UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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APPLE INC.
Petitioner

v.

GESTURE TECHNOLOGY PARTNERS LLC
Patent Owner

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Inter Partes Review Case No. IPR2021-00921
U.S. Patent No. 8,878,949

DECLARATION OF DR. BENJAMIN B. BEDERSON

I, Benjamin B. Bederson, hereby declare the following:

I. BACKGROUND AND QUALIFICATIONS

1. My name is Benjamin B. Bederson, Ph.D and I am over 21 years of age and otherwise competent to make this Declaration. I make this Declaration based on facts and matters within my own knowledge and on information provided to me by others.

2. I have been retained by counsel for Petitioner as a technical expert in the above-captioned case. Specifically, I have been asked to render certain opinions in regard to the IPR petition with respect to U.S. Patent No. 8,878,949 (the "'949 Patent"). I understand that the Challenged Claims are claims 1-18. My opinions are limited to those Challenged Claims.

3. My compensation in this matter is not based on the substance of my opinions or the outcome of this matter. I have no financial interest in Petitioner. I am being compensated at an hourly rate of $600 for my analysis and testimony in this case.

4. In writing this declaration, I have considered my own knowledge and experience, including my work experience in the field of electrical and computer engineering; my experience in teaching in this area; and my experience working with others involved in this field, including in both the design and analysis of multimedia-

focused communication systems and subsystems. In reaching my opinions in this matter, I have also reviewed the following references and materials:

- The '949 Patent (Ex. 1001)
- The '949 Patent File History (Ex. 1002)
- U.S. Patent No. 6,144,366 ("Numazaki") (Ex. 1004)
- JPH4-73631 to Osamu Nonaka ("Nonaka") (Ex. 1005)
- U.S. Patent No. 5,666,157 ("Aviv") (Ex. 1006)
- "CCD and CMOS Imaging Array Technologies," by Stuart Taylor ("*Taylor*") (Ex. 1013)
- Dana Harry Ballard and Christopher M. Brown. 1982. "Computer Vision" (1st. ed.). Prentice Hall Professional Technical Reference (Ex. 1015)
- Wallace, R.; Ong, P.; Bederson, B.; Schwartz, E. 1993. "Space Variant Image Processing", New York University TR-1993-633 (Ex. 1016)
- "First Mobile Videophone Introduced," May 18, 1999 (Ex. 1017)
- Any additional background materials cited below

A. Educational Background

5. I received a Bachelor of Science degree in Computer Science with a minor in Electrical Engineering from Rensselaer Polytechnic Institute ("RPI") in 1986. I received a Master of Science degree and a Ph.D. in Computer Science from New York University ("NYU") in 1989 and 1992, respectively.

B. Professional Experience

6. Since 1998, I have been a Professor of Computer Science at the University of Maryland ("UMD"), where I have joint appointments at the Institute for Advanced Computer Studies and the College of Information Studies (Maryland's "iSchool"), and am currently Professor Emeritus. I was also Associate Provost of Learning Initiatives and Executive Director of the Teaching and Learning

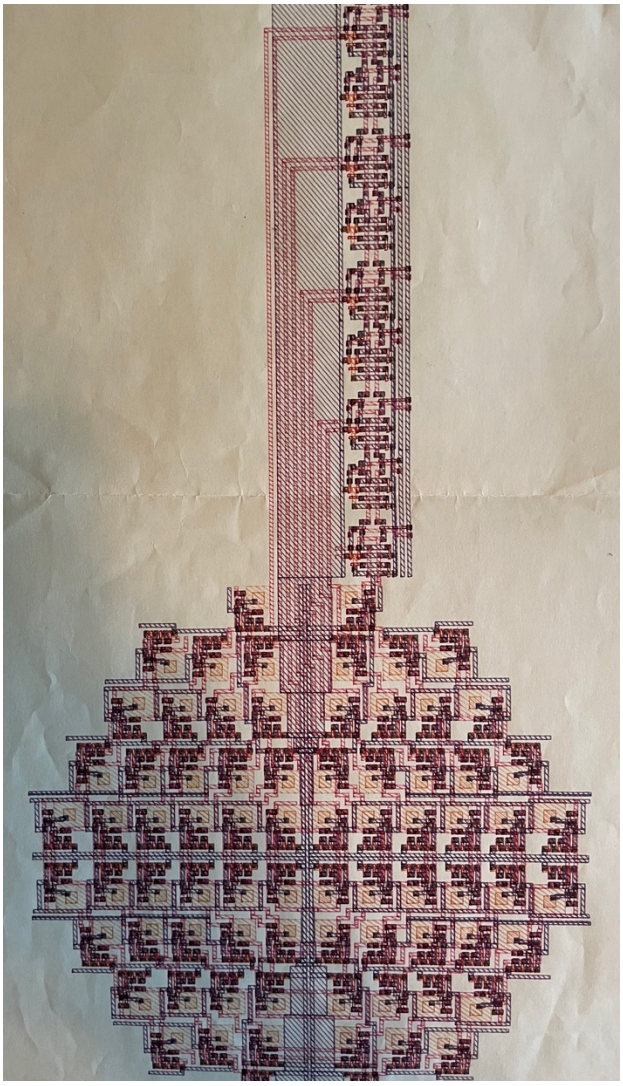
Transformation Center from 2014 to 2018. I am a member and previous director of the Human-Computer Interaction Lab ("HCIL"), the oldest and one of the best known Human-Computer Interaction research groups in the country. I was also co-founder and Chief Scientist of Zumobi, Inc. from 2006 to 2014, a Seattle-based startup that is a publisher of content applications and advertising platforms for smartphones. I am also co-founder and co-director of the International Children's Digital Library ("ICDL"), a web site launched in 2002 that provides the world's largest collection of freely available online children's books from around the world with an interface aimed to make it easy for children and adults to search and read children's books online. I am also co-founder and prior Chief Technology Officer of Hazel Analytics, a data analytics company whose product sends alerts in warranted circumstances. In addition, I have for more than 25 years consulted for numerous companies in the area of user interfaces, including Logitech, Microsoft, the Palo Alto Research Center, Sony, Lockheed Martin, Hillcrest Labs, and NASA Goddard Space Flight Center.

7. For more than 30 years, I have studied, designed, and worked in the field of computer science and human-computer interaction. My experience includes 30 years of teaching and research, with research interests in human-computer interaction and the software and technology underlying today's interactive computing systems. This includes the design and implementation of image sensing

and image processing systems as well as software applications on mobile devices, including smart phones and PDAs, such as my work on DateLens, LaunchTile, and StoryKit described below. My consulting included helping companies apply my work on "zoomable user interfaces" to their consumer-facing audio/video access software.

8. In 1992, I completed my Ph.D. dissertation at New York University titled "A Miniature Space-Variant Active Vision System: Cortex-I" (Ex. 1011)[1] in which I worked with both CMOS and CCD image sensors and wrote image processing software using those sensors. As depicted in the VLSI circuit layout image below, I designed a custom CMOS image sensor with a radial pixel layout. Figure 2.1 from my dissertation show the result of images taken with a camera I built using that image sensor. I then built a custom CCD-based camera by manufacturing a lens that I attached directly to a commercially available CCD sensor that is shown in Figure 2.2.

[1] Ex. 1011 is a pre-publication version of my thesis, which does not include the final chapter.



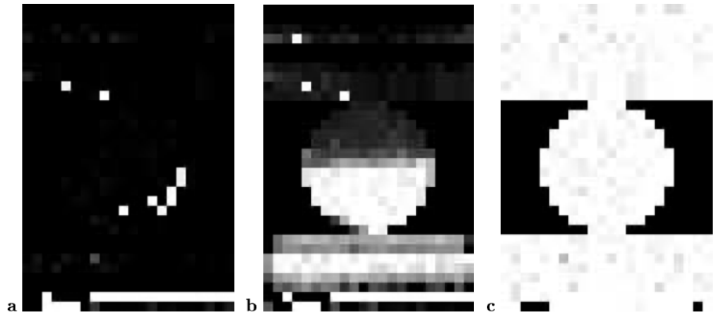


Figure 2.1: Images from our custom logmap sensor chip. They are the logmap images from the chip, and have not been mapped back to scene coordinates. They are scenes of **a)** an all black scene, **b)** a horizontal edge with the top half black and the bottom half white, and **c)** an all white scene. The circle in the center of the images is an artifact of the chip geometry.

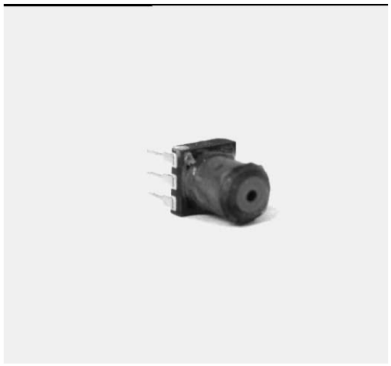


Figure 2.2: The fixed field of view camera. It consists of a four element lens assembly attached directly to a CCD sensor.

9. In 1995, I built an "audio augmented reality" system[2] that identified which piece of art a person was standing in front of. This worked by installing infrared transmitters in the ceiling above each piece of art which was identified by an infrared receiver controlled by a microcontroller. As depicted in Figure 1 below,

[2] Benjamin B. Bederson. 1995. Audio augmented reality: a prototype automated tour guide. In Conference Companion on Human Factors in Computing Systems (CHI '95), I. Katz, R. Mack, and L. Marks (Eds.). ACM, New York, NY, USA, 210-211. DOI=http://dx.doi.org/10.1145/223355.223526 (Ex. 1012).

a person wearing the receiver walked around, the microcontroller they were carrying would identify the code from the transmitter they were standing under.

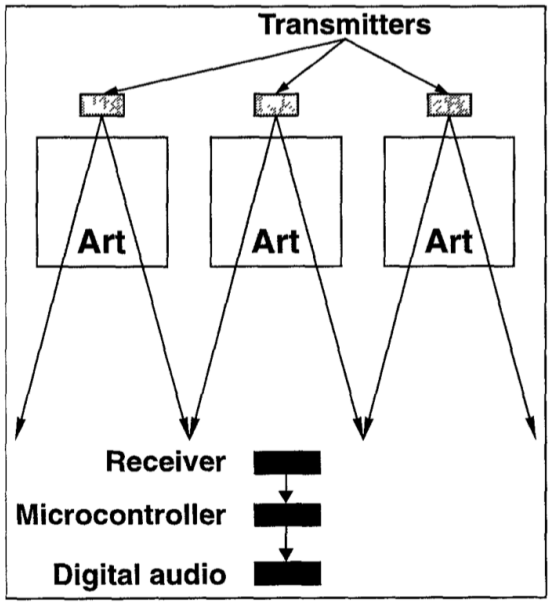


Figure 1: Schematic of automated tour guide prototype.

10. At UMD, my research is in the area of Human-Computer Interaction ("HCI"), a field that relates to the development and understanding of computing systems to serve users' needs. Researchers in this field are focused on making universally usable, useful, efficient and appealing systems to support people in their wide range of activities. My approach is to balance the development of innovative technology that serves people's practical needs. Example systems following this approach that I have built include PhotoMesa (software for end users to browse personal photos), DateLens (2002 software for end users to use their mobile devices to efficiently access their calendar information), LaunchTile (2005 "home screen" software for mobile devices to allow users to navigate apps in a zoomable

environment), SpaceTree (2001 software for end users to efficiently browse very large hierarchies), ICDL (as described above), and StoryKit (a 2009 iPhone app for children to create stories).

11. LaunchTile led to my creation of Zumobi in 2006, where I was responsible for investigating new software platforms and developing new user interface designs that provide efficient and engaging interfaces to permit end users to access a wide range of content on mobile platforms (including the iPhone and Android-based devices). For example, I designed and implemented software called "Ziibii," a "river" of news for iPhone, software called "ZoomCanvas," a zoomable user interface for several iPhone apps, and iPhone apps including "Inside Xbox" for Microsoft and Snow Report for REI. At the International Children's Digital Library (ICDL), I have since 2002 been the technical director responsible for the design and implementation of the web site, www.childrenslibrary.org (originally at www.icdlbooks.org). In particular, I have been closely involved in designing the user interfaces as well as the software architecture for the web site since its inception in 2002.

12. Beginning in the mid-1990s, I have been responsible for the design and implementation of numerous other web sites in addition to the ICDL. For example, I designed and built my own professional web site when I was an Assistant Professor of Computer Science at the University of New Mexico in 1995 and have continued

to design, write the code for, and update both that site (which I moved to the University of Maryland in 1998, currently at http://www.cs.umd.edu/~bederson/) as well as numerous project web sites, such as Pad++, http://www.cs.umd.edu/hcil/pad++/. I received the Janet Fabri Memorial Award for Outstanding Doctoral Dissertation for my Ph.D. work in robotics and computer vision. I have combined my hardware and software skills throughout my career in Human-Computer Interaction research, building various interactive electrical and mechanical systems that couple with software to provide an innovative user experience.

13. My work has been published extensively in more than 160 technical publications, and I have given about 100 invited talks, including 9 keynote lectures. I have won a number of awards including the Brian Shackel Award for "outstanding contribution with international impact in the field of HCI" in 2007, and the Social Impact Award in 2010 from Association for Computing Machinery's ("ACM") Special Interest Group on Computer Human Interaction ("SIGCHI"). ACM is the primary international professional community of computer scientists, and SIGCHI is the primary international professional HCI community. I have been honored by both professional organizations. I am an "ACM Distinguished Scientist," which "recognizes those ACM members with at least 15 years of professional experience and 5 years of continuous Professional Membership who have achieved significant

accomplishments or have made a significant impact on the computing field." I am a member of the "CHI Academy," which is described as follows: "The CHI Academy is an honorary group of individuals who have made substantial contributions to the field of human-computer interaction. These are the principal leaders of the field, whose efforts have shaped the disciplines and/or industry, and led the research and/or innovation in human-computer interaction." The criteria for election to the CHI Academy are: cumulative contributions to the field; impact on the field through development of new research directions and/or innovations; and (3) influence on the work of others.

14. I have appeared on radio shows numerous times to discuss issues relating to user interface design and people's use and frustration with common technologies, web sites, and mobile devices. My work has been discussed and I have been quoted by mainstream media around the world over 120 times, including by the New York Times, the Wall Street Journal, the Washington Post, Newsweek, the Seattle Post-Intelligencer, the Independent, Le Monde, NPR's All Things Considered, New Scientist Magazine, and MIT's Technology Review.

15. I have designed, programmed, and publicly deployed dozens of user-facing software products that have cumulatively been used by millions of users. My work is cited in patents by several major companies, including Amazon, Apple, Facebook, Google, and Microsoft. I am the co-inventor of 12 U.S. patents and 18

U.S. patent applications. The patents are generally directed to user interfaces/experience with some directed to mobile devices, including U.S. Patent No. 9,778,810 (issued 2017), entitled "Techniques to modify content and view content on mobile devices."

16. My curriculum vitae, which includes a more detailed summary of my background, experience, and publications, is attached as Appendix A.

II. LEGAL FRAMEWORK

A. Obviousness

17. I am a technical expert and do not offer any legal opinions. However, counsel has informed me as to certain legal principles regarding patentability and related matters under United States patent law, which I have applied in performing my analysis and arriving at my technical opinions in this matter.

18. I have been informed that the Patent Trial and Appeal Board ("PTAB") now applies the claim construction standard applied by Article III courts (i.e., the *Phillips* standard) regardless of whether a patent has expired. I have been informed that under the *Phillips* standard, claim terms are to be given the meaning they would have to a person having ordinary skill in the art at the time of the invention, taking into consideration the patent, its file history, and, secondarily, any applicable extrinsic evidence (e.g., dictionary definitions). I have reviewed the claim construction section in the Petition. In my analyses below, I have applied the express

construction set forth in the Petition and a plain and ordinary meaning for all other claim language pursuant to the *Phillips* standard.

19. I have also been informed that a person cannot obtain a patent on an invention if the differences between the invention and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art. I have been informed that a conclusion of obviousness may be founded upon more than a single item of prior art. I have been further informed that obviousness is determined by evaluating the following factors: (1) the scope and content of the prior art, (2) the differences between the prior art and the claim at issue, (3) the level of ordinary skill in the pertinent art, and (4) secondary considerations of non-obviousness. In addition, the obviousness inquiry should not be done in hindsight. Instead, the obviousness inquiry should be done through the eyes of a person having ordinary skill in the relevant art at the time the patent was filed.

20. In considering whether certain prior art renders a particular patent claim obvious, counsel has informed me that I can consider the scope and content of the prior art, including the fact that one of skill in the art would regularly look to the disclosures in patents, trade publications, journal articles, industry standards, product literature and documentation, texts describing competitive technologies, requests for comment published by standard setting organizations, and materials

from industry conferences, as examples. I have been informed that for a prior art reference to be proper for use in an obviousness analysis, the reference must be "analogous art" to the claimed invention. I have been informed that a reference is analogous art to the claimed invention if: (1) the reference is from the same field of endeavor as the claimed invention (even if it addresses a different problem); or (2) the reference is reasonably pertinent to the problem faced by the inventor (even if it is not in the same field of endeavor as the claimed invention). In order for a reference to be "reasonably pertinent" to the problem, it must logically have commended itself to an inventor's attention in considering his problem. In determining whether a reference is reasonably pertinent, one should consider the problem faced by the inventor, as reflected either explicitly or implicitly, in the specification. I believe that all of the references that my opinions in this IPR are based upon are well within the range of references a person having ordinary skill in the art would consult to address the type of problems described in the Challenged Claims.

21. I have been informed that, in order to establish that a claimed invention was obvious based on a combination of prior art elements, a clear articulation of the reason(s) why a claimed invention would have been obvious must be provided. Specifically, I am informed that, under the U.S. Supreme Court's *KSR* decision, a combination of multiple items of prior art renders a patent claim obvious when there was an apparent reason for one of ordinary skill in the art, at the time of the invention,

to combine the prior art, which can include, but is not limited to, any of the following rationales: (A) combining prior art methods according to known methods to yield predictable results; (B) substituting one known element for another to obtain predictable results; (C) using a known technique to improve a similar device in the same way; (D) applying a known technique to a known device ready for improvement to yield predictable results; (E) trying a finite number of identified, predictable potential solutions, with a reasonable expectation of success; (F) identifying that known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; or (G) identifying an explicit teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine the prior art references to arrive at the claimed invention.

22. I am informed that the existence of an explicit teaching, suggestion, or motivation to combine known elements of the prior art is a sufficient, but not a necessary, condition to a finding of obviousness. This so-called "teaching suggestion-motivation" test is not the exclusive test and is not to be applied rigidly in an obviousness analysis. In determining whether the subject matter of a patent claim is obvious, neither the particular motivation nor the avowed purpose of the patentee controls. Instead, the important consideration is the objective reach of the

claim. In other words, if the claim extends to what is obvious, then the claim is invalid. I am further informed that the obviousness analysis often necessitates consideration of the interrelated teachings of multiple patents, the effects of demands known to the technological community or present in the marketplace, and the background knowledge possessed by a person having ordinary skill in the art. All of these issues may be considered to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent.

23. I also am informed that in conducting an obviousness analysis, a precise teaching directed to the specific subject matter of the challenged claim need not be sought out because it is appropriate to take account of the inferences and creative steps that a person of ordinary skill in the art would employ. The prior art considered can be directed to any need or problem known in the field of endeavor at the time of invention and can provide a reason for combining the elements of the prior art in the manner claimed. In other words, the prior art need not be directed towards solving the same specific problem as the problem addressed by the patent. Further, the individual prior art references themselves need not all be directed towards solving the same problem. I am informed that, under the *KSR* obviousness standard, common sense is important and should be considered. Common sense teaches that familiar items may have obvious uses beyond their primary purposes.

24. I also am informed that the fact that a particular combination of prior art elements was "obvious to try" may indicate that the combination was obvious even if no one attempted the combination. If the combination was obvious to try (regardless of whether it was actually tried) or leads to anticipated success, then it is likely the result of ordinary skill and common sense rather than innovation. I am further informed that in many fields it may be that there is little discussion of obvious techniques or combinations, and it often may be the case that market demand, rather than scientific literature or knowledge, will drive the design of an invention. I am informed that an invention that is a combination of prior art must do more than yield predictable results to be non-obvious.

25. I am informed that for a patent claim to be obvious, the claim must be obvious to a person of ordinary skill in the art at the time of the invention. I am informed that the factors to consider in determining the level of ordinary skill in the art include (1) the educational level and experience of people working in the field at the time the invention was made, (2) the types of problems faced in the art and the solutions found to those problems, and (3) the sophistication of the technology in the field.

26. I am informed that it is improper to combine references where the references teach away from their combination. I am informed that a reference may be said to teach away when a person of ordinary skill in the relevant art, upon reading

the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the patent applicant. In general, a reference will teach away if it suggests that the line of development flowing from the reference's disclosure is unlikely to be productive of the result sought by the patentee. I am informed that a reference teaches away, for example, if (1) the combination would produce a seemingly inoperative device, or (2) the references leave the impression that the product would not have the property sought by the patentee. I also am informed, however, that a reference does not teach away if it merely expresses a general preference for an alternative invention but does not criticize, discredit, or otherwise discourage investigation into the invention claimed.

27. I am informed that even if a *prima facie* case of obviousness is established, the final determination of obviousness must also consider "secondary considerations" if presented. In most instances, the patentee raises these secondary considerations of non-obviousness. In that context, the patentee argues an invention would not have been obvious in view of these considerations, which include: (a) commercial success of a product due to the merits of the claimed invention; (b) a long-felt, but unsatisfied need for the invention; (c) failure of others to find the solution provided by the claimed invention; (d) deliberate copying of the invention by others; (e) unexpected results achieved by the invention; (f) praise of the

invention by others skilled in the art; (g) lack of independent simultaneous invention within a comparatively short space of time; (h) teaching away from the invention in the prior art.

28. I am further informed that secondary considerations evidence is only relevant if the offering party establishes a connection, or nexus, between the evidence and the claimed invention. The nexus cannot be based on prior art features. The establishment of a nexus is a question of fact. While I understand that the Patent Owner here has not offered any secondary considerations at this time, I will supplement my opinions in the event that the Patent Owner raises secondary considerations during the course of this proceeding.

III. OPINION

A. Level of a Person of Ordinary Skill in the Art

29. I was asked to provide my opinion as to the level of skill of a person having ordinary skill in the art ("PHOSITA") of the '949 Patent at the time of the claimed invention, which counsel has told me to assume is May 11, 1999. In determining the characteristics of a hypothetical person of ordinary skill in the art of the '949 Patent, I considered several factors, including the type of problems encountered in the art, the solutions to those problems, the rapidity with which innovations are made in the field, the sophistication of the technology, and the education level of active workers in the field. I also placed myself back in the time

frame of the claimed invention and considered the colleagues with whom I had worked at that time.

30. In my opinion, a PHOSITA at the time of the claimed invention of the '949 Patent would have had at least a bachelor's degree in electrical engineering or equivalent with at least one year of experience in the field of human computer interaction. Additional education or experience might substitute for the above requirements. Such a PHOSITA would have been capable of understanding the '949 Patent and the prior art references discussed herein.

31. Based on my education, training, and professional experience in the field of the claimed invention, I am familiar with the level and abilities of a person of ordinary skill in the art at the time of the claimed invention. Additionally, I met at least these minimum qualifications to be a person having ordinary skill in the art as of the time of the claimed invention of the '949 Patent.

B. Description of the Alleged Invention of the '949 Patent

32. Generally directed to digital imaging, the '949 Patent seeks to automate the process of taking a picture by analyzing the scene and capturing an image when "certain poses of objects, sequences of poses, motions of objects, or any other states or relationships of objects are represented." *'949 Patent* at 1:50-2:8. The patent describes a number of different scenarios that, when detected, cause the camera to capture an image. Some examples include detecting (1) a "[s]ubject in a certain

pose," (2) a "[s]ubject in a sequence of poses," (3) a "[p]ortion of [s]ubject in a sequence of poses (e.g., gestures)," (4) a "[s]ubject or portion(s) in a specific location or orientation," (5) a "[s]ubject in position relative to another object or person" such as a "bride and groom kissing in a wedding," and (6) "a subject undertak[ing] a particular signal comprising a position or gesture" such as "raising one's right hand." *Id*. at 5:30-49. Only gestures are claimed, however. Each of the Challenged Claims requires detecting or determining a "gesture has been performed." *Id*. at Independent Claims 1, 8, 13. Accordingly, the Challenged Claims are directed to a camera capable of detecting a predetermined gesture that, when detected, causes the camera to capture and store image(s).

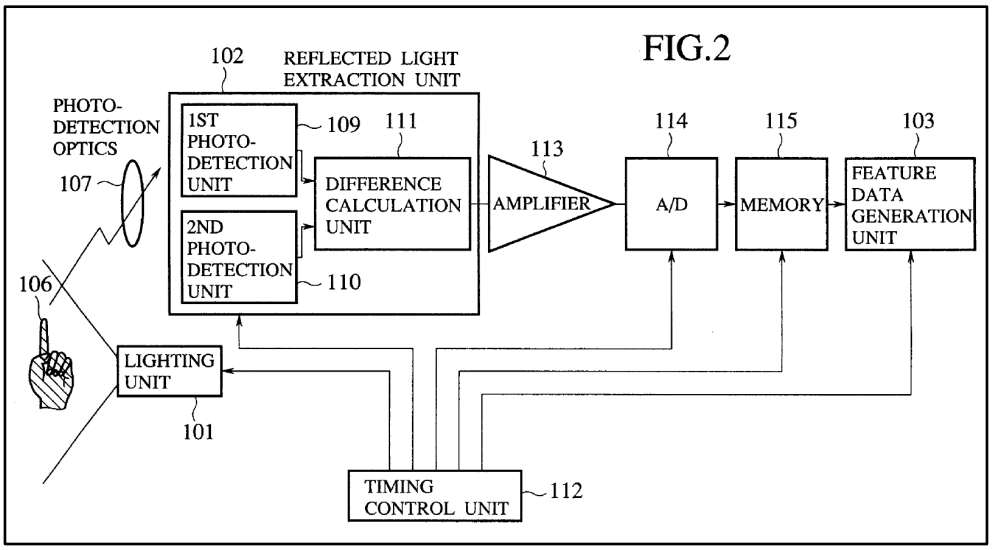
C. *Overview of Numazaki* (Ex. 1004)

33. *Numazaki* describes numerous hardware configurations and applications directed to users interacting with a computer via gestures. In the subsequent paragraphs, I address a few described embodiments that are particularly relevant to my opinions below.

Numazaki's First Embodiment—Two-Camera Gesture Detection

34. In its first embodiment, *Numazaki* describes a two-camera structure for detecting a user's gestures. Namely, *Numazaki* purports to have improved upon prior methods by using a controlled light source to illuminate the target object (e.g., the user's hand), a first camera unit (referred to by *Numazaki* as a "photo-detection

unit"), and a second camera unit. *Numazaki* at 11:9-23. This arrangement is illustrated in Fig. 2 below:



Id. at Fig. 2. A timing control unit is used to turn lighting unit 101 on (i.e., illuminating the target object) when the first camera unit is active and off when the second camera unit is active. *Id*. at 11:20-32. The result of this light control is the first camera unit captures an image of the target object illuminated by both natural light and the lighting unit 101 and the second camera unit captures an image of the target object illuminated by only natural light. *Id*. at 11:33-39. The difference between the two images—obtained by difference calculation unit 111—represents the "reflected light from the object resulting from the light emitted by the lighting unit 101." *Id*. at 11:43-51. This information is then used by feature data generation unit 103 to determine gestures, pointing, etc. of the target object that may be converted into commands executed by a computer. *Id*. at 10:57-66.

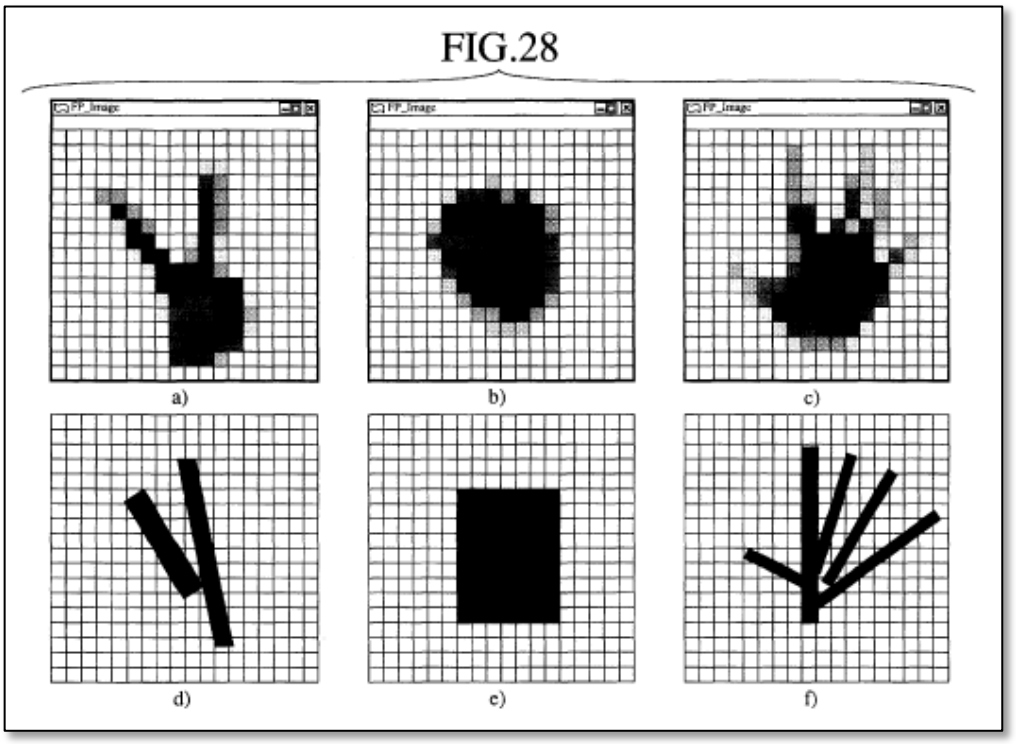
35. The "photo-detection units" depicted in Fig. 2 and described in *Numazaki* are "camera units." Each performs the basic function of a "camera," which is to capture image information based on light captured by the sensors' pixels. Further, *Numazaki* notes that these units can be "CMOS sensors" or "CCD image sensors." *Id*. at 15:24-16:19. These were two widely recognized technologies used to implement imaging sensors for cameras. *See, e.g.*, "CCD and CMOS Imaging Array Technologies," Stuart Taylor, Xerox Research Centre Europe, 1998 (Ex. 1013) (discussing the history of CCD and CMOS imaging technologies, concluding that CMOS is likely to overtake CCD devices for future imaging).

Numazaki's Third Embodiment—Converting Gestures into Commands

36. *Numazaki's* third embodiment is "another exemplary case of the feature data generation unit of the first embodiment, which realizes a gesture camera for recognizing the hand action easily and its application as a pointing device in the three-dimensional space." *Id*. at 29:4-8. In this embodiment, data reflecting pre-registered gestures or hand positions is stored in "shape memory unit 332." *Id*. at 29:19-55. This stored data is used to identify when the user has performed a pre-registered gesture and instructs the device to implement a "command corresponding to that [gesture]." *Id*. at 29:54-30:5. In addition to "hand [g]esture recognition as the means for inputting the command in the three-dimensional space and the like into the computer," the third embodiment contemplates additional gesture-based

instructions such as "instructing the power ON/OFF of the TV, the lighting equipment, etc." *Id*. at 31:3-10.

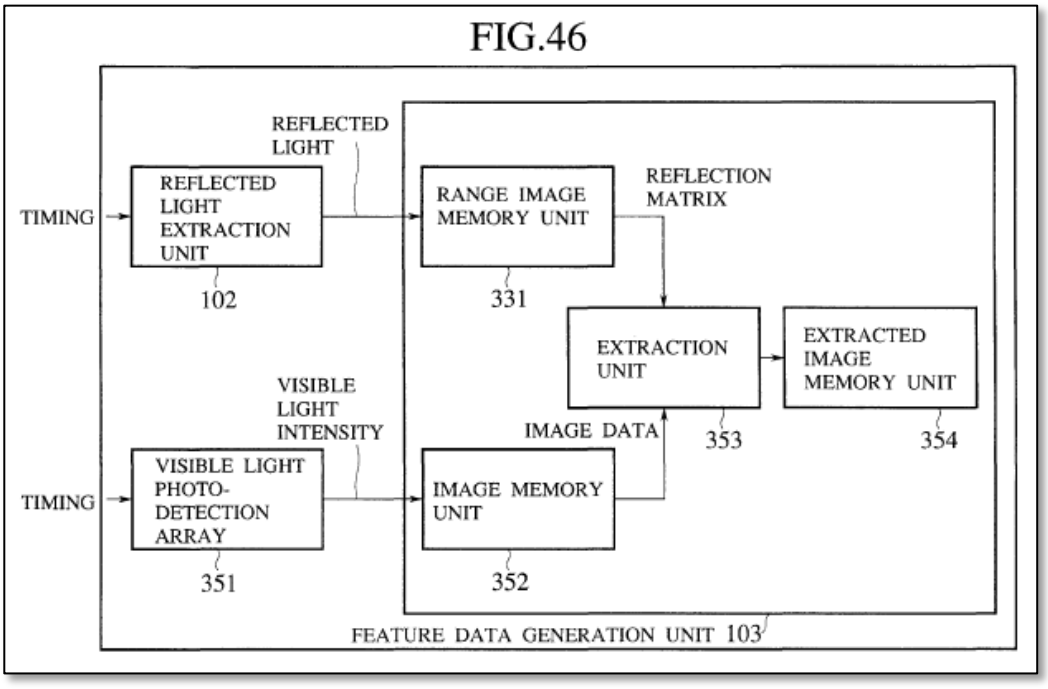
37. *Numazaki* cautions that gestures can be erroneously detected when the user did not intend to command the system and proposes a sequence of gestures to prevent such "erroneous commanding." *Id*. at 31:11-44, Fig. 29 (describing a sequence of "two fingers, fist, five fingers" that causes the system to "power on"). Such a sequence (frames a-c) and the rectangular data extracted from the images (frames d-f) are illustrated in Fig. 28 below:



Id. at Fig. 28.

Numazaki's Fifth Embodiment—Image Capture for Videoconference Applications

38. *Numazaki's* fifth embodiment is directed to video capture and transmission for applications such as videoconferencing. Specifically, the fifth embodiment recognizes the difficulties involved with videoconference applications using a portable device, including communication costs and power consumption. *Id*. at 39:6-16. To combat these difficulties, *Numazaki* teaches a "TV telephone" that extracts and transmits only the faces of the participating users, removing extraneous background information that would otherwise consume bandwidth and battery power. *Id*. at 39:12-20. To accomplish this improvement, *Numazaki* uses the same two-camera structure described with respect to the first embodiment, using the reflected light sensor to identify an outline of the subject and subtracting from the other sensor's image everything that falls outside the subject's outline. *Id*. at 39:24-60. Specifically, *Numazaki* uses the same two-camera "reflected light extraction unit 102" (i.e., the same component 102 from first embodiment) in conjunction with a separate "visible light photo-detection array 351 which is generally used as a CCD camera for taking video images." *Id*. at 39:21-49. This structure is depicted in Fig. 46 below:

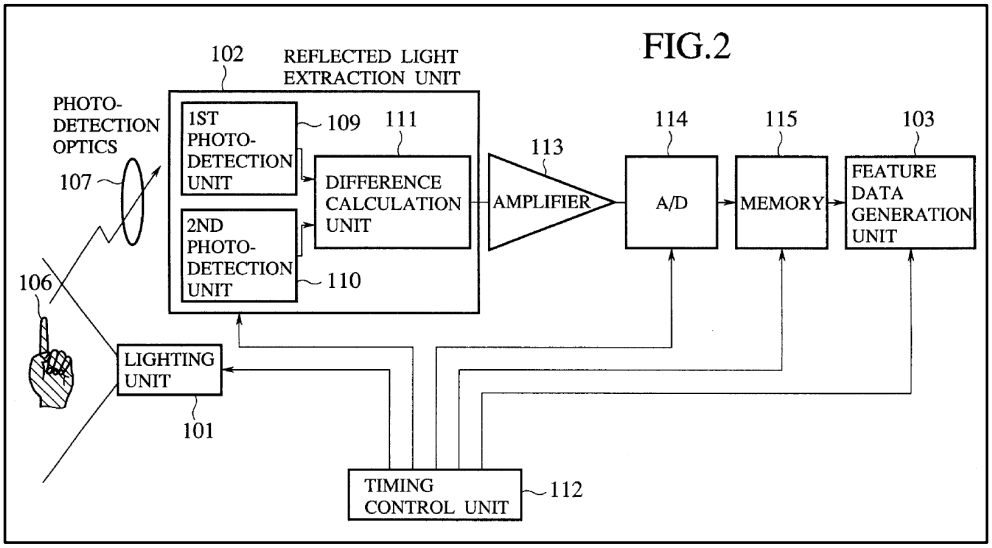


Id. at Fig. 46. Using this arrangement, the fifth embodiment processes the output of two-sensor structure 102 to identify an outline of the subject and subtracts everything outside this outline from the image captured by the visible light sensor 351. *Id*. at 39:24-60. In doing so, the fifth embodiment arrives at image information that contains only the subject without any background image information and uses much less data by removing the extraneous image information. *Id*. at 40:32-35 ("By recording the extracted image, it is possible to reduce the recording capacity considerably (in an order of one tenth to one hundredth)[.]").

Both the Third and Fifth Embodiments Use the Two-Sensor Reflected Light Extraction Unit Described in Numazaki's First Embodiment

39. For a number of reasons, A PHOSITA would have understood the "reflected light extraction unit" in the third embodiment and in the fifth embodiment

is the same two-sensor structure as "reflected light extraction unit 102" from the first embodiment. As described above, *Numazaki* purports to have improved upon prior methods by using a controlled light source to illuminate the target object (e.g., the user's hand), a first camera unit, and a second camera unit. *Numazaki* at 11:9-23. This arrangement is illustrated in Fig. 2 below:



Id. at Fig. 2. A timing control unit is used to turn lighting unit 101 on (i.e., illuminating the target object) when the first camera unit is active and off when the second camera unit is active. *Id*. at 11:20-32. The result of this light control is the first camera unit captures an image of the target object illuminated by both natural light and the lighting unit 101 and the second camera unit captures an image of the target object illuminated by only natural light. *Id*. at 11:33-39. The difference between the two images—obtained by difference calculation unit 111—represents the "reflected light from the object resulting from the light emitted by the lighting

unit 101." *Id*. at 11:43-51. In other words, *Numazaki's* "reflected light extraction unit 102" uses two image sensors to arrive at an image of an object such as the user's hand.

40. Both the third and fifth embodiments use the same language—reflected light extraction unit—to describe image sensor unit they rely upon for their respective functions. *Id*. at 29:22-24 (in the context of the third embodiment, noting "the range image extracted by the **reflected light extraction unit** is registered into the range image memory unit 331") (emphasis added), 39:24-26 (noting that the fifth embodiment, "as in the third [] embodiment[], the feature data generation unit 103 includes a range image memory unit 331 for storing the reflected light image"), 39:42-65 (repeatedly referring to the "reflected light extraction unit 102," which even uses the same reference number as the first embodiment).

41. Similarly, both the third and fifth embodiments refer to the output of the reflected light extraction unit using the same "range image" language as introduced in the first embodiment. *Id*. at 16:34-60 (the first embodiment describing the output of the reflected light extraction unit as a "range image" from which 3D information may be extracted), 29:22-24 (noting the third embodiment uses a "range image extracted by the reflected light extraction unit"), 39:24-26 (noting the fifth embodiment includes "a range image memory unit 331 for storing the reflected light image").

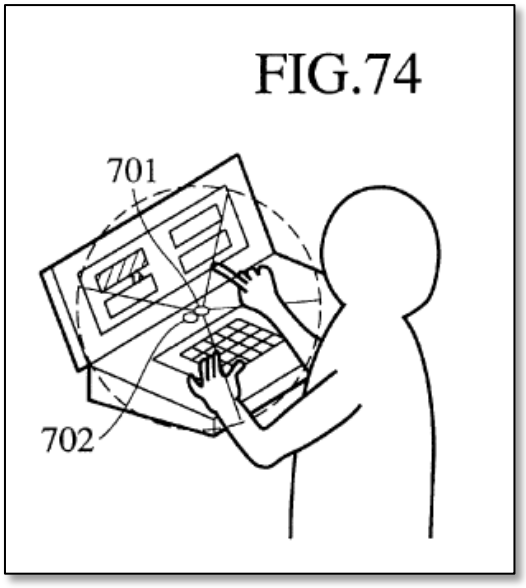
42. Finally, both the third and fifth embodiments expressly note that they are exemplary cases of the structure described in the first embodiment. *Id*. at 29:4-6 ("This third embodiment is directed to another exemplary case of the feature data generation unit of the first embodiment[.]"), 39:17-19 ("[T]his fifth embodiment is directed to another exemplary case of the feature data generation unit in the first embodiment[.]"). This is entirely consistent with the purpose of the reflected light extraction unit. In the first embodiment, this two-sensor structure is used with a controlled light source to obtain an image of an object such as a user. In the third embodiment, the same two-sensor structure is used to obtain an image just that—the user's hand such that the system can determine if a preregistered gesture/pose has been performed. Similarly, the fifth embodiment uses this two-sensor structure to obtain the outline of an object such as the user such that it can be used to remove extraneous video information from the image data captured by a third image sensor.

43. Based on all the above, a PHOSITA would have concluded that the "reflected light extraction units" described in the third and fifth embodiments are the same two-sensor units introduced and described in the first embodiment.

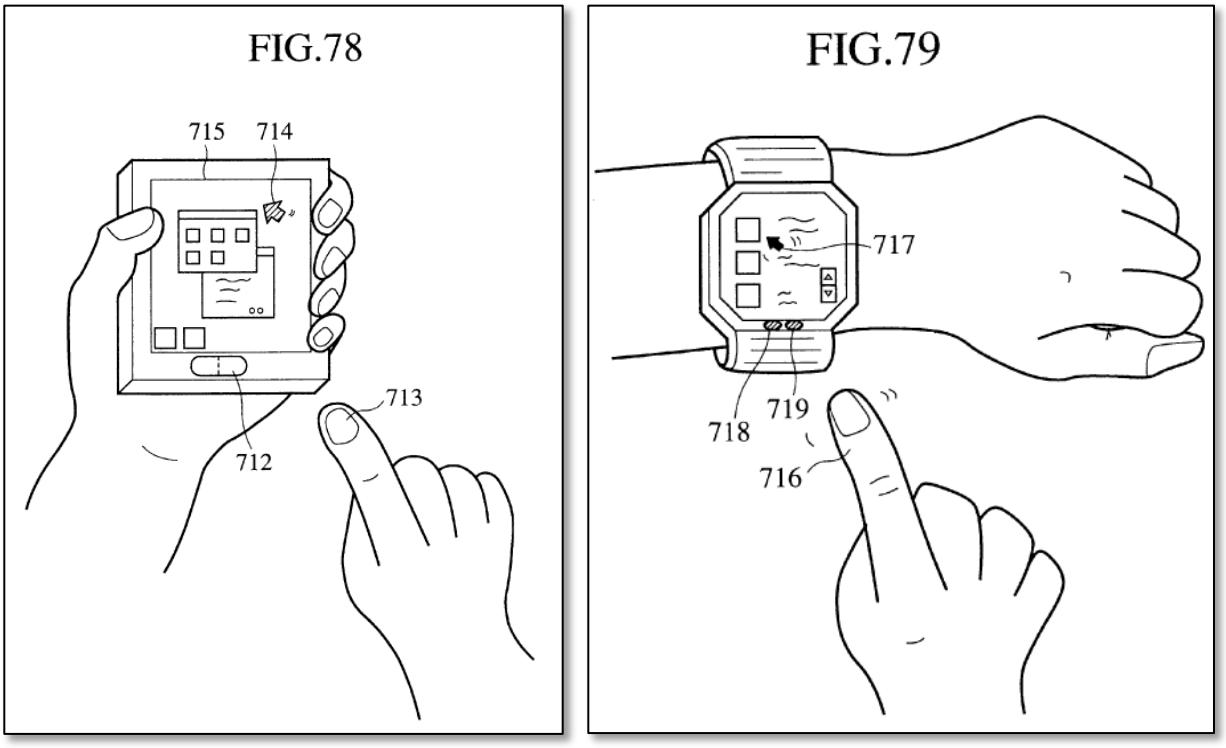
Numazaki's Eighth Embodiment—Portable Devices Implementing the Earlier Described Functionalities

44. *Numazaki's* eighth embodiment describes various portable computers such as laptops and handheld devices on which the earlier-described hardware and functionalities may be implemented. *Id*. at 50:19-24 ("This eighth embodiment is

directed to a system configuration incorporating the information input generation apparatus of the present invention as described in the above embodiments."). For example, Fig. 74 depicts a laptop computer with a lighting unit 701 and camera unit 702:



Id. at Fig. 74, 50:25-37 (describing the same). "In this configuration, the operator operating the keyboard can make the pointing or gesture input by slightly raising and moving the index finger. The user's convenience is remarkably improved here because the keyboard input and the pointing or gesture input can be made without hardly any shift of the hand position. It is also possible to provide a button for use in conjunction with the pointing or gesture input. The operations such as click and drag for selecting and moving icons on the screen can be carried out by using this button." *Id*. at 50:38-48. Similar implementations in which a user can control a cursor by moving a finger are depicted in Figs. 78-79 below:



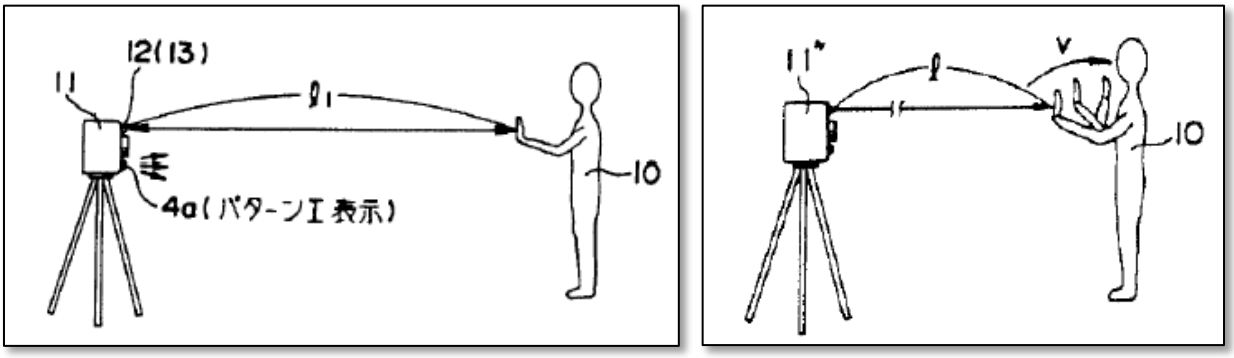
Id. at Figs. 78-79, 52:5-23 (describing the same). As noted above, *Numazaki* contemplates these portable devices implementing the information input generation apparatus described in the preceding embodiments. *Id*. at 50:19-24 ("This eighth embodiment is directed to a system configuration incorporating the information input generation apparatus of the present invention as described in the above embodiments."). For example, *Numazaki's* eighth embodiment devices include the controlled light and two-camera configuration described in its first embodiment. As described with respect to the first embodiment above, *Numazaki's* information input generation apparatus uses controlled lighting and two camera sensors to isolate an image of an object (such as a user's hand) by subtracting the image taken when the light is off from the image taken when the light is on, thereby obtaining an image

that focuses on the illuminated object. *Numazaki* teaches that this precise image difference calculation is included in the eighth embodiment. *Id*. at 53:22-36. Accordingly, a PHOSITA would have understood that *Numazaki's* eighth embodiment portable devices incorporate the controlled lighting and two-camera sensor structure described with respect to the first embodiment. Where relevant to my opinions below, I explain why a PHOSITA would also have been motivated to implement in the eighth embodiment devices hardware and functionalities described with respect to *Numazaki's* earlier described embodiments.

45. Because *Numazaki*, like the '949 Patent, discloses a camera system that may be controlled by human gesture input, *Numazaki* is in the same field of endeavor as the '949 Patent. *Compare Numazaki* at 31:3-10 (noting gesture recognition is used as "the means for inputting the command . . . into the computer" and noting gestures can be used to turn on/off equipment such as a TV or lighting equipment), 50:25-48 (describing a portable laptop device equipped with a light source and camera such that a user can control certain functionalities using hand gestures) *with '949 Patent* at 5:24-49 (describing the process of identifying a subject has performed a predetermined gesture and controlling the camera device to capture an image in response). Accordingly, a PHOSITA would have considered *Numazaki* analogous art to the '949 Patent.

D. *Overview of Nonaka* (Ex. 1005)

46. *Nonaka* teaches a "remote release device-equipped camera" that allows a user to signal a desire for the camera to take a picture by "mak[ing] a predetermined motion." *Nonaka* at 15:11-14. *Nonaka* contemplates multiple predetermined gestures such as holding one's hand out toward the camera (as depicted in Fig. 3 below left) or moving one's hand toward the camera (as depicted in Fig. 7 below right):



Id. at Figs. 3, 7, 3:34-4:4 (describing "the photographer giv[ing] a release instruction by means of a predetermined motion towards the camera . . . such as moving his or her hand forward"), 6:11-22 (describing "the photographer [giving] a release instruction . . . by . . . mov[ing] his or her hand, etc. at a certain speed").

47. Because *Nonaka*, like the '949 Patent, discloses a camera system that may be controlled by human gesture input, *Nonaka* is in the same field of endeavor as the '949 Patent. *Compare Nonaka* at 14:32-36 ("[D]uring the remote release operation of the camera according to the present exemplary embodiment, if the

photographer makes a motion such as moving his or her hand . . . when he or she intends to carry out the release operation, the photographer is thus able to communicate that intent to the camera.") *with '949 Patent* at 5:24-49 (describing the process of identifying a subject that has performed a predetermined gesture and controlling the camera device to capture an image in response). Accordingly, a PHOSITA would have considered *Nonaka* analogous art to the '949 Patent.

E. Motivation to Combine *Numazaki* and *Nonaka*

48. As discussed above, *Numazaki's* first embodiment teaches a two-camera "reflected light extraction unit" through which an object such as a user's hand can be detected. *Numazaki's* third embodiment takes the output from the two-sensor "reflected light extraction unit," compares it with stored data reflecting pre-registered gestures or hand positions in "shape memory unit 332" to detect when the user has performed a pre-registered gesture, and instructs the device to implement a "command corresponding to that [gesture]." *Numazaki* at 29:19-30:5. Such gesture commands, for example, can instruct the system to turn devices on or off. *Id*. at 31:3-10. In its fifth embodiment, *Numazaki* adds an additional "visible light photo-detection array 351 . . . for taking video images." *Id*. at 39:21-49. Using this arrangement, the fifth embodiment processes the output of two-sensor "reflected light extraction unit" 102 to identify an outline of the subject and subtracts everything outside this outline from the image captured by the visible light sensor

351, thereby decreasing the size of the ultimate video file. *Id*. at 39:24-60, 4:32-35. Finally, *Numazaki's* eighth embodiment teaches portable devices that implement the information input generation apparatus described in the preceding embodiments. *Id*. at 50:19-24. Although *Numazaki* does not expressly describe combining all these features into a single portable device such that a user could perform a gesture command (pursuant to its third embodiment) that causes video capture to initiate (pursuant to its fifth embodiment), a PHOSITA would have been motivated to implement *Numazaki's* portable device in this manner pursuant to *Nonaka's* image capture command gesture teachings.

49. First, implementing *Numazaki's* features as proposed would have improved *Numazaki's* portable laptop in the same way *Nonaka's* gesture-based image capture functionality benefits its camera device. *Numazaki* does not teach a specific process for initiating the video capture as part of its fifth embodiment, but a PHOSITA would have understood that this video capture process could be started using any of a number of standard methods for initiating a video. For example, the user could manually start the process by pressing a button or otherwise interacting with *Numazaki's* device such as through the mouse pad or a remote control. A PHOSITA would also have understood that many camera applications use timers, which allow the user some time to get prepared before the video capture begins. Better than either manual interaction or timers, *Numazaki's* native functionality of

associating hand gestures with commands would have been a natural fit as a means to initiate video capture. *Nonaka* explains that users desired the ability to remotely trigger image capture, but that then-existing options were limited to self-timer mechanisms and expensive wireless remote controls—both of which were undesirable. *Nonaka* (Ex. 1005), 2:6-25. According to *Nonaka*, its gesture-based image capture solution "achiev[es] a higher degree of freedom, good portability, and cost benefits." *Id*. at 2:26-29. A PHOSITA would have recognized that these same benefits would be realized in *Numazaki's* portable laptop. Namely, implementing *Numazaki's* laptop as proposed would provide a greater degree of freedom than alternative means of trigger image capture such as timers or manual initiation, ensuring the user is able to get in position and prepared before the video capture begins. Using gesture-based image capture initiation also maintains *Numazaki's* portability and reduces costs by employing *Numazaki's* native gesture recognition functionality, rather than adding wireless or wired remote control hardware.

50. Second, a PHOSITA would have been motivated to utilize distinct sensor units to perform the gesture recognition and video capture. Specifically, the lower resolution "reflected light extraction unit" 102 is well suited to monitor the scene and detect any gestures performed by the user, while the higher resolution "visible light photo-detection array 351" is better suited for taking full quality images of the scene (when such video is requested by the user). It was widely

recognized that lower resolution monitoring enables a system to quickly respond to changes in the environment and is preferable to higher resolution monitoring. A key requirement of many image processing systems is that they operate quickly enough to respond to changes in the visual environment in a timely fashion. This is especially true for systems that need to respond to events as they happen in the physical world. Because the essential nature of image processing is that the pixels in the image are examined, the more pixels there are, the heavier the computational requirements are, and the slower the system can respond. A tension is that if an image does not hold enough detail about a scene, the image processing algorithm will not have enough information to correctly analyze that scene. Thus, it is not surprising that managing the resolution of images for processing is an essential part of image processing systems. People have for decades found ways to work with lower resolution images—sometimes starting with lower resolution images at first, and then working with higher resolution images later for fine-tuned processing. This approach was described in a well-known computer vision textbook (one that I used myself as a graduate student):

> All of the computations listed above benefit from the idea of *resolution pyramids*. A pyramid is a generalized image data structure consisting of the same image at several successively increasing levels of resolution. As the resolution increases, more samples are required to represent the increased information and hence the successive levels are larger, making the entire structure look like a pyramid. Pyramids allow the introduction of many different coarse-to-fine image-resolution algorithms which are vastly more efficient than their single-level, high-resolution-only counterparts.

Dana Harry Ballard and Christopher M. Brown. 1982. "Computer Vision" (1st. ed.). Prentice Hall Professional Technical Reference (Ex. 1015) at p. 15. In my own work doing image processing, I would often use lower resolution images than were available from a camera in order to speed up processing. And the focus of my dissertation was on image processing that used images with a hybrid structure - where there was high resolution in the center of the image and low resolution in the periphery so as to balance the tension between number of pixels and acuity. With this technique, I was able to perform image processing at 32 frames per second on a tiny CCD sensor with 192x165 resolution by converting it into a hybrid structure with a total of just 1,376 pixels.

> We want to state clearly that our system *emulates* a logmap sensor with an embedded DSP and a conventional CCD. Specifically, an AD 2101 DSP reads pixel values digitized from the 192×165 Texas Instruments CCD chip TC211, and averages CCD pixels to form a 1376 pixel logmap. But the DSP is fast enough to run the readout at 32 fps, so the emulated sensor is, in effect, a sensor. The sensor emulator contained only commodity integrated circuits, which eliminated the need for costly custom VLSI.

Wallace, R.; Ong, P.; Bederson, B.; Schwartz, E. 1993. "Space Variant Image Processing", New York University TR-1993-633 (Ex. 1016) at p. 4.

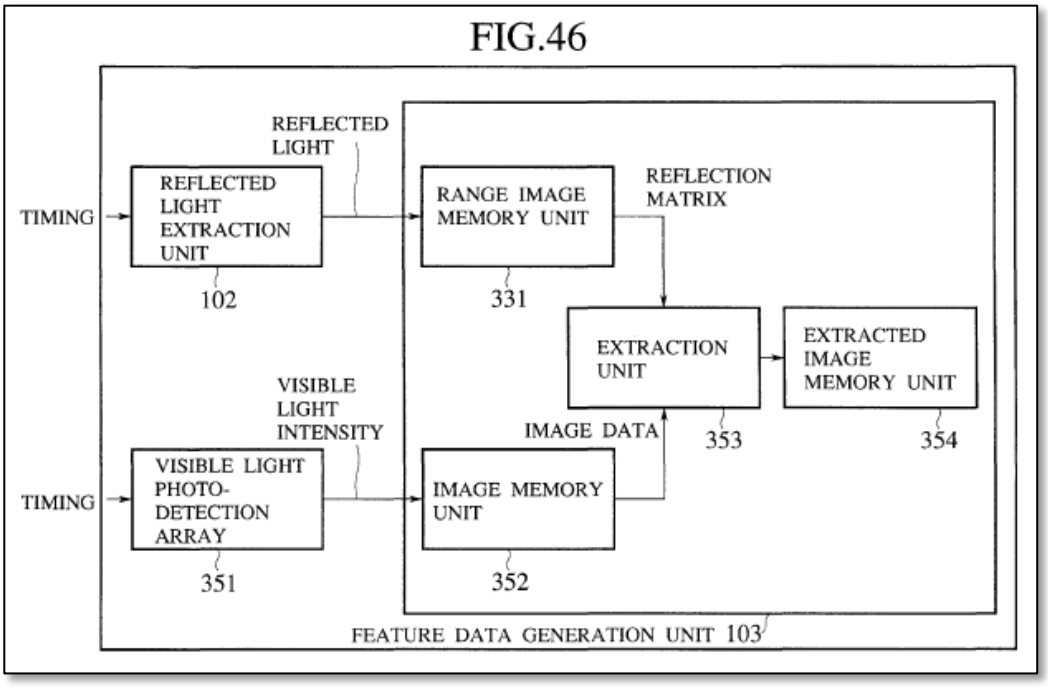
51. Third, a PHOSITA would have anticipated success in implementing *Numazaki* in this manner given that *Numazaki* already includes the technical hardware and programming necessary to detect gestures, associate gestures with commands, and capture video, and expressly contemplates incorporating these early-described embodiments in the eighth embodiment portable laptop. As discussed at length above, the third embodiment uses *Numazaki's* two-sensor reflected light extraction unit 102 to recognize hand-based gestures and then maps these gestures to commands such as turning a device on or off. The fifth embodiment uses the same two-sensor reflected light extraction unit 102 and adds a third "visible light photo-detection array" that serves as a video camera. The eighth embodiment's portable device, such as Fig. 74's laptop, already includes "the information input generation apparatus of the present invention as described in the above embodiments" (*Numazaki* at 50:19-24), which a PHOSITA would have recognized includes at least the two-sensor reflected light extraction unit 102 and gesture recognition functionality. *Id.* at 53:22-36 (teaching that the two-sensor differencing process for gesture recognition is part of the eighth embodiment portable devices). A PHOSITA would have understood that adding a third image sensor to the portable laptop in support of the fifth embodiment's video capture functionality would have been straightforward and well within the skill set of a PHOSITA. Indeed, *Numazaki* even notes that the multiple sensors could be "mixed[] within the same photo-detection

array, and share a photo-detection lens so as to reduce the size and the weight." *Numazaki* (Ex. 1004), 39:42-49. By mid-1999, portable videoconference devices were in the marketplace, demonstrating the technical feasibility. In fact, by the summer of 1999, Kyocera released a videoconferencing cellular phone device—a form factor much smaller than *Numazaki's* Fig. 74 laptop. "First Mobile Videophone Introduced," May 18, 1999 (Ex. 1017).

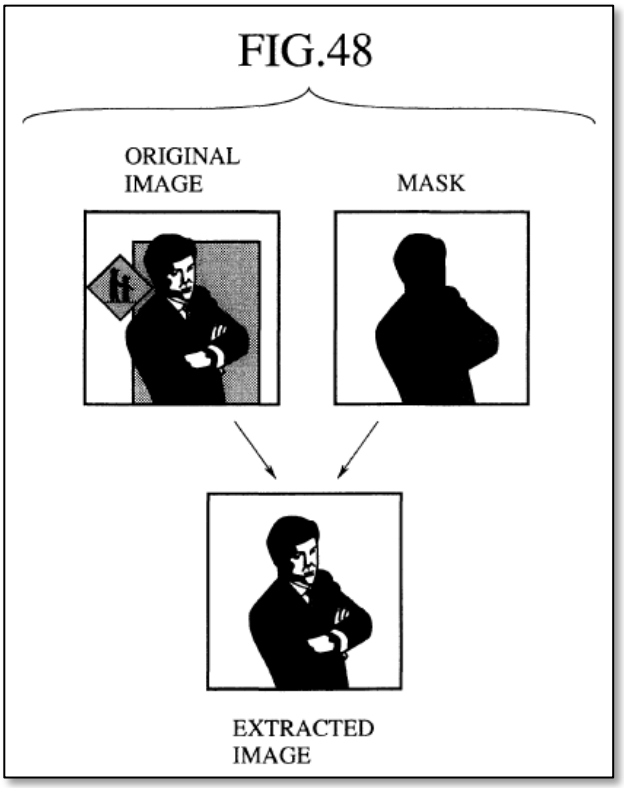
F. Opinions Supporting Obviousness over *Numazaki* in View of *Nonaka*

1. ***Claim 1(a): a device housing including a forward facing portion, the forward facing portion of the device housing encompassing an electro-optical sensor having a field of view and including a digital camera separate from the electro-optical sensor***

52. In its fifth embodiment videoconference application, *Numazaki* uses the same two-camera "reflected light extraction unit 102" (i.e., the same component 102 from first embodiment) in conjunction with a separate "visible light photo-detection array 351 which is generally used as a CCD camera for taking video images." *Id*. at 39:21-49. This structure is depicted in Fig. 46 below:



Id. at Fig. 46. Using this arrangement, the fifth embodiment processes the output of two-sensor structure 102 to identify an outline of the subject and subtracts everything outside this outline from the image captured by the visible light sensor 351. *Id*. at 39:24-60. Given this functionality in which the output of unit 102 is used to define which portions the video captured by camera 351 are retained, a PHOSITA would have understood that both are forward facing and have overlapping fields of view. If the sensor units were not both facing the same direction—forward toward the user—the output of the first unit could not be used to define which portions of the second unit's output should be retained. The process for using the unit 102 output to define which portions of the camera 351 image data are retained is illustrated in Fig. 48 below:



Numazaki at Fig. 48. As explained at 39:50-60, the "original image" in the top left is the output of camera 351 and the mask is the output of sensors 102. Using the mask to define the subject, *Numazaki's* fifth embodiment extracts all background image data falling outside the mask to arrive at a streamlined image that contains only the subject—the "extracted image."

2. ***Claim 1(b): a processing unit within the device housing and operatively coupled to an output of the electro-optical sensor, wherein the processing unit is adapted to: determine a gesture has been performed in the electro-optical sensor field of view based on the electro-optical sensor output***

53. As discussed above, *Numazaki's* third embodiment uses data reflecting pre-registered gestures or hand positions, which is stored in "shape memory unit

332." *Id*. at 29:19-55. This stored data is compared with the output from the two-sensor "reflected light extraction unit" (i.e., component 102 from first embodiment) to identify when the user has performed a pre-registered gesture and instructs the device to implement a "command corresponding to that [gesture]." *Id*. at 29:22-30:5. Because an image sensor can only capture data falling within its field of view, the gesture to be captured by the sensor unit 102 is necessarily performed in the sensor's field of view as claimed.

54. A PHOSITA would have understood that *Numazaki's* third embodiment gesture detection process would be implemented by "a processing unit" within *Numazaki's* laptop device and adapted (via software) to detect a user's gesture (or sequence of gestures). Laptop computers are equipped with general purpose processors that implement a wide variety of software-based routines. A PHOSITA would have understood the described gesture detection is a process particularly well-suited to software implementation and would have understood such a software governed process to be contemplated by *Numazaki*. In the alternative, a PHOSITA would certainly have been motivated to implement this gesture detection process in software, and given *Numazaki's* description, such an implementation would have been well within the abilities of a PHOSITA.

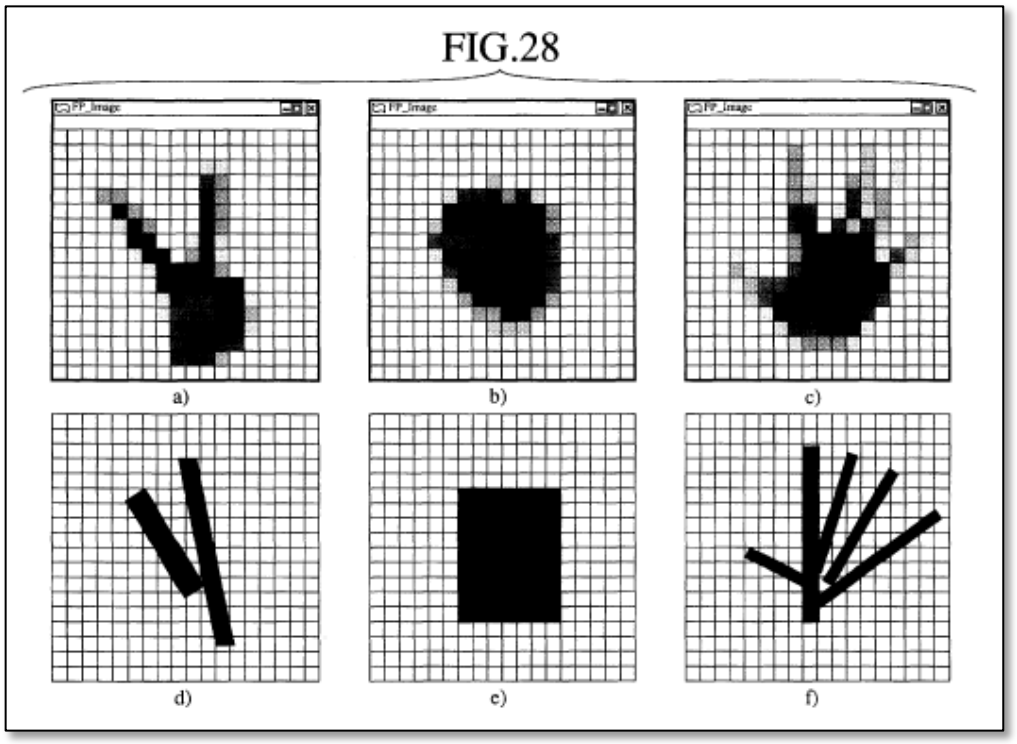
3. Claim 1(c): control the digital camera in response to the gesture performed in the electro-optical sensor field of view, wherein the gesture corresponds to an image capture command, and wherein the image capture command causes the digital camera to store an image to memory

55. As with the preceding limitation, a PHOSITA would have understood that *Numazaki's* gesture detection and image capture processes would be implemented by "a processing unit" within *Numazaki's* laptop device and adapted (via software) to perform these functions. Like *Numazaki's* gesture detection, A PHOSITA would have understood the described image capture is a process particularly well-suited to software implementation and would have understood such a software governed process to be contemplated by *Numazaki*. In the alternative, a PHOSITA would certainly have been motivated to implement this image capture process in software, and given *Numazaki's* description, such an implementation would have been well within the abilities of a PHOSITA.

4. Claim 2: The portable device of claim 1 wherein the determined gesture includes a hand motion.

56. As discussed above, *Numazaki* teaches detecting predetermined gestures and converting them into commands. But *Numazaki* cautions that gestures can be erroneously detected when the user did not intend to command the system and proposes a sequence of gestures to prevent such "erroneous commanding." *Id*. at 31:11-44, Fig. 29 (describing a sequence of "two fingers, fist, five fingers" that

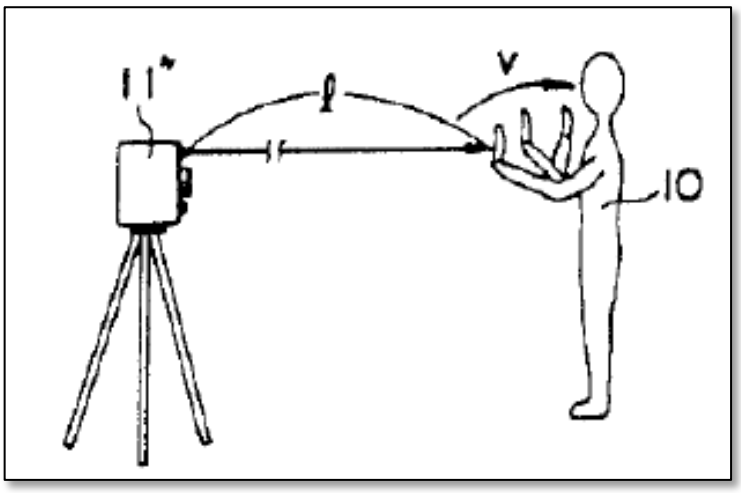
causes the system to "power on"). Such a sequence (frames a-c) and the rectangular data extracted from the images (frames d-f) are illustrated in Fig. 28 below:



Id. at Fig. 28. *Nonaka* is similarly concerned with ensuring a user intends to have performed an image capture gesture, and proposes its own solution for avoiding erroneous gesture detection. *Nonaka* at 3:34-5:26 (describing a process by which the user must perform "the motion for instructing release . . . twice in a row, [so] there is no uncertainty about the remote release operation"). Given both references' concerns over avoiding erroneous gesture detection, a PHOSITA would have been motivated to implement *Numazaki's* multiple-gesture approach to triggering image capture. Because Numazaki already includes the software to recognize sequences of hand poses and because it is a sufficiently unique gesture that will not be detected

unless a user intends to command the system through gesture, implementing *Numazaki's* "two fingers, fist, five fingers" would be effective at avoiding erroneous gesture detection. Because a user cannot transition between the depicted hand gestures without movement, a PHOSITA would have understood that sequencing between these hand signals necessarily involves hand motion.

57. In the event that *Numazaki's* gesture sequence is deemed insufficient for this limitation, it would have been obvious to implement *Nonaka's* velocity-based image capture gesture in *Numazaki's* laptop device. *Nonaka* contemplates multiple predetermined gestures, including moving one's hand toward the camera as depicted in Fig. 7 below:



Nonaka at Fig. 7, 6:11-22 (describing "the photographer [giving] a release instruction . . . by . . . mov[ing] his or her hand, etc. at a certain speed"). *Numazaki's* third embodiment expressly contemplates detecting gestures comprised of a user's hand (or finger) toward the device. Namely, *Numazaki* teaches that frames (a) and

(b) in Fig. 27 represent the "same hand action," but are distinguished in that (b) represents a hand closer to the device than (a). *Numazaki* at 30:9-38. By measuring the "transition time" between these two states, the system can detect a hand "mov[ing] forward into the depth direction" and convert this into a command. *Id*. A PHOSITA would have expected success in implementing such a motion-based gesture in *Numazaki's* laptop embodiment as a trigger to initiate video capture as discussed above.

5. ***Claim 3: The portable device of claim 1 wherein the determined gesture includes a pose.***

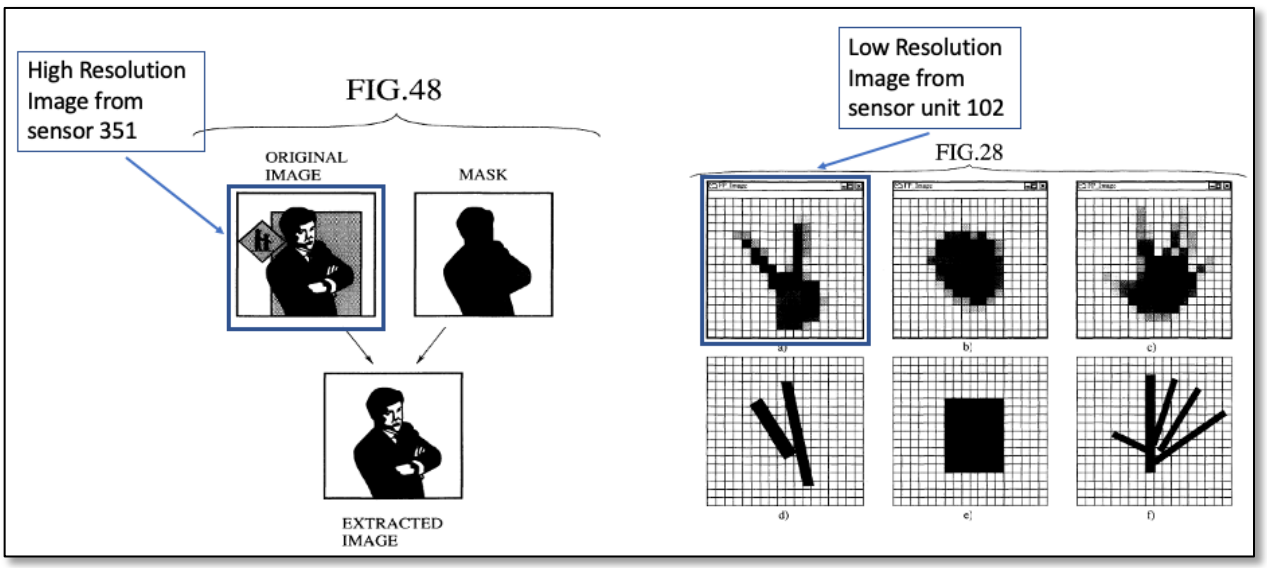
58. The '949 Patent distinguishes between a single pose and a sequence of poses and notes that a sequence of poses constitutes a "gesture." *'949 Patent* at 5:34-36. Based on this disclosure, a PHOSITA would have considered *Numazaki's* "two fingers, fist, five fingers" transition to be a sequence of poses—each unique hand position is a separate pose. Accordingly, *Numazaki's* gesture sequence illustrated in Fig. 28 "includes a pose" as claimed.

6. ***Claim 6: The portable device of claim 1 wherein the electro-optical sensor defines a resolution less than a resolution defined by the digital camera.***

59. *Numazaki* teaches that its electro-optical sensor (i.e., reflected light extraction unit) "can be manufactured at lower cost . . if it is possible to obtain" the desired information about the user's hand position/gesture "from the rough reflected light image." *Numazaki* at 17:51-56. *Numazaki* further explains that "it is possible

to obtain[] the pointing position [of a finger] by the resolution above the pixels." *Id.* at 18:15-21. A PHOSITA would have understood the principle described here to mean that a lower cost electro-optical sensor should be used when lower resolution imaging is sufficient for the given application. Choosing less expensive imaging components where higher resolution isn't required by the application is consistent with standard product design and component sourcing principles.

60. *Numazaki's* gesture recognition using its reflected light extraction unit 102 requires significantly less resolution than the visible light photo-detection array 351—the electro-optical sensor and digital camera, respectively, in *Numazaki's* fifth embodiment. Even a cursory assessment of these sensor outputs demonstrates that *Numazaki's* video camera is designed with much higher resolution than its gesture-detecting reflected light extraction unit 102:



Id. at Fig. 48 (annotated to indicate output of digital camera 351), 39:50-60

(describing the same), Fig. 28 (annotated to indicate output of reflected light extraction unit 102), 29:22-53 (noting the gesture recognition is performed using the output of reflected light extraction unit), 31:11-26 (describing Fig. 28). A PHOSITA would have understood that, based on the outputs of these units and *Numazaki's* express teaching that low resolution gesture detection sensors should be used to save costs, *Numazaki's* reflected light extraction unit 102 would have less resolution than the visible light photo-detection array 351. This is consistent with similar systems in the prior art. For example, U.S. Patent No. 5,666,157 to David G. Aviv ("*Aviv*") (Ex. 1006) teaches a scene monitoring and image capture system that includes "picture input means 10, [which] may be any conventional electronic picture pickup device operational within the infrared or visual spectrum (or both) including a vidicon and a CCD/TV camera of **moderate resolution**." *Aviv* at 4:19-23 (emphasis added). If the system detects a subject performing a gesture that matches a stored signature indicative of criminal intent, "an output 'alert' signal is sent from the comparison means 14 to a controller 18. The controller 18 controls the operation of a secondary, **high resolution** picture input means (video camera)." *Id*. at 7:14-18 (emphasis added). "The purpose of the secondary camera 20 is to provide a **detailed video signal** of the individual having assumed criminal intent." *Id*. at 7:26-28 (emphasis added). As I discuss above in ¶ 50, lower resolution monitoring enables a system to quickly respond to changes in the environment and is preferable to higher resolution

monitoring. Accordingly, not only would a PHOSITA have understood from the respective outputs that sensor unit 102 operates at lower resolution than sensor 351, a PHOSITA would have been motivated to ensure this is the case based on industry practice and performance concerns.

G. Opinions Related to *Aviv*

i. Overview of Aviv (Ex. 1006)

61. *Aviv* teaches a camera-based surveillance system for identifying "known characteristics of movements which are indicative of individuals having criminal intent." *Aviv* at Abstract. Reference gestures indicative of a criminal intent ("signatures of known criminal acts") are stored in memory and used to compare newly captured gestures to identify subjects engaged in criminal activity:

> **[A] collection of differencing signals for each moved object** of subsequent sampled frames of images (called a "track") **allows a determination of the type, speed and direction** (vector) **of each motion involved**, processing which will extract acceleration, i.e., note of change of velocity: and change in acceleration with respect to time (called "jerkiness"), **and correlating this with stored signatures of known physical criminal acts**. **For example,** subsequent differencing signals may reveal that **an individual's arm is moving to a high position, such as the upper limit of that arm's motion, i.e., above his head) at a fast speed**. This particular movement **could be perceived**, as described below, **as a hostile movement with a possible criminal activity** requiring the expert analysis of security personnel.

Id. at 6:13-26 (emphasis added), 7:5-10 ("[P]rocessed signal is sent to comparison means 14 which compares selected f[r]ames of the video signals from the picture input means 10 with 'signature' video signals stored in memory 16. The signature

signals are representative of various positions and movements of the body p[a]rts of an individual having various levels of criminal intent.").

62. *Aviv* teaches that "the picture input means 10, may be any conventional electronic picture pickup device operational within the infrared or visual spectrum (or both) including a vidicon and a CCD/TV camera of **moderate resolution**." *Id*. at 4:19-23 (emphasis added). If the system detects a subject performing a gesture that matches a stored signature indicative of criminal intent, "an output 'alert' signal is sent from the comparison means 14 to a controller 18. The controller 18 controls the operation of a secondary, **high resolution** picture input means (video camera)." *Id*. at 7:14-18 (emphasis added). "The purpose of the secondary camera 20 is to provide a **detailed video signal** of the individual having assumed criminal intent." *Id*. at 7:26-28 (emphasis added).

63. Because *Aviv*, like the '949 Patent, discloses a camera system that may be controlled by human gesture input, *Aviv* is in the same field of endeavor as the '949 Patent. *Compare Aviv* (Ex. 1006), 6:13-26, 7:5-10 (describing gesture recognition of a subject indicative of criminal intent) *with '949 Patent* (Ex 1001), 5:24-49 (describing the process of identifying a subject has performed a predetermined gesture and controlling the camera device to capture an image in response). Accordingly, a PHOSITA would have considered *Aviv* analogous art to the '949 Patent.

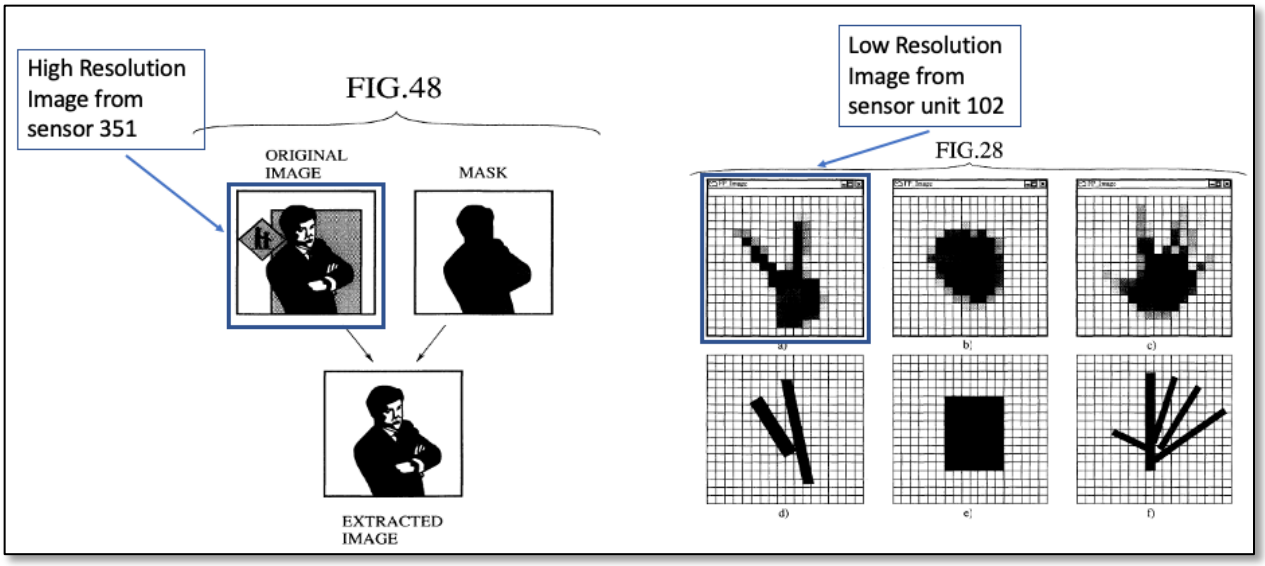
H. Motivation to Combine *Numazaki, Nonaka,* and *Amir*

64. As discussed above, a PHOSITA would have understood that, based on (1) the outputs of *Numazaki's* reflected light extraction unit 102 and visible light photo-detection array 351, (2) *Numazaki's* express teaching that low resolution gesture detection sensors should be used to save costs, (3) industry standards, and (4) performance concerns, *Numazaki's* reflected light extraction unit 102 would have less resolution than the visible light photo-detection array 351 and a PHOSITA would have been motivated to ensure the sensor units were implemented in this way. In the alternative, a PHOSITA would have been motivated to implement *Numazaki's* laptop device in this way pursuant to *Aviv's* express teachings.

65. *Aviv* summarizes its invention as providing "a surveillance system having at least **one primary video camera** for translating real images of a zone into electronic video signals **at a first level of resolution** . . . [and] means for activating **at least one secondary sensor** and associated recording device **having a second higher level of resolution**, said activating means being in response to determining a predetermined level of criminal activity." *Aviv* at 3:17-31. *Numazaki* similarly teaches that its scene monitoring and gesture detecting electro-optical sensor (i.e., reflected light extraction unit) "can be manufactured at lower cost . . if it is possible to obtain" the desired information about the user's hand position/gesture "from the rough reflected light image." *Numazaki* at 17:51-56. *Numazaki* further explains that

"it is possible to obtain[] the pointing position [of a finger] by the resolution above the pixels." *Id*. at 18:15-21. A PHOSITA would have understood the principle described here to mean that a lower cost electro-optical sensor should be used when lower resolution imaging is sufficient for the given application. Choosing less expensive imaging components where higher resolution isn't required by the application is consistent with standard product design and component sourcing principles. To accommodate this design goal, a PHOSITA would have been motivated to implement *Numazaki's* gesture detecting electro-optical sensor (i.e., reflected light extraction unit) at a lower resolution pursuant to the teachings of *Aviv*.

66. Further supporting the conclusion that a PHOSITA would have been motivated to implement *Numazaki's* gesture recognizing reflected light extraction unit 102 with lower resolution than the visible light photo-detection array 351, *Numazaki's* illustrations of these sensor outputs demonstrate unit 351 produces a higher resolution image than unit 102:

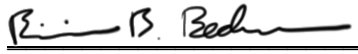


Numazaki at Fig. 48 (annotated to indicate output of digital camera 351), 39:50-60 (describing the same), Fig. 28 (annotated to indicate output of reflected light extraction unit 102), 29:22-53 (noting the gesture recognition is performed using the output of reflected light extraction unit), 31:11-26 (describing Fig. 28). A PHOSITA would have understood that, based on the outputs of these units and *Numazaki's* express teaching that low resolution gesture detection sensors should be used to save costs, pursuant to the teachings of *Aviv*, *Numazaki's* reflected light extraction unit 102 should be implemented with lower resolution than the visible light photo-detection array 351. As I discuss above in ¶ 50, lower resolution monitoring enables a system to quickly respond to changes in the environment and is preferable to higher resolution monitoring. Such performance concerns would have further motivated a PHOSITA to implement the gesture-detecting sensor unit with lower resolution than the video capture sensor unit.

IV. CONCLUSION

67. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and 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.

Date: 6/2/2021

By: 
Dr. Benjamin B. Bederson

Appendix A

Dr. Benjamin B. Bederson
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Professor Emeritus, Computer Science

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I have read the following and certify that it is a current and accurate statement of my professional record as of May 18, 2021.

1. PERSONAL INFORMATION

EDUCATION

9/89 – 6/92	**Ph.D., New York University, Computer Science Dept.**	**New York, NY**
9/87 – 8/89	**M.S., New York University, Computer Science Dept.**	**New York, NY**
9/82 – 6/86	**B.S., Rensselaer Polytechnic Institute, Computer Science Dept.** **Minor, Electrical Engineering**	**Troy, NY**

EMPLOYMENT

1/19 – Present	**Bederson Expert Services, Inc.** Technical consulting	**Brooklyn, NY**
1/98 – Present	**University of Maryland, Computer Science Dept./UMIACS** 7/19 – Present: Professor Emeritus, Computer Science Department. 4/14 – 6/18: Associate Provost of Learning Initiatives, and Executive Director of Teaching and Learning Transformation Center 4/13 – 4/14: Special Advisor to the Provost on Technology and Educational Transformation 8/11 – 6/19: Professor 9/04 – 7/11: Associate Professor 6/00 – 9/06: Director of the Human-Computer Interaction Lab (HCIL) 1/98 – 8/04: Assistant Professor	**College Park, MD**
1/06 – Present	**International Children's Digital Library Foundation** Co-founder and Technical Director for this library of exemplary free online children's books from around the world. 7/17 – present: President, secretary and treasurer	**Brooklyn, NY**
10/14 – Present	**Hazel Analytics, Inc.** Co-founder & Board member: regulatory data analytics 10/14 – 12/19: Chief Technology Officer	**Seattle, WA**
9/06 – 10/14	**Zumobi, Inc.** Co-founder of VC-funded startup for mobile apps and advertising. 9/06–1/08: VP Client Technologies 1/08–10/14: Chief Scientist	**Seattle, WA**
6/03 – 11/08	**Windsor Interfaces, Inc.** Founder: Small company to commercialize HCIL products.	**Chevy Chase, MD**
1/95 – 8/97	**University of New Mexico, Computer Science Department** Assistant Professor in the Computer Science Department.	**Albuquerque, NM**
9/92 – 8/94	**Bell Communications Research (Bellcore)** Research Scientist in Computer Graphics and Interactive Media group.	**Morristown, NJ**
6/93 – 7/94	**New York University, Media Research Laboratory** Visiting Research Scientist.	**New York, NY**

9/90 – 8/92	**Vision Applications, Inc.** Research Scientist.	**New York, NY**
9/88 – 6/90	**New York University, Computer Science Department** Teaching Assistant.	**New York, NY**
1/87 – 5/87	**North Slope Borough/North Slope Higher Education Center** Instructor. Taught Computers & Society to rural Eskimo population.	**Barrow, AK**

2. RESEARCH, SCHOLARLY, AND CREATIVE ACTIVITIES

Note about publications:

- In all references, my name is in bold.
- Authors are displayed as published. Authors are usually listed in order of decreasing contribution – except that sometimes the last author is the lead advising faculty member. I put an asterisk next to my name when I served that role.
- Students that I supervised are underlined.

A. BOOKS

i. Authored Books

1. Herrnson, P.S., Niemi, R.G., Hanmer, M.J., **Bederson, B. B.**, Conrad, F.G., Traugott, M., (2008) "Voting Technology and the Not-So-Simple Act of Casting a Ballot," *Brookings Institute Press*.

ii. Edited Collections

1. Teevan, J., Jones, W., **Bederson, B. B.** (Eds.) (2006) *Communications of the ACM (CACM)*, Editors of special issue on "Personal Information Management", 49 (1), ACM Press.
2. **Bederson, B. B.**, Shneiderman, B. (Eds.) (2003). *The Craft of Information Visualization: Readings and Reflections*. San Francisco: Morgan Kaufmann.

iii. Book Chapters

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2. Herrnson, P.S., Niemi, R.G., Hanmer, M.J., **Bederson, B. B.**, Conrad, F.G., Traugott, M.W. (2008) The Current State of Electronic Voting in the United States. Chen, H., Brandt, L., Dawes, S., Gregg, V., Hovy, E., Macintosh, A., Traunmüller, R., Larson, C. (Eds.) *Digital Government: Advanced Research and Case Studies,* Springer, 157-180.
3. Karlson, A., **Bederson, B. B.**, & Contreras-Vidal, Jose L. (2007) Understanding One Handed Use of Mobile Devices. Lumsden, Jo (Ed.), *Handbook of Research on User Interface Design and Evaluation for Mobile Technology,* Idea Group Reference, 86-101.
4. Hutchinson, H., Druin, A., **Bederson, B. B.** (2007) Designing Searching and Browsing Software for Elementary-Age Children. Lazar, J. (Ed.), *Universal Usability*. John Wiley. 1618-1630.
5. Druin, A., **Bederson, B. B.**, Boltman, A., Muira, A., Knotts-Callahan, D., & Platt, M. (1999). Children As Our Technology Design Partners. A. Druin (Ed.), *The Design of Children's Technology* (51-72). San Francisco: Morgan Kaufmann.
6. Hollan, J. D., **Bederson, B. B.**, & Helfman, J. (1998). Information Visualization. Helander, M., Landauer, T. K., & Prabhu, P. V. (eds.), *The Handbook of Human Computer Interaction* (Chap. 2, 33-48). Amsterdam: Elsevier Press.
7. **Bederson, B. B.**, Hollan, J. D., Stewart, J., Rogers, D., Druin, A., Vick, D., Ring, L., Grose, E., & Forsythe, C. (1997). A Zooming Web Browser. C. Forsythe, J. Ratner, & E. Grose (eds.), *Human Factors and Web Development* (Chap. 19, 255-266). New Jersey: Lawrence Erlbaum.

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9. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1993). A Miniaturized Space-Variant Active Vision System: Cortex-I. Richard Mammone (eds.), *Artificial Neural Networks for Speech and Vision*. Chapman-Hall Publishers.
10. Wallace, R. S., Ong, P.-W., **Bederson, B. B.**, & Schwartz, E. L. (1993). Connective Graphs in Space-Variant Active Vision. George A. Bekey & Ken Goldberg (eds.), *Neural Networks in Robotics*. Kluwer Academic Publishers.

B. REFEREED ARTICLES
i. Journals

1. **Bederson, B. B.**, Jin, G. Z., Leslie, P., Quinn, A. J., Zou, B. (2017) "Incomplete Disclosure: Evidence of Signaling and Countersignaling", in *American Economic Journal: Microeconomics*, (in press).
2. Anderson, L. B., Gardner, E. E., Wolvin, A., Kirby-Straker, R., Yalcin, A., & **Bederson, B. B.*** (2016), "Incorporating Learning Analytics into Basic Course Administration: How to Embrace the Opportunity to Identify Inconsistencies and Inform Responses", in *Journal of the Association for Communication Administration*, 35 (1), Winter-Spring 2016, pp 2-14.
3. Lee, T. Y., **Bederson, B. B.*** (2016) "Give the people what they want: studying end-user needs for enhancing the web", *PeerJ Computer Science,* Nov, 2016, 2:e91 https://doi.org/10.7717/peerj-cs.91
4. Yalcin, M. A., Elmqvist, N. &, **Bederson, B. B.***. (2015) "AggreSet: Rich and Scalable Set Exploration using Visualizations of Element Aggregations". in *IEEE Transactions on Visualization and Computer Graphics*, 22(1), 688–697, 2015.
5. Hu, C., Resnik, P., & **Bederson, B. B.*** (2014) "Crowdsourced Monolingual Translation", in *ACM Transactions on Computer-Human Interaction (TOCHI)*, 21 (4), Aug 2014, pp. 22:1–22:35.
6. Lee, T.Y., Mauriello, M., Ahn, J. & **Bederson, B. B.*** (2014) "CTArcade: Computational Thinking with Games in School Age Children", in *International Journal of Child-Computer Interaction*, 2 (1), Jan 2014, 26–33.
7. Bonsignore, E., Quinn, A. J., Druin, A. & **Bederson, B. B.*** (2013) "Sharing Stories 'In The Wild': A Mobile Storytelling Case Study using StoryKit", in *Transactions on Computer-Human Interaction (TOCHI)*, ACM, 20 (3), July 2013, Article 18.
8. Resnik, P., Buzek, O., Kronrod, Y., Hu, C., Quinn, A.J. & **Bederson, B. B.** (2013) "Using Targeted Paraphrasing and Monolingual Crowdsourcing to Improve Translation", in *Transactions on Intelligent Systems and Technology*, ACM, 4 (3), July 2013, Article 38, 21 pages.
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11. Conrad, F.G., **Bederson, B. B.**, Lewis, B., Peytcheva, E., Traugott, M.W., Hanmer, M.J., Herrnson, P.S., & Niemi, R.G. (2009) "Electronic voting eliminates hanging chads but introduces new usability challenges", *in International Journal of Human-Computer Studies (IJHCS)*, Elsevier Press, 67 (1), 111-124.
12. Hanmer, M.J., Park, W-H., Traugott, M.W., Niemi, R.G., Herrnson, P.S., **Bederson, B. B.**, and Conrad, F.C. (2008) "Losing Fewer Votes: The Impact of Changing Voting Systems on Residual Votes", *in Political Research Quarterly,* Sage Publications, September, 2008. doi:10.1177/1065912908324201.
13. **Bederson, B. B.**, Clamage, A., Plaisant, C. (2008) Enhancing In-Car Navigation Systems with Personal Experience, *in Transportation Research Record (TRR)*, The National Academies, 2064 (2008) 33-42.

14. Herrnson, P.S., Niemi, R.G., Hanmer, M.J., Francia, P.L., **Bederson, B. B.**, Conrad, F.G., Traugott, M. (2008) Voter's Evaluations of Electronic Voting Systems: Results from a Usability Field Study, *American Politics Research*, Sage Journals, 36 (4), July 2008, 580-611.

15. Cockburn, A., Karlson, A., & **Bederson, B. B.*** (2008) A Review of Overview+Detail, Zooming, and Focus+Context Interfaces, *ACM Computing Surveys*, ACM Press, December 2008, 41 (1).

16. Kang, H., **Bederson, B. B.**, & Suh, B. (2008) Capture, Annotate, Browse, Find, Share: Novel Interfaces for Personal Photo Management, *International Journal of Human-Computer Interaction (IJHCI)*, 23 (3), 1-23.

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21. Lee, B., Parr, C.S., Plaisant, C., **Bederson, B. B.**, Veksler, V.D., Gray, W.D., Kotfila, C. (2006) TreePlus: Interactive Exploration of Networks with Enhanced Tree Layouts, *IEEE Transactions on Vision and Computer Graphics (TVCG)*, IEEE Press, 12 (6), 1414-1426.

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23. Shneiderman, B., **Bederson, B. B.**, and Drucker, S., (2006) Find that photo! Interface strategies to annotate, browse, and share, *Communications of the ACM,* 49 (4), 69-71.

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27. Parr, C. S., Lee, B., & **Bederson, B. B.*** (2004). Visualizations for Taxonomic and Phylogenetic Trees. *Bioinformatics*, Oxford University Press, 20 (17), 2997-3004.

28. **Bederson, B. B.**, Grosjean, J., Meyer, J. (2004) Toolkit Design for Interactive Structured Graphics, *Transactions on Software Engineering*, New York: IEEE, 30 (8), 535-546.

29. Chipman, L. E., **Bederson, B. B.,** Golbeck, J. A.(2004) SlideBar: Analysis of a Linear Input Device. *Journal of Behaviour and Information Technology*, London, Taylor & Francis, 23 (1), 1-9.

30. **Bederson, B. B.**, Clamage, A., Czerwinski, M. P., & Robertson, G. G. (2004) DateLens: A Fisheye Calendar Interface for PDAs, *Transactions on Computer-Human Interaction*, New York: ACM, 11 (1), 90-119.

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32. Druin, A., **Bederson, B. B.**, Weeks, A., Farber, A., Grosjean, J., Guha, M. L., Hourcade, J. P., Lee, J., Liao, S., Reuter, K., Rose, A., Takayama, Y., & Zhang, L. (2003). The International Children's Digital Library: Description and Analysis of First Use. *First Monday*, *8*(5).

33. Druin, A., Revelle, G., **Bederson, B. B.**, Hourcade, J. P., Farber, A., Lee, J., & Campbell, D. (2003) A Collaborative Digital Library for Children: A Descriptive Study of Children's Collaborative Behavior and Dialogue. *The Journal of Computer-Assisted Learning*, 19 (2), 239-248.
34. Hourcade, J.P., **Bederson, B. B.**, Druin, A., Rose, A., Farber, A., Takayama, Y. (2003). The International Children's Digital Library: Viewing Digital Books Online. *Interacting with Computers*, Elsevier Press, 15 (3), 151-167.
35. Hornbæk, K., **Bederson, B. B.**, & Plaisant, C. (2002) Navigation Patterns and Usability of Zoomable User Interfaces With and Without an Overview, *ACM Transactions on Computer-Human Interaction*, 9 (4), 362-389.
36. **Bederson, B. B.**, Shneiderman, B., & Wattenberg, M. (2002) Ordered and Quantum Treemaps: Making Effective Use of 2D Space to Display Hierarchies, *ACM Transactions on Graphics*, 21 (4), 833-854, ACM Press.
37. Good, L., & **Bederson, B. B.*** (2002) Zoomable User Interfaces as a Medium for Slide Show Presentations, *Information Visualization*, Palgrave Macmillan, 35-49.
38. Revelle, G., Druin, A., Platner, M., **Bederson, B. B.**, Hourcade, J.P., & Sherman, L. (2002) A Visual Search Tool for Early Elementary Science Students, *Journal of Science Education and Technology*, 11(1), 49-57.
39. **Bederson, B. B.**, & Meyer, J. (1998). Implementing a Zooming User Interface: Experience Building Pad++. *Software: Practice and Experience*, 28(10), 1101-1135.
40. **Bederson, B. B.**, Hollan, J. D., Perlin, K., Meyer, J., Bacon, D., & Furnas, G. W. (1996). Pad++: A Zoomable Graphical Sketchpad for Exploring Alternate Interface Physics. *Journal of Visual Languages and Computing*, 7, 3-31.
41. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1995). A Miniaturized Space-Variant Active Vision System: Cortex-I. *Machine Vision and Applications*, 8 (2), 101-109.
42. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1994). A Miniature Pan-Tilt Actuator: the Spherical Pointing Motor. *IEEE Transactions on Robotics and Automation*, 10(3), 298-308.
43. Wallace, R. S., Ong, P.-W., **Bederson, B. B.**, & Schwartz, E. L. (1994). Space-Variant Image Processing. *International Journal of Computer Vision*, 13(1), 71-90.

ii. Peer-Reviewed Published Full-Length Conference Papers

1. Yalçın, M. A., Elmqvist, N., & **Bederson, B. B.*** (2017) Raising the Bars: Evaluating Treemaps vs. Wrapped Bars for Dense Visualization of Sorted Numeric Data, *Proceedings of Graphics Interface (GI 2017)*, 41-49. DOI: https://doi.org/10.20380/GI2017.06
2. Quinn, A., & **Bederson, B. B.*** (2014) AskSheet: Efficient Use of Web Workers to Support Decision Making, *Proceedings of ACM CSCW (CSCW 2014)*, ACM Press, pp. 1456–1466.
3. Yeh, T., Chang, T-H., Xie, B., Walsh, G., Watkins, I., Wongsuphasawat, K., Davis, L.S., & **Bederson, B. B.*** (2011) Creating Contextual Help for GUIs Using Screenshots, *Proceedings of ACM UIST (UIST 2011)*, ACM Press, 145-154.
4. Quinn, A., & **Bederson, B. B.*** (2011) Human Computation: A Survey and Taxonomy of a Growing Field, *Proceedings of ACM CHI (CHI 2011)*, ACM Press, 1403-1412.
5. Resnik, P., Buzek, O., Hu, C., Kronrod, Y., Quinn, A.J., & **Bederson, B. B.*** (2010) Improving Translation via Targeted Paraphrasing, *Proceedings of Conference on Empirical Methods in Natural Language Processing (EMNLP 2010)*, 127-137.
6. Hu, C., **Bederson, B. B.,** & Resnik, P. (2010) Translation by Interactive Collaboration between Monolingual Users, *Proceedings of Graphics Interface (GI 2010),* 39-46.
7. Dearman, D., Karlson, A., Meyers, B., & **Bederson, B. B.** (2010) Multi-Modal Text Entry and Selection on Mobile Devices, *Proceedings of Graphics Interface (GI 2010),* 19-26.

8. Quinn, A., Hu, C., Arisaka, T., & **Bederson, B. B.*** (2008) Readability of Scanned Books in Digital Libraries, *Proceedings of ACM CHI (CHI 2008)*, ACM Press, 705-714. [22% acceptance rate]

9. Karlson, A., & **Bederson, B. B.*** (2008) One-Handed Touchscreen Input for Legacy Applications, *Proceedings of ACM CHI (CHI 2008)*, ACM Press 1399-1408. [22% acceptance rate]

10. **Bederson, B. B.**, Clamage, A., Plaisant, C., (2008) Enhancing In-Car Navigation Systems with Personal Experience, *in Proc. of the Transportation Research Board 87th annual meeting*, The National Academies, Washington, DC (2008) 1-11.

11. Karlson, A., & **Bederson, B. B.*** (2007) ThumbSpace: Generalized One-Handed Input for Touchscreen-Based Mobile Devices, *Proceedings of INTERACT 2007*, 324-338 – **Winner of Brian Shackel Award for making an "outstanding contribution with international impact in the field of HCI".**

12. Druin, A., Weeks, A., Massey, S., & **Bederson, B. B.** (2007) Children's Interests and Concerns When Using the International Children's Digital Library: A four country case study, *Proceedings of the Joint Conference on Digital Libraries (JCDL 2007)*, 167-176. – **Nominated for Best Paper Award, came in #2.** [36% acceptance rate].

13. Parhi, P., Karlson, A., & **Bederson, B. B.*** (2006). "Target Size Study for One-Handed Thumb Use on Small Touchscreen Devices", *Proceedings of MobileHCI 2006*, ACM Press, 203-210. – **Winner of Best Historical Paper Award, September 2016.**

14. Hutchinson, H. B., **Bederson, B. B.**, & Druin, A. (2006). "The Evolution of the International Children's Digital Library Searching and Browsing Interface", *Proceedings of 5th International Conference for Interaction Design and Children (IDC 2006)*, ACM Press, 105-112. [38% acceptance rate]

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16. Shneiderman, B. & **Bederson, B. B.** (2005). "Maintaining Concentration to Achieve Task Completion", *Proceedings of Designing User Experience (DUX 2005)*.

17. Karlson, A., **Bederson, B. B.**, & SanGiovanni, J. (2005). AppLens and LaunchTile: Two Designs for One-Handed Thumb Use on Small Devices, CHI Letters, 7(1), 201-210. [25% acceptance rate] – **Nominated for Best Paper Award.**

18. Khella, A., **Bederson, B. B.*** (2004). Pocket PhotoMesa: A Zoomable Image Browser for PDAs. *In Proceedings of Mobile and Ubiquitous Multimedia (MUM 2004)* ACM Press, 19-24.

19. Lee, B., Parr, C. S., Campbell, D., & **Bederson, B. B.*** (2004). How Users Interact With Biodiversity Information Using TaxonTree. *In Proceedings of Advanced Visual Interfaces (AVI 2004)* ACM Press, 320-327. [25% acceptance rate]

20. Suh, B., Ling, H., **Bederson, B. B.**, & Jacobs, J. W. (2003). Automatic Thumbnail Cropping and Its Effectiveness. UIST 2003, ACM Symposium on User Interface Software and Technology, CHI Letters, 5(2), 95-104. [22% acceptance rate] – **Winner of Best Student Paper Award**.

21. **Bederson, B. B.**, Lee, B., Sherman, R., Herrnson, P. S., Niemi, R. G. (2003). Electronic Voting System Usability Issues. CHI 2003, ACM Conference on Human Factors in Computing Systems, CHI Letters, 5(1), 145-152. [16% acceptance rate]

22. Hutchinson, H., Mackay, W., Westerlund, B., **Bederson, B. B.**, Druin, A., Plaisant, C., Evans, H., Hansen, H., Conversy, S., Beaudouin-Lafon, M., Roussel, N., Lacomme, L., Eiderbäck, B., Lindquist, S., Sundblad, Y. (2003). Technology Probes: Inspiring Design for and with Families. CHI 2003, ACM Conference on Human Factors in Computing Systems, CHI Letters, 5(1), 17-24. [16% acceptance rate]

23. Knudtzon, K., Druin, A., Kaplan, N., Summers, K., Chisik, Y., Kulkarni, R., Moulthrop, S., Weeks, H., & **Bederson, B.** Starting an Intergenerational Technology Design Team: A Case Study. *In Proceedings of* Interaction Design and Chidlren (*IDC 2003*) ACM Press, 51-58.

24. Baudisch, P., Cutrell, P., Robbins, D., Czerwinski, M., Tandler, P., **Bederson, B. B.**, & Zierlinger, A. (2003) Drag-and-Pop and Drag-and-Pick: Techniques for Accessing Remote Screen Content on Touch- and Pen-Operated Systems. *Proceedings of Interact 2003*, Austria: International Federation for Information Processing, 57-64. [33% acceptance rate]

25. Plaisant, C., Grosjean, J., & **Bederson, B. B.*** (2002) SpaceTree: Design Evolution of a Node Link Tree Browser. *Proceedings of Information Visualization Symposium (InfoVis 2002)* New York: IEEE, 57-64. [27% acceptance rate]

26. Suh, B., & **Bederson, B. B.*** (2002) OZONE: A Zoomable Interface for Navigating Ontology Information. *Proceedings of International Conference on Advanced Visual Interfaces (AVI 2002)*, ACM Press, Trento, Italy, 139-143. [30% acceptance rate]

27. Boltman, A., Druin, A., **Bederson, B.**, Hourcade, J.P., Stanton, D., O'Malley, C., Cobb, S., Benford, S., Fast, C., Kjellin, M., & Sundblad, Y. (2002). The nature of children's storytelling with and without technology. *Proceedings of American Educational Research Association (AERA) Conference*, New Orleans.

28. **Bederson, B. B.** (2001). PhotoMesa: A Zoomable Image Browser Using Quantum Treemaps and Bubblemaps. UIST 2001, ACM Symposium on User Interface Software and Technology, CHI Letters, 3(2), 71-80. [19% acceptance rate]

29. Druin, A., **Bederson, B. B.**, Hourcade, J.P., Sherman, L., Revelle, G., Platner, M., Weng, S. (2001) Designing a Digital Library for Young Children. *In Proceedings of Joint Conference on Digital Libraries (JCDL 2001)* ACM Press, 398-405. [30% acceptance rate]

30. Benford, S., **Bederson, B. B.**, Åkesson, K., Bayon, V., Druin, A., Hansson, P., Hourcade, J. P., Ingram, R., Neale, H., O'Malley, C., Simsarian, K., Stanton, D., Sundblad, Y., & Taxén, G. (2000). Designing Storytelling Technologies to Encourage Collaboration Between Young Children. CHI 2000, ACM Conference on Human Factors in Computing Systems, CHI Letters, 2(1), 556-563. [19% acceptance rate]

31. **Bederson, B. B.**, Meyer, J., & Good, L. (2000). Jazz: An Extensible Zoomable User Interface Graphics Toolkit in Java. UIST 2000, ACM Symposium on User Interface Software and Technology, CHI Letters, 2(2), 171-180. [26% acceptance rate]

32. **Bederson, B. B.** (2000). Fisheye Menus. UIST 2000, ACM Symposium on User Interface Software and Technology, CHI Letters, 2(2), 217-225. [26% acceptance rate]

33. Gandhi, R., Kumar, G., **Bederson, B. B.**, & Shneiderman, B. (2000). Domain Name Based Visualization of Web Histories in a Zoomable User Interface. *In Proceedings of Eleventh International Workshop on Database and Expert Systems Applications – Second International Workshop on Web-Based Information Visualization (WebVis 2000)*, IEEE Computer Society, Los Alamitos, CA (2000), 591-598.

34. **Bederson, B. B.**, & Boltman, A. (1999). Does Animation Help Users Build Mental Maps of Spatial Information? *In Proceedings of Information Visualization Symposium (InfoVis 99)* New York: IEEE, 28-35. [23% acceptance rate]

35. Combs, T. T. A., & **Bederson, B. B.*** (1999). Does Zooming Improve Image Browsing? *In Proceedings of Digital Library (DL 99)* New York: ACM, 130-137. [21% acceptance rate]

36. Stewart, J., **Bederson, B. B.**, & Druin, A. (1999). Single Display Groupware: A Model for Co-Present Collaboration. *In Proceedings of Human Factors in Computing Systems (CHI 99)* ACM Press, 286-293. [25% acceptance rate]

37. Hightower, R. R., Ring, L., Helfman, J., **Bederson, B. B.**, & Hollan, J. D. (1998). Graphical Multiscale Web Histories: A Study of PadPrints. *In Proceedings of ACM Conference on Hypertext (Hypertext 98)* ACM Press, 58-65.

38. Druin, A., Stewart, J., Proft, D., **Bederson, B. B.**, & Hollan, J. D. (1997). KidPad: A Design Collaboration Between Children, Technologists, and Educators. *In Proceedings of Human Factors in Computing Systems (CHI 97)* ACM Press, 463-470. [22% acceptance rate]

39. **Bederson, B. B.**, Hollan, J. D., Stewart, J., Rogers, D., Druin, A., & Vick, D. (1996). A Zooming Web Browser. *In Proceedings of SPIE Multimedia Computing and Networking* New York: IEEE, 260-271. https://www.spiedigitallibrary.org/conference-proceedings-of-spie/2667/0000/Zooming-Web-browser/10.1117/12.235898.short

40. **Bederson, B. B.**, & Hollan, J. D. (1995). Advances in the Pad++ Zoomable Graphics Widget. *In Proceedings of USENIX Tcl/Tk '95 Workshop (Tcl/Tk 95)* New York: USENIX, 3.

41. Furnas, G. W., & **Bederson, B. B.** (1995). Space-Scale Diagrams: Understanding Multiscale Interfaces. *In Proc. of Human Factors in Computing Systems (CHI 95)* ACM Press, 234-241. [29% acceptance rate]

42. **Bederson, B. B.**, & Hollan, J. D. (1994). Pad++: A Zooming Graphical Interface for Exploring Alternate Interface Physics. *In Proc. of User Interface and Software Technology (UIST 94)* ACM Press, 17-26.

43. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1993). Control & Design of the Spherical Pointing Motor. *In Proceedings of IEEE International Conference on Robotics and Automation (ICRA 93)* New York: IEEE, 2, 630-636.

44. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1992). A Miniaturized Active Vision System. *In Proceedings of Eleventh International Conference on Pattern Recognition,* IEEE Press, 58-61.

45. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1992). Two Miniature Pan-Tilt Devices. *In Proceedings of IEEE International Conference on Robotics and Automation,* New York: IEEE Press, (1), 658-663.

46. Wallace, R. S., **Bederson, B. B.**, & Schwartz, E. L. (1992). Voice-Bandwidth Visual Communication Through Logmaps: the Telecortex. *In Proceedings of IEEE Workshop on Applications of Computer Vision* New York: IEEE Press, 4-10.

iii. Other Publications

1. Yalcin, M. A., Elmqvist, N., & **Bederson, B. B.*** (2017). Piled Bars: Dense Visualization of Numeric Data. Poster presented at Graphics Interfaces, 2017.

2. **Bederson, B. B.**, Barker, K., Owens, L., Kim, Y. J. & Palmer, K. (2017) Designing Organizations to Support Tech on Campus. Panel at SXSW Edu, Austin, TX, March 6, 2017.

3. Yalcin, M. A., Elmqvist, N., & **Bederson, B. B.*** (2016). Keshif: Out-of-the-Box Visual and Interactive Data Exploration Environment. In *Proceedings of IEEE VIS 2016 Workshop on Visualization in Practice: Open Source Visualization and Visual Analytics Software*.

4. Yalcin, M. A., Elmqvist, N., & **Bederson, B. B.*** (2016). Cognitive Stages in Visual Data Exploration. In *Proceedings of Beyond Time and Errors: Novel Evaluation Methods for Visualization* (BELIV 2016) at IEEE VIS 2016.

5. Roberts, S., Swan, L., & **Bederson, B. B.** (2016). "Fishing for Faculty: The Bait and Hooks", Workshop in 2016 Professional and Organizational Development (POD) Conference, Louisville, KY, November, 2016.

6. Anderson, L. B., Gardner, E. E., Wolvin, A., Kirby-Straker, R., Yalcin, A., & **Bederson, B. B.*** (2015), "Incorporating Learning Analytics into Basic Course Administration: How to Embrace the Opportunity to Identify Inconsistencies and Inform Responses". *In NCA 2015 - 101th Annual meeting of the National Communication Association*. **Top Paper in Basic Course Division.**

7. Anderson, L. B., Gardner, E. E., Wolvin, A., Kirby-Straker, R., Yalcin, A., & **Bederson, B. B.*** (2015), "Utilizing learning analytics to improve the basic course: A qualitative analysis of the instructor feedback captured in Revealer". *Paper presented at the annual meeting of the Eastern Communication Association, Philadelphia, PA, June 2015*.

8. Hara, K, Hajiaghayi, M., & **Bederson, B. B.** (2015). FluTCHA: Using Fluency to Distinguish Humans from Computers, short paper and poster, WWW2015, Florence, Italy, May 18-22, 2015.

9. Teasley, S., & **Bederson, B. B.** (2015). Learning Analytics and iSchools: What, Why & Worries, *at iConference*, Session for Interaction and Engagement, March 24-27, 2015, Newport Beach, CA.

10. Xu, Z., Goldwasser, D., **Bederson, B. B.**, Lin, J. (2014) Visual Analytics of MOOCs at Maryland, *Poster at Learning @ Scale Conference (L@S '14)*.

11. **Bederson, B. B.**, Jin, G., Leslie, P., Quinn, A.J., & Zhou, B. (alphabetical order), (2014) "Incomplete Disclosure: Insights from Maricopa", International Industrial Organization Conference, April 11-13, 2014, Chicago.

12. Lee, T.Y., Mauriello, M.L., Ingraham, J., Sopan, A., Ahn, J., & **Bederson, B. B.*** (2012) "CTArcade: Learning Computational Thinking while Training Virtual Characters Through Game Play", WiP at CHI 2012, ACM Press, 2309-2314.
13. Cranor, L., **Bederson, B. B.**, & Quesenberry, W. (2012) "Occupy CHI! Engaging U.S. Policymakers", Panel in CHI 2012, ACM Press, 1139-1142.
14. **Bederson, B. B.**, Quinn, A. J., & Rose, A. (2012) SearchParty: Learning to Search in a Web-based Classroom, Workshop paper at CHI 2012.
15. Hu, C., Resnik, P., Kronrod, Y., & **Bederson, B. B.*** (2012) Deploying MonoTrans Widgets in the Wild. Note at CHI 2012, ACM Press, 2935-2938.
16. Hu, C., Resnik, P., Kronrod, Y., Eidelman, V., Buzek, O., & **Bederson, B. B.*** (2011) The Value of Monolingual Crowdsourcing in a Real-World Translation Scenario: Simulation using Haitian Creole Emergency SMS Messages. *In Proceedings of EMNLP 2011 Sixth Workshop on Statistical Machine Translation, 399-404.*
17. Kronrad, Y., Hu, C., Buzek, O., & Quinn, A.J. (2011) Using Monolingual Crowd to Improve Translation. Student poster at AAAS 2011. **Winner of poster in Math, Technology and Engineering category.**
18. **Bederson, B. B.**, & Quinn, A.J. (2011) Web Workers Unite! Addressing Challenges of Online Laborers. Alt.CHI paper at CHI 2011, ACM Press, 97-106.
19. Hu, C., **Bederson, B. B.**, & Resnik, P. (2011) MonoTrans2: A New Human Computation System to Support Monolingual Translation. Short paper at CHI 2011, ACM Press, 1133-1136.
20. Kronrod, Y., Buzek, O., Hu, C., Quinn, A., Resnik, P., & **Bederson, B. B.*** (2010) Using Crowdsourcing to Translate Without Bilinguals. Poster at CrowdConf 2010.
21. Hu, C., **Bederson, B. B.**, and Resnik, P. (2010) Translation by Iterative Collaboration Between Monolingual Users. Abstract and demo at the Human Computation Workshop (HCOMP 2010), 54-55.
22. Buzek, O., Resnik, P., & **Bederson, B. B.*** (2010) Error Driven Paraphrase Annotation using Mechanical Turk, In Creating Speech and Language Data With Amazon's Mechanical Turk, NAACL 2010 Workshop, 2010.
23. Chen, R., Rose, A., & **Bederson, B. B.*** (2009) How People Read Books Online: Mining and Visualizing Web Logs for Use Information. In Proceedings of European Conference on Digital Libraries (ECDL 2009), Short Paper, 364-369.
24. **Bederson, B. B.**, Rutledge, P., Quinn, A. (2009) Generalizing the International Children's Digital Library. In Proceedings of the Digital Humanities Conference (DH 09), Poster.
25. **Bederson, B. B.**, Quinn, A., Druin, A. (2009) Designing the Reading Experience for Scanned Multi-lingual Picture Books on Mobile Phones. In Proceedings of the Joint Conference on Digital Libraries (JCDL 2009), Short Paper, ACM Press, New York, NY, 305-308.
26. Hu, C., Rose, A., **Bederson, B. B.*** (2009) Locating Text in Scanned Books. In Proceedings of the Joint Conference on Digital Libraries (JCDL 2009), Poster.
27. Druin, A., Cavallo, D., Fabian, C., **Bederson, B. B.**, Revelle, G., Rogers, Y. (2009) Mobile Technologies for the World's Children. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2009), ACM Press, Panel.
28. **Bederson, B. B.** (2008) "Experiencing the International Children's Digital Library", Interactions Magazine, ACM Press, 15 (6), 50-54.
29. Lazar, J., Hochheiser, H., Johnson, J., Karat, C-M., **Bederson, B. B.** (2008) "CHI Policy Issues Around the World", Panel in CHI 2008, ACM Press, 2277-2280.
30. Teevan, J., Jones, W., **Bederson, B. B.**, (2006) "Introduction: Personal Information Management," Communications of the ACM, 49 (1), 40-43. Ranked #3 "Year Rank" in annual downloads among ACM Magazines and Computing Surveys articles (CACM, 50 (12), 92-93).
31. Lee, B., Parr, C.S., Plaisant, C., **Bederson, B. B.**, (2006) "TreePlus: Visualizing Graphs as Trees," Video in InfoVis 2006.

32. Herrnson, P.S., Niemi, R.G., Hanmer, M.J., **Bederson, B. B.**, Conrad, F.G., Traugott, M., (2006) "The Importance of Usability Testing of Voting Systems," in Usenix/Accurate Electronic Voting Workshop.
33. Herrnson, P., Niemi, R., Hanmer, M., **Bederson, B. B.**, Conrad, F., Traugott, M., (2006) "Voter Errors in Electronic voting: Voting Systems, Ballot Type, and Voter Traits," In Midwest Political Science Association annual conference.
34. Herrnson, P., Niemi, R., Hanmer, M., **Bederson, B. B.**, Conrad, F., Traugott, M., (2006) "Voters' Abilities to Cast Write-In Votes Using Electronic Voting Systems," In Midwest Political Science Association annual conference.
35. Conrad, F., Peytcheva, E., Traugott, M., Lewis, B., Herrnson, P., **Bederson, B. B.** (2006) "Usability of Electronic Voting Systems: Field and Laboratory Experiments," In Midwest Political Science Association annual conference.
36. Lee, B., Parr, C. S., Plaisant, C., & **Bederson, B. B.*** (2005) "Visualizing Graphs as Trees: Plant a Seed and Watch it Grow", Proceedings of Graph Drawing 2005, 516-518.
37. Klein, C. &, **Bederson, B. B.*** (2005). "Benefits of Animated Scrolling", Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2005) ACM Press, Short Paper, 1965-1968.
38. Lee, B., Czerwinski, M., Robertson, G. G. &, **Bederson, B. B.** (2005). "Understanding Research Trends in Conferences using PaperLens", Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2005) ACM Press, Short Paper, 1969-1972.
39. Traugott, M.W., Hanmer, M.J., Park, W.H., Herrnson, P.S., Niemi, R.G., **Bederson, B. B.**, Conrad, F.G.,(2005) "The Impact of Voting Systems on Residual Votes, Incomplete Ballots, and Other Measures of Voting Behavior," In American Political Science Association meeting (APSA 2005).
40. Lee, B., Czerwinski, M., Robertson, G. G. &, **Bederson, B. B.** (2004). "Understanding Eight Years of InfoVis Conferences using PaperLens", InfoVis 2004 Symposium Compendium. **Winner of InfoVis Contest**.
41. **Bederson, B. B.** (2004) Interfaces for Staying in the Flow. In Ubiquity, ACM Press, (5) 27.
42. Hourcade, J. P., **Bederson, B. B.**, Druin, A. (2004) Preschool Children's Use of Mouse Buttons. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2004) ACM Press, Short Paper, 1411-1412.
43. Selker, T., Fischer, E. A., **Bederson, B. B.**, McCormack, C., Nass, C. (2003) Voting: User Experience, Technology and Practice. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2003) ACM Press, Panel, 700-701.
44. **Bederson, B. B.**, Clamage, A., Czerwinski, M. P., Robertson, G. G. (2003) A Fisheye Calendar Interface for PDAs: Providing Overviews in Small Displays. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2003) ACM Press, Demonstration, 618-619.
45. Hourcade, J.P., **Bederson, B. B.**, Druin, A., Rose, A., Farber, A., Takayama, Y. (2002). The International Children's Digital Library: Viewing Digital Books Online. Interaction Design and Children International Workshop, August 28-29, 2002, Eindhoven, The Netherlands 15 (3), 151-167.
46. Herrnson, P., **Bederson, B. B.** (2002) Debugging Maryland Balloting, Washington Post, Outlook Section, p. B08, Sunday May 12th, 2002.
47. Good, L., **Bederson, B. B.**, Stefik, M., Baudisch, P. (2002) Automatic Text Reduction For Changing Size Constraints. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2002) ACM Press, Short Paper, 798-799.
48. Hourcade, J.P., **Bederson, B. B.**, Druin, A., Taxén, G. (2002) KidPad: A Collaborative Storytelling Tool for Children. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2002) ACM Press, Referred Demo, 500-501.
49. Hourcade, J.P., **Bederson, B. B.**, Druin, A. (2002) SearchKids: A Digital Library Interface for Young Children. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 2002) ACM Press, Referred Demo, 512-513.

50. **Bederson, B. B.** (2001). PhotoMesa: A Zoomable Image Browser Using Quantum Treemaps and Bubblemaps. UIST 2001, ACM Symposium on User Interface Software and Technology. Refereed demo.

51. Browne, H., **Bederson, B. B.**, Druin, A., Sherman, L., & Westerman, W. (September 2000) Designing a Collaborative Finger Painting Application for Children, HCIL-2000-17, CS-TR-4184, UMIACS-TR-2000-66

52. Hourcade, J., **Bederson, B. B.** (May 1999) Architecture and Implementation of a Java Package for Multiple Input Devices (MID) HCIL-99-08, CS-TR-4018, UMIACS-TR-99-26

53. Hightower, R.R., Ring, L.T., Helfman, J.I., **Bederson, B. B.**, Hollan, J.D. (1998) PadPrints: Graphical Multiscale Web Histories. UIST 1998, ACM Symposium on User Interface Software and Technology. Tech Note, 121-122.

54. Stewart, J., Raybourn, E., **Bederson, B. B.**, & Druin, A. (1998). When Two Hands Are Better Than One: Enhancing Collaboration Using Single Display Groupware. In Proceedings of Extended Abstracts of Human Factors in Computing Systems (CHI 98) ACM Press, Short Paper, 287-288.

55. **Bederson, B. B.**, Hollan, J. D., Druin, A., Stewart, J., Rogers, D., & Proft, D. (1996). Local Tools: An Alternative to Tool Palettes. In Proceedings of User Interface and Software Technology (UIST 96) ACM Press, Short Paper, 169-170.

56. **Bederson, B. B.**, Hollan, J. D. (1995) Pad++: A Zoomable Graphical Interface System. In Proceedings of Conference on Human Factors in Computing Systems Conference Companion (CHI 95) ACM Press, Short Paper, 23-24.

57. **Bederson, B. B.**, & Davenport, G., & Druin, A., & Maes, P. (1994). Immersive Environments: A Physical Approach to the Multimedia Experience, In Proceedings of IEEE International Conference on Multimedia Computing and Systems, Boston, Massachusetts, May 17-19, 1994, (Panel).

58. **Bederson, B. B.** (1995). Audio Augmented Reality: A Prototype Automated Tour Guide. In Proceedings of Human Factors in Computing Systems (CHI 95) New York: ACM Press, (Short Paper), 210-211.

59. Stone, L. M., Erickson, T., **Bederson, B. B.**, Rothman, P., Muzzy, R. (1994) Visualizing Data: Is Virtual Reality the Key? IEEE Visualization, IEEE Press, Short Paper, 410-413.

60. **Bederson, B. B.**, Stead, L., & Hollan, J. D. (1994). Pad++: Advances in Multiscale Interfaces. In Proceedings of Human Factors in Computing Systems (CHI 94) New York: ACM Press, Short Paper, 315-316.

61. **Bederson, B. B.** (1992). A Miniature Space-Variant Active Vision System: Cortex-I. Doctoral dissertation, New York University, New York, NY.

E. TALKS, ABSTRACTS, AND OTHER PROFESSIONAL PAPERS PRESENTED
i. Keynote Talks

1. April 2017 **CHIuXiD - The International Conference in Human-Computer Interaction & User Experience**, Jakarta, Indonesia
   "From Human-Computer Interaction to Strategic Leadership for Change"

2. March 2017 **Maryland College Learning Center Association**, Shady Grove, MD
   "Fishing for Faculty: Teaching & Learning Engagement at UMD"

3. April 2014 **Innovations in Teaching and Learning Conference**, College Park, MD
   "An Introduction to the Teaching and Learning Transformation Center"

4. October, 2012 **South African Institute for Computer Scientists and Information Technologists** Johannesburg, South Africa
   "Social Participation: How Collective Activity Can Make Change"

5. September, 2010 **Visual Information Communication International Symposium**, Beijing, China
   "The Promise of Zoomable User Interfaces"

6. May, 2010 **Human-Computer Interaction Lab's 27th Annual Symposium**, College Park, MD
   "The Promise of Zoomable User Interfaces"

7. November, 2009 Raja Roy Singh Keynote Lecture at the **UNESCO Asia-Pacific Programme of Educational Innovation for Development**, Hangzhou. China
"Educational Technology for Creativity, Collaboration and Community"

8. February, 2009 **Microsoft Internal "UX Canvas Camp"**, Redmond, WA
"A Short History of Zoomable User Interfaces"

9. September, 2002 **IEEE Symposium on Human Centric Computing Languages and Environments (HCC 02)**, Arlington, VA
"Interfaces for Staying in the Flow"

ii. Invited Talks (doesn't include Keynote talks, which are listed above)

1. October 3, 2018, **Rutgers University**, Newark, NJ
"Transforming Teaching at the University of Maryland"

2. September 28, 2018, **EPAM Executive Roundtable**, Minsk, Belarus
"Workforce of the Future"
on Panel with Eugene Roman (Canada Tire), Sjoerd Gehring (Johnson & Johnson) & Sandra Loughlin (UMD)

3. September 27, 2018, **EPAM Software Engineering Conference (SEC 2018)**, Minsk, Belarus
"Open Company, Open Community, Open World"
on Panel with Elaina Shekhter (EPAM), Sjoerd Gehring (Johnson & Johnson), Scott Nissenbaum (Ben Franklin Technology Partners) & Sandra Loughlin (UMD)

4. December 4, 2017, **Cornell Tech**, New York, NY
"Academic Technologies in Higher Ed"

5. November 10, 2017, **Online Programs and MOOCs – Opportunities and Challenges**, in The 7th Annual MIS Academic Leadership Conference, RHSmith School of Business, University of Maryland

6. Sept 2, 2017, **Google**, New York, NY
"Academic Technologies in Higher Ed"

7. June 11, 2015 **Designing a Learning Environment**, in "Open Textbooks: Challenges for Policy" workshop, University of Haifa, Haifa, Israel

8. May 13, 2015 **Strategic Integration of MOOCs into Graduate and Professional STEM Programs**, Champaign, Illinois
Raineri, D., Breslow, L., **Bederson, B. B.**
"Future of MOOCs in Research Universities"

9. April 13, 2015 **#EduAnalyticsDC Workshop**, Washington, DC
"Understanding Consistency in a Large Multi-Section Course with Many Instructors"

10. March 3, 2015 **Coursera Partners Conference**, Newport Beach, CA
Verstelle, M., Bennett, A., **Bederson, B. B.**, & Jeffries, Pam
"Designing a MOOC Portfolio: Content Strategy for Online Education"

11. March 1, 2015 **Coursera Partners Conference**, Newport Beach, CA
Buitendijk, S., **Bederson, B. B.**, Kerrison, M., & Price, V.
"Value to Partners: Case Studies From Partner Institutions"

12. January 29, 2015 **University of Wisconsin, Madison**, Madison, WI
"Reflections on 20 Years Doing HCI Systems Research"
Department of Computer Science, Distinguished Lecture Series

13. Sheil, M., Rock, E., O'Brien, L., **Bederson, B. B.**, & Xiaoming, L. (2014) "Future Trajectories of MOOCS in Higher Ed", Panel at Coursera Partners' Conference.

14. February 12, 2014 **Patuxent Partnership**, Lexington Park, MD
"UMD MOOCs and What the Future Holds For Them"

15. January 29, 2014 **Carnegie Mellon University**, Pittsburgh, PA
"Power to the People: Approaches to Crowdsourcing"

16. January 14, 2014 **Microsoft**, Friendship Heights, MD
"Cracking the Code: Improving Computer Science Education Outcomes in the State of Maryland"
Panel participant on Microsoft public series "Conversations on Education"

17. November 20, 2013 **University of Maryland**, College Park, MD
"Mobile, Online, Flipped, Active: New Uses of Educational Technologies"
College of Education

18. October 11, 2013 **Huawei**, Hong Kong, China
"When Crowds Come Together"

19. October 8, 2013 **National Institute of Information and Communications Tecnology**, Osaka, Japan
"Crowdsourced Monolingual Translation"
in 2nd Workshop on Future Directions in Translation Research

20. February 1, 2013 **Google**, Mountain View, CA
"Social + MOOCs + Hcomp = SMOOCH: Computing Comes to Education"

21. January 29, 2013 **Google**, Mountain View, CA
"The Promise of Zoomable User Interfaces: Reflections on Design of Simple UX"

22. December 6, 2012 **Sunlight Foundation**, Washington, DC
"Digital Disclosure of a Nationally Standardized Database of Restaurant Food Safety Inspections" (with Ginger Jin)

23. November 19, 2012 **University of Maryland**, College Park, MD
"Innovation, Iteration & Creation: A Discussion about the Development of New Ideas in the Modern World"

24. November 6, 2012 **World Usability Day**, Minsk, Belarus
"The Promise of Zoomable User Interfaces"

25. November 2, 2012 **Central & Eastern European Software Engineering Conference in Russia** Moscow, Russia
"Learning to Code in an Online World"

26. November 2, 2012 **Central & Eastern European Software Engineering Conference in Russia** Moscow, Russia
Panelist in "Peopleware: what skills and qualifications we need to build a dream team of software engineers"

27. October 4, 2012 **UNISA – University of South Africa**, Johannesburg, South Africa
"Innovation, Iteration & Creation: A Discussion about the Development of New Ideas in the Modern World"

28. June 20, 2012 **University of Haifa**, Haifa, Israel
"Books that are Blue: What Children Can Teach Us About Creating New Technologies" (with Allison Druin)

29. June 19, 2012 **Interdisciplinary Center**, Herzilya, Israel
"Books that are Blue: What Children Can Teach Us About Creating New Technologies" (with Allison Druin)

30. Nov 17, 2011 **Future of Information Alliance**, College Park, MD
"Anonymity and Privacy While Learning"

31. Sept 21, 2011 **U.S. Senate and Congress Briefings**, Washington, DC
Panel participant in "Deconstructing the iPad: How Federally Supported Research Leads to Game-Changing Innovation" run by the Task Force on American Innovation and the CRA

32. Aug 24, 2011 **Summer Social Webshop** College Park, MD
"Translation by Collaboration Among Monolingual Users"

33. May, 2011 **National Science Foundation**, Arlington, VA
    Distinguished Lecture Series
    "Translation by Collaboration among Monolingual Users" (with Philip Resnik)

34. September, 2010 **Microsoft Research Asia**, Beijing, China
    "Collaborative Monolingual Translation"

35. September, 2010 **Tsinghua University**, Beijing, China
    "Collaborative Monolingual Translation"

36. April, 2010 **CHI 2010**, Atlanta, GA
    Social Impact Award talk

37. October, 2009 **Google**, Mountain View, CA
    Panel participant in "Breakthrough Learning in a Digital Age" invitation only conference

38. September, 2009 **Google Tech Talk**, Mountain View, CA
    "Translation by Iterative Collaboration between Monolingual Users"

39. April, 2009 **University of Illinois (CS Dept.)**, Champaign-Urbana, IL
    "Zoomable User Interfaces from Sun Sparcstations to iPhones"

40. April, 2009 **University of Illinois (iSchool)**, Champaign-Urbana, IL
    "From Ulann Baatar to iPhone: A Digital Library for the World's Children"

41. February, 2009 **Tufts University**, Medford, MA
    "From iPhone to Ulaan Baatar: A Digital Library for the World's Children"

42. February, 2009 **Microsoft Internal "UX Canvas Camp"**, Redmond, WA
    "A Short History of Zoomable User Interfaces"

43. September, 2008, **Carnegie Mellon University**, Pittsburgh, PA
    "Black Ears to Blonde Cats: Paths for Designing Change"

44. May, 2008, **Manchester Public Library** Manchester by the Sea, MA
    "No Road, Drive: The ICDL Travels to Mongolia"

45. April, 2008 **Web 2.0 Expo**, San Francisco, CA
    "Next Generation Mobile UI" (with John SanGiovanni)

46. February, 2008 **USACM Executive Council**, Washington, DC
    "Voting Technology: The Not-So-Simple Act of Casting a Ballot"

47. October, 2007 **Widget Summit**, San Francisco, CA
    "Mobile Widget Design"

48. September, 2007 **Knight Center for Specialized Journalism**, College Park, MD
    "Mobile Technology Trends"

49. June, 2007 **Mobile Marketing Association**, New York, NY
    "Designing for Usability"

50. May, 2007 **MIT Enterprise Forum**, Arlington, VA
    "Co-present Mobile Collaboration"

51. December, 2006 **Human Factors and Ergonomics Society Potomac Chapter**, Bethesda, MD
    "A Library for the World's Children"

52. June, 2006 **Open Society Forum**, Ulaan Baatar, Mongolia
    "A Library for the World's Children"

53. February, 2006 **Dingman Center for Entrepreneurship, R.H. Smith School of Business**, UMD
    "Web 2.0 UI"

54. December, 2005 **World Bank**, Washington, DC
    "The International Children's Digital Library"

55. December, 2005 **IBM T.J. Watson Research Center**, Hawthorne, NY
"Making Visualization Work"

56. November, 2005 **NSA**, Laurel, MD
"Making Visualization Work"

57. October, 2005 **IBM Research**, Cambridge, MA
"Making Visualization Work"

58. October, 2005 **Johns Hopkins University – Computer Science Dept.**, Baltimore, MD
"Making Visualization Work"

59. September, 2005 **InfoToday Conference on 'Innovations in Search'**, New York, NY
"Zooming Into Visual Search"

60. March, 2005 **NFAIS**, Philadelphia, PA
"Making Sense of Search Results"

61. February, 2005 **American Association for the Advancement of Science (AAAS)** Washington, DC
Panel in annual conference,
"Designing Interfaces for Voting Machines"

62. February, 2005 **National Association of State Election Directors (NASED)** Washington, DC
Invited talk at annual conference.
"Designing Interfaces for Voting Machines"

63. January, 2005 **Microsoft**, Seattle, WA
"Interfaces for Staying in the Flow"

64. January, 2005 **Google**, Mountain View, CA
"The International Children's Digital Library"

65. December, 2004 **National Library of New Zealand,** Wellington, New Zealand
"The International Children's Digital Library"

66. December, 2004 **University of Waikato**, Hamilton, New Zealand
"Interfaces for Staying in the Flow"

67. December, 2004 **Victoria University Wellington**, Wellington, New Zealand
"Interfaces for Staying in the Flow"

68. December, 2004 **University of Canterbury**, Christchurch, New Zealand
"Interfaces for Staying in the Flow"

69. November, 2004 **National Archives and Records Administration (NARA)**, College Park, MD
in Conference "Partnerships in Innovation: Serving a Networked Nation"
"International Children's Digital Library"

70. April, 2004 **Johns Hopkins University Applied Physics Lab**, Laurel, MD
"Interfaces for Staying in the Flow"

71. October, 2003 **University of Maryland, Robert H. Smith School of Business**, College Park, MD
on InForum 2003 panel on "Does IT Matter?"

72. September, 2003 **University of Maryland**, College Park, MD
"Making Visualization Work"

73. September, 2003 **University of Victoria**, Victoria, Canada
"Interfaces for Staying in the Flow"

74. March, 2003 **National Archives and Records Administration**, College Park, MD
"Visualizations for Archivists"

75. March, 2003 **Microsoft Research**, Redmond, WA
"DateLens: A Scalable Fisheye Calendar Interface"

76. January, 2003 **Sun Microsystems**, Menlo Park, CA
"Zoomable User Interfaces for Searching and Browsing"

77. September, 2002 **Microsoft Research Limited**, Cambridge, England
”Information Visualization for Mobile Devices”

78. July, 2002 **Microsoft Research**, Redmond ,WA
Demo of DateLens with Bill Gates at Microsoft Faculty Summit

79. July, 2002 **Microsoft Research**, Redmond, WA
”Scalable Interfaces for Mobile Devices”

80. June, 2002, **WebShop**, Dept. of Sociology, UMD, College Park, MD
”Access and Usability: The Importance of Internet Applications”

81. January, 2002 **Workshop on Election Standards and Technology**, Washington, DC
”Visualization Techniques for Electronic Voting”

82. October, 2001 **Microsoft Research**, Redmond, WA
“Zoomable User Interfaces for Searching and Browsing: SearchKids & PhotoMesa”

83. October, 2001 **Xerox PARC**, Palo Alto, CA
“Zoomable User Interfaces for Searching and Browsing: SearchKids & PhotoMesa”

84. November, 2000 **Census Bureau, Dept. of Commerce**, Suitland, MD
”Zoomable User Interfaces”

85. May, 2000 **Bowie State University**, Bowie, MD
“Zoomable User Interfaces and Single Display Groupware”

86. April, 2000 **University of Delaware**, DE
“Zoomable User Interfaces and Single Display Groupware”

87. August, 1999 **Xerox PARC**, Palo Alto, CA
“Zoomable User Interfaces and Single Display Groupware”

88. August, 1999 **University of California, Berkeley**, Berkeley, CA
“Zoomable User Interfaces and Single Display Groupware”

89. August, 1999 **Sun Microsystems, Inc. (Java Group)**, Palo Alto, CA
“Zoomable User Interfaces and Single Display Groupware”

90. July, 1999 **Nokia**, Linköping Sweden
"Zoomable Information Retrieval Systems and Single Display Groupware"

91. June, 1998 **IBM**, Yorktown, NY
"Zoomable User Interfaces"

92. May, 1998 **Washington DC Linux User's Group**, Alexandria, VA
"Zoomable User Interfaces"

93. April, 1998 **National Institute of Standards and Technology (NIST)**, Gaitherberg, MD
"Zoomable User Interfaces"

94. March, 1998 **Microsoft Research**, Redmond, WA
"Zoomable User Interfaces"

95. October, 1997 **Netherlands Design Institute**, Amsterdam, Holland
"Pad++: Zoomable User Interfaces"

96. October, 1997 **Philips Labs**, Eindhoven, Holland
"Pad++: Zoomable User Interfaces"

97. October, 1997 **CID, Royal Institute of Technology (KTY),** Stockholm, Sweden
"Pad++: Zoomable User Interfaces"

98. September, 1997 **Swedish Institute of Computer Science (SICS)**, Stockholm, Sweden
"Pad++: Zoomable User Interfaces"

99. October, 1996 **ART3000, A French society for the development of Art & Technology**, Paris, France
"Pad++: A Zoomable Graphical Interface”

100. October, 1996 **University of Michigan, Department of Information Sciences**, Ann Arbor, MI
"Pad++: A Zoomable Graphical Interface"

101. July, 1996 **AT&T Bell Labs**, NJ
"Pad++: A Zoomable Graphical Interface"

102. January, 1996 **Stanford University, Cognitive Psychology Group**, CA
"Pad++: A Zoomable Graphical Interface"

103. October, 1995 **Cornell University, Computer Science Department**, Ithaca, NY
"Pad++: A Zoomable Graphical Interface"

104. June, 1995 **Sandia National Labs**, Los Alamos, NM
"Pad++: A Zoomable Graphical Interface"

105. April, 1995 **Los Alamos National Labs**, Los Alamos, NM
"Pad++: A Zoomable Graphical Interface"

106. November, 1993 **Digital Equipment Corporation, Stanford Research Center**, CA
"Pad++: A Multiscale Hierarchical Sketchpad"

107. October, 1993 **Brown University, Computer Science Department**, Providence, RI
"Pad++: A Multiscale Hierarchical Sketchpad"

108. April, 1993 **University of Chicago, Computer Science Department**, |
"PA3D: A Multiscale Hierarchical Sketchpad"

109. October, 1992 **Rensselaer Polytechnic Institute, Computer Science Department**, Troy, NY
"Cortex-I: A Miniature Active Vision System"

H. ORIGINAL DESIGNS, PLANS, INVENTIONS, AND PATENTS
i. Patents

1. SanGiovanni, J., & **Bederson, B. B.**, and Painter, B. (Inventors). 2018 *Systems and methods for adaptive third party content*. US Patent #10,019,963.
2. SanGiovanni, J., & **Bederson, B. B.** (Inventors). (2018) *Systems, methods, and computer program products displaying interctive elements on a canvas*. US Patent #9,959,020.
3. **Bederson, B. B.,** & SanGiovanni, J. (Inventors). (2017) *Techniques to modify content and view content on mobile devices*. US Patent #9,778,810.
4. SanGiovanni, J., & **Bederson, B. B.** (Inventors). (2016) *Systems, Methods, and Computer Program Products Providing an Integrated User Interface for Reading Content*. US Patent #9,361,130.
5. SanGiovanni, J., & **Bederson, B. B.** (Inventors). (2014) *Systems, Methods, and Computer Program Products Displaying Interactive Elements on a Canvas.* US Patent #8,819,750.
6. Pahud, M., Murillo, O. E., Karlson, A. K., & **Bederson, B. B.** (Inventors). (2012). *Monitoring Pointer Trajectory and Modifying Display Interface*. US Patent #8,261,211.
7. Good, L.E., **Bederson, B. B.**, & Stefik, M.J. (Inventors). (2010). *Methods and Systems for Supporting Presentation Tools Using Zoomable User Interfaces*. US Patent #7,707,503.
8. **Bederson, B. B.**, Good, L. E., & Stefik, M.J. (Inventors). (2009). *Methods and Systems for Incrementally Changing Text Representation*. US Patent #7,650,562 B2.
9. **Bederson, B. B.**, Good, L. E., & Stefik, M. J. (Inventors). (2009). *Methods and Systems for Incrementally Changing Text Representation*. US Patent #7,549,114 B2.
10. Wallace, R. S., **Bederson, B. B.**, & Schwartz, E. L. (Inventors). (1997). *TV Picture Compression and Expansion*. US Patent #5,642,167.
11. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (Inventors). (1993). *Two-Dimensional Pointing Motor*. US Patent #5,204,573.

12. Wallace, R. S., **Bederson, B. B.**, & Schwartz, E. L. (Inventors). (1992). *Telephone Line Picture Transmission*. US Patent #5,175,617.

ii. University Disclosures

1. **Bederson, B. B.** & Lin, J. (Inventors) (2009), CrowdFlow: A Computer-Human Hybrid Cloud Computing Model.
2. **Bederson, B. B.** (Inventor) (2002), Fisheye Calendar: A Calendar interface for small to large devices, IS-2002-015.
3. **Bederson, B. B.** (Inventor) (2001), PhotoMesa: A Zoomable Image Browser, IS-2001-053
4. **Bederson, B. B.**, & Chipman, L. G. (Inventors) (2000), *Physical Linear Slider Device to Control Computer Interface*, IS-2000-018.
5. **Bederson, B. B.** (Inventor) *Fisheye Menus For Selecting an Item From a Long List*, IS-2000-025.
6. **Bederson, B. B.**, Druin, A., & Pablo, J. P. (Inventors) (2000), *KidPad: A Collaborative Storytelling Environment for Children*, IS-2000-019.

I. CONTRACTS AND GRANTS

Total Funding: $18,036,144
UMD Portion: $10,329,299

1. **Ithaka SR, July 2016, co-PI**
   Elementary Statistics with an adaptive learning system
   $113,500
2. **Maryland Innovation Initiative, March 2014, PI**
   A Nationwide Database of Food Safety Inspections for Retail Establishments
   $100,000
3. **Huawei, July 2013, PI**
   XParty: Synchronous Online Language Learning
   $54,000
4. **Google, March 2013, PI**
   XParty: Synchronous Peer Learning in MOOCs (extension)
   $48,872
5. **Google, December 2011, PI**
   Search Party: Learning to Search in a Web-Based Classroom
   $60,000
6. **Alfred P. Sloan Foundation, November 2011, co-PI**
   Digital Disclosure of a Nationally Standardized Database of Restaurant Food Safety Inspections
   $465,272
7. **Google, June 2011, PI**
   Search Party: Web-Based Classroom Learning to Search
   $15,000
8. **Google, June 2011, co-PI**
   Translate the World: A Unified Framework for Crowdsourcing Translation
   $150,000
9. **Nokia Research, July 2010, PI**
   Mobile Learning
   $36,000

10. **NSF, CDI Type I: Translation as a Collaborative Process, Sep 2009, PI**
    $630,000

11. **Google, July 2009, PI**
    Translation as a Collaborative Process
    $70,000

12. **Sesame Workshop, January 2009, co-PI**
    Literacy 360 Alliance
    $22,500

13. **Eliassen Foundation, Nov 2008, co-PI**
    ICDL Elias Project
    $50,000

14. **Intel, Nov 2008, co-PI**
    ICDL ClassmatePC Project
    $50,000

15. **NSF, Designing and Understanding Intergenerational Mobile Learning Communities, Sep 2008, co-PI**
    $100,000

16. **Government of Mongolia Ministry of Education, Culture and Science – Nov2008, PI**
    International Children's Digital Library Phase 2
    $230,000
    $190,000 (for UMD)

17. **NSF, Usability Study of Independent Voter Verification Systems – July 2006, co-PI**
    PI – Paul Herrnson (Gov't & Politics)
    $68,000

18. **Government of Mongolia Ministry of Education, Culture and Science – May 2006, PI**
    Creating Digital Libraries in Mongolia
    $75,000

19. **IBM Faculty Award – December 2005, PI**
    Award to support my research on the open source Piccolo graphics toolkit.
    $30,000

20. **Maryland State Board of Elections, September 2005 – January 2006, co-PI**
    PI – Paul Herrnson (Gov't & Politics)
    $70,000

21. **(Agency not disclosed), April 2005 – March 2006, co-PI**
    Joint Institute for Knowledge Discovery
    $224,000 (my part of larger $2,000,000 effort led by VS Subrahmanian)

22. **Booz Allen (subcontract from ARDA), March 2005 – April 2006**
    Human-Information Interaction Research
    $325,000

23. **Toshiba, July 2004 – December 2006, PI**
    Automatic Thumbnail Cropping
    $20,000

24. **Microsoft, January 2004 – December 2006, PI**
    Interaction Design and Visualization
    $1,000,000

25. **DARPA, February, 2003 – January 2006, PI**
    Zoomable User Interfaces for the Semantic Web
    $230,000

26. **NSF, September, 2003 – August 2006, co-PI**
PI – Paul Herrnson (Gov't & Politics), co-PI, Richard Niemi (Univ. of Rochester), Michael Traugott (Univ. of Michigan)
An Assessment of Voting Technology and Ballot Design
$900,000 – approx $540K for UMD research

27. **Chevron, Oct 2002 – Oct 2003, co-PI**
PI – Catherine Plaisant (UMIACS)
Information Visualization for the Oilfield of the Future
$75,000

28. **IBM, September, 2002, PI**
T221 high-resolution display
$9,000 in kind

29. **IMLS, September, 2002 – August, 2005, co-PI**
PI – Allison Druin (CLIS)
The Children's International Digital Library
$397,162

30. **NSF, September, 2002 – August 2005, PI**
Search Interfaces for Biodiversity Informatics
$380,000

31. **NSF, September 2002 – August 2007, co-PI**
PI – Allison Druin (CLIS), co-PI, Anne Weeks
Developing a Children's International Digital Library
$3,000,000 ($2,125,000 to UMD)

32. **NSF, September 2002 – August 2005, co-PI**
co-PI – Allison Druin (CLIS), PI - Nancy Kaplan (Univ. of Baltimore), Stuart Malthrop (U. of Balt.)
An HCI Partnership Serving Under represented Groups
$420,000 ($133,000 to UMD)

33. **Microsoft Research, May 2002 – April 2001, PI**
Mobile Interfaces and .NET
$100,000

34. **Microsoft Research, September 2001 – August 2002, PI**
Mobile Interfaces
$50,000

35. **DARPA, May 2001 – August 2003, PI**
Zoomable User Interfaces for the Semantic Web
$320,000

36. **European Union – Esprit, The Disappearing Computer, Jan 2001 – December 2003, co-PI**
co-PI – Allison Druin (CLIS), Several PIs in Europe
With Royal Institute of Technology (KTH – Sweden), Univ. of Paris Sud, France.
InterLiving: Designing Interactive, Intergenerational Interfaces for Living Together
~$1,500,000 - approx $400K for UMD research

37. **Chevron, Nov 2000 – May, 2002, PI**
co-PI – Catherine Plaisant (UMIACS)
Information Visualization
$141,000

38. **DARPA, May 1998 – June 2002, PI**
Zoomable User Interfaces for InImEx and Command Post of the Future (CPOF)
$1,000,000

39. **Lockheed Martin Corp. sub-contract from DARPA, June 1999 - June 2000, PI**
Unified Zoomable Environment (UZE) for Command Post of the Future
$40,000

40. **European Union – Esprit, Intelligent Information Interfaces, Sept. 1998 – August 2001, co-PI**
co-PI – Allison Druin (CLIS), Several PIs in Europe
With Swedish Institute of Computer Science, Royal Institute of Technology (KTH – Sweden)
University of Nottingham, England.
KidStory
~$1,500,000 - approx $300K for UMD research

41. **Sun Microsystems, May 1999, PI**
Zoomable User Interfaces
$30,000 in equipment

42. **UNM sub-contract from DARPA, February 1998 – March 1999, PI**
Pad++: Zoomable User Interfaces
$200,000

43. **Microsoft, April, 1998, PI**
Productivity and development software
$5,000 in software and tech support

44. **Trivista, PI January 1998 - January 1999, PI**
Graphical User Interfaces based on Zooming
$50,000

UNIVERSITY OF NEW MEXICO

45. **Sony Research Corporation, PI**
co-PI – Jim Hollan (Univ. of New Mexico), co-PI – Ken Perlin (New York University)
Licensing of Pad++ software from UNM and NYU
$500,000 plus royalties

46. **Intel Donation, January, 1997, co-PI**
PI – Jim Hollan (Univ. of New Mexico)
200 MHz PC Computer
$4,000 in-kind

47. **DARPA, July'94 - June'97, Worked on grant with Jim Hollan**
Beyond Imitation: A Strategy For Building A New Generation of HCI Design Environments
$3,000,000 over 3 years with subcontracts to New York University and the Univ. of Michigan

48. **Sandia LDRD (Sandia internal research project) Oct'95 - Oct'96, PI**
Data Zooming - A New Physics for Information Navigation
$64,000

49. **Sandia SURP (Sandia University Research Program) Oct'95 - Oct'96, PI**
Pad++: A Zoomable Interface to the World-Wide Web
$40,000

50. **Sony Research Corporation, Jan'96, PI**
co-PI – Allison Druin (University of New Mexico)
Help plan Sony's efforts to develop a Zooming User Interface system
$3,674

51. **Sandia LDRD (Sandia internal research project) Oct'94 - Oct'95, Worked on grant with Jim Hollan**
$40,000

52. **Bellcore Donation, July'93, PI**
SGI Indigo Workstation computer
$30,000 in-kind

J. FELLOWSHIPS, PRIZES, AWARDS

1. **2016 – Winner of Best Historical Paper Award.** Joint with Pekka Parhi and Amy K. Karlson MobileHCI 2016 – 18th International Conference on Human-Computer Interaction With Mobile Devices and Services for "Target Size Study for One-Handed Thumb Use on Small Touchscreen Devices", MobileHCI 2006.

2. **2012 – Elected to the CHI Academy**
   http://www.sigchi.org/about/awards/

   The CHI Academy is an honorary group of individuals who have made substantial contributions to the field of human-computer interaction. These are the principal leaders of the field, whose efforts have shaped the disciplines and/or industry, and led the research and/or innovation in human-computer interaction. The criteria for election to the CHI Academy are:
   - Cumulative contributions to the field.
   - Impact on the field through development of new research directions and/or innovations.
   - Influence on the work of others.

3. **2011 – Recognized as an ACM Distinguished Scientist**
   http://awards.acm.org/distinguished_member/year.cfm

   The Distinguished Member Grade recognizes those ACM members with at least 15 years of professional experience and 5 years of continuous Professional Membership who have achieved significant accomplishments or have made a significant impact on the computing field.

4. **2010 – ICDL received the American Library Association President's Award for International Library Innovation**. Joint with Allison Druin and Ann Weeks.

5. **2010 – Winner of SIGCHI Social Impact Award**
   http://www.sigchi.org/about/awards/2010-sigchi-awards

6. **2009 – Winner of Digital Education Achievement Award from the Center for Digital Education and Converge magazine**
   For joint work on the International Children's Digital Library with Allison Druin and Ann Weeks.

7. **2007 – Winner of Brian Shackel Award for "outstanding contribution with international impact in the field of HCI"**
   Karlson, A., & Bederson, B. B. (2007) ThumbSpace: Generalized One-Handed Input for Touchscreen-Based Mobile Devices, *Proceedings of INTERACT 2007*, 324-338.

8. **2005 – IBM Faculty Award**
   $30,000 gift to support my work on open source Piccolo graphics toolkit

9. **2005 – The International Children's Digital Library (www.icdlbooks.org)** website was selected for inclusion by the National Endowment for the Humanities on their EDSITEment website (http://edsitement.neh.gov) as one of the best online resources for education in the humanities.

10. **2004 – Winner of InfoVis Contest**
    Lee, B., Czerwinski, M., Robertson, G. G. &, Bederson, B. B. (2004). "Understanding Eight Years of InfoVis Conferences using PaperLens", InfoVis 2004, IEEE, 216-217.

11. **2003 – Winner of Best Student Paper Award**
    Suh, B., Ling, H., Bederson, B. B., & Jacobs, J. W. (2003). "Automatic Thumbnail Cropping and Its Effectiveness". UIST 2003, ACM Symposium on User Interface Software and Technology, CHI Letters, 5(2), 95-104.

12. **1992 – Janet Fabri Memorial Award for Outstanding Doctoral Dissertation**,
    Department of Computer Science, Courant Institute, New York University

K. REVIEWING ACTIVITIES

ACM Conference on Graphics (SIGGRAPH)

ACM Conference on Human Factors in Computing Systems (CHI)
ACM Conference on Information Retrieval (IR)
ACM Conference on User Interfaces and Software Technology (UIST)
ACM Transactions on Computer-Human Interaction (TOCHI)
Communications of the ACM (CACM)
Computer Graphics and Applications
Graphics Interface Conference, Canada (GI)
International Conference on Information Visualization
International Journal of Human-Computer Interaction
IEEE Symposium on Information Visualization (InfoVis)
IEEE Symposium on Visual Analytics Science and Technology (VAST)
IEEE Transactions on Software Engineering (TSE)
IEEE Transactions on Visualization and Computer Graphics (TVCG)
Journal of Experimental Algorithmics
Journal of Information Visualization
Journal of Software Practice and Engineering (SPE)
NSERC (Canadian scientific funding agency)
National Science Foundation

L. OTHER
i. Software

StoryKit	iPhone app for children and their elders to create new books. Put in iPhone App Store August, 2009. Typical usage of 100,000 hours of story writing per month.
ICDL for iPhone	iPhone app for reading books from the International Children's Digital Library. Put in iPhone App Store November, 2008.
International Children's Digital Library	A library of children's books. Put on the Web Nov, 2002. http://www.childrensbooks.org • Unique accessors total: > 7,000,000 • Unique accessors monthly: ~130,000
DateLens	A calendar program for PDAs. Put on the Web July, 2002
SpaceTree	A general purpose tree browser. Put on the Web Dec, 2002. http://www.cs.umd.edu/hcil/spacetree
PhotoMesa	An end-user zoomable photo browser. Put on the Web May, 2001. http://www.cs.umd.edu/hcil/photomesa
CounterPoint	A zoomable presentation tool that works as a plug-in for Microsoft PowerPoint. Put on the Web in late 2001. http://www.cs.umd.edu/hcil/counterpoint
Piccolo	A library to support structured 2D graphics, the successor to jazz. Put on the Web in July 2002. http://www.cs.umd.edu/hcil/piccolo
Jazz	A general-purpose Java toolkit for building Zoomable User Interfaces. Put on the Web as Open Source software July 1999. http://www.cs.umd.edu/hcil/jazz
KidPad	An application that teaches young children communication skills through collaborative storytelling. Built using MID and KidPad. Put on the Web for non-commercial use March 2000. Access through March 2001 follow. http://www.cs.umd.edu/hcil/kidpad
Fisheye Menus	A new user interface widget for selecting one item for a long list using graphical distortion. Put on the Web for non-commercial use June 2000. Access through March 2001 follow. http://www.cs.umd.edu/hcil/fisheyemenu
MID	A general-purpose Java toolkit for supporting multiple input devices. It currently supports multiple USB mice on Windows 98. Put on the Web as Open Source software July 1999. It is used by the small but growing community of researchers investigating Single Display Groupware http://www.cs.umd.edu/hcil/mid
Pad++	Pad++ is described in detail in the papers referenced above. http://www.cs.umd.edu/hcil/pad++
Togl	An extension to Tcl/Tk that allows the creation of OpenGL graphics written in C to appear in a window managed by Tk. In addition, Tcl event bindings can be attached to the window which can then communicate with the C code that did the OpenGL rendering. Put on the net for public access. http://togl.sourceforge.net/

ii. Media

1. February 2, 2017 **The Diamondback** by Carly Taylor
"McKeldin Mall's Newest Academic Building Will Be Completed in March After Nearly 3 Years"
http://www.dbknews.com/2017/02/02/edward-st-john-construction-umd/

2. August 29, 2016 **The Diamondback** by Andrew Dunn
"University System of Maryland to offer an online course for free"
http://www.dbknews.com/2016/08/30/mooc-umb-umuc-online-usm/

3. February 15, 2016 **The Diamondback** by Samantha Reilly
"SGA passes resolution to revive 2012 syllabus bill"
http://www.dbknews.com/2016/02/16/umd-sga-passes-syllabus-resolution-to-revive-university-senate-bill/

4. September 24, 2015 **The Diamondback** by Taylor Swaak
"Active-Learning Courses Gain Traction at the University of Maryland"
http://www.diamondbackonline.com/news/active-learning-courses-gain-traction-at-the-university-of-maryland/article_435098ca-6247-11e5-a8e2-df59d97181a5.html

5. September 14, 2015 **Washington Post Express** by Beth Luberecki
"Massive open online courses (MOOCs) can help you achieve the next step in your career"
https://www.washingtonpost.com/express/wp/2015/09/14/massive-open-online-courses-moocs-can-help-you-achieve-the-next-step-in-your-career/

6. April 30, 2015 **The Diamondback** by Talia Richman
"USM Center for Academic Innovation to be renamed to honor Brit Kirwan"
http://www.diamondbackonline.com/news/article_51cbc02c-eeb7-11e4-a838-6b9857ba8e37.html

7. April 13, 2015 **The Diamondback** by Rokia Hassanein
"UMD Team Creates Nation's Largest Food Safety Inspection Database"
http://www.diamondbackonline.com/news/article_553da506-e181-11e4-b6c9-0f23d720b7cc.html#.VS1VV_HbNqc.twitter

8. April 6, 2015 **Quality Assurance & Food Safety Magazine**
"Database of Food Safety Inspection Information Created"
http://www.qualityassurancemag.com/food-safety-inspection-information.aspx

9. February 23, 2015 **Diamondback, UMD Student Newspaper** by Taylor Swaak
"New UMD website offers alternative ways to save money on textbooks"
http://www.diamondbackonline.com/news/article_0d910a34-baf5-11e4-826a-dfbcb9e8b5f8.html

10. January 13, 2015 **WAMU Kojo Nnamdi Show**
"The Rise of Mobile Apps"
http://thekojonnamdishow.org/shows/2015-01-13/tt_the_rise_of_mobile_apps

11. October 1, 2014 **The Chronicle of Higher Education**
"Optimism About MOOCs Fades in Campus IT Offices"
http://chronicle.com/blogs/wiredcampus/optimism-about-moocs-fades-in-campus-it-offices-survey-finds/54705

12. September 8, 2014 **WAMU Kojo Nnamdi Show**
"Beefing Up Photo, Cloud and Online Security"
http://thekojonnamdishow.org/shows/2014-09-09/beefing-photo-cloud-and-online-security

13. April 29, 2014 **Diamondback, UMD Student Newspaper** by James Levin
"Learning to ask for help"
http://www.diamondbackonline.com/news/article_632cbbb8-cf5b-11e3-b8b4-0017a43b2370.html

14. April 18, 2014 **CNN.com** by Emanuella Grinberg
"Removing 'barriers' to education through free college textbooks"
http://www.cnn.com/2014/04/18/living/open-textbooks-online-education-resources/

15. January 27, 2014 **DiamondBack, UMD Student Newspaper** by Ellie Silverman
"University expanding online class sequences through Vanderbilt partnership"
http://www.diamondbackonline.com/news/campus/article_dff739f4-86ed-11e3-9a18-001a4bcf6878.html

16. September 27, 2013 **Baltimore Business Journal** by Sarah Gantz
"Maryland Schools use Online Model to Tout Brand, Attract Students"
http://www.bizjournals.com/baltimore/print-edition/2013/09/27/maryland-schools-use-online-model-to.html?page=all

17. July 16, 2013 **HuffingtonPost.com**
"Blended Learning: College Classrooms of the Future"
http://www.huffingtonpost.com/uloop/blended-learning-college-_b_3598718.html

18. December 5, 2012 **Diamondback, UMD Student Newspaper** by Allison Gray
"University members hoping to see 'massive open online courses' integrated"
http://www.diamondbackonline.com/news/article_4873330c-3ef1-11e2-9a16-0019bb30f31a.html

19. September 21, 2012 **SmartMoney.com** by Quentin Fottrell
In Apple's Maps War vs. Google, Consumers Lose
http://blogs.smartmoney.com/advice/2012/09/21/in-apples-maps-war-vs-google-consumers-lose/?link=SM_hp_ls4e

20. September 18, 2012 **WAMU Kojo Nnamdi Show**
"Creativity and the Patent Wars" (guest on one-hour show)
http://thekojonnamdishow.org/shows/2012-09-18/creativity-and-patent-wars

21. September 7, 2012 **New York Magazine** by Matthew Shaer
"The Digital Elite: Smartphones are getting huge. Can the average-size thumb keep up?" (discusses my study on thumb size and mobile touch screens.

22. Aug 13, 2012 **Fact Witness in Apple v. Samsung trial covered broadly**
http://blogs.wsj.com/digits/2012/08/13/samsungs-first-witnesses-push-prior-art-after-minor-victory/

http://news.cnet.com/8301-13579_3-57492486-37/samsung-goes-on-offense-aims-to-bust-apple-patents/

http://arstechnica.com/tech-policy/2012/08/apple-rests-patent-case-as-judge-tosses-three-samsung-phones-from-trial/

http://www.forbes.com/sites/connieguglielmo/2012/08/13/apple-says-it-complained-about-samsung-copying-in-2010-live-blog/

http://allthingsd.com/20120813/judge-refuses-to-toss-most-of-apples-suit-against-samsung/

http://www.theverge.com/2012/8/13/3240686/samsung-apple-patents-launchtile-diamondtouch-table

http://www.eweek.com/c/a/Mobile-and-Wireless/Samsung-Begins-Presenting-Case-in-Apple-Patent-Infringement-Trial-162894/

23. May 7, 2012 **WAMU Kojo Nnamdi Show**
"Free Online Courses - Higher Ed of the Future?" (guest on hour show)
http://thekojonnamdishow.org/shows/2012-05-07/free-online-courses-higher-ed-future

24. January 24, 2012 **Washington Post** by Bonnie Berkowitz and Alberto Cuadra
"Touchscreens: How they work", I am the primary source
http://www.washingtonpost.com/national/health-science/touchscreens-how-they-work/2012/01/23/gIQAZHlAMQ_graphic.html

25. June 28, 2011 **New Scientist** by Jim Giles
"The man-machine: Harnessing humans in a hive mind", discussed MonoTrans.
http://www.newscientist.com/article/mg21028181.900-the-manmachine-harnessing-humans-in-a-hive-mind.html

26. June 14, 2011 **WAMU Kojo Nnamdi Show**
"A Shift in Cloud Computing" (guest on hour show)
http://thekojonnamdishow.org/shows/2011-06-14/shift-cloud-computing

27. May 13, 2011 **Discovery News** by Alyssa Danigelis
"Tech Turns Air into a Multi-touch screen", quoted.
http://news.discovery.com/tech/touch-screen-technology-zerotouch-110513.html

28. April 28, 2011 **Converge Magazine** by Tanya Roscorla
"Music Apps Take Top Prizes in U of Maryland Contest", discusses mobile app from the University of Maryland mobile app contest that I ran.

29. April 26, 2011 **Voice of America** by Do Noghte Sefr (in Persian)
"Mobility Initiative ابتکار تحرک"
http://www.youtube.com/donoghtesefr

30. April 24, 2011 **Washington Post**
"Business Rx: A jukebox democracy in search of voters", discusses mobile app from the University of Maryland mobile app contest that I ran.

31. February 25, 2011 **New Scientist** by Jim Giles and Jacob Aron
"Crowdsourced translations get the word out from Libya", discusses my MonoTrans project
http://www.newscientist.com/article/dn20174-crowdsourced-translations-get-the-word-out-from-libya.html

32. February 9, 2011 **DiamondBack, UMD Student Newspaper**
"Creativity at her fingertips" by Erin Egan
http://www.diamondbackonline.com/news/article_f7143841-131c-5695-a310-42596336345d.html

33. February 8, 2011 **WAMU Kojo Nnamdi Show**
"A Revolution in Tech Jobs? The Murky World of Online Labor" (hour show with me as only guest)
http://thekojonnamdishow.org/shows/2011-02-08/revolution-tech-jobs-murky-world-online-labor

34. November 23, 2010 **WAMU Kojo Nnamdi Show**
"The End of Email and other Tech Prognostications"
(hour show with me and one other guest)
http://thekojonnamdishow.org/shows/2010-11-23/end-email-and-other-tech-prognostications

35. November 9, 2010 **MIT Technology Review** by Erica Naone
"Gesturing at Your TV Isn't Ready for Prime Time" quotes me discussing Microsoft Kinect
http://www.technologyreview.com/computing/26691/

36. October 27, 2010 **MIT News** by Larry Hardesty
"Programming crowds" quotes me in analyzing Rob Miller's work
http://web.mit.edu/newsoffice/2010/programming-crowds-1027.html

37. October 2, 2010 **News 8 TV Austin**
"App Wrap: eReading for Kids" discussing StoryKit app for iPhone
http://www.news8austin.com/content/headlines/274426/app-wrap--ereading-for-kids

38. August 24, 2010 **WAMU Kojo Nnamdi Show**
"Automating Language Translation: The Future of a Unified Internet?" discussing my research and the general topic of crowdsourcing and translation.
http://thekojonnamdishow.org/shows/2010-08-24/automating-language-translation-future-unified-internet

39. May 4, 2010 **Technology Review**
"Redesigning the Web for Touch Screens"
http://www.technologyreview.com/printer_friendly_article.aspx?id=25236&channel=computing&section=

40. April 2010 **FutureGov Magazine** by Kelly Ng, Singapore
Description of ICDL for iPad application

41. April 17, 2010 **ABC 7 News, WLS-TV Chicago**
"Chicago Students Face Off in Battle of Books"
http://abclocal.go.com/wls/story?section=news/local&id=7392055

42. April 8, 2010 **Publisher's Weekly**
"The iPad Meets the Children's Book"
http://www.publishersweekly.com/article/455914-The_iPad_Meets_the_Children_s_Book.php?nid=2788&source=link&rid=16811925

43. April 3, 2010 **The Independent**, London
"Chlidren's book iPad apps offer multilingual tales, long-distance bedtime stories"
http://www.independent.co.uk/arts-entertainment/books/childrens-book-ipad-apps-offer-multilingual-tales-longdistance-bedtime-stories-1934847.html

44. January 28, 2010 **Baltimore Sun**, Baltimore, MD
"Apple unveils tablet computer" by Gus G. Sentementes
http://www.baltimoresun.com/business/technology/bal-bz.ipad28jan28,0,5120135.story

45. December 2009 **FutureGov Magazine** by Kelly Ng, Singapore
"Inside the Teacher's Lounge" covered Ben's keynote UNESCO talk in Hangzhou, China

46. November 20, 2009 **World Bank Blog**
http://blogs.worldbank.org/edutech/icdl-1

47. November 2, 2009 **Technology Review.com**
"First Test for Election Cryptography"
http://www.technologyreview.com/web/23836/

48. December 23, 2008 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy"

49. September 18, 2008 **America.gov**
"Kids Help Design International Children's Digital Library" by Jeffrey Thomas
http://www.america.gov/st/educ-english/2008/September/200809181459141CJsamohT0.2946283.html
Also published in **gulf-times.com** in Qatar
http://www.gulf-times.com/site/topics/article.asp?cu_no=2&item_no=245520&version=1&template_id=46&parent_id=26

50. April 25, 2008 **C|Net News.com**
"The Six Secrets of Mobile Computing Success" by Tom Krazit

51. February 8, 2008 **WYPR Maryland Morning**, Baltimore, MD
10 minute radio interview about usability of voting systems

52. January 30, 2008 **KCSN News** by Jessica Caldera
Short radio interview about usability of voting systems

53. January 29, 2008 **Technology Review.com** by Erica Naone
"Voting with (Little) Confidence"
http://www.technologyreview.com/Infotech/20122/

54. January 28, 2008 **ScienceDaily.com**
"Touch Screen Voting A Hit; Critics Miss Mark on Security, Study Says"
http://www.sciencedaily.com/releases/2008/01/080123170954.htm

55. January 26, 2008 **Newsweek** by Barrett Sheridan
"Like a Super Hero: Humans weren't made for scrolling and searching. We were made for zooming."
http://www.newsweek.com/id/105532/output/print

56. January 25, 2008 **Government Executive.com** by Gautham Nagesh
"Voters confused by e-voting machines, study finds"
http://www.govexec.com/dailyfed/0108/012508n1.htm

57. January 22, 2008 **WAMU Kojo Nnamdi Show**, Washington, DC
Thirty minute segment on "Technology User Frustrations – Spotlight on Cellphones"
http://wamu.org/programs/kn/08/01/22.php#19083

58. January 16, 2008 **KUOW, The Conversation**, Seattle, WA
The guest on an hour-long call-in talk show on the future of cellphones.
http://www.kuow.org/defaultProgram.asp?ID=14159

59. October 30, 2007 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy", talking about software reliability

60. August 7, 2007 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy", current tech events, iPhone, Tivo, and listeners email and calls
http://wamu.org/programs/kn/07/08/07.php

61. June 13, 2007 **New York Times** by John Markoff
"That iPhone has a keyboard, but it's not mechanical"
http://www.nytimes.com/2007/06/13/technology/13phone.ready.html

62. June 5, 2007 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy", Microsoft Surface, cell phone problems, and listeners email and calls
http://wamu.org/programs/kn/computerguys/07/cg070605.php

63. April 3, 2007 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy", Physical and virtual convergence, and listeners email and calls
http://wamu.org/programs/kn/computerguys/07/cg070403.php

64. March 17, 2007 **Science News** weekly magazine, by Ivars Peterson
"Games Theory", several quotes by me on article about von Ahn's games.
http://www.sciencenews.org/articles/20070317/bob9.asp

65. January 18, 2007 **Wall Street Journal**, by Jeremy Wagstaff
"The March of Time", covering DateLens

66. December 31, 2006 **Associated Press**, by Brian Bergstein
"Low-Cost Laptop Could Transform Learning"
http://www.washingtonpost.com/wp-dyn/content/article/2006/12/31/AR2006123100380.html
AP story picked up in 175 locations, including:

    - Washington Post
    - BusinessWeek
    - Chicago Tribune
    - Boston Globe
    - ABC News
    - CNN
    - FOX News
    - Eyewitness News
    - Forbes
    - BBC News, UK
    - Sydney Morning Herald, Australia
    - The Age, Australia
    - Economic Times, India

67. December 5, 2006 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy", Vista, holiday tech gifts, and listeners email and calls
http://www.wamu.org/programs/kn/06/12/05.php#12452

68. September 22, 2006 **Salon.com** by Katharine Mieszkowski
"Written out of the story", discussing write-in votes using the Hart eSlate system
http://www.salon.com/news/feature/2006/09/22/delay_write_in/index_np.html

69. May 2, 2006 **WAMU Kojo Nnamdi Show**, Washington, DC
"Computer Guy – life in the fast lane", discussing broadband at home
http://www.wamu.org/programs/kn/06/05/02.php#10686

70. April 23, 2006 **Pittsburgh Post-Gazette** by Mark Roth
"Experts see computers getting bigger and smaller at the same time"
http://www.post-gazette.com/pg/06113/684425-96.stm

71. March 9, 2006 **Baltimore Sun** by Mike Himowitz
"PhotoMesa a nifty way to organize photographs"
http://www.baltimoresun.com/technology/bal-bz.himowitz09mar09,0,3518441.column

72. February 21, 2006 **WAMU Kojo Nnamdi Show**, Washington, DC
"Wiki Sites"
http://www.wamu.org/programs/kn/06/02/21.php#10383

73. February 3, 2006 **Baltimore Sun** by Frank D. Roylance
"Spreading the e-word" (quoted about Sony's new ebook reader e-paper)
http://www.baltimoresun.com/news/health/bal-hs.eink03feb03,1,3010066.story

74. January 13, 2006 **Washington Business Journal** by Jennifer Nycz-Conner
"What was I doing, again?"
http://www.bizjournals.com/washington/stories/2006/01/16/focus1.html

75. November 18, 2005 **c|net News.com** by Stefanie Olsen
"The 'millenials' usher in a new era" (about ICDL)
http://news.com.com/The+millennials+usher+in+a+new+era/2009-1025_3-5944666.html?tag=nefd.lede

76. September, 2005 **Chicago Parent** by Jane Huth
"Screen time=reading time"
http://www.chicagoparent.com/main.asp?SectionID=10&SubSectionID=32&ArticleID=529&TM=67415.63

77. September 22, 2005 **Delphos Herald**
"Site Seeing"
http://www.delphosherald.com/page2.php?story=8655&archive=

78. April, 2005 **Chicago Parent** by Judy Belanger
"Explore the world by turning pages"
http://www.chicagoparent.com/main.asp?SectionID=10&SubSectionID=33&ArticleID=306&TM=67012.6

79. April 5, 2005 **EE Times** by Nicolas Mokhoff
" Microsoft touts 'thumb-as-stylus' interface progress"
http://www.eetimes.com/showArticle.jhtml;jsessionid=NHVZOY3L1AQWUQSNDBGCKH0CJUMEKJVN?articleID=160500234
Also picked up by **Information Week**

80. March 10, 2005 **folha equilibrio (Brazil)** by Sérgio Rizzo
"Cibertentações" (article about computer-based distraction, describing some of my work.)

81. March, 2005 **Radio City (Ecuador) / BBC Affiliate**
5 minute radio interview (performed in English, translated into Spanish)

82. March 1, 2005 **The Statesman (India)** by Stanley Theodore
"Webcrawler: All About E-Attention Deficit Disorder"
http://www.thestatesman.net/page.news.php?clid=24&theme=&usrsess=1&id=70119

83. February 28, 2005 **Washington Times** by Ann Geracimos
"New Chapter in Online Books"
http://washingtontimes.com/metro/20050227-101610-1015r.htm

84. February 18, 2005 **North Carolina State Technician** by Danny Frye
"Research targets computer distraction such as AIM"
http://technicianonline.com/story.php?id=011167

85. February 13, 2005 **Bloomberg Radio, "Simply Put"** by Michael Goldman & Tom Moroney
9 minute interview discussing attention and interruptions on the computer

86. February 10, 2005 **New York Times** by Katie Hafner
"You There, at the Computer: Pay Attention"
http://www.nytimes.com/2005/02/10/technology/circuits/10info.html
Also picked up by
    a. **International Herald Tribune (France)**
    b. **ABS CBN News (Philippines)**
    c. **CNET News.com**
    d. **Spartanburg Herald (SC)**
    e. **Wilmington Morning Star (NC)**
    f. **Minneapolis Star Tribune (MN)**

87. Nov 11, 2004 **Maryland Public Television** by Frank Batavick
"Message in a Bottle", Bob the vid-tech guy 30 minute special including 5 minute segment of Allison Druin and me explaining email and instant messaging to children.

88. May 7, 2004 **Baltimore Sun** by Elizabeth Schuman
"Research Lab Crosses Cultures"

89. October 20, 2003 **The Feature** by Jeff Goldman
"A View Into Your Phone"
http://www.thefeature.com/article?articleid=100146

90. October 10, 2003 **The Independent** by Charles Arthur
"Treemap Offers a New Way of Visualizing Complex Data. Nothing Beats it for Simplicity and the "wow!" effect when you first use it."
http://news.independent.co.uk/digital/features/story.jsp?story=451099

91. July, 2003 **Higher Learning – Technology Serving Education**
"Web Sites: The International Children's Digital Library"

92. July 7, 2003 **Pittsburgh Post-Gazette** by Karen MacPherson
"Web Site Invites Children to Read Online: International Children's Digital Library Caters to Young Around the Globe"

93. June 15, 2003 **San Antonio News 9** by Michael Garfield
"Website a Fun Way to Encourage Kids to Read"

94. April 11, 2003 **San Jose Mercury News** by Dan Gillmor
"Designing New Handhelds to Improve Interactions Between Humans, Computers"
Also picked up by **New Jersey Star Ledger (NJ)**

95. February 12, 2003 **Tech TV Live** by Peter Barnes
Also on **abcnews.com**
"Easy Online Reader: An International Online Nook for Children's Books"

96. January 17, 2003 **Voice of America TV** by Larry Clamage
4.5 minute video of children's design team focusing on ICDL

97. December, 2002 **Sun's Java Website**
ICDL Linked to from http://java.sun.com/industry/

98. December 17, 2002 **Associated Press**
Picture of Ben Bederson w/ Bill Gates at Microsoft about DateLens project
    a. **Seattle Post Intelligencer (WA)**
    b. **Times Daily (AL)**
    c. **Sarasota Herald-Tribute (FL)**
    d. **Naples Daily (FL)**

99. December 16, 2002 **Baltimore Sun** by Alex MacGillis
"Two Study Intricacies of Voting Machines"
Also picked up by AP, excerpts in:
    a. **USA Today**
    b. **WMAR (MD)**
    c. **WBAL-TV (MD)**
    d. **News Channel 8.net**

100. December 12, 2002 **Philadelphia Inquirer** by Joyce Kasman Valenza
"tech.life @ school | New virtual library offers children much"

101. December 10, 2002 **Le Monde (France)** by Chantal Dussuel
"Livres en ligne pour internautes on herbe"

102. December 10, 2002 **Christian Science Monitor**
News in Brief – ICDL

103. December 5, 2002 **New York Times** by Lisa Guernsey
"Online Library Project Plans a Digital and Cultural Trove for Children"

104. December 1, 2002 **Die Burger (South Africa)**
"Paragrawe"

105. November 30, 2002 **The Vancouver Sun (Canada)**
"Book Endz: Free Kid's Books"

106. November 30, 2002 **La Vanguardia (Spain)**
"Nuevos Proyectos: TalentMatch.com, International Children's Digital Library SoapCity"

107. November 27, 2002 **USA Today** by Karen Thomas
"World Books, Children Click"

108. November 27, 2002 **The Ohama World-Herald**
"TechBytes: Digital Library Links Kids to Other Cultures"

109. November 27, 2002 **Education Week**
"Internet Library for Children Invites the World to Read"

110. November 26, 2002 **The Gold Coast Bulletin (Australia)**
"The Net: News Bytes"

111. November 25, 2002 **intern.de (Germany)**
"Kinderbibliothek"

112. November 25, 2002 **Seattle Post-Intelligencer**
"Kids Books Now Online"

113. November 21, 2002 **AP Wire** by Sam Hannel
"Web Site to Give Free Access to Children's Books"
    a. **ABCNews.com**
    b. **The Age (Australia)**
    c. **Ananova.com (UK)**
    d. **Asia Pacific Media Network**
    e. **The Baltimore Sun**
    f. **Globetechnology.com (Canada)**
    g. **KTVU 2 News (Bay Area)**
    h. **Indiana Gazette**
    i. **MSNBC.com**
    j. **Newsday.com**
    k. **Rapid City Journal**
    l. **San Jose Mercury News**
    m. **Sarasota Herald-Tribune (Florida)**
    n. **Santa Fe New Mexican**
    o. **Seattle Post-Intelligencer**
    p. **Sydney Morning Herald (Australia)**
    q. **Waterloo/Cedar Falls**
    r. **WFTV (Florida)**

114. November 21, 2002 **24ur.com (Slovenia)**
"Knjige brezplacno na internetu"

115. November 21, 2002 **Courier Mail (Australia)**

116. November 21, 2002 **United Press International (UPI)**
"New Online Library for Kids Launched"

117. November 21, 2002 **Washington Post (.COM Column)** by Leslie Walker
"A Library for Young Browsers"
    a. **International Herald Tribute**
    b. **SFGate.com (San Francisco)**

118. November 21, 2002 **Internet Magazine**
"Site Offers Free Access to Kids Books"

119. November 20, 2002 **Magasinet (Norway)**
"Lager verdensbarnebibliotek"

120. November 20, 2002 **Fox 5 TV News** by John Henrehan
Live 1.5 minutes on 5:00pm news

121. November 18, 2002 **All Things Considered on NPR** by David Kestenbaum
”Library for Kids Goes Online” (11 minutes)

122. October, 2002 **Digital Computer Magazine**
Review of PhotoMesa

123. September 23, 2002 **ComputerSweden** by Anders Lotsson
”Square Zoom in the Hand”

124. August 19, 2002 **Ohio Repository** by Joan Renner
”Ensuring validity is a big concern in electronic voting”

125. August 18, 2002 **Ohio Repository** by Joan Renner
”Voting test shows pros, cons”

126. August 12, 2002 **eWeek**, by Anne Chen
”DateLens Stays Organized in C#”

127. August 5, 2002 **Grid Today**
”Bill Gates Highlights Academic Collaboration Key to Future”

128. July 29, 2002 **eWeek**, by Anne Chen
”Gates: .NET Won’t Happen Overnight”

129. July 29, 2002 **InfoWorld**, by Matt Berger
”Gates, academics joins on security, shared source”

130. July 29, 2002 **NetworkWorldFusion**, by Matt Berger
”Gates, academics joins on security, shared source”

131. May 9, 2002 **Washington Post (.COM Column)**, by Leslie Walker
”A Visual Rather Than Verbal Future”

132. May 9, 2002 **Washington Post Website**, by Eleanor Hong
”Human-Computer Interaction Lab at the University of Maryland” – Interview with me, Allison Druin, and Ben Shneiderman.

133. August 1, 2001 **Sun Microsystems Java Website**, by Jon Byous
”View With a Zoom: Browse and Zoom Digital Images in One Application” describes PhotoMesa and my treemap algorithms.

134. July 2, 2001 **ComputerWorld** by Sami Lais
”Treemaps Bloom” describes my photo browser application PhotoMesa which uses Jazz

135. June 4, 2001 **ComputerWorld** by Sami Lais
”Software for the 4th Dimension” describes TimeSearcher which uses Jazz

136. August 12, 2000 **New Scientist Magazine**
”Maximizing MinimalisM”, an article Zoomable User Interfaces, KidPad, and Fisheye Menus

137. Fall, 2000 **College Park**, by Tom Ventsias
”Zooming Ahead”, an article about Zoomable User Interfaces

138. June 26, 2000 **ComputerWorld**, by Sami Lais
”Zoomin’ Ahead”, an article about Zoomable User Interfaces and Fisheye Menus

139. September, 1999 **Sun Microsystems Java Website**, by Jon Byous
An interview with me under their face-to-face column.

140. December 21, 1998 **Baltimore Sun**
Reprinted in New York Newsday, Dec. 30, 1998
“Children first: In designing toys, one lab turns to the experts in the field.”

141. April 4, 1997 **The Chronicle of Higher Education** by Jeffrey R. Young
"New Ways of Organizing Data Could Change Nature of Computers"

142. February, 1997 **Nov'Art**
a French Magazine sponsored by Art3000, a society devoted to integration of technology and art.

143. October 23, 1996 **The New York Times Online (CyberTimes)** by Ashley Dunn
"Seeing the Forest of Knowledge for the Trees of Data"

144. June, 1995 **The X Advisor**, by Gary Welz
"Peripheral Visions: Zooming Through Information Space on Pad++"

3. TEACHING AND ADVISING

A. COURSES TAUGHT
i. General

Fall 2015 *Paths to CS* (CMSC198C/D/E) – 96 Students

Fall 2013 *Paths to CS* (CMSC198C/D/E, 1-3 credits) – 36 Students
CMSC198C
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.6 (College comparison: 2.8)
Effective teacher: 3.9 (College comparison: 2.9)
CMSC198D
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.8 (College comparison: 2.8)
Effective teacher: 4.0 (College comparison: 2.9)

Fall 2012 *Tech for CS Startups – Team taught* (CMSC 498E, 1 credit) – 19 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.0 (College comparison: 3.2)
Effective teacher: 3.7 (College comparison: 2.9)

Spring 2012 *Reading Seminar: Future of HCI – Team taught* (CMSC 838B, 1 credit) – 13 Students

Fall 2011 *Social Computing Seminar* (CMSC 838B, 3 credits) – 20 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.7 (College comparison: 3.2)
Effective teacher: 3.8 (College comparison: 3.2)

Fall 2011 *Intro to Human-Computer Interaction* (CMSC 434) – 37 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.5 (College comparison: 3.2)
Effective teacher: 3.5 (College comparison: 3.0)

Spring 2011 *Intro to Human-Computer Interaction* (CMSC 434) – 42 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 2.9 (College comparison: 3.2)
Effective teacher: 3.0 (College comparison: 3.0)

Fall 2010 *Reading Seminar in Human Computation* (CMSC 838B, 1 credit) – 9 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.8 (College comparison: 3.2)
Effective teacher: 3.9 (College comparison: 3.5)

Fall 2010 *Digital Cultures and Creativity* (HDCC 105, co-taught) – 56 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 2.4 (College comparison: 2.5)
Effective teacher: 3.2 (College comparison: 3.4)

Spring 2010 *Object-Oriented Programming I* (CMSC 131H) – 10 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.8 (College comparison: 2.9)
Effective teacher: 4.0 (College comparison: 3.0)

Fall 2009 *Intro to Human-Computer Interaction* (CMSC 434) – 39 Students
Student Evaluations (Scale: 0 Poor – 4 Excellent)
Students "learned a lot": 3.3 (College comparison: 3.2)
Effective teacher: 3.5 (College comparison: 3.0)

Spring 2008	*Intro to Human-Computer Interaction* (CMSC 434) – 32 Students Student Evaluations (Scale: 0 Poor – 4 Excellent) Students "learned a lot": 3.1 (College comparison: 3.1) Effective teacher: 3.2 (College comparison: 3.0)
Spring 2005	*Developing User Interfaces* (CMSC 498B) – 14 Students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.6 Instructor's teaching: 3.8
Spring 2004	*Object Oriented Programming I* (CMSC 131) – 75 Students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.0 Instructor's teaching: 2.9
Spring 2003	*Information Visualization* (CMSC 828B) – 17 Students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.1 Instructor's teaching: 3.4
Spring 2002	*Developing User Interfaces* (CMSC 498B) – 25 Students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.6 Instructor's teaching: 3.9
Fall 2001	*Human Computer Interaction* (CMSC 434/828S) – 50 Students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.5 Instructor's teaching: 3.6
Spring 2001	*Information Visualization* Taught by Catherine Plaisant and Ben Shneiderman due to my illness
Fall 2000	*Human Computer Interaction* (CMSC 434/828S) – 50 Student*s* No evaluation due to my illness
Spring 2000	*Computer Graphics* (CMSC 427) – 45 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.4 Instructor's teaching: 3.3
Fall 1999	*Human Computer Interaction* (CMSC 434/828S) – 44 Students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.9 Instructor's teaching: 3.9
Spring 1999	*Zoomable User Interfaces* (CMSC 838B) – 15 Students
Fall 1998	*Software Engineering* (CMSC 435) – 45 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.6 Instructor's teaching: 3.5
Spring 1998	*Computer Graphics* (CMSC 427) – 24 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.7 Instructor's teaching: 3.7
Spring 1997	*Software Engineering* (CS460) @ UNM (Didn't receive evaluations)
Fall 1996	*Introduction to Data Structures* (CS251) - 100 Students @ UNM (Didn't receive evaluations)

Spring 1996	*Human Computer Interaction* (CS462) @ UNM Student Evaluations (ICES scale: 1 poor - 6 excellent) Course content: 5.2 Instructor: 5.5 Course in general: 5.2
Spring 1996	*Computers & Society* (CS491/591) @ UNM Introduced this course for the first time in the CS dept. 1 credit seminar Student Evaluations (ICES scale: 1 poor - 6 excellent) Course content: 4.9 Instructor: 4.8 Course in general: 4.8
Spring 1996	Taught one week *Computer Ethics* @ UNM section of a new five week introductory class on computing at UNM (CS101). Did this two times.

ii. Specialized

Fall 2016	*Learning Analytics Research Group (TLTC 708)* – 1 credit, 3 students, 20 participants
Spring 2016	*Learning Analytics Research Group* – 0 credits, 30 participants
Fall 2015	*Learning Analytics Reading Group* – 0 credits, 20 participants
Spring 2015	*Learning Analytics Reading Group* – 0 credits, 20 participants
Fall 2003	*Readings in HCI Seminar* (CMSC 838B) – 1 credit, 13 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.9 Instructor's teaching: 3.8
Fall 2001	*Readings in HCI Seminar* (CMSC 838B) – 1 credit, 12 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.8 Instructor's teaching: 3.8
Fall 2000	*Readings in HCI Seminar* (CMSC 838B) – 1 credit, 15 students
Fall 1999	*Readings in HCI Seminar* (CMSC 838B) – 1 credit, 6 students
Spring 1999	*Zoomable User Interfaces* (CMSC 838B) – 15 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 3.5 Instructor's teaching: 3.2
Fall 1998	*Readings in HCI Seminar* (CMSC 838B) - 1 credit, 9 students Student Evaluations (Scale: 0 Poor - 4 Excellent) Course quality: 4.0 Instructor's teaching: 3.8

F. ADVISING RESEARCH DIRECTION
i. Undergraduate

	Independent Study Advisor:
2013	Andrej Resevic – new Paths to Computer Science course
2012 – 2013	Danny Michaelis – new Paths to Computer Science course
2010 – 2011	Jonathan Speiser Worked on tournament programmer in educational technologies group
2003-2004	Christian Klein Studied effect of animation when scrolling while reading

2000 – 2002	Rob Sherman Customized undergraduate degree in HCI & Law – focused on voting systems
Fall 2001	Steve Betten Visualizations for real-time monitoring
Spring 2000/ Fall 2000	Beth Weinstein Geographical interfaces for digital library for children
Spring 1999	Nuno Pereria End-user customizable systems
Spring 1996	Philip Eckenroth and Mike Tipping Built a 3D modeling system
Fall 1995	Josh Saiz Novel searching techniques in Pad++ (dynamic indicators)

ii. Master's

Thesis Committee:

2005	Julie Staub in Applied Math. Research on Chaum's scheme for encrypted voter receipts.
1999	George Ziets in Psychology. Advisor is Kent Norman. Research is on gauge design for multiple orders of magnitude.

Independent Study Advisor:

2013	Alina Goldman (iSchool) – Motivation in a self-paced computer science course
2012	Adam O'Sullivan – Computer vision for relative phone location
2000	Stephanie Thibeault (Dance Dept.) Technology and dance
1996	Ellen Killion Built a software library access tool in Pad++
1995	Tom Claus Worked on KidPad
1995	Sam Cancilla Shared calendar application in Pad++
1995	David Rogers Tossing for user interfaces
1995	Richard Bleakman Interfaces for teaching genetic algorithms
1995	Tom Claus Worked on Pad++

iii. Doctorate

Dissertation Advisor:

2017	Tak Yeon Lee, Ph.D. (2017) in Computer Science. "Toward Symbiotic Human-AI Interaction Focusing on Programming by Example". **Currently at Adobe Research.**
2016	Adil Yalcin, Ph.D. (2016) in Computer Science. "Towards Rapid, Effective, and Expressive Visual Data Exploration". **Currently founding startup to commercialize his dissertation research - https://keshif.me/.**

2014	Alex Quinn, Ph.D. (2014) in Computer Science. "Crowdsourcing Decision Support: Frugal Human Computation for Efficient Decision Input Acquisition". **Currently Assistant Professor of ECE at Purdue.**
2012	Chang Hu, Ph.D. (2012) in Computer Science. "Crowdsourced Monolingual Translation". **Currently at Microsoft.**
2007	Amy Karlson, Ph.D. (2007) in Computer Science. Research on personal information management. **Winner of Microsoft Graduate Fellowship. Two CHI papers nominated for best paper. Worked at Microsoft Research for several years.**
2006	Bongshin Lee, Ph.D. (2006) in Computer Science. "Interactive Visualization for Trees and Graphs". **Co-first place winner of IEEE InfoVis 2004 Contest. Currently at Microsoft Research.**
2005	Hilary Hutchinson, Ph.D. (2005) in Computer Science. "Children's Interface Design for Searching and Browsing". **Awarded UMD CS Minker Fellowship. Awarded NSF Graduate Fellowship. Currently at Google.**
2005	Bongwon Suh, Ph.D. (2005) in Computer Science. "Image Management Using Pattern Recognition". **Worked at PARC, then at Adobe Research, now Assoc. Prof. at Seoul National University (Korea).**
2003	Lance Good, Ph. D. (2003) in Computer Science. "Zoomable User Interfaces for the Authoring and Delivery of Slide Presentations". **Worked at PARC as researcher for several years, now at Google.**
2003	Juan Pablo Hourcade, Ph.D. (2003) in Computer Science. "User Interface Technologies and Guidelines to Support Children's Creativity, Collaboration, and Learning". **Currently Assoc. Prof. of Computer Science at the University of Iowa.**
1998	Jason Stewart, Ph.D. (1998) in Computer Science at UNM. Research is on collaborative user interfaces for children using Pad++. **Awarded 1995 DEC Fellowship at UNM.**
	Dissertation Committee:
2020	Virginia Leigh Byrne (2020) in Education. Advisor is Diane Jass Ketelhut. "The Chilling Effect of Cyberbullying on Women's Social Presence in Online Discussions"
2019	Zhenpeng Zhao (2019) in Computer Science. Advisor is Niklas Elmqvist. "Data-Driven Storytelling for Casual Users"
2016	Uran Oh, Ph.D. (2016) in Computer Science. Advisor is Leah Findlater. "Accessible On-Body Interaction for People with Visual Impairments"
2016	Kotaro Hara, Ph.D. (2016) in Computer Science. Advisor is Jon Froehlich. "Scalable methods to collect and visualize sidewalk accessibility data for people with mobility impairments"
2014	Aaron Dinin, Ph.D. (2014) in English. Advisor is Martha Nell Smith. "Hacking Literature: A Study in the Technology of Language."
2014	Brian Danielak, Ph.D. (2014) in College of Education. Advisor is Andy Elby. "How Electrical Engineering Students Design Computer Programs."
2013	Irene Eleta Mogollon, Ph.D. (2013) in iSchool. Advisor is Jen Golbeck. "Multilingual use of Twitter: Language Choice and Language Bridges in a Social Network."
2013	John Alexis Guerra Gomez, Ph.D. (2013) in Computer Science. Advisor is Ben Shneiderman. "Exploring Differences in Multivariate Datasets Using Hierarchies: An Interactive Information Visualization Approach"
2013	Sureyya Tarkan, Ph.D. (2013) in Computer Science. Advisor is Ben Shendierman. "Interactive Visual Displays for Results Management in Complex Medical Workflows"
2010	Taowei David Wang, Ph.D. (2010) in Computer Science. Advisor is Ben Shneiderman. "Interactive Visualization Techniques for Searching Temporal Categorical Data"

2009	Jerry Fails, Ph.D. (2009) in Computer Science. Advisor is Allison Druin. "Mobile Collaboration for Young Children"
2008	Chunyuan Liao, Ph.D. (2008) in Computer Science. Advisor is Francois Guimbretiere. "PapierCraft: A New Paper-Based Interface To Support Interaction With Digital Documents"
2008	Aleks Aris, Ph.D. (2008) in Computer Science. Advisor is Ben Shneiderman. "Visualization & Exploring Networks Using Semantic Substrates"
2008	Adam Perer, Ph.D. (2008) in Computer Science. Advisor is Ben Shneiderman. "Integrating Statistics and Visualization to Improve Exploratory Social Network Analysis"
2008	Walky Rivadeneira, Ph.D. (2008) in Psychology. Advisor is Kent Norman. "Tag Clouds: How Format and Categorical Structure Affect Categorization Judgement"
2007	Matthias Mayer, Ph.D. (2007) in Dept. Informatik, Universität Hamburg where I was an outside reader. Advisor is Prof. Dr. Arno Rolf. "Visualizing Web Sessions".
2007	Leslie Eugene Chipman, Ph.D. (2007) in Computer Science. Advisor is Allison Druin. "Collaborative Technology for Young Children's Outdoor Education".
2006	Haibin Ling, Ph.D. (2006) in Computer Science. Advisor is David Jacobs. "Techniques for Image Retrieval: Deformation Insensitivity and Automatic Thumbnail Cropping".
2005	Jinwook Seo, Ph.D. (2005) in Computer Science. Advisor is Ben Shneiderman. "Information Visualization Design for Multidimensional Data: Integrating the Rank-By-Feature Framework with Hierarchical Clustering".
2005	Jen Golbeck, Ph.D. (2005) in Computer Science. Advisor is Jim Hendler. "Computing and Applying Trust in Web-Based Social Networks".
2003	Harry Hochheiser, Ph.D. (2003) in Computer Science. Advisor is Ben Shneiderman. Research on interfaces for time-series data.
2002	Jenny Sterling, Ph.D. (2002) in Music. Advisor is Laszlo Payerle. Research on educational software she developed to teach undergrad music form. She won the campus award on educational technologies from the Center for Teaching Excellence.
2001	Mike Beynon, Ph.D. (2001) in Computer Science. Advisor is Joel Saltz. Research on filter-based programming model for grid computing.
2001	Angela Boltman, Ph.D. (2001) in Education, Advisor is Allison Druin. Research on KidPad's effect on children's storytelling.
2001	Jeff Heflin, Ph.D. (2001) in Computer Science. Advisor is Jim Hendler. Research on the semantic web.
2001	Egemen Tanin, Ph.D. (2001) in Computer Science. Advisor is Ben Shneiderman. Research on browsing large online databases using exploratory overviews.
2000	Vasanth Philomin, Ph.D. (2000) in Computer Science. Advisor is Larry Davis. Research on real-time computer vision for in-car navigation and warning systems.
2000	Byoung-Kee Yi, Ph.D. (2000) in Computer Science. Advisor is Christos Faloutsos. Research on similarity search and data mining in time-sequence databases.
2000	Chris North, Ph.D. (2000) in Computer Science. Advisor is Ben Shneiderman. Research on tight coupling between different visualizations.
1999	Richard Potter, Ph.D. (1999) in Computer Science. Advisor is Ben Shneiderman. Research on pixel data access for end-user customization.
1999	Harald Winroth, Ph.D. (1999) in Computer Science at the Royal Institute of Technology (KTH) in Stockholm, SWEDEN. I was invited to be the *opponent*. Advisor is Jan-Olof Eklundh Research on dynamic projective geometry.

1999	Ismail Haritaoglu, Ph.D. (1999) in Computer Science. Advisor is Larry Davis. Research on real-time computer vision for tracking people.
1999	Zhijun Zhang, Ph.D. (1999) in Computer Science. Advisors are Vic Basili and Ben Shneiderman. Research on perspective-based usability inspection techniques.
1998	Elaine Raybourne, Ph.D. (1998) in Communication and Journalism at the University of New Mexico. Advisor is Ed Rogers. Dissertation is on the use of MUDs for anonymous role-playing to teach about issues of culture, identity, and power.
1998	Fan-Tao Pu, Ph.D. (1998) in Computer Science, Advisor is David Mount. Research on data structures for view-independent 3D object visibility detection.
1998	Eser Kandogan, Ph.D. (1998) in Computer Science, Advisor is Ben Shneiderman. Research on a technique for window management – elastic windows.
1996	Eric Freeman, Ph.D. (1996) in Computer Science at Yale University. Advisor is David Gelernter. "Lifestreams", a computer interface that eliminates the need for filenames by indexing all files and connecting applications to a database.
	Proposal Committee:
2019	Maddalena Romano in Geographic Information Systems (City College of New York) Advisor is Carsten Kessler. "Distributed WiFi for Distributed GIS"
2018	Virginia Leigh Byrne in Education. Advisor is Diane Jass Ketelhut. "The Chilling Effect of Cyberbullying on Women's Social Presence in Online Discussions"
2017	Zhenpeng Zhao in HCI. Advisor is Niklas Elmqvist. "A Framework of Media Types for Data-Driven Storytelling"
2012	Irene Eleta in iSchool. Advisor is Jen Golbeck. "Multilingual Use of Twitter: Language Choice and Language Bridges in a Social Network"
2012	John Alexis Guerra Gómez in Computer Science. Advisor is Ben Shneiderman. "Exploring Differences in Trees by Comparing Structure and Node Value Changes: An Interactive Information Visualization Approach"
2011	Alex Quinn in Computer Science. Advisor is me. "Crowdsourcing Decision Support: Frugal Human Computation for Efficient Decision Input Acquisition"
2011	Sureyya Tarkan in Coputer Science. Advisor is Ben Shneiderman. "Enhancing Timely Management of Workflow with Interactive Visual Displays and Actions for Situation Awareness Processing"
2010	Chris Hayden in Computer Science. Advisors are Mike Hicks and Jeff Foster. "Clear and Correct Runtime Upgrades"
2010	Chang Hu in Computer Science. Advisor is me. "Translation by Collaboration Between Monolinguals"
2008	Walky Rivadeneira in Psychology. Advisor is Kent Norman. "Tag Clouds: How Format and Categorical Structure Affect Categorization Judgement"
2007	Jerry Fails in Computer Science. Advisor is Allison Druin. Research on children's collaborative mobile interfaces.
2005	Haibin Ling in Computer Science. Advisor is David Jacobs. Research on invariance in computer vision.
2001	Jaime Montemayor in Computer Science. Advisor is Allison Druin. Research on physical programming for children.
2001	Harry Hochheiser in Computer Science. Advisor is Ben Shneiderman. Research on interfaces for time-series data.

2001	Angela Boltman in Education. Advisor is Allison Druin. Research on the technology of storytelling.
2000	Jeff Heflin in Computer Science. Advisor is Jim Hendler. Research on knowledge representation on the Web.
1998	Egemen Tanin in Computer Science. Advisor is Ben Shneiderman. Research on query previews.
1998	Thanarat Horprasert in Computer Science. Advisor is Larry Davis. Research on real-time computer vision.
1998	Vasanth Philomin in Computer Science. Advisor is Larry Davis. Research on real-time computer vision.
1998	Chris North in Computer Science. Advisor is Ben Shneiderman. Research on Tightly Coupled Windows.

iv. Post-doc

2009-2012	Tom Yeh working in applied computer vision and HCI (co-mentored with Larry Davis). **Currently at Univ. of Colorado, Boulder.**

4. SERVICE

A. PROFESSIONAL

i. Office and Committee Memberships

2015 – 2018	SIGCHI Adjunct Chair for Awards
2015	TOCHI Special Issue Editor
2015	Learning @ Scale Program Committee
2014	Learning @ Scale Program Committee
2011	CHI 2011 Papers Subcommittee Co-chair
2010	CHI 2010 Papers Subcommittee Co-chair
2005 – 2016	US ACM Committee member
2004 – 2007	SIGCHI Adjunct Chair for US Public Policy Committee
2000	CHI Conference Video Paper Co-Chair
1999	CHI Conference Video Paper Chair
1998	UIST Technical Program Committee
1998	UIST Conference Panel Chair, Technical Program Committee
1998	CHI Conference Video Co-Chair.

ii. Editorial Boards

2015 – 2018	**PeerJ Computer Science**, PeerJ
2012 – 2018	**Transactions on Computer-Human Interaction (TOCHI)**, ACM Press
2007 – 2014	**Foundations and Trends in HCI** (Editor-in-chief), NOW Publishers
2002 – 2016	**Information Visualization**, Palgrave Press

iii. Advisory Boards

2016 – 2018	**Coursera**, Mountain View, CA Coursera Council advisory group
2012 – 2015	**Barrie School**, Silver Spring, MD Board of Trustees for this independent K-12 school 2013 – 2016: Secretary

2003	**Microsoft Research**, Redmond, WA University Relations Faculty Advisory Board	

iv. Other non-University committees, commissions, panels, etc.

2012	**Judge for Joan Ganz Cooney, National STEM Video Game Challenge**	

vi. Paid Consultancies

2020 – present	**Logitech** Consultant to help with new product development	**Seattle, WA**
2009 – present	**Consulting as an expert witness** largely for patent infringement cases for a range of clients	
2006 – 2014	**Zumobi, Inc.** Founder of startup company to create mobile information services software	**Seattle, WA**
2008 – 2009	**Microsoft Research** Consultant to help with products related to my research	**Seattle, WA**
2005 – 2009	**Hillcrest Laboratories, Inc.** Advisor to help this start-up develop novel in-home entertainment system	**Rockville, MD**
2003 – 2008	**Windsor Interfaces, Inc.** President and CEO of start-up company to commercialize some HCIL projects	**Chevy Chase, MD**
2005	**ScholarOne, Inc.** Consultant to help them with visualization in their scholarly publication and conference management software	**Charlottsville, VA**
2004 – 2005	**ATTAP, Inc.** Consultant to help this start-up develop novel mobile device interfaces for personal information management	**New York, NY**
2003	**Microsoft Research Corp** On University Relations Faculty Advisory Board	**Redmond, WA**
2001 – 2003	**PARC** Advised on project to support brainstorming	**Palo Alto, CA**
2000	**NASA Goddard Space Flight Center** Designed prototype visualizations for satellite constellation control	**Greenbelt, MD**
1999 – 2001	**Swedish Institute of Computer Science (SICS)** Worked on European Union KidStory project	**Stockholm, Sweden**
1998 – 1999	**Lockheed Martin Astronautics** Advised on use of Pad++ for image analyst application	**Denver, CO**
1996 – 1997	**Sony Research Corporation** Advised on use of Pad++ for product development	**New York, NY**

B. UNIVERSITY
i. Departmental

2013 – 2014	CS Educational Transformation Committee co-chair
2008 – 2012	CS Teaching Evaluation Committee

2008 – 2011	CS Department Council
2007 – 2010	Software Engineering Field Committee chair
2010	UMIACS APT Committee
2009	CS Faculty Search Committee
2007	Chair of APT committee for Evan Golub's promotion to Senior Lecturer
2006	Undergraduate curriculum committee
2006	CS Distinguished Lecturer committee
2004	UMIACS steering committee
2004	High school programming contest
2004	Undergraduate curriculum
2003 – 2005	CS Department Council
2002	CFAR faculty recruiting committee
2001 – 2002	Lab committee
2001 – 2002	On department faculty recruiting committee
2001	Taught 1.5 hour course for high school students in Governor's program.
2000	Represented the computer science department on Capitol Hill for an exhibition to encourage Congressional appropriations for NSF.
2000	Helped with Computer Science Dept. research review day – made departmental demo.
1999 – 2000	Technical staff liaison – to help CS admin and technical staff.
1999	Helped with Computer Science Programming Contest
1996 – 1997	Graduate Admissions coordinator for the UNM Computer Science Department.

iii. University

2016 – 2018	USM Faculty Workload Workgroup
2015 – 2018	DIT Learning Technology Working Group
2015 – 2017	Senate Library Council Committee
2015 – 2018	Senate Educational Affairs Committee
2014 – 2018	Provost's Data Policy Advisory Committee
2013 – 2018	USM Academic Transformation Advisory Committee
2013 – 2018	Future of Information Alliance brainstorming board
2013 – 2018	DIT Technology Accessibility Committee
2013 – 2014	Journalism Faculty Search Committee
2013 – 2014	Learning @ Technology Working Group for DIT
2012 – 2013	Provost's Commission on Blended and Online Education
2012 – 2013	VP IT/CIO – IT Council
2012	CMNS Distinguished Research Scientist Prize comittee
2011	VP / CIO Search Committee
2010	UMD Campus-Wide Mobile App Programming Contest Chair

2002 – 2005	Advisory board member for MITH (Maryland Institute for Technology and the Humanities)
2000	Served on search committee for new intellectual property manager for Office of Technology Commercialization.
2000	Ran event for Maryland Day – opened lab to children to use KidPad to tell collaborative stories