We There Yet? Nuts & Volts. 2015. Sep.
 Watch Winders: An Offbeat Application of Robotics. Servo. 2015. Oct.
 Wanted: Magnetic Free Zone. Nuts & Volts. 2015. Oct.
 Robotics Engineers v Experimentalists. Servo. 2015. Nov.
 Old School Can Be The Best School for Learning. Nuts & Volts. 2015. Nov.

The Cost of Custom. Servo. 2015. Dec.

2016

Easing Into STEM. Nuts & Volts. 2016. Jan.

BioGears: It's Alive! Servo. 2016. Jan.

When All You Have Is A Hammer...Nuts & Volts. 2016. Feb.

FAA Licensing: A Sign That Drones Have Arrived. Servo. 2016. Feb.

Leaded Components: Reports of Their Death Have Been Greatly Exaggerated. 2016. Mar.

PicoPower. Servo. 2016. Mar.

Indestructibles: The Lure of Tube Audio Equipment. Nuts & Volts. 2016. Apr.

Specifications: Believe Them or Not. Servo. 2016. Apr.

Vinyl Flashback. Nuts & Volts. 2016. May.

Noodle Chef Robots: Precursor to Pathogen-Free Fast Food? Servo. 2016. May.

Wall Light Switches: Relics of the Tungsten Age? Nuts & Volts. 2016. June.

Flying Cameras. Servo. 2016. June.

The Art of Electronics: What Constitutes the Atomic Level? Nuts & Volts. 2016. July.

Automatic Braking Systems: A Gentle Introduction to Autonomous Vehicles. 2016. July.

Make History: Keep a Logbook. Nuts & Volts. 2016. Aug.

Getting from A to B. Servo. 2016. Aug.

What is Electronics? Nuts & Volts. 2016. Sep.

3D Printing: Too Good? Servo. 2016. Sep.

Self-Monitoring Made Easy. Nuts & Volts. 2016. Oct.

Facebook and Microsoft Messenger Bots: It's Déjà vu All Over Again. Servo. 2016. Oct.

Superfluous Technology. Nuts & Volts. 2016. Nov.

Smart Fabrics. Servo. 2016. Nov.

Spy Gear. Nuts & Volts. 2016. Dec.

Optimization. Servo. 2016. Dec.

2017

7

What's In Your Grab-and-Go? Nuts & Volts. 2017. Jan.

Underwater Remotely Operated Vehicles: The Next Big Thing in Robotic? Servo. 2017. Jan.

Conspiracy Theory. Nuts & Volts. 2017. Feb.

A Matter of Trust. Servo. 2017. Feb.

What's On Your Workbench? Nuts & Volts. 2017. Mar.

Translational Reality: A Better Way to Interface With Devices. Nuts & Volts. 2017. Mar.

Automate Best Practices. Servo. 2017. Mar.

Real Electronics? Nuts & Volts. 2017. Apr.

The Serious Side of Robotics. Servo. 2017. Apr.

EMG Control of a Servo Gripper: Closing the Loop. Servo. 2017. Apr.

Translational Reality Part II: Control the World by Playing Pong. Nuts & Volts. 2017. Apr.

Biology + Electronics. Nuts & Volts. 2017. May.

Basic Biological Signal Monitoring – With a Translational Platforms. Servo. 2012. Oct.

Full Power to the Shields. Nuts & Volts. 2012. Oct.

Curiosity. Servo. 2012. Nov.

ArduPilot 2.5. Servo. 2012. Nov.

- Hand-Wired Electronics. Nuts & Volts. 2012. Nov.
- Reality Twist. Nuts & Volts. 2017. May.
- Pokémon Go – The Killer App for Augmented Reality? Servo. 2017. May.
- Keep It Simple. Nuts & Volts. 2017. June.
- Wanted: Robotics Experimentalist – No Experience Necessary (Or Desired). Servo. 2017. June.
- The Zombie Apocalypse – Are You Ready? Nuts & Volts. 2017. July.
- The Robotics Cottage Industry – It’s Alive and Well. Servo. 2017. July.
- Heirloom Electronics: How to Build The Very Best. Nuts & Volts. 2017. Aug.
- What’s Your Robot Type? Servo. 2017. Aug.
- Electronics: A Multipurpose Modeling Tool. Nuts & Volts. 2017. Sep.
- Extending Life as an Embedded Intelligence: What Could Possibly Go Wrong? Servo. 2017. Sep.
- My First Time Machine: Or At Least My First Flux Capacitor. Nuts & Volts. 2017. Oct.
- Finger Spinners: Killer App for 3D Printing? Servo. 2017. Oct.
- Easing Into Tubes. Nuts & Volts. 2017. Nov.
- Downsizing: Robots and The Tools to Build Them. Servo 2017. Nov.
- Basic Biological Signal Monitoring - With a Translational Reality Twist. Nuts & Volts. 2017. Dec.
- Where Has All The Science Gone? Servo 2017. Dec.
- 2018
- What Your Preferred MCU/MPU Says About You. Nuts & Volts. 2018. Jan.
- Now, Open Wide.... Servo. 2018. Jan.
- Electronics Padawans. Nuts & Volts. 2018. Feb.
- By Land, Sea or Air (or Underground)? Servo. 2018. Feb.
- Electronics as a Portal to Other Hobbies. Nuts & Volts. 2018. Mar.
- Microcontrollers – They’ve Finally Made it to Cracker Jacks. Servo. 2018. Mar.
- Go Ahead – Play With Your Food. Nuts & Volts. 2018. Apr.
- A Robotics Infrastructure For The Experimenter: Hardware Essentials. Servo. 2018. Apr.
- The Ergonomics of Learning. Nuts & Volts. 2018. May/June.
- A Robotics Infrastructure For The Experimenter: Accessories. Servo. 2018. May/June.
- Degrees of Automation. Nuts & Volts. 2018. July/Aug.
- Mass Customization: Why Aren’t We There Yet? Servo. 2018. July/Aug.
- DIY Biotech: The Ultimate STEM Track? Nuts & Volts. 2018. Sept/Oct.
- Robot Lies. Servo. 2018. Sept/Oct.
- Perlage. Nuts & Volts. 2018. Nov/Dec.
- DIY Biotech: Harnessing Bacterial Fermentation. Nuts & Volts. 2018. Nov/Dec.
- UFOs, Government Secrets, and The Unknown Laws of Physics. Servo. 2018. Nov/Dec.
- 2019
- The Boiling Frog. Nuts & Volts. 2019. Jan/Feb.
- A Renaissance of the Kit Building Era. Servo. 2019. Jan/Feb.
- DIY Biotech: Open-Source PCR Thermocycler. Nuts & Volts. 2019. Jan/Feb.
- Death, Taxes and Electromagnetic Radiation. Nuts & Volts. 2019. Mar/Apr.
- The Waterfall Display: An Intuitive Interface for Observing Parallel Robotic Processes. Servo. 2019. Mar/Apr.
- DIY Biotech: Spectrophotometer for Measuring Bacterial Growth. Nuts & Volts. 2019. Mar/Apr.
- Coming Full Circle. Keynote. 2019. Mar.
- Q-Signals. Keynote. 2019. Mar.

The Challenging Life of Urban Hams. Nuts & Volts. May/Jun.
 Learn Morse Code With the Morserino-32, an ESP32-Based, Open-Source Kit
 It's A Great Time to Fly. Servo. May/Jun.
 DIY Biotech: Gel Electrophoresis. Nuts & Volts. 2019. May/Jun.
 The Joys of Key Restoration and Maintenance. Keynote. 2019. Jun.
 How to Learn CW. Nuts & Volts. 2019. Jul/Aug.
 The Failure of Schematic Diagrams. Servo. 2019. Jul/Aug.
 DIY Biotech: Genetic Engineering With the DNA Playground. Nuts & Volts. 2019. Jul/Aug.
 A Drone Platform for STEM Education. Nuts & Volts. 2019. Sept/Oct.
 Flying Drones are Driving the Evolution of the Imaging Industry. Servo. Sept/Oct.
 Is Passion for CW a Lifestyle Marker? Keynote. 2019. Sep.
 RIP: Terrestrial AM Radio. Nuts & Volts. 2019. Nov/Dec.
 Hearing Things. Keynote. 2019. Sep.
 An Analog Artifact Worthy of Your Robotics Toolkit. Servo. 2019. Nov/Dec.
 My Reasons for CW. Keynote. 2019. Dec.
 Fountain Pens and Morse Code. Keynote. 2019. Dec.
 There's Just Something About the Cold and CW. Keynote. 2019. Dec.

2020

Creating an Infrastructure Supportive of Vintage Electronics. Nuts & Volts. 2020. Jan/Feb.
 Restoring a Vintage Zenith Table Top AM/FM Receiver from the 60's. Nuts & Volts. 2020. Jan/Feb.
 Vintage Tech: Resolving Schematic Dissonance. Nuts & Volts. 2020. Jan/Feb.
 Instinctive Behavior and Robotics. Servo. 2020. Jan/Feb.
 Flying Blind. Keynote. 2020. Mar.
 When It Comes to Vintage Restoration, Beware of NOS (New Old Stock). Nuts & Volts. 2020. Mar/Apr.
 UV Sanitizer: How to Build One and Verify Its' Efficacy. Nuts & Volts. 2020. Mar/Apr.
 Restoration of the Vintage Telefunken Jubilate AM/SW/FM Receiver. Nuts & Volts. 2020. Mar/Apr.
 Respiratory Masks. Nuts & Volts. 2020. Mar/Apr.
 Vintage Tech: AC Current Limiters. Nuts & Volts. 2020. Mar/Apr.
 COVID-19: Opportunities for D3 Robotics. Servo. 2020. Mar/Apr.
 UV Sanitizer 2: More Powerful Anti-Viral Chamber. Nuts & Volts. 2020. May/Jun.
 Vintage Tech: Continuously Variable Autotransformers. Nuts & Volts. 2020. May/Jun.
 A Shot in the Arm for Online AR and VR. Nuts & Volts. 2020. May/Jun.
 Maximum Intelligent Interface Count (MaxIIC): A Dunbar Number for Smart Devices. Servo. 2020. May/Jun.
 Starting Over. Keynote. 2020. Jun.
 Restoration of an Abused, 1965 McIntosh C22 All-Tube Preamp. Nuts & Volts. 2020. May/Jun.
 The Economics of Robotics. Servo. 2020. Jul/Aug.
 Vintage Tech: Line Isolation Transformers. Nuts & Volts. 2020. Jul/Aug.
 eTracer Digital Tube Tester and Curve Tracer Kit. Nuts & Volts. 2020. Jul/Aug.
 Vintage Tech: Tube Checkers: From Conductance and Transconductance Meters to Computerized Curve Plotters. Nuts & Volts. 2020. Sep/Oct.
 You Never Really Own a Straight Key. You Are Simply Holding it for the Next Generation. 7Keynote. 2020. Sept.

- Restoration of a Vintage Zenith G725 AM/FM Receiver. Nuts & Volts. 2020. Sep/Oct.
- Online STEM Education a Potential Boon for Affordable, At-Home Simulators. Servo. 2020. Sep/Oct.
- All Dressed Up and Nowhere to Go. Nuts & Volts. 2020. Nov/Dec.
- First Contact: Will Humans be Ready? Keynote. 2020. Dec.
- How to Learn CW. Keynote. 2020. Dec.
- Emotionally Intelligent Communications: Is Mode That Important? Keynote. 2020. Dec.
- 2021
- Increasing Complexity: Unavoidable? Nuts & Volts. 2021. Dec/Jan.
- Seeing Things in a New Light: Affordable Color IR Imaging. Servo. 2021. Dec/Jan.
- Collaboration – Pre-Internet Style. Nuts & Volts. 2021. Feb/Mar.
- Alternative Computing Models: Part 1: The Abacus. Servo. 2021. Feb/Mar.
- Exploring Alternative Robotic Platforms: Leveraging Kits to Bootstrap New Platforms. Servo. 2021. Feb/Mar.
- When the Going Gets Tough, the Tough Get CW. Keynote. 2021. Mar.
- Audio and Video Options for Streaming. Nuts & Volts. 2021. Apr/May.
- Alternative Computing Models: Part 2: Sliding Rules. Servo. 2021. Apr/May.
- Capacitance Meters. Nuts & Volts. 2021. Apr/May.
- Rescue Robots – A Biomimetic Approach. Servo. 2021. Apr/May.
- Piano, Guitar, or Straight key? Keynote. 2021. June.
- Vintage Instruments for Vintage Repairs. Nuts & Volts. 2021. Jun/Jul.
- Alternative Computing Models: Part 3: Analog Computing. Servo. 2021. Jun/Jul.
- Evolution of the Junkbox. Nuts & Volts. 2021. Aug/Sep.
- Core Infrastructure for Robotics. Servo. 2021. Aug/Sep.
- 40m CW – My New Easy Listening Station. Keynote. 2021. Sept.
- If You Could Do It All Over Again, What Would You Change? Nuts & Vols. 2021. Oct/Nov.
- Ham Radio For Dummies. Book Review. Nuts & Vols. 2021. Oct/Nov.
- When Bad Things Happen to Good Equipment. Servo. 2021. Oct/Nov.
- Key Clicks, Chirps and Other Sounds That Have Gone the Way of the Ivory Woodpecker. Keynote. 2021. Dec.
- 2022
- Restoration of a Vintage Telefunken Gavotte 8U AM/SW/FM Receiver. Nuts & Volts. 2022. Dec/Jan.
- Restoration of a Vintage Telefunken Opus 6 AM/SW/FM Receiver. Nuts & Volts. 2022. Feb/Mar.
- Testing and Refurbishing a Pair of Vintage Spender BC1Studio Monitors. Nuts & Volts. 2022. Apr/May.
- How to Diagnose, Repair and Refurbish a Vintage Tube Amplifier – The McIntosh 240. Nuts & Volts. 2022. Jun/Jul.
- A Dummy Load for Audio Amp Testing and Measurement. Nuts & Volts. 2022. Jun/Jul.
- Restoration of the McIntosh MR 71 Vintage FM Tuner. Nuts & Volts. 2022. Aug/Sep.
- Restoration of the SABA Konstanz Stereo KN E Vintage AM/SW/FM Stereo Tabletop Receiver. Nuts & Volts. 2022. Aug/Sep.
- Remote Collaboration on a Ham Radio Construction Project. Nuts & Volts. 2022. Oct/Nov.
- Vintage Spender BC1Studio Monitors Revisited – How Far to Go With an Interconnect Upgrade. Nuts & Volts. 2022. Oct/Nov.
- Vintage Tec: Varistor Inrush Current Limiters Nuts & Volts. 2022. Oct/Nov.

- EleKit TU-8900 300B/2A3 Single Ended Power Amplifier Kit. Nuts & Volts. 2022. Oct/Nov.
- Speaker Impedance vs Frequency. Nuts & Volts. 2022. Oct/Nov.
- Refurbishing a Vintage Classic: The McIntosh MC2105 Power Amplifier, Part I. Nuts & Volts. 2022. Oct/Nov.
- Refurbishing a Vintage Classic: The McIntosh MC2105 Power Amplifier, Part II. Nuts & Volts. 2022. Oct/Nov.
- Vintage Tec: Harmonic Distortion Meters. Nuts & Volts.
- Morse Code in the Media. Keynote. 2022.
- An Asteroid Prospecting Primer for Roboticists. SERVO. 2022.
- Morse Code – Means to an End or Inherently Valuable? Keynote. 2022.
- The Dots and Dashes of Morse Code Cover the Red Planet. Keynote. 2022.
- Morse Code and Neuroplasticity. Keynote. 2022.
- Too Much Junk in the Trunk. Keynote. 2022.
- 2023 Bryan Bergeron tells ChatGPT: “Write an article on AI and ham radio”. Keynote. 2023.

White Papers

- 1994 Temporal Issues in the Design and Application of Virtual Patient Encounters. DSG, Brigham & Women’s Hospital, Boston, MA.
- Toward Automated Evaluation of Patient Simulation Interactions Through Linear Programming. DSG, Brigham & Women’s Hospital, Boston, MA.
- Making the Most of Educational Technology: A Guide to Anyone Who Uses Technology to Teach. Harvard - MIT Health Sciences and Technology, Boston, MA.
- 1995 An Enterprise-Wide Strategy for Knowledge Assembly, Warehousing, and Dissemination: A Collaborative Initiative for the Harvard Medical Area. HMS, Boston, MA.
- 1997 Teletesting: Design and Implementation Issues. MGH, Boston, MA.
- Multimedia Product Development. MGH, Boston, MA.
- 1998 Clinical Informaticians In Modern Health Care Organizations: A Needs and Training Assessment. MGH, Boston, MA.
- Computer-Enabled Medical Education. MGH, Boston, MA.
- Web Links: Ownership, Control and Liability. MGH, Boston, MA.
- 1999 Strategic Plan of the MGH Treadwell Library. MGH, Boston, MA.
- 2005 Video Game Development for Military Personnel: Design Document. National Geospatial-Intelligence Agency, Washington, DC.

Hardware Design/Products

- 2008 Mannequin-Based Patient Simulator. Cardiac and Pulmonic Simulator for HMS, Boston, MA.
- 2011 Augmented Reality Radiation Detection System for National Center for Deterrence of Biowarfare and Bioterrorism, University of Louisville, Louisville, KY.
- 2012 Distributed Intelligent System. Wireless, Embedded System for National Center for Deterrence of Biowarfare and Bioterrorism, University of Louisville, Louisville, KY.

2014 Adaptive Retinopathy Simulator. Wireless, Adaptive, Embedded System for USAMRMC/TATRC.

Interviews

1974 Civil Defense Emergency Response: Experiences of running an emergency shelter during a major hurricane. Associated Press. 1974.

1984 Home Health Software: Patient Care Software. The Times Picayune. 1984.

1991 Apple Computer. Macintosh in Medicine and The Life Sciences. TV Commercial. Jan 1991.

1996 Blister Basics. Better Homes and Gardens. 1996; 74(4);104.

1998 Cookbook Medicine. Advance for Managers of Respiratory Care. 1998; 7(7); 15-8.

2000 What a Web Site Can Do For You. Hippocrates. 2000; 14(4); 38-43.

Building Your Own Practice Web Site. Hippocrates. 2000; 14(5); 41-5.

Health Care Turns to the Web: Medical Groups View the Net as a Way to Cut Medical Mistakes. Internet Week. May 1, 2000.

Challenges for CIOs in the New Millennium. Healthcare Informatics. 2000; 17(10); 18.

The status of eCommerce. www.worldcom.com. 2000.

State of the Industry. Personal Fitness Professional. 2000; 2(3); 14.

2001 Customer Service, Touch Points, and Loyalty. Customer Contact World. 2001; 2(3); 16-21.

ECommerce in Asia. The Peak Magazine (Singapore). 2001.

The Future of Technology and Healthcare. HIMSS Journal. 2001; 15(3); 189-97.

CRM From a Latin American Perspective. El Economista (Mexico). 2001.

Can Handheld Computers Improve the Quality of Care? The Lancet. Oct 27, 2001.

2002 Guarding the Charts. Technology in Practice Magazine. 2001; 2(9); 22-30.

The Inevitable Loss of Digital Data. CNET Radio. Feb 19, 2002.

Hot & Cold on PDAs. Healthcare Informatics. 2002, 19(5); 32-6.

Customer Relationship Management. CIO Radio. Mar, 2002.

Why Your Digital Data Could One Day Disappear HBS Working Knowledge. Feb, 2002.

Hospital Staffers Find Benefits in Portable Phones. The Lexington Herald-Leader/Tribune News Service. Apr 18, 2002.

eCRM. Selling Power Magazine. July, 2002.

S'pore a Decade Behind as Biotech Innovator. Business Times. May, 2002.

CPOs. TheStreet.Com. June, 2002.

Wireless in Healthcare. The Australian Financial Review. July, 2002.

Modern-day Alchemy: Turning Ideas Into Gold. The Nation (Thailand). June 21, 2002.

Death of Data. Forbes.com. Sept 12, 2002.

2003 Wireless in Healthcare. Deloitte Touche Magazine. Feb, 2003.

2011 Video Games as Medical Education Tools. AAMC Reporter. June, 2011.

- 2012 Featured Engineer. EE Web. May 28, 2012.
- 2014 Serious Games for HIV Prevention in Rural U.S. WBHM-FM, Birmingham. Nov, 2014.
- 2015 Nerds Rage Over Ahmed's Clock. The Daily Beast. Sept 21, 2015.

Other Publications

- 2000 Aim Your Sights at Your Career: Get Organized About Setting and Achieving Your Goals. Personal Fitness Prof. 2000. 2(1); 39-40.
 Get Organized: Time Management For Personal Trainers. Personal Fitness Prof. 2000. 2(2); 34.
 Summer Strategies to Keep Clients Working Out. Personal Fitness Prof. 2000. 2(3); 12-6.
 Bringing Personal Training to the Martial Arts Arena. Personal Fitness Prof. 2000. 2(4); www.fit-pro.com.
- 2001 A Recipe for Success. Personal Excellence. 2001. Apr; 3.
- 2013 Big Data, a Key Enabler in Modern, Cost-Conscious and Outcomes Responsive Healthcare. HIMSS Blog Post. 2013. Mar 4. Blog.himss.org.

Other Activities

- 2017-22 Judge, MIT State and Regional Science and Engineering Fairs

Expert Witness History

Cases/IPRs: 107

ITC: 3

Deposed: 34 times (9 virtual)

Testified: 13 times (1 virtual)

Presented at Markman: 3 times

For Plaintiff/Petitioner: 56 times

For Defendant: 54 times

Dates are Start of Case

- 2007 Medical Device Telemetry/Pill Camera. *Olympus Corporation, et al. v Given Imaging, et al.*, Civil Action No. 06 CV 02132 (JKG) (HSP) (E.D. Pa.). Source code analysis. Hardware analysis. Non-infringement and Invalidity. Plaintiff. Kenyon & Kenyon, NY.
- 2008 Electronic Medical Record System. *Prompt Medical Systems L.P., v NextGen Healthcare*. Case No. 4:07-cv-04497 (S.D. Tex.). Non-infringement and Invalidity. Source code analysis. Defendant. Pepper Hamilton, Boston, MA.
- 2009 Medical Telemetry System/Home Monitoring. Invalidity analysis for *Robert Bosch Healthcare Systems, Inc.* Bell Boyd Lloyd. Defendant. Chicago, IL.
Electronic Medical Record System/Coding Systems. Source code analysis. For *NextGen*. Pepper Hamilton, Boston, MA.
Medical Devices and Methods Patent Portfolio Analysis. Code and hardware analysis. For *Alcatel-Lucent*. Murray Hill, NJ.
- 2010 Electronic Medical Record System. *Medical Monitoring and Paging, LLP v General Electric Company d/b/a GE Healthcare, Draeger Medical Inc. and Cerner Corporation*. Case No. 4:09-CV-01994 (S.D. Tex.). Invalidity. Defendant. Shook Hardy & Bacon, San Francisco, CA.
Digital Signal Processing/Pulse Oximetry. *Masimo Corp. v Philips Electronics North America Corp. and Philips Medizin Systeme Boblingen GmbH*. Case No. 1:16-cv-00137 (D. Del.) Invalidity. Plaintiff. Knobbe Martens Olson & Bear, Irvine, CA.
- 2011 Telemedicine Kiosk/Remote Telemetry. *Computerized Screening, Inc. v Lifeclinic International Re-Exam*. Re-Examination No. 90/010780. Patent reexamination and Invalidity. **Testified** at USPTO. Plaintiff. SilverSky Group, LLC and Sterne Kessler Goldstein Fox, Washington, DC.
Remote Telemetry Medical Device/Insulin Pump. *Medgraph, Inc. v Medtronic, Inc.*, Case No. 6:09-cv-06610-DGL (W.D.N.Y.). Non-infringement and Invalidity. Software and hardware analysis. **Deposed**. Plaintiff. Meredith & Keyhani, Princeton, NJ.
- 2012 Telemedicine Kiosk. *Computerized Screening, Inc. v Lifeclinic*. Case No. 3:09-cv-00465-RJC-WGC (D. Nev.). Claim construction, Non-infringement and Invalidity. Hardware analysis. Plaintiff. Armstrong Teasdale, St. Louis, MO.
Medical Claims Processing System. *Cave Consulting Group, LLC v Ingenix, Inc.*, No. 5:11-cv-469 EJD (N.D. Cal.). Infringement and invalidity. **Deposed** and **Testified x2**. Infringement and *Bosch Healthcare Systems, Inc. v ExpressMD Solutions LLC*. Case No. 3:12-cv-00068 JW (N.D. Cal.). Non-infringement and Invalidity. Plaintiff. Dorsey & Whitney, Seattle, WA.
Telemedicine. *Robert Bosch Healthcare Systems, Inc. v MedApps, Inc.* Case No. 3:12-cv-113-RS (N.D. Cal.). Non-infringement and Invalidity. Plaintiff. Dorsey & Whitney, Seattle, WA.

- 2013 Remote Telemetry Medical Device. *CardioNet, Inc. v ScottCare Corporation and Ambucor Health Solutions, Inc.* Civil Action No. 12-cv-2516-PBT (E.D. Pa.). Claim construction, Non-infringement and Invalidity. Defendant. Source code analysis. Hardware analysis. **Deposed x 2**. Defendant. Ulmer & Berne, Cleveland, OH.
- Telemedicine. *My Health and University of Rochester v Cardiocom LLC*. Invalidity. Case No. 2:13-cv-136 (E.D. Tex.). Inter Partes Review. Defendant. Merchant and Gould, Minneapolis, MN.
- Medical Device/Laboratory Automation. *Alifax S.p.A. and Nuclear Medica S.p.A. v ALCOR Scientific Inc.* Case No. 1:14-cv-00440-S-LDA (D.R.I.). Non-infringement. Hardware analysis. Plaintiff. Holland & Knight, Boston, MA.
- Patient Monitoring. *Theranos, Inc. and Elizabeth Holmes v Fuisz Pharma, et al.* Case No. 5:11-cv-05236-PSG (N.D. Cal.) Inventorship. **Deposed**. Defendant. Banie & Ishimoto, Redwood City, CA.
- Medical Device/Bedside Monitoring. *Fresenius Kabi USA, LLC v CareFusion*. Inter Partes Review. Plaintiff. Mayer Brown, Chicago, IL.
- Pharmaceutical Business Process. *IMS Health v Symphony Health Solutions*. Case No. 1:13-cv-02071 (D. Del). Non-infringement. Plaintiff. Fish & Richardson P.C., Washington, DC.
- Electronic Medical Records/Personal Health Records. *HealthTrio v Aetna, Inc., ActiveHealth Management, Inc. and Medicity, Inc.* Civil Action No. 1:12-cv-03229 (D. Colo.). Declaration. Non-infringement. Source code analysis. **Deposed**. Plaintiff. Skiermont Puckett, Dallas, TX.
- Electronic Medical Record System. *RLIS, Inc. v Cerner Corporation*. Case No. 3:12-cv-00209 (S.D. Tex.). Non-infringement. Source code analysis. **Testified** (jury trial). Defendant. Shook Hardy & Bacon, Houston, TX.
- Electronic Medical Record System. *RLIS, Inc. v Allscripts Healthcare Solutions, Inc.* Case No. 3:12-cv-00208 (S.D. Tex.). Non-infringement. Source code analysis. Multiple declarations. Defendant. Greenberg Traurig, Houston, TX and Latham & Watkins, LLP, Chicago, IL.
- 2014 Computerized Meal Planning. *Dietgoal Innovations LLC v Kellan Restaurant Management Corp. d/b/a 54th Street Grill & Bar* (lead case). Civil Action No. 2:12-cv-00761-JRG-RSP (E.D. Tex.). Invalidity and Non-infringement. Source code analysis. **Deposed x3**. Plaintiff. Buether Joe & Carpenter, Dallas, TX.
- Telemedicine. *My Health and University of Rochester v Click4Care, Inc.* Case No. 2:13-cv-00137 (E.D. Tex.). Invalidity. Inter Partes Review, PTAB Case IPR2014-00435. Defendant. Vorys, Sater, Seymour and Pease LLP, Washington, DC.
- Medical Device/Wearable Fitness Monitor. *FitnessAge Services, Inc. v Polar Electro, Inc.* Case No. 2:11-cv-01444-ECR (GWF), USDC NVD. Invalidity and Non-infringement. Source code analysis. Defendant. Holland & Knight, Washington, DC.
- Medical Insurance System. *Athenahealth Inc. v CareCloud Corporation*. PTAB Case No. CBM2014-00143. Invalidity. Covered business method. **Deposed x 2**. Defendant. Hunton & Williams, Washington, DC.
- Medical Device/Wearable Fitness Monitor. *FEGO Precision Industrial Co., Ltd. v Aliphcom*. Case No. 2:13-cv-01152 (E.D. Tex.). Invalidity and Non-infringement. Defendant. Cooley, LLP, Washington, DC.
- Radiation Oncology Planning System. *Prowess, Inc. v Siemens Medical Solutions USA, Inc.* JAMS Arbitration. Ref# 1100072826. **Testified** (bench, remotely). Defendant. Reed Smith, LLP, San Francisco, CA.
- Electronic Medical Record System. *Cardinal Health v Allscripts Healthcare Solutions, Inc.* Case No. 13CV002123 (Ohio Ct. of Common Pleas, Franklin County.). Defendant. Jannik, LLP, Cleveland, OH.

- Telemedicine. *My Health and University of Rochester v Biotronik, Inc., LifeScan, Inc. and Sotera Wireless, Inc.* PTAB Case No. IPR2015-00102. Invalidity. Inter Partes Review. Defendants. Sidley Austin, LLP, Los Angeles, CA.
- Optical Character Recognition. *The Neat Company*. Docket No. 104974.000078, Inter Partes Review, Petitioner. Baker & Hostetler, LLP, Philadelphia, PA.
- Augmented Reality. *Lennon Image Technologies, Inc. v Macy's Retail Holdings, Inc. and Luxottica USA LL d/b/a Ray-Ban*. Civil Action No. 2:13-cv-235, USDC TX ED. Invalidity and Non-infringement. Plaintiff. Buether Joe & Carpenter, Dallas, TX.
- Medical Device. *Alifax S.p.A. and Nuclear Medica S.p.A. v ALCOR Scientific Inc.* Case No. 1:14-cv-00440 (D.R.I.). Non-infringement, Trade Secret and Copyright. **Presented at Markman hearing. Deposed and Testified** (jury trial). Hardware analysis. Source code analysis. Plaintiff. Manelli Selter, PLLC, Washington, DC/Pierce Atwood, Boston, MA.
- Secure Medical Systems. *Golden Hour Data Systems, Inc. v Reach Air Medical Services, LLC and Air Methods Corp.* Covered Business Reviews, Case No. 3:14-cv-01059, USDC CA SD. Multiple declarations. Defendants. Fish & Richardson, Dallas, TX.
- 2015
- Medical Device. *International Biomedical, LTD. v General Electric Company and Datex-Ohmeda, Inc. (d/b/a GE Healthcare)*. Case No. 1:14-cv-00397-LY (W.D. Tex.). Non-infringement. Hardware analysis. **Deposed**. Defendant Arnold & Porter, LLP, Los Angeles, CA.
- Decision Support System. *Cerner v Humedica*. Case No. 1:14-cv-00880-LPS (D. Del.). Non-infringement. Source code analysis. Plaintiff. Shook Hardy & Bacon, Houston, TX.
- Telemedicine. *HealthSpot, Inc. v Computerized Screening, Inc.* Case No. 1:14-cv-00804 (N.D. Ohio). Invalidity and Non-Infringement. Hardware analysis. Defendant. Armstrong Teasdale, St. Louis, MO.
- Telemedicine. *My Health and University of Rochester v Bosch and BodyMedia, Inc.* PTAB Case No. IPR2015-01218. Inter Partes Review. Petitioners. Orrick, Herrington & Sutcliffe, Menlo Park, CA
- Digital Signal Processing. *Masimo Corp. v Philips Electronics North America Corp. and Philips Medizin Systeme Boblingen GmbH*. Case No. 1:16-cv-00137 (D. Del.). Invalidity and Non-Infringement. **Deposed**. Defendant. Source code analysis. Hardware analysis. Mayer Brown, Washington, DC.
- Electronic Medical Record System. *Roberto Cordero v Patrick McGonigle, MedInformatix, Inc., Thomas McGonigle, et al.* Defendant. Orrick, Herrington & Sutcliffe, Irvine, CA.
- 2016
- Clinical Decision Support Software. *Cerner Corporation, Cerner Health Services, Inc., Allscripts Healthcare Solutions, Inc., Epic Systems Corporation and Epic Hosting, LLC v Uniloc USA, Inc. and Uniloc Luxembourg S.A.* Inter Partes Review. PTAB Case No. IPR2015-01608. **Deposed**. Petitioners. Shook, Hardy & Bacon, Houston, TX.
- Drug Distribution Systems. *Par Pharmaceuticals v Jazz Pharmaceuticals*. Seven Inter Partes Reviews. PTAB Case Nos. IPR2015-01903, IPR2015-00545, IPR2015-00546, IPR2015-00547, IPR2015-00548, IPR2015-00551, IPR2015-00554. **Deposed**. Defendant. Jones Day, Cleveland, OH and Quinn Emanuel Urquhart & Sullivan, LLP, New York, NY.
- Medical Sensor Design. *Masimo Corp. v Philips Electronics North America Corp. and Philips Medizin Systeme Boblingen GmbH*. Case No. 1:16-cv-00137 (D. Del.). Antitrust. **Deposed**. Defendant. Mayer Brown, Washington, DC.
- Radiation Oncology Planning System – Linear Accelerator (Qualified in general radiation therapy, and in the specific fields of computer science, medical informatics, simulation and optimization with respect to radiation therapy). *Varian Medical Systems. v Elekta AB et al.* Case No. 1:16-cv-00994 (D. Del.). Non-infringement. Domestic Industry. **Deposed and Testified** (bench trial). Plaintiff. Source code analysis. ITC Case. ITC-337-TA-968. Quinn Emanuel Urquhart & Sullivan, LLP, San Francisco, CA.

- Bedside Monitoring System. *The University of Florida Research Foundation, Inc. v Medtronic PLC*. Case No. 1:16-cv-00183 (N.D. Fla.). Non-infringement. Plaintiff. Shore Chan DePumpo, LLP, Houston, TX.
- Medical Claims Processing System. *Cave Consulting Group, LLC v Truven Health Analytics, Inc.*, No. 5:15-cv-02177-S (N.D. Cal.). Infringement and invalidity. **Deposed x 2**. Plaintiff. Source Code Review. Armstrong Teasdale, St. Louis, MO.
- Telemedicine. *McKesson Technologies Inc., InTouch Technologies, Inc. and DeVilbliss Healthcare, Inc. v My Health, Inc.* PTAB Case No. IPR2017-00312. Invalidity. Inter Partes Review. Plaintiff. Jackson Walker, LLP, Houston, TX.
- Drug Distribution Systems. *Par Pharmaceuticals v Jazz Pharmaceuticals*. No. 2:10-cv-06108 (D.N.J.). Inter Partes Review. Defendant. Quinn Emanuel Urquhart & Sullivan, LLP, New York, NY.
- 2017 Physiological Monitor. *Biosig Instruments v Nautilus, Inc.* No. 10-cv-7722 (AKH) (S.D.N.Y.). Invalidity. Defendant. Software Analysis. Klarquist Sparkman, LLP, Portland, OR.
- Radiation Oncology Planning System. *Elekta AB et al. v Varian Medical Systems*. No. IPR2016-00842. Inter Partes Review. Defendant. Quinn Emanuel Urquhart & Sullivan, LLP, San Francisco, CA.
- Radiation Oncology Planning System. *Elekta AB et al. v Varian Medical Systems*. No. IPR2016-00843. Inter Partes Review. Defendant. Quinn Emanuel Urquhart & Sullivan, LLP, San Francisco, CA.
- Radiation Oncology Planning System. *Elekta AB et al. v Varian Medical Systems*. No. IPR2016-00844. Inter Partes Review. Defendant. Quinn Emanuel Urquhart & Sullivan, LLP, San Francisco, CA.
- Bedside Monitoring System. *The University of Florida Research Foundation, Inc.* Patent validity. Defendant. Shore Chan DePumpo, LLP, Houston, TX.
- Wireless Communications System. *Gimme Vending, LLC v. VendSys et al.*, C.A. No. 1:17-cv-11137-WGY (D. Mass.). **Testified** (bench). Defendant. Hardware and Source Code Review. PierceAtwood, Boston, MA.
- Haptics and Augmented Reality. *POWERbahn, LLC v. Saris Cycling Group, Inc.* d/b/a CycleOps. W.D. Wis. No.17-cv-003-wmc (W.D. Wis.). Defendant. Hardware and Source Code Review. Godfrey & Kahn, S.C., Madison, WI.
- 3D Dental Imaging and Reconstruction. *Align Technology v 3Shape A/S*. ITC No. 337-TA-1090. **Presented at Markman Hearing**. Plaintiff. Paul Hasting LLP, Washington, DC.
- 3D Dental Imaging and Reconstruction. *Align Technology v 3Shape A/S*. ITC No. 337-TA-1091. **Presented at Markman Hearing. Deposed. Testified x2** (infringement and validity) Plaintiff. Paul Hasting LLP, Washington, DC.
- Voice Recognition Adaptation. *Nuance Communications, Inc. v. MModal LLC, LP Parent, Inc. and Legend Parent, Inc.* **Deposed**. Plaintiff. Weil, Gotshal & Manges LLP, NY.
- Medical Claims Processing System. *Cave Consulting Group, LLC v OptumInsight, Inc.*, No. 3:15-cv-03424 (N.D. Cal.). Infectious Unenforceability. **Deposed**. Plaintiff. Source Code Review. Armstrong Teasdale, St. Louis, MO.
- 2018 Physiological Monitor. *Smart Wearable Technologies Inc. v. Fitbit, Inc.* Case No. 3:17-cv-05068 (N.D. Cal.) **Deposed**. Plaintiff. Post-Ruling Sanctions. Flachsbart and Greenspoon, Chicago, IL.
- Trade Secret Misappropriation. *Syntel Sterling Best Shores Mauritius Limited and Syntel, Inc., v. The Trizetto Group Inc. and Cognizant Technology Corp* 2:15-cv-00211 (LGS)(JLC) Source Code Review. **Deposed and Testified** (jury). Defendant/Counterclaimants. Kirkland & Ellis, LLP, Chicago, IL.

- Electronic Medical Record. *Celgene Corp. v. Dr. Reddy's Labs., Ltd. and Dr. Reddy's Labs., Inc.* Case Nos. 2:16-cv-07704-SDW-LDW, 2:17-cv-05314-SDW-LDW, and 2:18-cv-06378-SDW-LDW (D.N.J.) Defendant. Perkins Coie, LLP, Washington, DC.
- Augmented Reality. *Peloton v. Flywheel Sports Inc.* Three Inter Partes Reviews. PTAB Case Nos. IPR2019-00294, IPR2019-00295, IPR2019-00564. Civil Action No. 2:18-cv-00390 (RWS)(RSP) IPR. **Deposed.** Defendant. Patterson Belknap Webb & Tyler LLP, New York, NY.
- Radiation Oncology Planning System. *Best Medical International, Inc., v. Varian Medical Systems.* Case No. 1-99-CV-DE280 (DE). Defendant. Kekker, Van Nest & Peters LLP, San Francisco, CA.
- Physiological Monitor. *Polar Electro OY v. Suunto OY, America Sports Winter & Outdoor d/b/a/ Suunto USA et al.* C.A. No. 1:17-cv-0139-CW. Hardware Testing and Source Code Review. **Deposed.** Plaintiff. Holland Knight, LLC, Washington, DC.
- Telemedicine. *20/20 Vision Center, LLC v. Vision Precision Holdings, LLC et. Al.* 9:18-cv- 80670 (USDC -W. Palm Beach, FL). Defendant. Shutts & Bowen, LLP, W. Palm Beach, FL.
- 2019 Haptics and Augmented Reality. *POWERbahn, LLC v. Foundation Fitness LLC and Wahoo Fitness, LLC.* Civil Action No.1:17-cv-02965-AT. **Deposed.** Defendant. Hardware and Source Code Review. Polsinelli PC, St. Louis, MO.
- Trade Secrets, Direct Primary Care System. *Accresa Health, LLC v. Hint Health, Inc.* **Testified.** Plaintiff. Trade Secret. Winston & Strawn, LLP. Houston, TX.
- Electronic Medical Record System. *Athenahealth, Inc., et al v. Clinicomp, International, Inc.* No. IPR2018-01634. Inter Partes Review. **Deposed.** Defendant. Quinn Emanuel Urquhart & Sullivan, LLP, Los Angeles, CA.
- Consumer Database Management System. *CXT Systems, Inc. v Tailored Brands, Inc.,* No. 2:18-cv-00235 (RWS)(RSP). Infringement. Defendant. Armstrong Teasdale, St. Louis, MO.
- Electronic Medical Record System. *Clinicomp, International, Inc. v AthenaHealth.* No. 1:18-CV-00425-LY (W.D., Texas). Invalidity and Non-Infringement. **Deposed** (remotely). Plaintiff. Manatt, Phelps & Philips, LLP, Los Angeles, CA.
- 2020 Medical Imaging. *University of South Florida Research Center v. Hologic, Inc.,* Varex Imaging Corp and MeVis Medical Solutions AG. No. 2:20-cv-352 (U.S. District Court for District of Delaware). IPR. Defendant. King and Spalding, LLP, Chicago, Il.
- Wireless Bedside Monitors. *Masimo Corp. v. Sotera Wireless, Inc., et. al.* No. 3:19-cv-01100-BAS-NLS (S.D. Cal.). Defendant. Husch Blackwell, LLP, St. Louis, MO.
- Continuous Monitoring. *Roche Diabetes Care, Inc. v. Insulet Corp.,* C.A. No. 20-825-MN. Plaintiff. WilmerHale, LLP, New York, NY.
- HIPPA Compliance. *Enserion, LLC v. Orthofix, Inc.* C.A. No. 4:20-cv-00108-ALM (E.D. Tx.) Plaintiff. Budo Law, CO.
- Cardiac Telemetry. *Braemar Manufacturing LLC, et al. v. The ScottCare Corporation and Ambucor Health Solutions.* 2:12-cv-02516-PBT (E.D. Pa.). Defendant. Conrad O'Brien. New York.
- 2021 Portable ECG Monitor. *AliveCor, Inc. v. Apple, Inc.* No. 6:20-cv-011122. Plaintiff. Quinn Emanuel, San Francisco, CA.
- Wireless Wearables Telemetry. *Sotera Wireless, Inc. v. Masimo Corporation.* Three Inter BNos. IPR2020-01033, IPR2020-01033 and IPR2020-01019. **Deposed** (remotely). Petitioner. HuschBlackwell. St. Louis, MO.
- Bedside Monitor Alarm Delay. *Sotera Wireless, Inc. v. Masimo Corporation.* Four Inter Partes Reviews Nos. IPR2020-00912, IPR2020-01015, IPR2020-872623 and IPR2020-00954. **Deposed** (remotely). Petitioner. HuschBlackwell. St. Louis, MO.

Wireless Bedside Telemetry. *Sotera Wireless, Inc. v. Masimo Corporation*. Inter Partes Review. No. IPR2020-01078. Petitioner. HuschBlackwell. St. Louis, MO.

Electronic Medical Record Forensics. *Merlino v. Women & Infants Hospital of Rhode Island*. C.A. No. PC2019-10490. Plaintiff. Decof, Bary, Mega & Quin. Providence, RI.

Healthcare Payment System. Cigna. Crowell & Moring, LLP. New York.

Robotic Telemedicine. Teledoc-Amwell. Inter Partes Review. Three Inter Partes Reviews. Nos. IPR2021-00748, IPR2021-00749 and IPR2021-00836. Defendant. **Deposed x 3** (remotely). Norton Rose Fulbright, LLP. Houston, TX.

Augmented Reality. *Lennon Image Technologies, Inc. v Target, Inc.* Case No. 2:20-cv-00362-JRG-RSP. Invalidity and Non-infringement. Plaintiff. Buether Joe & Carpenter, Dallas, TX.

2022 Electronic Medical Record System. *Clinicomp, International, Inc. v Cerner Corporation*. Plaintiff. Manatt, Phelps & Philips, LLP, Los Angeles, CA.

Interactive Exercise. *Nike, Inc. v. Lululemon Athletica inc. et al.*, Case No.: 1:22-cv-00082-RA-OTW. S District NY. Plaintiff. Arnold & Porter Kaye Scholer, Washington, DC.

Interactive Exercise. *iFIT Inc. f/k/a ICON Health & Fitness, Inc. v. Peloton Interactive, Inc.* Plaintiff. **Deposed** (remotely). Foley & Lardner, LLP, Milwaukee, WI.

Interactive Exercise. *F45 Training Pty Ltd v. Body Fit Training USA, Inc.* Defendant. Case No. 1:20-cv-1194 (D. Del.). Willkie Farr & Gallagher, LLP, New York, NY.

Robotic Telemedicine. *Teledoc Health, Inc. v. Avail Medsys*. Inter Partes Review. No. IPR2022-00445. Defendant. **Deposed** (remotely). Norton Rose Fulbright, LLP. Houston, TX.

Healthcare Payment System. *Milliman, Inc., et al. v. Gradient A.I. Corp., et al.*, No. 1:21-cv-10865. Defendant. Cholate, Hall & Stewart, LLP, Boston, MA.

Natural Language Processing/Electronic Medical Records. *NewWave Telecom and Technologies, Inc. v. Ze Jiang, et al.*, Superior Court, Delaware. Plaintiff. **Deposed and testified**. Holland & Knight, LLP. Washington, DC.

3D Dental Imaging and Reconstruction. *3Shape A/S v Carestream Dental LLC et al.*, Case No. 1:22-cv-01829-WMR (N.D.G.A). Defendant. Quinn Emanuel Urquhart & Sullivan, LLP, San Francisco, CA.

Electronic Medical Record System. *Meridian Hospital Systems Corp. v. Post Acute Medical, LLC, et al.*, Case No. 2019-23790, 11th District Court of Harris County, TX. Defendant. Morgan, Lewis & Bockius, LLP, Houston, TX.

Learning Management System. *GO1 Pty, Ltd., v. OpenSesame, Inc.* Inter Partes Review. No. IPR2022-01439. Patent Owner. Buchalter. Irvine, CA.

Robotic Surgery. Joel Sanchez, et.al. v. David Dyslin, Tammy Nguyen, US Anesthesia Partners, and Intuitive Surgical. Case No. DC-22-13128. Hardware and software review. Plaintiff. Slack Davis Sanger, LLP, Ft. Worth, TX.