UNITED STATES INTERNATIONAL TRADE COMMISSION
WASHINGTON, D.C.

Before the Honorable E. James Gildea
Administrative Law Judge

In the Matter of **CERTAIN PORTABLE ELECTRONIC DEVICES AND RELATED SOFTWARE**	**Investigation No. 337-TA-797**

INITIAL EXPERT REPORT OF BENJAMIN B. BEDERSON ON CLAIM CONSTRUCTION

I. INTRODUCTION

1. I have been retained by counsel for Respondents HTC Corp., HTC America, Inc., and Exedea, Inc. (collectively, "HTC") as an expert in this Investigation to provide opinions regarding certain claim terms related to U.S. Patent Nos. 7,084,859 (the '859 patent), 7,469,381 (the '381 patent), and 7,844,915 (the '915 patent). In particular, I have been asked to analyze what a person of ordinary skill in the art would understand certain claims terms to mean at the time of invention for each of the above-mentioned patents.

2. I have been engaged by counsel for HTC. I am being compensated by counsel for HTC at a hourly rate of $450. My compensation does not depend in any way on the outcome of this investigation or the particular testimony or opinions I provide.

3. I understand that the following claims are asserted against HTC:

a. For the '859 patent, claims 14-20, 25, 28.

b. For the '915 patent, claims 1-5, 7-12, 14-19, 21.

c. For the '381 patents, claims 1-20.

4. In rendering my opinions, I considered the items listed in Exhibit RXM-2 Ex. B, the items discussed or listed herein, as well as my own experiences in the field. I understand that discovery in this investigation is still ongoing, and I reserve the right to amend or supplement my opinions in light of further documents, depositions, or discovery disclosures. I also understand that Complainant Apple, Inc. is seeking to add previously unasserted claims from the '859 and '915 patents to this investigation, and I reserve the right to amend or supplement my opinions with respect to any additional claims. I further reserve the right to rely upon any additional information or materials that may be provided to me or that are relied upon by any of Apple's experts or witnesses, if called to testify or to give additional opinions regarding this matter.

II. QUALIFICATIONS AND EXPERIENCE

5. I am 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"). I am a member and previous director of the Human-Computer Interaction Lab (HCIL), the oldest and one of the best known HCI research groups in the country. I am also co-founder and Chief Scientist of Zumobi, Inc., a Seattle-based startup that is a publisher of content apps for high end mobile phones. Finally, I am also co-founder and co-director of the International Children's Digital Library (ICDL), a website providing 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. In addition, I have consulted for numerous companies in the area of user interfaces, including Microsoft, the Palo Alto Research Center, Sony, Lockheed Martin, and NASA Goddard Space Flight Center.

6. At UMD, I work in the area of Human-Computer Interaction (HCI), a field that

considers the development and understanding of computing systems to serve user's 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 serve people's practical needs. Example systems following this approach that I have built include PhotoMesa (software for end users to browse personal photos), DateLens (software for end users to use their mobile devices to efficiently access their calendar information), SpaceTree (software for end users to efficiently browser very large hierarchies), ICDL, and StoryKit (an iPhone app for children to create stories).

7. At Zumobi, I am responsible for investigating new platforms and developing new user interface designs that offer efficient and engaging interfaces to end users to access a wide range of content on mobile platforms including iPhone and Android. For example, I was the principle designer and implementer of Ziibii (a "river" of news for iPhone), of the "ZoomCanvas" zoomable user interface for several iPhone apps including the Today Show app and the Rachel Maddow app, and of the "ZoomCarousel" iPhone apps including "Inside Xbox" for Microsoft and Snow Report for REI.

8. At the International Children's Digital Library (ICDL), I am the technical director where I have been responsible for managing the design and implementation of this public website at www.childrenslibrary.org. The design goal of the website is to support children and adults from around the world to efficiently and easily search and read books online. With over five million users since the site's launch in 2002, I have developed significant experience in meeting those design goals.

9. My degrees (B.S., M.S. and Ph.D.) are in computer science with an undergraduate minor in electrical engineering. I received the Janet Fabri Memorial Award for Outstanding

Doctoral Dissertation for my Ph.D. work in robotics and computer vision where I designed and built a custom robotics platform. I have combined my hardware and software skills throughout my career in HCI research building various interactive electrical and mechanical systems that couple with software to provide an innovative user experience.

10. I have published extensively with about 140 technical publications. I have given 80 invited talks, including 5 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 ACM's SIGCHI. ACM is the Association for Computing Machinery, and 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 "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: 1) Cumulative contributions to the field; 2) Impact on the field through development of new research directions and/or innovations; and 3) Influence on the work of others."

11. I have appeared on public radio numerous times to discuss issues relating to user interface design and people's use and frustration with common technologies, websites, and mobile devices. My work has been discussed and I have been quoted in mainstream media around the world

over 100 times including 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*.

12. I have designed, programmed and publicly deployed dozens of user-facing software products which have cumulatively had millions of users. My work is cited in significant patents that are central to several major companies user interfaces, including Sony and Apple.

13. I have worked as an expert in several legal matters as a consulting expert, a fact witness, and an expert witness. I have written expert reports, have had my deposition taken, and provided trial testimony.

14. I attach as Exhibit RXM-2 Ex. A my *curriculum vitae*¸ which includes a complete list of my qualifications and also includes a list of matters in which I have provided expert testimony, either at deposition or at trial in the last 5 years.

III. LEGAL STANDARDS

15. I understand that claim construction is a matter of law for the arbiter of law to decide. I further understand that claim terms should be given their ordinary and customary meaning within the context of the patent in which the terms are used, i.e., the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention in light of what the patent teaches.

16. I understand that to determine how a person of ordinary skill would understand a claim term, one should look to those sources available that show what a person of skill in the art would have understood disputed claim language to mean. Such sources include the words of the claims themselves, the remainder of the patent's specification, the prosecution history of the patent (all considered "intrinsic" evidence), and "extrinsic" evidence concerning relevant scientific

principles, the meaning of technical terms, and the state of the art.

17. I understand that words or terms should be given their ordinary and accepted meaning unless it appears that the inventors were using them to mean something else. In making this determination, however, of paramount importance are the claims, the patent specification, and the prosecution history. Additionally, the specification and prosecution history must be consulted to confirm whether the patentee has acted as its own lexicographer (i.e., provided its own special meaning to any disputed terms), or intentionally disclaimed, disavowed, or surrendered any claim scope.

18. I understand that the claims of a patent define the scope of the rights conferred by the patent. The claims particularly point out and distinctly claim the subject matter which the patentee regards as his invention. Because the patentee is required to define precisely what he claims his invention to be, it is improper to construe claims in a manner different from the plain import of the terms used consistent with the specification. Accordingly, a claim construction analysis must begin and remain centered on the claim language itself. Additionally, the context in which a term is used in the asserted claim can be highly instructive. Likewise, other claims of the patent in question, both asserted and unasserted, can inform the meaning of a claim term. For example, because claim terms are normally used consistently throughout the patent, the usage of a term in one claim can often illuminate the meaning of the same term in other claims. Differences among claims can also be a useful guide in understanding the meaning of particular claim terms.

19. I understand that a person of ordinary skill in the art is deemed to read a claim term not only in the context of the particular claim in which the disputed term appears, but in the context of the entire patent, including the specification. For this reason, the words of the claim must be interpreted in view of the entire specification. The specification is the primary basis for construing

the claims and provides a safeguard such that correct constructions closely align with the specification. Ultimately, the interpretation to be given a term can only be determined and confirmed with a full understanding of what the inventors actually invented and intended to envelop with the claim as set forth in the patent itself.

20. I understand that the role of the specification is to describe and enable the invention. In turn, the claims cannot be of broader scope than the invention that is set forth in the specification. Care must be taken lest word-by-word definition, removed from the context of the patent, leads to an overall result that departs significantly from the patented invention.

21. I understand that claim terms must be construed in a manner consistent with the context of the intrinsic record. In addition to consulting the specification, one should also consider the patent's prosecution history. The prosecution file history provides evidence of how both the Patent Office and the inventors understood the terms of the patent, particularly in light of what was known in the prior art. Further, where the specification describes a claim term broadly, arguments and amendments made during prosecution may require a more narrow interpretation.

22. I understand that while intrinsic evidence is of primary importance, extrinsic evidence, e.g., all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises, can also be considered. For example, technical dictionaries may help one better understand the underlying technology and the way in which one of skill in the art might use the claim terms. Extrinsic evidence should not be considered, however, divorced from the context of the intrinsic evidence. Evidence beyond the patent specification, prosecution history, and other claims in the patent should not be relied upon unless the claim language is ambiguous in light of these intrinsic sources. Furthermore, while extrinsic evidence can shed useful light on the relevant art, it is less significant than the intrinsic record in

determining the legally operative meaning of claim language.

23. I understand that claims of a patent may be written in what is known as a "means-plus-function" form. I understand that a claim element is in means-plus-function form when it is expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support of the function. I understand that such claims are construed to cover the corresponding structure, material, or acts described in the specification and their equivalents. I also understand that in a means-plus-function claim in which the disclosed structure is a computer, or microprocessor, programmed to carry out an algorithm, the disclosed structure is not the general purpose computer, but rather the special purpose computer programmed to perform the disclosed algorithm. Absent any such algorithm, the claim lacks sufficient disclosure of structure and is therefore indefinite.

IV. THE '859 PATENT

24. The '859 patent, titled "Programmable tactile touch screen displays and man-machine interfaces for improved vehicle instrumentation and telematics," was filed in the United States on February 22, 2001, and allegedly claims priority to two provisional applications, the earliest of which was filed on February 22, 2000, and, on its face, states that it is a continuation-in-part to seven non-provisional applications, the earliest of which was filed on September 18, 1992. I understand that the parties dispute the priority date to which this patent is entitled. I understand HTC contends that the priority date is February 22, 2001 and Apple contends that the priority date is September 18, 1992. My opinions on the meaning of terms to persons of ordinary skill would not change using either February 22, 2001 or September 18, 1992 as the priority date.

25. For the purposes of this report, I have been asked to assume that the date of the alleged invention is the filing date of February 22, 2001.

26. The ‘859 patent specification describes a dash-mounted touch screen display for a car and touch gestures that are recognized by the touch screen display. As explained in the specification, one example of such a display is shown in Fig. 3b-3c of the patent. Other examples are shown in Figs. 24b and 25 of the patent. As shown in these figures and explained in the text in the ‘859 specification accompanying these figures, particular objects such as “virtual knobs” and Excel cells can be displayed on the dash-mounted touch screen and the user can use two-finger touch gestures on the touch screen to identify and manipulate the displayed objects.

A. LEVEL OF ORDINARY SKILL IN THE ART OF THE ‘859 PATENT

27. In my opinion, for the ‘859 patent, a person of ordinary skill in the art would have had at least a bachelor’s degree in computer science, and 2-3 years of software design and implementation experience, including experience with graphical user interface design and with touch-sensing technologies, or would have equivalent educational and work experience.

28. I meet these criteria and consider myself a person with at least ordinary skill in the art pertaining to the ‘859 patent. I would have been such a person at the time of invention of the ‘859 patent.

B. “PINCH OR BRACKET DISPLAYED DATA”

29. I understand the parties have proposed the following construction for this term:

Apple’s Proposed Construction	HTC’s Proposed Construction	Staff’s Proposed Construction
move two fingers toward each other in a pinching motion, or bracket data, to interact with data displayed on a screen	squeeze or bracket to identify displayed data	squeeze or bracket to identify displayed data

30. The term “pinch or bracket displayed data” appears only in asserted independent

claim 14 of the '859 patent:

> 14. Method for controlling a computer system, the method comprising
>
> (a) displaying visually observable data on a capacitive touch sensitive display screen that is effectively responsive to touch at a plurality of positions at once,
>
> (b) touching the capacitive touch sensitive display screen with at least two fingers, and
>
> (c) using the action of the fingers while in contact with the capacitive touch sensitive display screen, causing a desired control action of the computer system, and wherein the two fingers of the at least two fingers simultaneously being used to ***pinch or bracket displayed data*** on the screen.

(JXM-7 '859 Patent at claim 14 (emphasis added).)

31. The words "pinch" and "bracket" do not appear frequently in the specification of the '859 patent. "Bracket" only appears once in the '859 specification, in Col. 51:30-50, in connection with Fig. 24b. The figure and the accompanying text describe a way to identify a cursor position by bracketing a desired point using two fingers. "Pinch" appears more frequently in the '859 specification than "bracket," but it is only explained in any detail in Col. 51:64 – 52:16 in connection with Fig. 25. This figure and the accompanying text describe a way of identifying data, such as an Excel cell, by pinching or squeezing the data using two fingers.

32. In particular, the '859 specification describes the complete interaction sequence to also include "un-pinching" – "[w]hen movement stops and the fingers ***un-pinch*** the program in this case would paste the data there. This move is totally natural, just as one would pinch any small object and move it to somewhere else and deposit it." (JXM-7 '859 Patent at Col. 52:9-13 (emphasis added).) The fact that the specification distinguishes between pinching and unpinching makes it clear that these are two different actions, and from the description, it is clear that "pinching" refers to the act of moving the fingers towards each other while "unpinching" refers to the act of moving the fingers apart from each other.

33. Based on my experience, at the time of the allegedly invention in 2001, as well as of the alleged priority of September 1992, the terms "pinch" and "bracket" were not terms of art and there was no consensus as to what this gesture should do on a touch screen. Thus one of ordinary skill would not understand these terms to have well-established meanings in the art. Different systems can associate "pinch" or "bracket" with any number of multi-touch gestures. Accordingly, when reviewing the '859 patent, one of ordinary skill in the art would look to the specification and the ordinary meaning of the words "pinch" and "bracket" to understand what touch gestures the inventor meant to denote with these terms. Given this fact and the way the terms were used in the intrinsic evidence and defined in the extrinsic evidence, it is my opinion that a person of ordinary skill in the art at the time of the invention of the '859 patent in 2001 would understand the term "pinch or bracket displayed data" to mean "squeeze or bracket to identify displayed data."

34. In contrast, in my opinion, Apple's construction is overly broad. Under Apple's construction, claim 14 encompasses any type of interaction with the on-screen data by the user using two fingers. This goes well beyond what is actually disclosed in the '859 specification and is not consistent with the way a person of ordinary skill would have understood the claims after reading the '859 specification.

35. I have reviewed the file history of the '859 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

V. THE '915 PATENT

36. The '915 patent, titled "Application programming interfaces for scrolling operations," was filed in the United States on January 7, 2007, and claims no earlier priority. For the purposes of this report, I have been asked to assume to date of the alleged invention is the filing date of January

7, 2007.

37. The asserted claims of '915 patent are primarily directed at a particular programming implementation for "scrolling" operations and non-scrolling "gesture" operations (for example, scaling operations). According to the claims, if the user input consists of a single input point, a scrolling operation is invoked. If the user input consists of two or more input points, a scaling operation is instead invoked.

38. As its title indicates, much of the '915 specification describes an application programming interface that defines "calls" for certain operations. However, the '915 specification fails to disclose any algorithm that implements the calls defined in that application programming interface.

A. LEVEL OF ORDINARY SKILL IN THE ART OF THE '915 PATENT

39. In my opinion, for the '915 patent, a person of ordinary skill in the art would have had at least a bachelor's degree in computer science, and 2-3 years of software design and implementation experience, including experience with graphical user interface design and with touch-sensing technologies, or would have equivalent educational and work experience.

40. I meet these criteria and consider myself a person with at least ordinary skill in the art pertaining to the '915 patent. I would have been such a person at the time of invention of the '915 patent.

B. "MEANS FOR RECEIVING, THROUGH A HARDWARE DEVICE, A USER INPUT ON A TOUCH-SENSITIVE DISPLAY OF THE APPARATUS, THE USER INPUT IS ONE OF MORE INPUT POINTS APPLIED TO THE TOUCH-SENSITIVE DISPLAY THAT IS INTEGRATED WITH THE APPARATUS" [CLAIM 15]

41. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	**HTC's Proposed Construction**	**Staff's Proposed Construction**
Function: receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus. Structure: a multi-point capacitive touch input screen ['915, col. 19:23-34; Fig. 29, block 2954]	Function: receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus. Structure: display/input device 2954 as described in col. 19:23-34; and Fig. 29, block 2954	Function: receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus. Structure: display/input device 2954 as described in col. 19:23-34; and Fig. 29, block 2954

42. One of ordinary skill in the art in 2007 would not limit the corresponding structure of "means for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one of more input points applied to the touch-sensitive display that is integrated with the apparatus" in the specification of the '915 patent to be only capacitive touch screens.

43. "[M]eans for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one of more input points applied to the touch-sensitive display that is integrated with the apparatus" appears in claim 15:

> 15. An apparatus, comprising:
>
> ***means for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus;***
>
> means for creating an event object in response to the user input;
>
> means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation;

> means for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation;
>
> means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object; and
>
> means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input.

(JXM-10 '915 Patent at claim 15 (emphasis added).)

44. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus." I further understand that the Staff agree with HTC's construction of the corresponding structure.

45. The parties and the Staff cite to identical specification support for the corresponding structure, namely, block 2954 of Fig. 29 and Col. 19:23-34 of the specification. The only substantive issue appears to be whether the corresponding structure should be limited to "a multi-point capacitive touch input screen" as proposed by Apple or a general "display/input device" as proposed by HTC/Staff.

46. In my opinion, the '915 specification supports HTC's and the Staff's proposed construction that the corresponding structure should be a general "display/input device." Capacitive touch screens are mentioned only once in the '915 specification as "***one embodiment***" of the display/input device 2954, in which the " multi-point touch screen is a ***capacitive sensing medium*** configured to detect multiple touches." (J10-9 '915 Patent at Col. 19:23-37 (emphasis added).) In my opinion a person of ordinary skill would understand that the '915 specification discloses capacitive touch screens as only one embodiment – not the sole embodiment – of the display/input device required by the claims.

47. On the other hand, the '915 specification is replete with instances where it mentions

touch input display devices generally without specifying how the sensing is done. (*See e.g.* JXM-10 '915 Patent at Col. 8:4-7; Col. 9:10-13; 9:39-42.) The '915 specification makes it clear that the display/input device is not limited to the single embodiment shown in Figure 29:

> In some embodiments, the methods, systems, and apparatuses of the present disclosure can be implemented in various devices including electronic devices, consumer devices, data processing devices, desktop computers, portable computers, wireless devices, cellular devices, tablet devices, handheld devices, multi touch devices, multi touch data processing devices, any combination of these devices, or other like devices. FIGS. 4-6 and 28-33 illustrate examples of a few of these devices.

(*Id*. at Col. 18:16-24.)

48. The '915 patent specification likewise explains that the display/input device may be a "touch input screen that also includes an LCD," without any mention that this screen must include a capacitive sensing medium. (Proposed JXM-10 at 18:50-51.)

49. Thus, in my opinion, the structure disclosed in the '915 specification that corresponds to "receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus" is not limited to only capacitive touch screen devices but rather any type of display/input device, including any "multi-point touch input screen in addition to being a display, such as an LCD" (col. 19:24-25). The '915 patent discloses several forms of an "display/input device," including a "multi-point touch input screen" generally, potentially including an LCD, or potentially including a specific capacitive sensing medium. (Proposed JXM at 19:23-34.)

50. I have reviewed the file history of the '915 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

C. "MEANS FOR CREATING AN EVENT OBJECT IN RESPONSE TO THE USER INPUT" [CLAIM 15]

51. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	**HTC's Proposed Construction**	**Staff's Proposed Construction**
Function: creating an event object in response to the user input. Structure: a microprocessor executing the software algorithm shown in block 104 of Figure 1 to create event object in response to user input ['915 patent, col. 1:59-67; col. 2:37-42; 6:36-37; col. 12:30-32; col. 21:31-41, Fig. 1, Fig. 13, Fig. 32, block 3202].	Function: creating an event object in response to the user input. Structure: none disclosed	Function: creating an event object in response to the user input. Structure: a microprocessor configured to execute the software algorithm shown in block 104 of Figure 1 to create an event object in response to user input as described in col. 6:36-37; col. 12:30-32; and Fig. 32, block 3202.

52. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for creating an event object in response to the user input" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

53. "[M]eans for creating an event object in response to the user input" appears in claim 15:

> 15. An apparatus, comprising:
>
> means for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus;
>
> ***means for creating an event object in response to the user input;***
>
> means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation;
>
> means for issuing at least one scroll or gesture call based on invoking the

> scroll or gesture operation;
>
> means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object; and
>
> means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input.

(JXM-10 '915 Patent at claim 15 (emphasis added).)

54. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "creating an event object in response to the user input."

55. In my opinion, the specification fails to disclose any algorithm that would "creat[e] an event object in response to the user input." One of ordinary skill in the art in January 2007 would have understood that a system performing this function would build a new software programming structure – an event object – that did not exist in the system memory previously. To do so "in response to the user input" requires an algorithm for at least determining when a response is appropriate. Moreover, there are multiple different algorithms available for "creating an event object." A person of ordinary skill would find no algorithm for the function of "creating an event object in response to the user input" in the '915 patent specification.

56. Creating the object "in response to user input" requires an algorithm to process data from the display/input device's hardware or firmware, and to determine whether and when a response is appropriate based on that data. This is not a trivial process. Processing touch sensor data is an area of extensive research. There are many ways to design algorithms to analyze this touch sensor data and to determine whether and when to respond to a perceived input event. Designing the appropriate algorithm often involves trade-offs between accuracy and responsiveness. Algorithms making determinations based on small sample sizes of touch sensor data may offer faster

performance, but less accuracy, than algorithms that require larger sample sizes of sensor data to determine whether (and what sort of) input has occurred.

57. "Creating an event object" may occur using many different algorithms. For example, there are many different ways to represent an event, and a person of ordinary skill may decide to track many different characteristics of an event in different ways, using different data structures and employing different mechanisms to encapsulate and provide access to data about an event. The '915 patent does not explain what data about an event should be recorded or represented in an event object, or how to include that data in an event object. Without this information, a person of ordinary skill would not know which approach was used to create an event object in the '915 patent, including the specific data that should be included in such an object.

58. I have reviewed Apple's proposed construction of this term. I understand that Apple has identified the corresponding structure for this function as "a microprocessor executing the software algorithm shown in block 104 of Figure 1 to create event object in response to user input ['915 patent, col. 1:59-67; col. 2:37-42; 6:36-37; col. 12:30-32; col. 21:31-41, Fig. 1, Fig. 13, Fig. 32, block 3202]." I have reviewed the passages of the '915 specification cited by Apple and in my opinion, there is no algorithm for this function in any of the passages cited by Apple.

59. The first portion of Apple's proposed structure is "a microprocessor executing the software algorithm shown in block 104 of Figure 1 to create event object in response to user input." Block 104 of Figure 1 is not an algorithm. It is a function – specifically, the function recited in claim 15(b). Likewise, the text accompanying Fig. 1 cited by Apple, Col. 6:36-37, is also a restatement of the claimed function. A person of ordinary skill would not understand this description of the function itself as an algorithm explaining how to perform that function.

60. The second portion of Apple's proposed structure is a bracketed citation to various

passages in the ‘915 specification. First, it is unclear how some of these citations are connected to the claimed function. Figure 13 discloses functions performed by the system after the event object has already been created. (JXM-10 ‘915 Patent at Col. 12:32-42.) Thus the figure and its descriptions are unrelated to the claim function. Col. 1:59-67, Col. 2:37-42, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states “microprocessor.” There is no description in block 3202 of Figure 32, or anywhere else in Figure 32 for that matter, about how the microprocessor would perform the claimed function and create an event object in response to user input. What is absent is any description of how these component work to perform the claimed function. These citations add nothing of substance.

61. Finally, Apple cites to Col. 12:30-32. This passage states “[a] multi-touch driver of the device receives the user input and packages the event into an event object.” This does not disclose an algorithm. In my opinion, this sentence is purely functional. Like “create,” “package” is a generic term in the art that does not convey any notion of an algorithm for creating an object. At best, this disclosure identifies the driver as performing the function of “packaging,” but does not disclose any algorithm for how that “packaging” is done. In fact the term “packaging” is more generic and more ambiguous than the term “creating:” “creating” at least indicates that something new is being made, whereas “packaging” can mean either creating something new or manipulating something that already existed. A person of ordinary skill would not understand this language as a step-by-step algorithm for creating an event object in response to using input.

62. I have reviewed the file history of the ‘915 patent. I found nothing in the file history

to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

D. "MEANS FOR DETERMINING WHETHER THE EVENT OBJECT INVOKES A SCROLL OR GESTURE OPERATION BY DISTINGUISHING BETWEEN A SINGLE INPUT POINT APPLIED TO THE TOUCH-SENSITIVE DISPLAY THAT IS INTERPRETED AS THE SCROLL OPERATION AND TWO OR MORE INPUT POINTS APPLIED TO THE TOUCH-SENSITIVE DISPLAY THAT ARE INTERPRETED AS THE GESTURE OPERATION" [CLAIM 15]

63. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Function: determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation. Structure: a microprocessor executing the software algorithm shown in block 106 of Figure 1 to determine whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation ['915 patent, col. 1:59-67; col. 2:37-42; 6:37-46; col. 9:61- col. 11:13; col. 12:19-13:51; col. 21:31-41, Fig. 1, block 106; Fig. 7 - Fig. 10, Fig. 32, block 3202].	Function: determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 106 of Fig. 1 as described in col. 6:37-46 or col. 12:32-34; and block 3202 of Fig. 32.	Function: determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation. Structure: a microprocessor configured to execute the software algorithm shown in block 106 of Figure 1 to determine whether an event object invokes a scroll or gesture operation as described in col. 6:37-46; col. 12:32-34; and Fig. 32, block 3202.

64. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

65. "[M]eans for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation" appears in claim 15:

> 15. An apparatus, comprising:
>
> means for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus;
>
> means for creating an event object in response to the user input;
>
> ***means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation;***
>
> means for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation;
>
> means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object; and
>
> means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input.

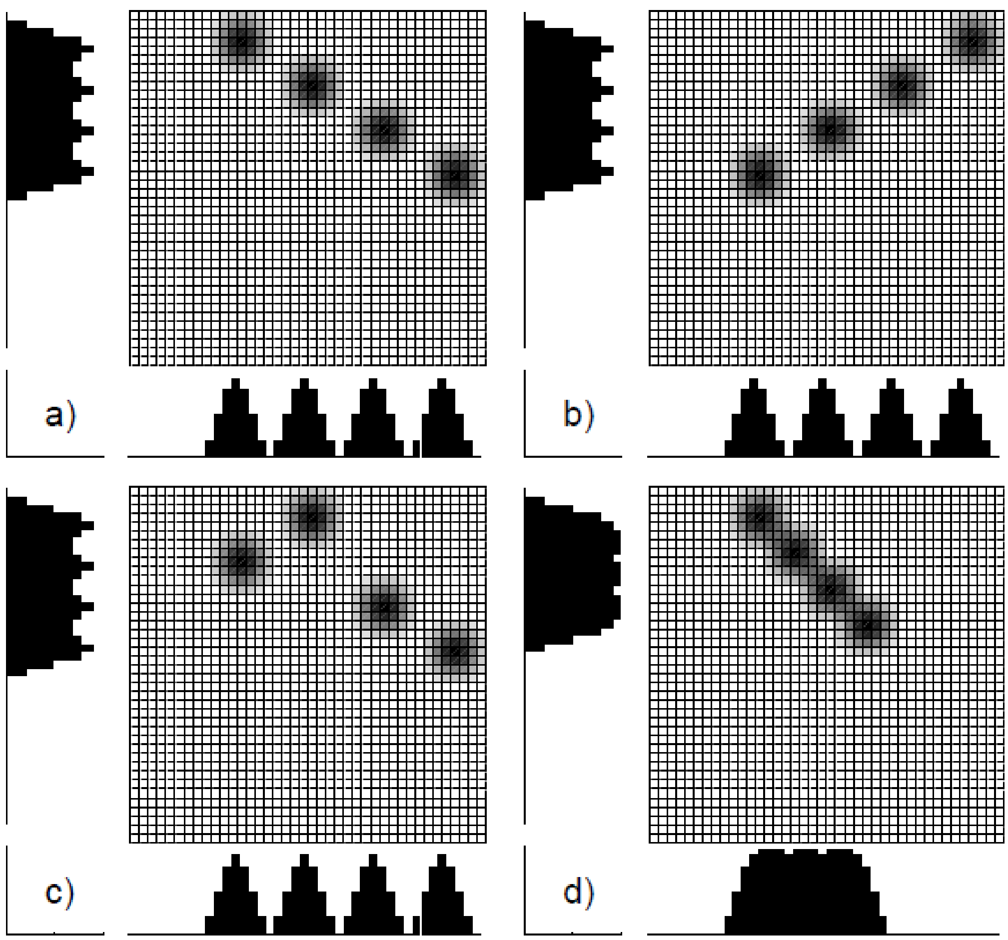
(JXM-10 '915 Patent at claim 15 (emphasis added).)

66. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation."

67. One of ordinary skill in the art in January 2007 would have understood that the determination in the claimed function required some data processing to ascertain whether a given

user input includes one input point or two or more input points. This analysis is non-trivial, and is the subject of extensive research in the field of computer science. There are many different algorithms that can be used to analyze touch sensor data and determine the number of input points. The data processing required for this determination may be quite extensive.

68. To accurately and consistently recognize and distinguish between one-finger and multi-finger touches for a large user population under a variety of circumstances, a robust data processing algorithm is necessary.



(RXM-6 Wayne Westerman, *Hand Tracking, Finger Identification, And Chordic Manipulation On A Multi-Touch Surface* (1999) at 35.)

69. Ultimately, the determination in the claimed function requires processing that distills

raw touch data to a binary decision: did the touch input consist of one input point, or multiple input points? My review of the specification reveals that it fails to disclose any algorithm that would accomplish this function.

70. I understand that Apple has identified the corresponding structure as "a microprocessor executing the software algorithm shown in block 106 of Figure 1 to determine whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation [‘915 patent, col. 1:59-67; col. 2:37-42; 6:37-46; col. 9:61- col. 11:13; col. 12:19-13:51; col. 21:31-41, Fig. 1, block 106; Fig. 7 - Fig. 10, Fig. 32, block 3202]." I have reviewed the passages of the ‘915 specification cited by Apple and in my opinion, there is no algorithm in any of the passages cited by Apple.

71. The first portion of Apple's proposed structure is "a microprocessor executing the software algorithm shown in block 106 of Figure 1 to" perform the claimed function. Block 106 of Figure 1 has no recitation of an algorithm. It is simply a box in a flowchart containing the text "determine whether the event object invokes a scroll or gesture operation" – a simplified version of the claimed function. Thus, block 106 of Fig. 1 is simply a restatement of the function and is not a recitation of algorithm. Likewise, the text accompanying Fig. 1 cited by Apple, Col. 6:37-46, is also a restatement of the claimed function.

72. The second portion of Apple's proposed structure is a bracketed citation to various passages in the ‘915 specification. Col. 1:59-67, Col. 2:37-42, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not

all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states "microprocessor." There is no description in block 3202 of Figure 32, or anywhere else in Figure 32 for that matter, about how the microprocessor would perform the claimed function. There is no description of how these component work to perform the claimed function. These citations add nothing of substance.

73. Apple also cites to Figs. 7-10. Col. 9:61-11:13 and Col. 12:19-13:51, but there is no discussion in these citations on distinguishing between scrolling and gestures operations or on how to recognize touch events as single-finger versus multi-finger events. The closest these passages get to disclosing a determination is on Col. 12:32-34, which states that "a window server receives the event object and determines whether the event object is a gesture event object." But even this passage provides no disclosure of the algorithm for the claimed function. Notably, this passage is disclosing "whether the event object is a gesture event object," i.e., it is disclosing determining the *type* of the object, whereas the claimed function is "determining whether the event object *invokes* a scroll or gesture operation." These are different functions. Inspecting an object to determine its type is not the same as determining whether that object "invokes a scroll or gesture operation." Notably, the '915 patent specification never describes determining an object type as a way to determine what operation to invoke, and in fact never describes scrolling operations at all in column 12. Accordingly, a person of ordinary skill would understand this passage as disclosing a determination that is unrelated to the determination recited in the claimed function.

74. I have reviewed the file history of the '915 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

E. "MEANS FOR ISSUING AT LEAST ONE SCROLL OR GESTURE CALL BASED ON INVOKING THE SCROLL OR GESTURE OPERATION"

[CLAIM 15]

75. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Function: issuing at least one scroll or gesture call based on invoking the scroll or gesture operation. Structure: a microprocessor executing the software algorithm shown in block 108 of Figure 1 to issue at least one scroll or gesture call based on invoking the scroll or gesture operation ['915 patent, col. 1:59-67; col. 2:37-42; col. 5:9-24; col. 6:46-48; col. 21:31-41, Fig. 1, block 108; Fig. 32, block 3202].	Function: issuing at least one scroll or gesture call based on invoking the scroll or gesture operation. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 108 of Fig. 1 as described in col. 6:46-48; and block 3202 of Fig. 32.	Function: issuing at least one scroll or gesture call based on invoking the scroll or gesture operation. Structure: a microprocessor configured to execute the software algorithm shown in block 108 of Figure 1 to issue at least one scroll or gesture call based on invoking the scroll or gesture operation as described in col. 6:46-48; and Fig. 32, block 3202.

76. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

77. "[M]eans for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation" appears in claim 15:

> 15. An apparatus, comprising:
>
> means for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus;
>
> means for creating an event object in response to the user input;
>
> means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-

> sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation;
>
> ***means for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation;***
>
> means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object; and
>
> means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input.

(JXM-10 '915 Patent at claim 15 (emphasis added).)

78. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "issuing at least one scroll or gesture call based on invoking the scroll or gesture operation."

79. In my opinion, the specification fails to disclose structure, such as an algorithm, to "issu[e] at least one scroll or gesture call based on invoking the scroll or gesture operation." It is well known to one of skill in the art that that a computer system can issue calls to methods or functions. However, the specification fails to explain how this should occur. For example, depending on how the designer wants to implement the scroll operation, one or more calls may be needed to implement scrolling. The '915 specification fails to disclose an algorithm for scrolling operations, and as a consequence, fails to disclose which calls should be issued to implement that scrolling algorithm. Additionally, after invoking a gesture operation, a series of calls can be used to implement scaling. However, the '915 specification fails to disclose an algorithm for scaling operations, and various calls may be required depending on the implementation. The '915 specification fails to disclose any algorithm that explains how to make the appropriate calls to implement the claimed functions.

80. I understand that Apple has identified the corresponding structure as "a

microprocessor executing the software algorithm shown in block 108 of Figure 1 to issue at least one scroll or gesture call based on invoking the scroll or gesture operation [‘915 patent, col. 1:59-67; col. 2:37-42; col. 5:9-24; col. 6:46-48; col. 21:31-41, Fig. 1, block 108; Fig. 32, block 3202].” I have reviewed the passages of the ‘915 specification cited by Apple and in my opinion, there is no algorithm for this function in any of the passages cited by Apple.

81. The first portion of Apple’s proposed structure is “a microprocessor executing the software algorithm shown in block 108 of Figure 1 to” perform the claimed function. Block 108 of Figure 1 has no recitation of an algorithm. It is simply a box in a flowchart containing the text “issue at least one scroll or gesture call based on invoking the scroll or gesture operation” – word-for-word identical to the claimed function. Thus, block 108 of Fig. 1 is simply a restatement of the function and is not a recitation of algorithm. Likewise, the text accompanying Fig. 1 cited by Apple, Col. 6:46-48, is also a restatement of the claimed function.

82. The second portion of Apple’s proposed structure is a bracketed citation to various passages in the ‘915 specification. Col. 1:59-67, Col. 2:37-42, Col. 5:9-24, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states “microprocessor.” There is no description in block 3202 of Figure 32, or anywhere else in Figure 32 for that matter, about how the microprocessor would perform the claimed function. There is no description of how these component work to perform the claimed function. These citations add nothing of substance.

83. I have reviewed the file history of the ‘915 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of

the invention.

F. "MEANS FOR RESPONDING TO AT LEAST ONE SCROLL CALL, IF ISSUED, BY SCROLLING A WINDOW HAVING A VIEW ASSOCIATED WITH THE EVENT OBJECT" [CLAIM 15]

84. I understand the parties have proposed the following construction for this term:

Apple's Proposed	HTC's Proposed	Staff's Proposed
Function: responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object. Structure: a microprocessor executing the software algorithm shown in block 110 of Figure 1 to respond to at least one scroll call, if issued, by scrolling a window having a view associated with the event object ['915 patent, col. 1:59-67; col. 2:37-42; col. 5:9-24; col. 6:46-56; col. 9:61 – col. 11:13; col. 21:31-41, Fig. 1, block 110; Figs. 7-10 Fig. 32, block 3202, block 3210].	Function: responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 110 of Fig. 1 as described in col. 6:46-56 or col. 9:61-11:13; and block 3202 of Fig. 32.	Function: responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object. Structure: a microprocessor configured to execute the software algorithm shown in block 110 of Figure 1 to respond to at least one scroll call, if issued, and a controller to scroll a window having a view associated with the view object as described in col. 6:46-56; col. 9:61-11:13; Figs. 7-10; and Fig. 32, block 3202.

85. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

86. "[M]eans for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object" appears in claim 15:

> 15. An apparatus, comprising:
>
> means for receiving, through a hardware device, a user input on a touch-

> sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus;
>
> means for creating an event object in response to the user input;
>
> means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation;
>
> means for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation;
>
> ***means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object;*** and
>
> means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input.

(JXM-10 '915 Patent at claim 15 (emphasis added).)

87. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object."

88. In my opinion, the specification fails to disclose any structure, such as an algorithm, that would "respond[] to at least one scroll call, if issued, by scrolling a window having a view associated with the event object." There are myriad ways to implement a scroll operation. But without any specific disclosure in the '915 specification, one of ordinary skill in the art would not know which of those algorithms were covered by this means plus function limitation. Implementing document translation requires a series of steps to update the screen. The algorithm used for this operation may vary (e.g., how often to render content, how to buffer content for successive rendering operations, etc.). For example, the entire screen might be re-rendered each time some portion of the screen changes. Alternatively it may be desirable to update the screen by copying the portion of the

screen that has already been rendered to a new location and only re-rendering the newly exposed portion of the screen, as I have done myself and described in one of my publications. (RXM-8 Bederson, B. B., & Meyer, J., *Implementing a Zooming User Interface: Experience Building Pad++ Software: Practice and Experience* (1998) at 15.) A similar mechanism is also used by Java's JViewport object which not only copies the portion of the screen that has already been rendered, but also avoids the use of double buffering through this copying, and thus reduces the amount of data which needs to be copied and resulting in a significant speed improvement. (*See* RXM-7 http://docs.oracle.com/javase/1.4.2/docs/api/javax/swing/JViewport.html (noting that "[w]e have implemented a faster scrolling algorithm that does not require a buffer to draw in").) Other possibilities exist for scrolling that are based on the data structure used to represent the underlying document. Tile-based systems, such as Google Maps, can take advantage of the structure of those tiles and use various caching techniques to speed up scrolling. Determining the best approach involves tradeoffs between the underlying data structure, performance characteristics of the system in question, desired user experience and the available level of resources. There is no single "best" way to scroll a document in all scenarios, and there clearly are multiple alternatives. A system designer might choose an algorithm that is faster, but requires more software engineering time to create. An algorithm might be chosen that renders more frequently and appears "smoother," but requires additional processing and memory resources. Alternatively, an algorithm might be chosen that works well for one kind of data and for a specific machine architecture, while another algorithm might have been chosen for a different kind of data or machine architecture.

89. In addition to designing the appropriate algorithm for document translation, different scrolling algorithms require different decisions on the degree of translation that will correspond to a given user input. For example, a document may be translated based on the position of the inputs. In

precise scrolling algorithms, movement of the finger by one inch causes the displayed data to move one inch. In proportional scrolling systems, movement of the finger by one inch causes the displayed data to move some multiple of that movement (e.g., two inches). In my opinion the '915 patent fails to provide a step-by-step explanation for how to determine the degree of translation that will correspond to a given user input.

90. Additionally, direction of the scrolling may depend on whether scrolling is done by scrolling the content itself, or scrolling the window via scroll bars. For example, in programs such as Adobe Acrobat, dragging ***down*** the scroll indicator on the scroll bar to the right of the document moves the document ***up*** (i.e., pans the window down). However, using the hand tool over the content of the document, scrolling is reversed; dragging the document ***up*** moves the document ***up***.

91. I understand that Apple has identified the corresponding structure as "a microprocessor executing the software algorithm shown in block 110 of Figure 1 to respond to at least one scroll call, if issued, by scrolling a window having a view associated with the event object ['915 patent, col. 1:59-67; col. 2:37-42; col. 5:9-24; col. 6:46-56; col. 9:61 – col. 11:13; col. 21:31-41, Fig. 1, block 110; Figs. 7-10, Fig. 32, block 3202, block 3210]." I have reviewed the passages of the '915 specification cited by Apple and in my opinion, there is no algorithm for this function in any of the passages cited by Apple.

92. The first portion of Apple's proposed structure is "a microprocessor executing the software algorithm shown in block 110 of Figure 1 to" perform the claimed function. Block 110 of Figure 1 has no recitation of an algorithm. It is simply a box in a flowchart containing the text "respond to at least one scroll call, if issued, scroll a window having a view associated with the event object based on an amount of a scroll with the scroll stopped at a predetermined position in relation to the user input." This disclosure only echoes the claim language, with some additional disclosure

regarding where scrolling stops, but not how scrolling should occur. Likewise, the text accompanying Fig. 1 cited by Apple, Col. 6:46-56, is also a restatement of the claimed function.

93. The second portion of Apple's proposed structure is a bracketed citation to various passages in the '915 specification. Col. 1:59-67, Col. 2:37-42, Col. 5:9-24, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states "microprocessor." Block 3210 is a box that simply states "display controller and display device." There is no description in blocks 3202 and 3210 of Figure 32, or anywhere else in Figure 32 for that matter, about *how* the microprocessor or display would perform the claimed function. There is no description of how these component work to perform the claimed function. These citations do not disclose an algorithm.

94. Apple also cites to Figs. 7-10 and Col. 9:61-11:13, but there is no discussion in these sections of the patent explaining how to scroll a window. These figures and passages disclose features such as locking a scroll direction or decelerating a scroll, that would only operate once a scroll operation has already started. They also disclose features such as setting the hysteresis value that would only operate before a scroll is initiated. Thus, nothing in these disclosures is sufficient to implement the claimed function of responding to a scroll call to scroll a window.

95. I have reviewed the file history of the '915 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

G. "MEANS FOR RESPONDING TO AT LEAST ONE GESTURE CALL, IF ISSUED, BY SCALING THE VIEW ASSOCIATED WITH THE EVENT OBJECT BASED ON RECEIVING THE TWO OR MORE INPUT POINTS IN THE FORM OF THE USER INPUT" [CLAIM 15]

96. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Function: responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input. Structure: a microprocessor executing the software algorithm shown in block 112 of Figure 1 to respond to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input ['915 patent, col. 1:59-67; col. 2:22-26, 37-42; col. 5:9-24; col. 6:57-60; col. 7:8-10; col. 12:19-col. 14:24; col. 21:31-41, Fig. 1, block 112; Fig. 13, 14, 15, 16A-C, Fig. 32, block 3202].	Function: responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 112 of Fig. 1, Figs. 13-15, or Figs. 16-A-C as described in col. 2:22-26, col. 6:57-60, col. 7:4-10, or col. 12:19-14:24; and block 3202 of Fig. 32.	Function: responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input. Structure: a microprocessor configured to execute the software algorithm shown in block 112 of Figure 1 to respond to at least one gesture call, if issued, by scaling a view associated with the event object by zooming in or zooming out based on receiving the user input as described in col. 2:22-26; col. 6:57-60; col. 7:4-10; col. 12:19-col. 14:24; Figs. 13-15; Figs. 16A-C, and Fig. 32, block 3202.

97. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

98. "[M]eans for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the

user input" appears in claim 15:

> 15. An apparatus, comprising:
>
> means for receiving, through a hardware device, a user input on a touch-sensitive display of the apparatus, the user input is one or more input points applied to the touch-sensitive display that is integrated with the apparatus;
>
> means for creating an event object in response to the user input;
>
> means for determining whether the event object invokes a scroll or gesture operation by distinguishing between a single input point applied to the touch-sensitive display that is interpreted as the scroll operation and two or more input points applied to the touch-sensitive display that are interpreted as the gesture operation;
>
> means for issuing at least one scroll or gesture call based on invoking the scroll or gesture operation;
>
> means for responding to at least one scroll call, if issued, by scrolling a window having a view associated with the event object; and
>
> ***means for responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input.***

(JXM-10 '915 Patent at claim 15 (emphasis added).)

99. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "responding to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input."

100. In my opinion, the specification fails to disclose any algorithm that would "respond[] to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input." There are myriad way to implement a scale operation. But without any specific disclosure in the '915 specification, one of ordinary skill in the art would not know which of those algorithms were covered by this means plus function limitation. Implementing document scaling requires a series of steps to update the screen.

The algorithm used for this operation may vary, *e.g.*, how often to render content, how to scale in response to user input, etc. For example, rather than re-rendering the entire view at every scale step, the previous view could be scaled as an image, pixel by pixel, and then after some point, possibly when the scaling operation completes or perhaps when the user stopped scaling for a moment, the view could be completely re-rendered, removing any visual artifacts introduced by the pixel scaling approach.

101. Furthermore, such pixel based scaling itself can be implemented with numerous different algorithms with varying tradeoffs between performance, quality and resource usage. I considered all of these issues myself when I implemented Pad++, a graphical user interface system that supports scaling. A paper I wrote described many of these issues in detail. (*See* RXM-8 Bederson, B. B., & Meyer, J., *Implementing a Zooming User Interface: Experience Building Pad++ Software: Practice and Experience* (1998).) For example, the section "Damage and Restoration" on page 12 describes a process of "refinement" used to visually repair the screen some time after a faster, but lower quality algorithm was used for rendering when speed was desired. An example of one of these faster, but lower quality, algorithms which efficiently scales a view via pixel-by-pixel replication is described for scaling images in the section "Images in 2D" on pages 9-11.

102. I understand that Apple has identified the corresponding structure as "a microprocessor executing the software algorithm shown in block 112 of Figure 1 to respond to at least one gesture call, if issued, by scaling the view associated with the event object based on receiving the two or more input points in the form of the user input ['915 patent, col. 1:59-67; col. 2:22-26, 37-42; col. 5:9-24; col. 6:57-60; col. 7:8-10; col. 12:19-col. 14:24; col. 21:31-41, Fig. 1, block 112; Fig. 13, 14, 15, 16A-C, Fig. 32, block 3202]." I have reviewed the passages of the '915 specification cited by Apple and in my opinion, there is no algorithm for this function in any of the

passages cited by Apple.

103. The first portion of Apple's proposed structure is "a microprocessor executing the software algorithm shown in block 112 of Figure 1 to" perform the claimed function. Block 112 of Figure 1 has no recitation of an algorithm. It is simply a box in a flowchart containing the text "responding to at least one gesture call, if issued, change a view associated with the event object based on receiving a plurality of input points in the form of the user input" – a simple rewording of the claimed function. Likewise, the text accompanying Fig. 1 cited by Apple, Col. 6:57-60, is also a restatement of the claimed function.

104. The second portion of Apple's proposed structure is a bracketed citation to various passages in the '915 specification. Col. 1:59-67, Col. 2:37-42, Col. 5:9-24, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states "microprocessor." There is no description in block 3202 of Figure 32, or anywhere else in Figure 32 for that matter, about how the microprocessor would perform the claimed function. There is no description of how these component work to perform the claimed function. These citations add nothing of substance.

105. Apple's other citations, which never address block 112 of Figure 1, similarly lack a step-by-step algorithm. They simply restate the function (col. 2:22-26 & 7:8-10), illustrate the results of the function (Figs. 16A-C), or describe various "calls" that signal the beginning and end of the function – without explaining how the function is performed (Figs. 13-15 & col. 12:19-14:24). In my opinion, none of these passages disclose an algorithm for the claimed function.

106. I have reviewed the file history of the '915 patent. I found nothing in the file history

to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

H. "MEANS FOR RUBBERBANDING A SCROLLING REGION DISPLAYED WITHIN THE WINDOW BY A PREDETERMINED MAXIMUM DISPLACEMENT WHEN THE SCROLLING REGION EXCEEDS A WINDOW EDGE BASED ON THE SCROLL" [CLAIM 16]

107. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Function: rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll. Structure: a microprocessor executing the software algorithm shown in block 302 of Figure 3 to rubberband a scrolled region by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll ['915 patent, col. 1:59-67; col. 2:37-42; col. 7:46-67; col. 8:61-col. 9:60; col. 21:31-41; Fig. 3, block 302; Figs. 6A-D; Fig. 32, block 3202.	Function: rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 302 of Fig. 3 or Figs. 6A-D as described in col. 7:46-67 or col. 8:61-9:60; and block 3202 of Fig. 32.	Function: rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll. Structure: a microprocessor configured to execute the software algorithm shown in block 302 of Figure 3 to rubberband a scrolled region by a predetermined maximum scrolled region exceeds a window edge based on the scroll as described in col. 7:46-67; col. 8:61-9:60; Figs. 6A-D; and Fig. 32, block 3202.

108. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

109. "[M]eans for rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll" appears in claim 16:

> 16. The apparatus as in claim 15, further comprising: ***means for rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll***.

(JXM-10 '915 Patent at claim 16 (emphasis added).)

110. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "rubberbanding a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll."

111. In my opinion, the specification fails to disclose any algorithm that would "rubberband[] a scrolling region displayed within the window by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll." The claimed function can be implemented in a variety of different ways and the designer would have to make numerous decisions such as (1) determining when does the scrolling operation end and the rubberbanding operation begin; (2) which parameters, such as time, scrolled distance, position of the touch, etc. should be used to make such a determination; (3) determining the predetermined maximum displacement; (4) deciding which elastic features should the rubberbanding function have, for example, whether the scrolled content should move at constant speed during rubberbanding or slow down as it gets closer to the display edge, whether the scroll content should immediately snap to the display edge or have an overshoot animation, etc. Without any such disclosures in the '915 specification, a person of ordinary skill in the art would not know what algorithm was used by the '915 patent. Nothing that I have reviewed in the patent specification provides this disclosure.

112. I understand that Apple has identified the corresponding structure as "a microprocessor executing the software algorithm shown in block 302 of Figure 3 to rubberband a scrolled region by a predetermined maximum displacement when the scrolling region exceeds a window edge based on the scroll [‘915 patent, col. 1:59-67; col. 2:37-42; col. 7:46-67; col. 8:61-col. 9:60; col. 21:31-41; Fig. 3, block 302; Figs. 6A-D; Fig. 32, block 3202]." I have reviewed the passages of the ‘915 specification cited by Apple and in my opinion, there is no algorithm for this function in any of the passages cited by Apple.

113. The first portion of Apple's proposed structure is "a microprocessor executing the software algorithm shown in block 302 of Figure 3 to" perform the claimed function. Block 302 of Figure 3 has no recitation of an algorithm. It is simply a box in a flowchart containing the text "transfer a rubberband call to cause rubberbanding a scrolled region displayed within a display region" – a simple rewording of the claimed function. Likewise, the text accompanying Fig. 3 cited by Apple, Col. 7:46-67, is also a restatement of the claimed function. Further, it is unclear where the rubberband call is transferred from and where it is transferring to.

114. The second portion of Apple's proposed structure is a bracketed citation to various passages in the ‘915 specification. Col. 1:59-67, Col. 2:37-42, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states "microprocessor." There is no description in block 3202 of Figure 32, or anywhere else in Figure 32 for that matter, about how the microprocessor would perform the claimed function . There is no description of how these component work to perform the claimed function. These citations add nothing of substance.

115. Apple's other citations, which never mention block 302 of Figure 3, similarly lack a step-by-step algorithm. Col. 8:61-col. 9:60 and Figs. 6A-6D only show the results of the claimed function, but not how the function is performed.

116. I have reviewed the file history of the '915 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

I. "MEANS FOR ATTACHING SCROLL INDICATORS TO A CONTENT EDGE OF THE WINDOW" [CLAIM 17]

117. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Function: attaching scroll indicators to a content edge of the window. Structure: a microprocessor executing the software algorithm shown in block 1104 of Figure 11 to attach scroll indicators to a content edge of a window ['915 patent, col. 1:59-67; col. 2:37-42; col. 6:61-67; col. 11:14-46; col. 21:31-41; Fig. 11; Fig. 32, block 3202.	Function: attaching scroll indicators to a content edge of the window. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 1104 of Fig. 11 as described in col. 6:61-64, col. 6:65-7:3, or col. 11:14-46; and block 3202 of Fig. 32.	Function: attaching scroll indicators to a content edge of the window. Structure: a microprocessor configured to execute the software algorithm shown in block 1104 of Figure 11 to attach scroll indicators to a content edge of a window as described in col. 6:61-7:3; col. 11:14-46; Fig. 11; and Fig. 32, block 3202.

118. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for attaching scroll indicators to a content edge of the window" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

119. "[M]eans for attaching scroll indicators to a content edge of the window" appears in claim 17:

> 17. The apparatus as in claim 15, further comprising: ***means for attaching scroll indicators to a content edge of the window***.

(JXM-10 '915 Patent at claim 17 (emphasis added).)

120. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "attaching scroll indicators to a content edge of the window."

121. In my opinion, the specification fails to disclose any algorithm that would "attach[] scroll indicators to a content edge of the window." Claim 18 is similar to claim 17, except that it recites "attaching scroll indicators to the window edge." Nowhere in the '915 specification is there any discussion on what is a content edge and what is a window edge and how these two edges are different. Thus a person of ordinary skill in the art, after reviewing the '915 specification, would not understand precisely what a "window edge" is as opposed to a "content edge of the window." Further, the '915 specification is also silent on what information the scroll indicators should convey to the user. For example, the position of the scroll indicators on the display can be used to indicate the position of the displayed portion of a document relative to the entire document, and the size of the scroll indicators can be used to indicate the size of the displayed portion of a document relative to the entire document. Without any such disclosure on what is actually implemented, a person of ordinary skill in the art would not know what algorithms or structures are covered by this means plus function limitation.

122. I understand that Apple has identified the corresponding structure as "a microprocessor executing the software algorithm shown in block 1104 of Figure 11 to attach scroll indicators to a content edge of a window ['915 patent, col. 1:59-67; col. 2:37-42; col. 6:61-67; col. 11:14-46; col. 21:31-41; Fig. 11; Fig. 32, block 3202]." I have reviewed the passages of the '915 specification cited by Apple and in my opinion, there is no algorithm for this function in any of the

passages cited by Apple.

123. The first portion of Apple's proposed structure is "a microprocessor executing the software algorithm shown in block 1104 of Figure 11 to" perform the claimed function. Block 1104 of Figure 11 has no recitation of an algorithm. It is simply a box in a flowchart containing the text "optionally attach scroll indicators to a scroll region based on the scroll indicator call" – a simple rewording of the claimed function. Likewise, the text accompanying Fig. 11 cited by Apple, Col. 11:14-46, is simply a description of an application programming interface and its associated calls and not any algorithm that implements that application programming interface.

124. The second portion of Apple's proposed structure is a bracketed citation to various passages in the '915 specification. Col. 1:59-67, Col. 2:37-42, and Col. 21:31-41 contain descriptions of generic software and hardware components, such as application programming interfaces, machine readable media, and analog-to-digital converters, that are present in most if not all modern computer systems. Block 3202 of Figure 32 is a box in a block diagram whose text simply states "microprocessor." There is no description in block 3202 of Figure 32, or anywhere else in Figure 32 for that matter, about how the microprocessor would perform the claimed function. There is no description of how these component work to perform the claimed function. These citations add nothing of substance.

125. Apple's other citations, which never address block 1104 of Figure 11, similarly lack a step-by-step algorithm. Col. 11:14-46 only show the results of the claimed function, that scroll indicators are attached in relation to user input, but not how the function is performed. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for attaching scroll indicators to a content edge of the window."

126. I have reviewed the file history of the '915 patent. I found nothing in the file history

to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

J. "MEANS FOR ATTACHING SCROLL INDICATORS TO THE WINDOW EDGE" [CLAIM 18]

127. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Function: attaching scroll indicators to the window edge. Structure: a microprocessor executing the software algorithm shown in block 1106 of Figure 11 to attach scroll indicators to the window edge ['915 patent, col. 1:59-67; col. 2:37-42; col. 6:61-67; col. 11:14-46; col. 21:31-41; Fig. 11; Fig. 32, block 3202.	Function: attaching scroll indicators to the window edge. Structure: none disclosed Alternatively, the following structure is related to the recited function: block 1106 of Fig. 11 as described in col. 6:61-64, col. 6:65-7:3, or col. 11:14-46; and block 3202 of Fig. 32.	Function: attaching scroll indicators to the window edge. Structure: a microprocessor configured to execute the software algorithm shown in block 1106 of Figure 11 to attach scroll indicators to the window edge as described in col. 6:61-7:3; col. 11:14-46; Fig. 11; and Fig. 32, block 3202.

128. One of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "means for attaching scroll indicators to the window edge" in the specification of the '915 patent because the specification fails to disclose the corresponding structure for performing this function.

129. "[M]eans for attaching scroll indicators to the window edge" appears in claim 18:

> 18. The apparatus as in claim 15, further comprising: ***means for attaching scroll indicators to the window edge***.

(JXM-10 '915 Patent at claim 18 (emphasis added).)

130. I understand that the parties agree that this is a means-plus-function term. I also understand that the parties agree that the claimed function is "attaching scroll indicators to the window edge."

131. In my opinion, this means-plus-function limitation is indefinite for the same reasons as the limitation "means for attaching scroll indicators to a content edge of the window" of claim 17. My opinions regarding claim 17 are hereby incorporated by reference.

VI. THE '381 PATENT

132. The '381 patent, titled "List scrolling and document translation, scaling, and rotation on a touch-screen display," was filed in the United States on December 14, 2007, and claims priority to several provisional applications, the earliest of which was filed on January 7, 2007. For the purposes of this report, I have been asked to assume to date of the alleged invention is the filing date of January 7, 2007.

133. The '381 patent is primarily directed at a user interface feature that allows a user of a touch screen to overscroll content on the touch screen. When the user ceases the overscroll, i.e., lifts his finger, the content bounces back so that it is aligned with the edges of the screen.

A. LEVEL OF ORDINARY SKILL IN THE ART OF THE '381 PATENT

134. In my opinion, for the '381 patent, a person of ordinary skill in the art would have had at least a bachelor's degree in computer science, and 2-3 years of software design and implementation experience, including experience with graphical user interface design and with touch-sensing technologies, or would have equivalent educational and work experience.

135. I meet these criteria and consider myself a person with at least ordinary skill in the art pertaining to the '381 patent. I would have been such a person at the time of invention of the '381 patent.

B. "ELECTRONIC DOCUMENT"

136. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Plain and ordinary meaning.	Electronic data that can be stored and displayed.	Electronic data that can be stored and displayed.

137. In my opinion, the term "electronic document" has no clear ordinary and meaning to a person of ordinary skill in the art because it has multiple meanings within the art, depending on the context in which the term is used. For example, a database systems analyst might understand an electronic document to be a record in a database whereas a programmer of word processing applications might understand an electronic document to be a text file.

138. Given that there is no precise, universal, agreed-upon definition of the term "electronic document" on its own, to determine the meaning of the term, one of ordinary skill in the art in 2007 would have looked to the specification of the patent to determine the meaning of "electronic document" as used in the patent.

139. "Electronic document" appears in claim 1:

> 1. A computer-implemented method, comprising: at a device with a touch screen display:
>
> displaying a first portion of an ***electronic document***
>
> detecting a movement of an object on or near the touch screen display;
>
> in response to detecting the movement, translating the ***electronic document*** displayed on the touch screen display in a first direction to display a second portion of the ***electronic document***, wherein the second portion is different from the first portion;
>
> in response to an edge of the ***electronic document*** being reached while translating the ***electronic document*** in the first direction while the object is still detected on or near the touch screen display:
>
> displaying an area beyond the edge of the document, and displaying a third portion of the ***electronic document***, wherein the third portion is smaller than the first portion; and

> in response to detecting that the object is no longer on or near the touch screen display, translating the ***electronic document*** in a second direction until the area beyond the edge of the ***electronic document*** is no longer displayed to display a fourth portion of the ***electronic document***, wherein the fourth portion is different from the first portion.

(JXM-4 '381 Patent at claim 1 (emphasis added).)

140. The term "electronic document" appears in asserted claims 1, 2, 6-9, 17-20 of the '381 patent. The claims include the following examples of electronic documents: "a web page" (JXM-4 '381 Patent at claim 6), a "digital image" (JXM-4 '381 Patent at claim 7); "a word processing, spreadsheet, email or presentation document" (JXM-4 '381 Patent at claim 8); and "a list of items" (JXM-4 '381 Patent at claim 9).

141. The term "electronic document" appears frequently in the specification of the '381 patent and is used to refer to specific types of electronic documents. For example, "electronic document" appears in the '381 specification in reference lists of items, e.g., a list of emails displayed in an inbox (JXM-4 '381 Patent Figs. 6A – 6D), web pages (JXM-4 '381 Patent Figs. 8A – 8D), and digital images (JXM-4 '381 Patent Figs. 13A – 13C). As another example, in its discussion of Figures 8A - 8D, the specification described the web page shown in the figures: "[w]eb page 3912 or other structured document, which is made of blocks 3914 of text content and other graphics (e.g., images)." (JXM-4 '381 Patent at Col. 28:62-64.)

142. I have reviewed the file history of the '381 patent. (JXM-3.) Within the file history of the '381 patent, there is a December 14, 2007, communication from the Applicant to the USPTO as part of its petition for accelerated examination. In its petition for accelerated examination, the Applicant submitted claim charts mapping its proposed claims to prior art references, including to U.S. Patent No. 6,690,387 to John Zimmerman and Jacquelyn A. Martino and U.S. Patent Application Publication No. 2005/0012723 to Matt Pallakoff. The Applicant analyzed the prior art

references and cited to portions of those references as disclosing elements of the claims in the '381 application. (JXM-3, at 797APPLE00001145-55.) For example, for the draft claim 1 element of "in response to detecting the movement, translating an electronic document displayed on the touch screen display in a first direction," the Applicant identified the following passage from U.S. Patent No. 6,690,387 as disclosing the display of an electronic document: "the invention proceeds to step 104, converting the speed and direction of motion of the touch into corresponding initial scrolling motion of the *displayed data*." (RXM-9 U.S. Patent No. 6,690,387 at Col. 3:55-57.) For the same claim element, the Applicant identified a paragraph from U.S. Patent Application Publication No. 2005/0012723 which included this explanation: "Note that one alternative way to allow scrolling of displayed content (which is not incompatible with those covered here) is to let the user move the content around simply by touching a point on the touch screen over *any part of the displayed content that is not a link, button, or other selectable item* . . . ." (RXM-10 U.S. Patent Application Publication No. 2005/0012723 at ¶ 0120.)

143. Thus, after my review of the examples of electronic document provided in the '381 claims and specification and the Applicant's charting of the two prior art references to its draft claims including the term "electronic document" found in the '381 file history, it is my opinion that a person of ordinary skill in that art at the time of the invention would understand that "electronic document" was used in the '381 patent broadly to refer to "electronic data that can be stored and displayed." Each of the examples discussed above share these defining characteristics: they are data that is stored and displayed.

144. I have reviewed portions of the deposition transcripts of the inventor of the '381 Patent, Bas Ording, and Apple's expert, Dr. Ravin Balakrishnan, in the technology in an on-going District Court action, *Apple, Inc. v. Samsung Elecs. Co.*, 5:11-CV-01846-LHK (N.D. Cal.). The

testimony for both further confirm my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

145. When asked at deposition what "electronic document" meant in the context of the '381 Patent, Dr. Balakrishnan responded, "In the context of this patent and the claims, reading the patent and the claims, I would say that would be a – my definition of an electronic document would be something visually representable on the screen that – that has a defined set of boundaries." (RXM-11C Balakrishnan Tr. at 27:13 – 28:18, *Apple, Inc. v. Samsung Elecs. Co.*, 5:11-CV-01846-LHK (objections omitted).)

146. Although I do not generally agree with Dr. Balakrishnan's testimony, I do agree with Dr. Balakrishnan's testimony that "electronic document" as used in the '381 is something "visually representable," as his testimony is merely another way to say the "display of electronic data." Again, because the storing of electronic data is inherent to the display of an electronic document, Dr. Balakrishnan's testimony is consistent with my opinion.

147. The testimony of the '381 inventor, Bas Ording, also supports HTC and the Staff's proposed construction of electronic document. When asked at deposition what "electronic document" means, the inventor of the '381 Patent, Bas Ording, answered, "[t]o me it means things that are electronically stored on some kind of computer, I believe. And I guess in the context of this idea, it's -- it has to do with something that's visible. . . . Or something that can be displayed somehow." (RXM-12C Ording Tr. at 20:18 – 21:10, *Apple, Inc. v. Samsung Elecs. Co.*, 5:11-CV-01846-LHK (objections omitted).)

148. Mr. Ording also testified at his deposition for this investigation that it was possible to display "multiple electronic documents on the same web page." (RXM-14C Ording Tr. at 55:19 – 56:6.)

149. Although I do not generally agree with Mr. Ording's testimony, I do generally agree with his understanding of electronic document as used in the '381 Patent as things that are electronically stored and displayed and that multiple electronic documents may be displayed within a web page for example.

150. Neither Dr. Balakrishnan's nor Mr. Ording's testimony regarding the meaning of "electronic document" as used in the '381 patent is surprising as they both generally reflect the use of the term by the '381 patent to refer to electronic data that is stored and displayed.

151. Based on my experience, at the time of the allegedly invention in 2007, the term "electronic document" was not a term of art and thus one of ordinary skill would not understand this term to have a well-established meaning in the art. Accordingly, when reviewing the '381 patent, one of ordinary skill in the art would look to the specification and the meaning of the word "electronic document" as used in the specification to understand what the inventor meant to denote with these term. Given this fact and the way the term was used in the intrinsic evidence, it is my opinion that a person of ordinary skill in the art at the time of the invention of the '381 patent in 2007 would understand the term "electronic document" to mean "electronic data that can be stored and displayed."

C. INSTRUCTIONS FOR DISPLAYING A FIRST PORTION OF AN ELECTRONIC DOCUMENT [CLAIM 19]

152. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Not subject to § 112 ¶ 6; plain and ordinary meaning.	Indefinite, subject to § 112 ¶ 6. Function: displaying a first portion of an electronic document. Structure: not disclosed. Alternatively, the following structure is related to the recited function: Figs 6A or 8A as described in col. 26:2-5, col. 27:5-7, or col. 29:15-20.	Subject to § 112 ¶ 6. Function: displaying a first portion of an electronic document. Structure: a processor configured to execute the software algorithm to display a first portion of an electronic document as described in 26:2-5; 27:5-7, Figs. 6A and 8A; col. 29:15-20.

153. I understand that HTC and the Staff agree that this limitation is subject to 35 U.S.C. § 112 ¶ 6 and should be treated accordingly as a means-plus-function term. I understand Apple disagrees that the limitation is subject to 35 U.S.C. § 112 ¶ 6 and has taken the position that the limitation should be given its plain and ordinary meaning. I also understand that HTC and the Staff agree that the claimed function is "displaying a first portion of an electronic document." I further understand that the Staff states that the structure is "a processor configured to execute the software algorithm to display a first portion of an electronic document as described in 26:2-5; 27:5-7, Figs. 6A and 8A; col. 29:15-20." I understand that HTC's position is that no structure is disclosed. I also understand that as an alternative position to the extent a structure is disclosed in the '381 specification, HTC and the Staff cite to identical specification support, namely Figs 6A or 8A as described in col. 26:2-5, col. 27:5-7, or col. 29:15-20.

154. The Microsoft Computer Dictionary defines "instruction" as "instruction n. An action statement in any computer language, most often in machine or assembly language. Most programs consist of two types of statements: declarations and instructions." (RXM-13 Excerpt of Microsoft Computer Dictionary, 276 (Fifth Ed. 2002).)

155. In my opinion, the context for the phrase "instructions for displaying a first portion of an electronic document" is as follows: "one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the programs including: instructions for displaying a first portion of an electronic document . . . ." It is my opinion that in this context, "instructions" means computer code such as statements in a programming language, which is consistent with the definition found in the Microsoft Computer Dictionary, Fifth Edition. There is no computer code of any kind anywhere in the '381 patent.

156. In my opinion, there is no corresponding structure for "instructions for displaying a first portion of an electronic document" in the specification of the '381 Patent because the specification fails to disclose the corresponding structure for performing this function. Each time the '381 Patent refers to this limitation, the patent discusses the functions of the limitation but does not identify or describe the components needed to perform those functions. For example, the specification provides: "In the example, of FIG. 6A, a portion of a list of emails is displayed in the screen area, including a top displayed email 3530 from Bruce Walker and a bottom displayed email 3532 from Kim Brook" (JXM-4 '381 Patent at Col. 26:2-5.) Another example is "an electronic document displayed on the touch screen display . . . ." (JXM-4 '381 Patent at Col. 27:6.) A person of ordinary skill in the art cannot discern the structure of the limitation from the specification of the '381 patent. Nor can a person of ordinary skill in that art determine whether a particular product or method infringes this limitation.

157. Displaying an electronic document requires an algorithm to process the data to be displayed and to render that data for display. Rendering data for display is a non-trivial task and an area of extensive discussion in graphical user interface design. Many different algorithms are available to process and render data for display. Selecting the appropriate algorithm often involves

trade-offs between speed and resolution of the display. Algorithms processing data for display may offer faster performance, but less resolution, than algorithms that process the data with higher display resolution. In my opinion, the '381 patent specification fails to disclose any algorithm to process and render data for display.

158. I have reviewed portions of the deposition transcript of the inventor of the '381 patent, Bas Ording, in this action. The testimony further confirm my opinion that there are multiple ways to perform the function of "displaying a first portion of an electronic document" of limitation [19e] as well as multiple ways to perform the functions claimed in limitations [19f] – [19i] and that one of ordinary skill in the art would be aware of multiple ways to perform these claimed functions.

159. When asked at deposition whether there was more than one way to perform each of the functions of claim 19, Mr. Ording answered, "[w]ell, if I bring it back to my prototype[,] I can imagine there are probably other ways you could do it so." (RXM-14C Ording Tr. at 139:25 – 140:7, *In re Certain Portable Electronic Devices and Related Software*¸ Inv. No. 337-TA-797 (Jan. 13, 2012) (objection omitted).)

160. Although I do not generally agree with Mr. Ording's testimony, I do generally agree with his understanding that there is more than one way to perform each of the functions claimed in claim 19 of the '381 patent.

161. I understand that Apple has proposed that the limitation should be construed as its plain and ordinary meaning and the Staff has proposed the structure is "a processor configured to execute the software algorithm to display a first portion of an electronic document" as described in the '381 specification. But neither of these proposed constructions connotes structure and nor do they inform one of the ordinary skill in the art of a particular hardware structure, software algorithm, or combination of hardware and software that performs the claimed function, nor does the

specification provide such disclosures. Both Apple's and the Staff's broad proposed constructions could cover every conceivable way to perform the claimed functions. These proposed constructions do not provide any guidance to one of ordinary skill in the art regarding the scope of the limitation, rather they leave the limitation boundless.

162. My review of Mr. Ording's testimony further confirms my opinion that the '381 patent does not disclose any structures, algorithms or computer code to inform one of ordinary skill in the art *how* to perform the claimed function of limitation [19e] or the functions claimed in limitations [19f] – [19i].

163. When asked at deposition whether the '381 patent disclosed how to perform the functions of claim 19, Mr. Ording could not identify any disclosures:

> Q. So ***if instructions as described in claim 19 are referring to software instructions, code instructions, you'd agree with me that there's no disclosure of specific code instructions in the '381 patent; correct?***
> A. ***Well, as far as I know I haven't seen any computer code in this patent.***
> Q. And for example, on instructions for translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed, ***we didn't see any descriptions of the specific algorithms for such instructions in the patent; correct?***
> A. ***Yeah, as far as I know there is no computer code showing in this patent.***
> Q. And you didn't see any computer algorithms in this patent as well; right?
> A. Well, it depends what an algorithm means.
> Q. ***Or a description of how the code works at the instruction level. Did you see anything like that?***
> A. ***Well, I saw it from block diagrams, but other than that no.***
> Q. ***And in the block diagrams what we saw were just statements of functions?***
> A. ***Correct. That's what it looked like.***
> Q. ***It didn't tell us how you would actually carry out those functions in a computer algorithm; right?***
> A. ***It didn't look like it, not to me.***

(RXM-14C Ording Tr. at 158:21 – 160:15, *In re Certain Portable Electronic Devices and Related*

Software¸ Inv. No. 337-TA-797 (Jan. 13, 2012) (objections omitted) (emphasis added).)

164. Although I do not generally agree with Mr. Ording's testimony, I do generally agree with his understanding that the '381 patent does not disclose computer code or algorithms to implement the functions claimed in [19e] – [19i] and that the flow charts restate the functions of the limitations [19e] – [19i].

165. I have reviewed the file history of the '381 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

D. INSTRUCTIONS FOR DETECTING A MOVEMENT OF AN OBJECT ON OR NEAR THE TOUCH SCREEN DISPLAY [CLAIM 19]

166. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Not subject to § 112 ¶ 6; plain and ordinary meaning.	Indefinite, subject to § 112 ¶ 6. Function: detecting a movement of an object on or near the touch screen display. Structure: not disclosed. Alternatively, the following structure is related to the recited function: block 502 of Fig. 5 or block 702 of Fig. 7 as described in col. 15:6-28, col. 20:29-51, col. 23:64-67, col. 25:18-22, col. 26:5-22, col. 27:1-4, or col. 29:41-44.	Subject to § 112 ¶ 6. Function: detecting a movement of an object on or near the touch screen display. Structure: a processor configured to execute the software algorithm as described in block 502 of Fig. 5 and block 702 of Fig. 7 to detect a movement of an object on or near the touch screen display as described in col. 15:6-28; col. 20:29-51; col. 23:64-67; col. 25:18-22; col. 26:5-22; col. 27:1-4; col. 29:41-44.

167. I understand that HTC and the Staff agree that this limitation is subject to 35 U.S.C. § 112 ¶ 6 and should be treated accordingly as a means-plus-function term. I understand Apple

disagrees that the limitation is subject to 35 U.S.C. § 112 ¶ 6 and has taken the position that the limitation should be given its plain and ordinary meaning. I also understand that HTC and the Staff agree that the claimed function is "detecting a movement of an object on or near the touch screen display." I further understand that the Staff states that the structure is "a processor configured to execute the software algorithm as described in block 502 of Fig. 5 and block 702 of Fig. 7 to detect a movement of an object on or near the touch screen display as described in col. 15:6-28; col. 20:29-51; col. 23:64-67; col. 25:18-22; col. 26:5-22; col. 27:1-4; col. 29:41-44." I understand that HTC's position is that no structure is disclosed. I also understand that as an alternative position to the extent a structure is disclosed in the '381 specification, HTC and the Staff cite to identical specification support, namely block 502 of Fig. 5 or block 702 of Fig. 7 as described in col. 15:6-28, col. 20:29-51, col. 23:64-67, col. 25:18-22, col. 26:5-22, col. 27:1-4, or col. 29:41-44.

168. In my opinion, the phrase "instructions for detecting a movement of an object on or near the touch screen display" does not have a plain and ordinary meaning to one of ordinary skill in the art. Nor is the phrase a term of art with a specialized meaning in the field of user interface design. Furthermore, the context of "instructions" in this claim is as follows: "one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the programs including: . . instructions for detecting a movement of an object on or near the touch screen display." It is my opinion that in this context, "instructions" means computer code such as statements in a programming language. There is no computer code of any kind anywhere in the '381 patent.

169. In my opinion, one of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "instructions for detecting a movement of an object on or near the touch screen display" in the specification of the '381 Patent because the specification fails

to disclose the corresponding structure for performing this function. Each time the '381 Patent refers to this limitation, the patent discusses the functions of the limitation but does not identify or describe the components needed to perform those functions. For example, block 702 of Figure 7 merely provides "[d]etect a movement of an object (e.g., a finger) on or near a touch screen display of a device." The text accompanying Figure 7 also discusses the function without disclosing the corresponding structure for performing the function. For example, the specification states: "Movement of an object is detected on or near a touch screen display of a device (702). In some embodiments, the object is a finger. In some embodiments, the device is a portable multifunction device." (JXM-4 '381 Patent at Col. 27:1-4.) A person of ordinary skill in the art cannot discern the structure of the limitation from the specification of the '381 patent. Nor can a person of ordinary skill in that art determine whether a particular product or method infringes this limitation. As I explained above, there are numerous methods to detect touch input data and many non-trivial algorithms to process the raw touch input data into information that the computer system can use. *See* ¶¶ 67 – 68 above.

170. I understand that Apple has proposed that the limitation should be construed as its plain and ordinary meaning and the Staff has proposed the structure is "a processor configured to execute the software algorithm" as described in the '381 specification. But neither of these proposed constructions connote structure and nor do they inform one of the ordinary skill in the art of a particular hardware structure, software algorithm, or combination of hardware and software that performs the claimed function, nor does the specification provide such disclosures. Both Apple's and the Staff's broad proposed constructions could cover every conceivable way to perform the claimed functions. These proposed constructions do not provide any guidance to one of ordinary skill in the art regarding the scope of the limitation, rather they leave the limitation boundless.

171. I have reviewed the file history of the '381 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

E. INSTRUCTIONS FOR TRANSLATING THE ELECTRONIC DOCUMENT DISPLAYED ON THE TOUCH SCREEN DISPLAY IN A FIRST DIRECTION TO DISPLAY A SECOND PORTION OF THE ELECTRONIC DOCUMENT, WHEREIN THE SECOND PORTION IS DIFFERENT FROM THE FIRST PORTION, IN RESPONSE TO DETECTING THE MOVEMENT [CLAIM 19]

172. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Not subject to § 112 ¶ 6; plain and ordinary meaning.	Indefinite, subject to § 112 ¶ 6. Function: translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document. Structure: not disclosed. Alternatively, the following structure is related to the recited function: block 504 of Fig. 5, Figs. 6A-6B, block 704 of Fig. 7, or Figs. 8A-8B as described in col. 24:1-18, col. 24:61-67, col. 25:18-22, col. 26:5-24, col. 27:5-24, or col. 29:44-55.	Subject to § 112 ¶ 6. Function: translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document. Structure: a processor configured to execute the software algorithm as described in block 504 of Fig. 5 and block 704 of Fig. 7 to scroll the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document as described in col. 24:1-18; col. 24:61-67; col. 25:18-22; col. 26:5-24; col. 27:5-24; Figs. 6A-6B and 8A-8B; col. 29:44-55.

173. I understand that HTC and the Staff agree that this limitation is subject to 35 U.S.C. § 112 ¶ 6 and should be treated accordingly as a means-plus-function term. I understand Apple disagrees that the limitation is subject to 35 U.S.C. § 112 ¶ 6 and has taken the position that the

limitation should be given its plain and ordinary meaning. I also understand that HTC and the Staff agree that the claimed function is "translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document." I further understand that the Staff states that the structure is "a processor configured to execute the software algorithm as described in block 504 of Fig. 5 and block 704 of Fig. 7 to scroll the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document as described in col. 24:1-18; col. 24:61-67; col. 25:18-22; col. 26:5-24; col. 27:5-24; Figs. 6A-6B and 8A-8B; col. 29:44-55." I understand that HTC's position is that no structure is disclosed. I also understand that as an alternative position to the extent a structure is disclosed in the '381 specification, HTC and the Staff cite to identical specification support, namely block 504 of Fig. 5, Figs. 6A-6B, block 704 of Fig. 7, or Figs. 8A-8B as described in col. 24:1-18, col. 24:61-67, col. 25:18-22, col. 26:5-24, col. 27:5-24, or col. 29:44-55.

174. In my opinion, the phrase "instructions for translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document, wherein the second portion is different from the first portion, in response to detecting the movement" does not have a plain and ordinary meaning to one of ordinary skill in the art. Nor is the phrase a term of art with a specialized meaning in the field of user interface design. Furthermore, the context of "instructions" in this claim is as follows: "one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the programs including: . . instructions for translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document, wherein the second portion is different from the first portion, in response to detecting the movement." It is my opinion that in this context, "instructions" means computer code such as

statements in a programming language. There is no computer code of any kind anywhere in the '381 patent.

175. In my opinion, one of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "instructions for translating the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document, wherein the second portion is different from the first portion, in response to detecting the movement" in the specification of the '381 Patent because the specification fails to disclose the corresponding structure for performing this function. Each time the '381 Patent refers to this limitation, the patent discusses the functions of the limitation but does not identify or describe the components needed to perform those functions. For example, block 704 of Figure 7 merely provides "[t]ranslate an electronic document displayed on the touch screen display in a first direction (e.g., vertical, horizontal, or diagonal)." The text accompanying Figure 7 also discusses the function without disclosing the corresponding structure for performing the function. For example, the specification states: "[i]n response to detecting the movement, an electronic document displayed on the touch screen display is scrolled in a first direction (704)." (JXM-4 '381 Patent at Col. 27:5-7.). A person of ordinary skill in the art cannot discern the structure of the limitation from the specification of the '381 patent. Nor can a person of ordinary skill in that art determine whether a particular product or method infringes this limitation. As I explained above, there are numerous ways for one of ordinary skill in the art in January 2007 to device a way to implement a scroll or translation operation. *See* ¶¶ 88 - 90 above.

176. I understand that Apple has proposed that the limitation should be construed as its plain and ordinary meaning and the Staff has proposed the structure is "a processor configured to execute the software algorithm as described in block 504 of Fig. 5 and block 704 of Fig. 7 to scroll

the electronic document displayed on the touch screen display in a first direction to display a second portion of the electronic document" as described in the '381 specification. But neither of these proposed constructions connotes structure and nor do they inform one of the ordinary skill in the art of a particular hardware structure, software algorithm, or combination of hardware and software that performs the claimed function, nor does the specification provide such disclosures. Both Apple's and the Staff's broad proposed constructions could cover every conceivable way to perform the claimed functions. These proposed constructions do not provide any guidance to one of ordinary skill in the art regarding the scope of the limitation, rather they leave the limitation boundless.

177. I have reviewed the file history of the '381 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

F. INSTRUCTIONS FOR DISPLAYING AN AREA BEYOND AN EDGE OF THE ELECTRONIC DOCUMENT AND DISPLAYING A THIRD PORTION OF THE ELECTRONIC DOCUMENT, WHEREIN THE THIRD PORTION IS SMALLER THAN THE FIRST PORTION, IN RESPONSE TO THE EDGE OF THE ELECTRONIC DOCUMENT BEING REACHED WHILE TRANSLATING THE ELECTRONIC DOCUMENT IN THE FIRST DIRECTION WHILE THE OBJECT IS STILL DETECTED ON OR NEAR THE TOUCH SCREEN DISPLAY [CLAIM 19]

178. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	HTC's Proposed Construction	Staff's Proposed Construction
Not subject to § 112 ¶ 6; plain and ordinary meaning.	Indefinite, subject to § 112 ¶ 6. Function: displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document. Structure: not disclosed. Alternatively, the following structure is related to the recited function: blocks 510 and 514 of Fig. 5, Fig. 6C, blocks 710 and 714 of Fig. 7 or Fig. 8C as described in col. 24:19-32, col. 24:52-60, col. 24:67-25:11, col. 25:18-22, col. 26:25-36, col. 26:46-52, col. 27:25-39, or col. 29:55-63.	Subject to § 112 ¶ 6. Function: displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document. Structure: a processor configured to execute the software algorithm as described in blocks 510 and 514 of Fig. 5 and blocks 710 and 714 of Fig. 7 to displayl an area beyond an edge of the electronic document and displaying a third portion of the electronic document as described in col. 24:19-32; col. 24:52-60; col. 24:67-25:11; col. 25:18-22; col. 26:25-36; col. 26:46-52; col. 27:25-39; Figs. 6C; col. 29:55-63; Figs. 8C.

179. I understand that HTC and the Staff agree that this limitation is subject to 35 U.S.C. § 112 ¶ 6 and should be treated accordingly as a means-plus-function term. I understand Apple disagrees that the limitation is subject to 35 U.S.C. § 112 ¶ 6 and has taken the position that the limitation should be given its plain and ordinary meaning. I also understand that HTC and the Staff agree that the claimed function is "displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document." I further understand that the Staff states that the structure is "a processor configured to execute the software algorithm as described in blocks 510 and 514 of Fig. 5 and blocks 710 and 714 of Fig. 7 to scroll an area beyond an edge of the electronic document and displaying a third portion of the electronic document as described in col. 24:19-32; col. 24:52-60; col. 24:67-25:11; col. 25:18-22; col. 26:25-36; col. 26:46-52; col. 27:25-39; Figs. 6C; col. 29:55-63; Figs. 8C." I understand that HTC's position is that no structure is disclosed. I also

understand that as an alternative position to the extent a structure is disclosed in the '381 specification, HTC and the Staff cite to identical specification support, namely blocks 510 and 514 of Fig. 5, Fig. 6C, blocks 710 and 714 of Fig. 7 or Fig. 8C as described in col. 24:19-32, col. 24:52-60, col. 24:67-25:11, col. 25:18-22, col. 26:25-36, col. 26:46-52, col. 27:25-39, or col. 29:55-63.

180. In my opinion, the phrase "instructions for displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document, wherein the third portion is smaller than the first portion, in response to the edge of the electronic document being reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen display" does not have a plain and ordinary meaning to one of ordinary skill in the art. Nor is the phrase a term of art with a specialized meaning in the field of user interface design. Furthermore, the context of "instructions" in this claim is as follows: "one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the programs including: . . instructions for displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document, wherein the third portion is smaller than the first portion, in response to the edge of the electronic document being reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen display." It is my opinion that in this context, "instructions" means computer code such as statements in a programming language. There is no computer code of any kind anywhere in the '381 patent.

181. In my opinion, one of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "instructions for displaying an area beyond an edge of the electronic document and displaying a third portion of the electronic document, wherein the third portion is smaller than the first portion, in response to the edge of the electronic document being

reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen display" in the specification of the '381 Patent because the specification fails to disclose the corresponding structure for performing this function. Each time the '381 Patent refers to this limitation, the patent discusses the functions of the limitation but does not identify or describe the components needed to perform those functions. For example, block 710 of Figure 7 provides: "[i]s an edge of the electronic document reached while translating the electronic document in the first direction while the object is still detected on or near the touch screen?" and block 714 provides: "[d]isplay an area beyond the edge of the document." The text accompanying Figure 7 also discusses the function without disclosing the corresponding structure for performing the function. For example, the specification states:

> If an edge of the electronic document is reached (e.g., upon reaching the edge of the document) while translating the electronic document in the first direction while the object is still detected on or near the touch screen display, an area beyond the edge of the electronic document is displayed (710-Yes, 714).

(JXM-4 '381 Patent at Col. 27:25-30.). A person of ordinary skill in the art cannot discern the structure of the limitation from the specification of the '381 patent. Nor can a person of ordinary skill in that art determine whether a particular product or method infringes this limitation. As I explained above, there are numerous design choices a design would have to make an overscroll or rubberbanding feature, such as determining when does the scrolling operation end and the rubberbanding operation begin and using which parameters, such as time, scrolled distance, position of the touch, to make such a determination. *See* ¶¶ 107 - 116 above.

182. I understand that Apple has proposed that the limitation should be construed as its plain and ordinary meaning and the Staff has proposed the structure is "a processor configured to execute the software algorithm as described in blocks 510 and 514 of Fig. 5 and blocks 710 and 714

of Fig. 7 to scroll an area beyond an edge of the electronic document and displaying a third portion of the electronic document" as described in the '381 specification. But neither of these proposed constructions connotes structure and nor do they inform one of the ordinary skill in the art of a particular hardware structure, software algorithm, or combination of hardware and software that performs the claimed function, nor does the specification provide such disclosures. Both Apple's and the Staff's broad proposed constructions could cover every conceivable way to perform the claimed functions. These proposed constructions do not provide any guidance to one of ordinary skill in the art regarding the scope of the limitation, rather they leave the limitation boundless.

183. I have reviewed the file history of the '381 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

G. INSTRUCTIONS FOR TRANSLATING THE ELECTRONIC DOCUMENT IN A SECOND DIRECTION UNTIL THE AREA BEYOND THE EDGE OF THE ELECTRONIC DOCUMENT IS NO LONGER DISPLAYED TO DISPLAY A FOURTH PORTION OF THE ELECTRONIC DOCUMENT, WHEREIN THE FOURTH PORTION IS DIFFERENT FROM THE FIRST PORTION, IN RESPONSE TO DETECTING THAT THE OBJECT IS NO LONGER ON OR NEAR THE TOUCH SCREEN DISPLAY [CLAIM 19]

184. I understand the parties have proposed the following construction for this term:

Apple's Proposed Construction	**HTC's Proposed Construction**	**Staff's Proposed Construction**
Not subject to § 112 ¶ 6; plain and ordinary meaning.	Indefinite, subject to § 112 ¶ 6. Function: translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document. Structure: not disclosed. Alternatively, the following structure is related to the recited function: block 520 of Fig. 5, Fig. 6D, block 720 of Fig. 7, or Figs. 8D as described in col. 24:33-44, col. 25:18-22, col. 26:37-45, col. 27:40-55, or col. 29:64-30:10.	Subject to § 112 ¶ 6. Function: translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document. Structure: a processor configured to execute the software algorithm as described in block 520 of Fig. 5 and block 720 of Fig. 7 to scroll the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document as described in col. 24:33-44; col. 25:18-22; col. 26:37-45; col. 27:40-55; or col. 29:64-30:10; Figs 6D and 8D.

185. I understand that HTC and the Staff agree that this limitation is subject to 35 U.S.C. § 112 ¶ 6 and should be treated accordingly as a means-plus-function term. I understand Apple disagrees that the limitation is subject to 35 U.S.C. § 112 ¶ 6 and has taken the position that the limitation should be given its plain and ordinary meaning. I also understand that HTC and the Staff agree that the claimed function is "translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document." I further understand that the Staff states that the structure is "a processor configured to execute the software algorithm as described in block 520 of Fig. 5 and block 720 of Fig. 7 to the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document as

described in col. 24:33-44; col. 25:18-22; col. 26:37-45." I understand that HTC's position is that no structure is disclosed. I also understand that as an alternative position to the extent a structure is disclosed in the '381 specification, HTC and the Staff cite to identical specification support, namely block 520 of Fig. 5, Fig. 6D, block 720 of Fig. 7, or Figs. 8D as described in col. 24:33-44, col. 25:18-22, col. 26:37-45, col. 27:40-55, or col. 29:64-30:10.

186. In my opinion, the phrase "instructions for translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document, wherein the fourth portion is different from the first portion, in response to detecting that the object is no longer on or near the touch screen display" does not have a plain and ordinary meaning to one of ordinary skill in the art. Nor is the phrase a term of art with a specialized meaning in the field of user interface design. Furthermore, the context of "instructions" in this claim is as follows: "one or more programs, wherein the one or more programs are stored in the memory and configured to be executed by the one or more processors, the programs including: . . instructions for translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document, wherein the fourth portion is different from the first portion, in response to detecting that the object is no longer on or near the touch screen display." It is my opinion that in this context, "instructions" means computer code such as statements in a programming language. There is no computer code of any kind anywhere in the '381 patent.

187. In my opinion, one of ordinary skill in the art in 2007 would not have been able to identify the corresponding structure for "instructions for translating the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document, wherein the fourth portion is different from the

first portion, in response to detecting that the object is no longer on or near the touch screen display" in the specification of the '381 Patent because the specification fails to disclose the corresponding structure for performing this function. Each time the '381 Patent refers to this limitation, the patent discusses the functions of the limitation but does not identify or describe the components needed to perform those functions. For example, block 720 of Figure 7 provides: "[a]fter the object is no longer detected on or near the touch screen display, translate the document in a second direction (e.g., opposite the first direction) until the area beyond the edge of the document is not longer displayed." The text accompanying Figure 7 also discusses the function without disclosing the corresponding structure for performing the function. For example, the specification states "[a]fter the object is no longer detected on or near the touch screen display, the electronic document is translated in a second direction until the area beyond the edge is no longer displayed (720)." (JXM-4 '381 Patent at Col. 27:40-43.) A person of ordinary skill in the art cannot discern the structure of the limitation from the specification of the '381 patent. Nor can a person of ordinary skill in that art determine whether a particular product or method infringes this limitation. As I explained above, there are numerous design choices a design would have to make an overscroll or rubberbanding feature, such as whether the scrolled content should move at constant speed during rubberbanding or slow down as it gets closer to the display edge, whether the scroll content should snap to the display edge or have an overshoot animation. *See* ¶¶ 107 - 116 above.

188. I understand that Apple has proposed that the limitation should be construed as its plain and ordinary meaning and the Staff has proposed the structure is "a processor configured to execute the software algorithm as described in block 520 of Fig. 5 and block 720 of Fig. 7 to the electronic document in a second direction until the area beyond the edge of the electronic document is no longer displayed to display a fourth portion of the electronic document" as described in the '381

specification. But neither of these proposed constructions connotes structure and nor do they inform one of the ordinary skill in the art of a particular hardware structure, software algorithm, or combination of hardware and software that performs the claimed function, nor does the specification provide such disclosures. Both Apple's and the Staff's broad proposed constructions could cover every conceivable way to perform the claimed functions. These proposed constructions do not provide any guidance to one of ordinary skill in the art regarding the scope of the limitation, rather they leave the limitation boundless.

189. I have reviewed the file history of the '381 patent. I found nothing in the file history to change my opinion of the meaning of this term to a person of ordinary skill in the art at the time of the invention.

VII. OTHER COMMENTS

190. The opinions expressed in this report are my preliminary opinions based on my review to date of the evidence produced at this stage of the case. My opinions are subject to change based on additional opinions that Apple's experts may present and information I may receive in the future. I reserve my right to amend or update my opinions as appropriate in response to any future developments. With this in mind, based on the analysis I have conducted and for the reasons set forth above, I have preliminarily reached the conclusions and opinions in this report.

191. At a hearing or at trial I may use as exhibits various documents produced in this case that refer or relate to the matters discussed in this report. I have not yet selected the particular exhibits that might be used. I may also rely on visual aids and may rely on analogies concerning elements of the patents discussed above, the accused products, the references cited in this report, or any related technologies. In addition, I may create or assist in the creation of certain demonstrative evidence to assist me in testifying, and I reserve the right to do so, such as demonstrations of devices

and software to further support the positions in this report.

I declare under penalty of perjury that the foregoing is true and correct. Executed in College Park, Maryland on January 18, 2012.

By ______________________
Benjamin Bederson

Exhibit A

Dr. Benjamin B. Bederson
University of Maryland, College Park
Professor
Computer Science Department (50%)
Institute for Advanced Computer Studies (UMIACS), Human-Computer Interaction Lab (HCIL) (50%)

I have read the following and certify that it is a current and accurate statement of my professional record as of January 3, 2012.

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.**	**Troy, NY**

EMPLOYMENT

1/98 – Present	**University of Maryland, Computer Science Dept./UMIACS** Prof. in the Computer Science Dept. and the Inst. of Advanced Computer Studies. Affiliate appt in iSchool (2008 – present). 6/00-9/06: Director of the Human-Computer Interaction Lab (HCIL). 1/98-8/04: Assistant Professor 9/04-7/11: Associate Professor	**College Park, MD**
9/06 – Present	**Zumobi, Inc.** Co-founder and Chief Scientist for VC-funded startup to commercialize mobile media for cell phones. 9/06-1/08: VP Client Technologies	**Seattle, WA**
1/06 – Present	**International Children's Digital Library Foundation** Cofounder and Technical Director for this library of exemplary free online children's books from around the world.	**Manchester, MA**
6/03 – 11/08	**Windsor Interfaces, Inc.** 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. Research in zoomable user interfaces.	**Albuquerque, NM**
9/92 – 8/94	**Bell Communications Research (Bellcore)** Research Scientist in Computer Graphics and Interactive Media group. Research in information visualization	**Morristown, NJ**
6/93 – 7/94	**New York University, Media Research Laboratory** Visiting Research Scientist. Research in audio augmented reality.	**New York, NY**
9/90 – 8/92	**Vision Applications, Inc.** Research Scientist. Research in robotics and computer vision.	**New York, NY**
9/88 – 6/90	**New York University, Computer Science Department** Teaching Assistant. Computer Vision, Computer Graphics, and Computer Architecture.	**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

1. Fails, J., Druin, A., **Bederson, B.B.**, Weeks, A., & Rose, A. (2009) A Child's Mobile Digital Library: Collaboration, Community and Change. Druin, A. (Ed.) *Mobile Technology for Children: Designing for Interaction and Learning,* Morgan Kaufmann Press.
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. **Bederson, B. B.**, Hollan, J. D., Stewart, J., Rogers, D., Druin, A., Vick, D., Ring, L., Grose, E., & Forsythe, C. (1998). A Zooming Web Browser. C. Forsythe, J. Ratner, & E. Grose (eds.), *Human Factors and Web Development* (Chap. 19, 255-266). New Jersey: Lawrence Erlbaum.
7. Hollan, J. D., **Bederson, B. B.**, & Helfman, J. (1997). Information Visualization. T. K. L. a. P. V. P. Martin G. Helander (eds.), *The Handbook of Human Computer Interaction* (Chap. 2, 33-48). Amsterdam: Elsevier Press.
8. **Bederson, B. B.**, & Druin, A. (1995). Computer Augmented Environments: Physical Spaces to Enrich Our Lives. Jakob Nielsen (eds.), *Advances in Human-Computer Interaction* (Vol. 5, Chap. 2, 37-66). New Jersey: Ablex Press.
9. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1994). 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. (1992). Connective Graphs in Space-Variant Active Vision. Ken Goldberg (eds.), *Neural Networks in Robotics*. Kluwer Academic Publishers.

B. REFEREED ARTICLES
i. Journals

1. Resnik, P., Buzek, O., Kronrod, Y., Hu, C., Quinn, A.J. & **Bederson, B.B.** (2011) "Using Targeted Paraphrasing and Monolingual Crowdsourcing to Improve Translation", in *Transactions on Intelligent Systems and Technology*, ACM (in press).

2. **Bederson, B.B.**. (2011) "The Promise of Zoomable User Interfaces", *in Behaviour & Information Technology*, Taylor & Francis, Nov-Dec 2011, 30 (6), 853-866.

3. Druin, A., **Bederson, B.B.**, Rose, A., Weeks, A. (2009) "From New Zealand to Mongolia: Co-Designing and Deploying a Digital Library for the World's Children", *in Children, Youth and Environments*, University of Colorado, 19 (1), 34-57.

4. Conrad, F.G., **Bederson, B.B.**, Lewis, B., Traugott, M.W., Hanmer, M.J., Herrnson, P.S., Niemi, R.G. & Peytcheva, E. (2009) "Electronic voting eliminates hanging chads but introduces new usability challenges", *in International Journal of Human-Computer Studies (IJHCS)*, Elsevier Press, 67, 111-124.

5. Hanmer, M.J., Park, W-H., Traugott, M.W., Niemi, R.G., Herrnson, P.S., **Bederson, B.B.**, and Conrad, F.C. (2009) "Losing Fewer Votes: The Impact of Changing Voting Systems on Residual Votes", *in Political Research Quarterly,* Sage Publications, September, 2008. doi:10.1177/1065912908324201.

6. **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.

7. 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.

8. 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).

9. 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.

10. Parr, C.S., Lee, B., **Bederson, B. B.** (2007) EcoLens: Integration and Interactive Visualization of Ecological Datasets, *Journal of Ecological Informatics*, Elsevier, 2 (1), 61-69.

11. Suh, B., and **Bederson, B.B** (2007) Semi-Automatic Photo Annotation Strategies Using Event Based Clustering and Clothing Based Person Recognition, *Interacting With Computers*, Elsevier, 19 (4), 524-544.

12. Hutchinson, H., **Bederson, B.B.**, Druin, A., (2007) Supporting Elementary-Age Children's Searching and Browsing: Design and Evaluation Using the International Children's Digital Library, *Journal of the American Society for Information Science and Technology*, John Wiley & Sons, 58 (11), 1618-1630.

13. Kang, H., Plaisant, C., Lee, B., **Bederson, B.B.***, (2007) NetLens: Iterative Exploration of Content-Actor Network Data, *Information Visualization*, Palgrave Macmillan, 6 (1), 18-31.

14. 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.

15. Plaisant, C., **Bederson, B.B.**, Clamage, A., Hutchinson, H.B., Druin, A. (2006) Shared Family Calendars: Promoting Symmetry and Accessibility, *Transactions on Computer-Human Interaction*, New York: ACM, 13 (3), 313-346.

16. 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.

17. Hutchinson, H.B., Rose, A., **Bederson, B.B.**, Weeks, A.C., Druin, A. (2005) The International Children's Digital Library: A Case Study in Designing for a Multi-Lingual, Multi-Cultural, Multi-Generational Audience, *Information Technology and Libraries*, 24 (1), 4-12.

18. Herrnson, P.S., Abbe, O.G., Francia, P.L., **Bederson, B.B.**, Lee, B., Sherman, R.M., Conrad, F., Niemi, R.G., Traugott, M. (2005) Early Appraisals of Electronic Voting, *Social Science Computing Review*, 23 (3), 274-292.

19. Hourcade, J. P., **Bederson, B. B.**, Druin, A., & Guimbretière, F. (2004) Accuracy, Target Reentry and Fitts' Law: Performance of Preschool Children Using Mice, *Transactions on Computer-Human Interaction*, New York: ACM, 11 (4), 357-386.

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

21. **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.

22. 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.

23. **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.

24. Hourcade, J. P., **Bederson, B. B.**, & Druin, A. (2004) Building KidPad: An Application for Children's Collaborative Storytelling, *Software: Practice & Experience*, New Jersey: John Wiley & Sons, Ltd, 34 (9), 895-914.

25. 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).

26. 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.

27. 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.

28. 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.

29. **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.

30. Good, L., & **Bederson, B.B.** (2002) Zoomable User Interfaces as a Medium for Slide Show Presentations, *Information Visualization*, Palgrave Macmillan, 35-49.

31. 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.

32. **Bederson, B. B.**, & Meyer, J. (1998). Implementing a Zooming User Interface: Experience Building Pad++. *Software: Practice and Experience*, 28(10), 1101-1135.

33. **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.

34. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (1995). A Miniaturized Space-Variant Active Vision System: Cortex-I. *Machine Vision and Applications*, 101-109.

35. **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.

36. 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. 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.
2. 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.
3. 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.
4. Hu, C., **Bederson, B.B.,** & Resnik, P. (2010) Translation by Interactive Collaboration between Monolingual Users, *Proceedings of Graphics Interface (GI 2010),* 39-46.
5. 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.
6. 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]
7. 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]
8. **Bederson, B.B.**, Clamage, A., Plaisantx, 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.
9. 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".**
10. 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].
11. 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.
12. 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]
13. Hutchinson, H., Druin, A., **Bederson, B.B.**, Reuter, K., Rose, A., Weeks, A. (2005) How do I Find Blue Books About Dogs? The Errors and Frustrations of Young Digital Library Users, *Proceedings of HCII 2005*, Las Vegas, NV (CD-ROM).
14. Shneiderman, B. & **Bederson, B. B.** (2005). "Maintaining Concentration to Achieve Task Completion", *Proceedings of Designing User Experience (DUX 2005).*
15. 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.**
16. 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.
17. 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]

18. 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**.
19. **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]
20. 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]
21. 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.
22. 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]
23. Grosjean, J., Plaisant, C., & **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]
24. Suh, B., & **Bederson, B. B.*** (2002) OZONE: A Zoomable Interface for Navigating Ontology Information. *Proceedings of International Conference on Advanced Visual Interfaces (AVI 2002)*, Trento, Italy, 139-143, ACM Press. [30% acceptance rate]
25. 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.
26. **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]
27. Druin, A., **Bederson, B. B.**, Hourcade, J.P., Sherman, L., Revelle, G., Platner, M., Weng, S. (2001) Designing a Digital Library for Young Children : An Intergenerational Partnership. *In Proceedings of Joint Conference on Digital Libraries (JCDL 2001)* ACM Press, 398-405. [30% acceptance rate]
28. 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]
29. **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]
30. **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]
31. 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.
32. **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]
33. 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]

34. 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]

35. 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.

36. 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]

37. **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.

38. **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,

39. 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]

40. **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.

41. **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,

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

43. **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,

44. 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,

iii. Other Publications

1. Hu, C., Resnik, P., Kronrod, Y., & **Bederson, B.B.** (2012) Deploying MonoTrans Widgets in the Wild. Note at CHI 2012, ACM Press, (in press).

2. 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.*

3. Kronrad, Y., Hu, C., Buzek, O., & Quinn, A.J. (2011) Using Monolingual Crowd to Improve Translation. Student poster at AAAS 2011. Winning poster in Math, Technology and Engineering category.

4. 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.

5. 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.

6. Kronrod, Y., Buzek, O., Hu, C., Quinn, A., Resnik, P., & Bederson, B. B. (2010) Using Crowdsourcing to Translate Without Bilinguals. Poster at CrowdConf 2010.

7. Hu, C., Bederson, B. B., and Resnik, P. (2010) Monotrans: Human-Computer Collaborative Translation. Abstract and demo at the Human Computation Workshop (HCOMP 2010).

8. 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.

9. 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.

10. 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.

11. 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.

12. 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.

13. 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.

14. Bederson, B.B. (2008) "Experiencing the International Children's Digital Library", Interactions Magazine, ACM Press, 50-54.

15. Lazar, J., Hochheiser, H., Johnson, J., Karat, C-M., Bederson, B.B. (2008) "CHI Policy Issues Around the World", Panel in CHI 2008, ACM.

16. 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).

17. Lee, B., Parr, C.S., Plaisant, C., Bederson, B.B., (2006) "TreePlus: Visualizing Graphs as Trees," Video in InfoVis 2006.

18. 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.

19. Herrnson, P., Niemi, R., Hanmer, M., Bederson, 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.

20. Herrnson, P., Niemi, R., Hanmer, M., Bederson, B., Conrad, F., Traugott, M., (2006) "Voters' Abilities to Cast Write-In Votes Using Electronic Voting Systems," In Midwest Political Science Association annual conference.

21. Conrad, F., Peytcheva, E., Traugott, M., Lewis, B., Herrnson, P., Bederson, B. (2006) "Usability of Electronic Voting Systems: Field and Laboratory Experiments," In Midwest Political Science Association annual conference.

22. 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.

23. 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.

24. 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.

25. Traugott, M.W., Hanmer, M.J., Park, W.H., Herrnson, P.S., Niemi, R.G., Conrad, F.G., Bederson, B.B. (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).

26. 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.

27. Bederson, B. B. (2004) Interfaces for Staying in the Flow. In Ubiquity, ACM Press, (5) 27.

28. 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.

29. Selker, T., Fischer, E. A., Bederson, Benjamin 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.

30. 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.

31. 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.

32. Herrnson, P., Bederson, B. B. (2002) Debugging Maryland Balloting, Washington Post, Outlook Section, p. B08, Sunday May 12th, 2002.

33. 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.

34. Hourcade, J.P., Bederson, B.B., Druin, A., Taxén. (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.

35. 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.

36. 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.

37. Hightower, R.R., Ring, L.T., Helfman, J.I., Bederson, B.B., Hollan, J.D. PadPrints: Graphical Multiscale Web Histories. UIST 2001, ACM Symposium on User Interface Software and Technology. Tech Note, 121-122.

38. 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, 287-288.

39. 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, 169-170.

40. 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, 23-24.

41. 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).

42. 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, 210-211.

43. Bederson, B. B., & Hollan, J. D. (1995). Pad++: A Zooming Graphical Interface System. In Proceedings of Human Factors in Computing Systems (CHI 95) New York: ACM Press, 23-24.

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

45. 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, 315-316.

46. 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. October, 2012 **South African Institute for Computer Scientists and Information Technologists** South Africa
2. September, 2010 **Visual Information Communication International Symposium**, Beijing, China
   "The Promise of Zoomable User Interfaces"
3. May, 2010 **Human-Computer Interaction Lab's 27th Annual Symposium**, College Park, MD
   "The Promise of Zoomable User Interfaces"
4. 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"
5. February, 2009 **Microsoft Internal "UX Canvas Camp"**, Redmond, WA
   "A Short History of Zoomable User Interfaces"
6. 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. Nov 17, 2011 **Future of Information Alliance**, College Park, MD
   "Anonymity and Privacy While Learning"
2. 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
3. Aug 24, 2011 **Summer Social Webshop** College Park, MD
   "Translation by Collaboration Among Monolingual Users"
4. May, 2011 **National Science Foundation**, Arlington, VA
   Distinguished Lecture Series
   "Translation by Collaboration among Monolingual Users" (with Philip Resnik)
5. September, 2010 **Microsoft Research Asia**, Beijing, China
   "Collaborative Monolingual Translation"
6. September, 2010 **Tsinghua University**, Beijing, China
   "Collaborative Monolingual Translation"
7. April, 2010 **CHI 2010**, Atlanta, GA
   Social Impact Award talk
8. October, 2009 **Google**, Mountain View, CA
   Panel participant in "Breakthrough Learning in a Digital Age" invitation only conference
9. September, 2009 **Google Tech Talk**, Mountain View, CA
   "Translation by Iterative Collaboration between Monolingual Users"

10. April, 2009 **University of Illinois (CS Dept.)**, Champaign-Urbana, IL
“Zoomable User Interfaces from Sun Sparcstations to iPhones”
11. April, 2009 **University of Illinois (iSchool)**, Champaign-Urbana, IL
“From Ulann Baatar to iPhone: A Digital Library for the World’s Children”
12. February, 2009 **Tufts University**, Medford, MA
“From iPhone to Ulaan Baatar: A Digital Library for the World’s Children”
13. February, 2009 **Microsoft Internal “UX Canvas Camp”**, Redmond, WA
“A Short History of Zoomable User Interfaces”
14. September, 2008, **Carnegie Mellon University**, Pittsburgh, PA
“Black Ears to Blonde Cats: Paths for Designing Change”
15. May, 2008, **Manchester Public Library** Manchester by the Sea, MA
“No Road, Drive: The ICDL Travels to Mongolia”
16. April, 2008 **Web 2.0 Expo**, San Francisco, CA
“Next Generation Mobile UI” (with John SanGiovanni)
17. February, 2008 **USACM Executive Council**, Washington, DC
“Voting Technology: The Not-So-Simple Act of Casting a Ballot”
18. October, 2007 **Widget Summit**, San Francisco, CA
“Mobile Widget Design”
19. September, 2007 **Knight Center for Specialized Journalism**, College Park, MD
“Mobile Technology Trends”
20. June, 2007 **Mobile Marketing Association**, New York, NY
“Designing for Usability”
21. May, 2007 **MIT Enterprise Forum**, Arlington, VA
“Co-present Mobile Collaboration”
22. December, 2006 **Human Factors and Ergonomics Society Potomac Chapter**, Bethesda, MD
“A Library for the World’s Children”
23. June, 2006 **Open Society Forum**, Ulaan Baatar, Mongolia
“A Library for the World’s Children”
24. February, 2006 **Dingman Center for Entrepreneurship, R.H. Smith School of Business**, UMD
“Web 2.0 UI”
25. December, 2005 **World Bank**, Washington, DC
“The International Children’s Digital Library”
26. December, 2005 **IBM T.J. Watson Research Center**, Hawthorne, NY
“Making Visualization Work”
27. November, 2005 **NSA**, Laurel, MD
“Making Visualization Work”
28. October, 2005 **IBM Research**, Cambridge, MA
“Making Visualization Work”
29. October, 2005 **Johns Hopkins University – Computer Science Dept.**, Baltimore, MD
“Making Visualization Work”
30. September, 2005 **InfoToday Conference on ‘Innovations in Search’**, New York, NY
“Zooming Into Visual Search”
31. March, 2005 **NFAIS**, Philadelphia, PA
”Making Sense of Search Results”

32. February, 2005 **American Association for the Advancement of Science (AAAS)** Washington, DC
Panel in annual conference,
"Designing Interfaces for Voting Machines"
33. February, 2005 **National Association of State Election Directors (NASED)** Washington, DC
Invited talk at annual conference.
"Designing Interfaces for Voting Machines"
34. January, 2005 **Microsoft**, Seattle, WA
"Interfaces for Staying in the Flow"
35. January, 2005 **Google**, Mountain View, CA
"The International Children's Digital Library"
36. December, 2004 **National Library of New Zealand,** Wellington, New Zealand
"The International Children's Digital Library"
37. December, 2004 **University of Waikato**, Hamilton, New Zealand
"Interfaces for Staying in the Flow"
38. December, 2004 **Victoria University Wellington**, Wellington, New Zealand
"Interfaces for Staying in the Flow"
39. December, 2004 **University of Canterbury**, Christchurch, New Zealand
"Interfaces for Staying in the Flow"
40. 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"
41. April, 2004 **Johns Hopkins University Applied Physics Lab**, Laurel, MD
"Interfaces for Staying in the Flow"
42. October, 2003 **University of Maryland, Robert H. Smith School of Business**, College Park, MD
on InForum 2003 panel on "Does IT Matter?"
43. September, 2003 **University of Maryland**, College Park, MD
"Making Visualization Work"
44. September, 2003 **University of Victoria**, Victoria, Canada
"Interfaces for Staying in the Flow"
45. March, 2003 **National Archives and Records Administration**, College Park, MD
"Visualizations for Archivists"
46. March, 2003 **Microsoft Research**, Redmond, WA
"DateLens: A Scalable Fisheye Calendar Interface"
47. January, 2003 **Sun Microsystems**, Menlo Park, CA
"Zoomable User Interfaces for Searching and Browsing"
48. September, 2002 **Microsoft Research Limited**, Cambridge, England
"Information Visualization for Mobile Devices"
49. July, 2002 **Microsoft Research**, Redmond ,WA
Demo of DateLens with Bill Gates at Microsoft Faculty Summit
50. July, 2002 **Microsoft Research**, Redmond, WA
"Scalable Interfaces for Mobile Devices"
51. June, 2002, **WebShop**, Dept. of Sociology, UMD, College Park, MD
"Access and Usability: The Importance of Internet Applications"
52. January, 2002 **Workshop on Election Standards and Technology**, Washington, DC
"Visualization Techniques for Electronic Voting"
53. October, 2001 **Microsoft Research**, Redmond, WA
"Zoomable User Interfaces for Searching and Browsing: SearchKids & PhotoMesa"

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

77. November, 1993 **Digital Equipment Corporation, Stanford Research Center**, CA
"Pad++: A Multiscale Hierarchical Sketchpad"
78. October, 1993 **Brown University, Computer Science Department**, Providence, RI
"Pad++: A Multiscale Hierarchical Sketchpad"
79. April, 1993 **University of Chicago, Computer Science Department**, |
"PA3D: A Multiscale Hierarchical Sketchpad"
80. 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. Good, L.E., **Bederson, B. B.**, & Stefik, M.J. (Inventors). (2010). *Methods and Systems for Supporting Presentation Tools Using Zooamble User Interfaes*. US Patent #7,707,503.
2. **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.
3. **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.
4. Wallace, R. S., **Bederson, B. B.**, & Schwartz, E. L. (Inventors). (1997). *TV Picture Compression and Expansion*. US Patent #5,642,167.
5. **Bederson, B. B.**, Wallace, R. S., & Schwartz, E. L. (Inventors). (1993). *Two-Dimensional Pointing Motor*. US Patent #5,204,573.
6. 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: $17,719,772
UMD Portion: $10,012,927

1. **Google, December 2011, PI**
Search Party: Learning to Search in a Web-Based Classroom
$60,000
2. **Alfred P. Sloan Foundation, November 2011, co-PI**
Digital Disclosure of a Nationally Standardized Database of Restaurant Food Safety Inspections
$465,272

3. **Google, June 2011, PI**
   Search Party: Web-Based Classroom Learning to Search
   $15,000

4. **Google, June 2011, co-PI**
   Translate the World: A Unified Framework for Crowdsourcing Translation
   $150,000

5. **Nokia Research, July 2010, PI**
   Mobile Learning
   $36,000

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

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

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

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

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

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

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

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

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

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

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

17. **(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)

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

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

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

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

22. **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

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

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

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

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

27. **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)

28. **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)

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

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

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

32. **European Union – Esprit, The Disappear 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

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

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

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

36. **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

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

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

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

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

UNIVERSITY OF NEW MEXICO

41. **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

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

43. **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

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

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

46. **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

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

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

J. FELLOWSHIPS, PRIZES, AWARDS

1. **2011 – 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.

2. **2011 – Recognized as an ACM Distinguished Scientist**
http://awards.acm.org/homepage.cfm?awd=157

   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.

3. **2010 – ICDL received the American Library Association President's Award for International Library Innovation**. Joint with Allison Druin and Ann Weeks.

4. **2010 – Winner of SIGCHI Social Impact Award**
http://www.sigchi.org/about/awards/2010-sigchi-awards

5. **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.

6. **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.

7. **2005 – IBM Faculty Award**
$30,000 gift to support my work on open source Piccolo graphics toolkit

8. **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.

9. **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.

10. **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.

11. **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.

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: > 4,000,000
- Unique accessors monthly: ~100,000

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. 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

2. 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

3. 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

4. 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.

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

6. 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.

7. 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

8. 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

9. 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

10. 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/

11. 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

12. 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

13. 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

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

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

16. 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

17. 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

18. 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

19. 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

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

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

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

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

24. 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 publised 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

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

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

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

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

29. 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

30. 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

31. 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

32. 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

33. 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

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

35. 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

36. 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

37. 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

38. 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

39. 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

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

41. 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

42. 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

43. 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

44. 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

45. 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

46. 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

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

48. 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

49. 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

50. 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

51. 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

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

53. 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

54. 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**

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

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

57. 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

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

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

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

61. 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)**

62. 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.

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

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

65. 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

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

67. 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"

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

69. 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)**

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

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

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

73. 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)**

74. 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**

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

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

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

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

79. December 1, 2002 **Die Burger (South Africa)**
”Paragrawe”

80. November 30, 2002 **The Vancouver Sun (Canada)**
”Book Endz: Free Kid’s Books”

81. November 30, 2002 **La Vanguardia (Spain)**
”Nuevos Proyectos: TalentMatch.com, International Children’s Digital Library SoapCity”

82. November 27, 2002 **USA Today** by Karen Thomas
”World Books, Children Click”

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

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

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

86. November 25, 2002 **intern.de (Germany)**
”Kinderbibliothek”

87. November 25, 2002 **Seattle Post-Intelligencer**
”Kids Books Now Online”

88. 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)**
89. November 21, 2002 **24ur.com (Slovenia)**
    "Knjige brezplacno na internetu"
90. November 21, 2002 **Courier Mail (Australia)**
91. November 21, 2002 **United Press International (UPI)**
    "New Online Library for Kids Launched"
92. November 21, 2002 **Washington Post (.COM Column)** by Leslie Walker
    "A Library for Young Browsers"
    a. **International Herald Tribute**
    b. **SFGate.com (San Francisco)**
93. November 21, 2002 **Internet Magazine**
    "Site Offers Free Access to Kids Books"
94. November 20, 2002 **Magasinet (Norway)**
    "Lager verdensbarnebibliotek"
95. November 20, 2002 **Fox 5 TV News** by John Henrehan
    Live 1.5 minutes on 5:00pm news
96. November 18, 2002 **All Things Considered on NPR** by David Kestenbaum
    "Library for Kids Goes Online" (11 minutes)
97. October, 2002 **Digital Computer Magazine**
    Review of PhotoMesa
98. September 23, 2002 **ComputerSweden** by Anders Lotsson
    "Square Zoom in the Hand"
99. August 19, 2002 **Ohio Repository** by Joan Renner
    "Ensuring validity is a big concern in electronic voting"
100. August 18, 2002 **Ohio Repository** by Joan Renner
    "Voting test shows pros, cons"
101. August 12, 2002 **eWeek**, by Anne Chen
    "DateLens Stays Organized in C#"
102. August 5, 2002 **Grid Today**
    "Bill Gates Highlights Academic Collaboration Key to Future"
103. July 29, 2002 **eWeek**, by Anne Chen
    "Gates: .NET Won't Happen Overnight"

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

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

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

107. 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.

108. 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.

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

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

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

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

113. June 26, 2000 **ComputerWorld**, by Sami Lais
"Zoomin' Ahead", an article about Zoomable User Interfaces and Fisheye Menus

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

115. 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."

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

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

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

119. 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

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 Students	
	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 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:

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:

Spring 2000	Stephanie Thibeault (Dance Dept.) Technology and dance
Spring 1996	Ellen Killion Built a software library access tool in Pad++
Fall 1995	Tom Claus Worked on KidPad
Fall 1995	Sam Cancilla Shared calendar application in Pad++
Fall 1995	David Rogers Tossing for user interfaces
Summer 1995	Richard Bleakman Interfaces for teaching genetic algorithms
Spring 1995	Tom Claus Worked on Pad++

iii. Doctorate

Dissertation Advisor:

2006-present	Chang Hu in Computer Science. Research on distributed human computation.
2006-present	Alex Quinn in Computer Science. Research on distributed human computation.

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. Currently at Microsoft Research.**
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". **Currently at PARC.**
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 Assistant Professor 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:
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:
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-present	Tom Yeh working in applied computer vision and HCI.

4. SERVICE

A. PROFESSIONAL

i. Office and Committee Memberships

2011	CHI 2011 Papers Subcommittee Co-chair
2010	CHI 2010 Papers Subcommittee Co-chair
2005 – present	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

2007 – present	**Foundations and Trends in HCI** (Editor-in-chief), NOW Publishers
2002 – present	**Information Visualization**, Palgrave Press

iii. Advisory Boards

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

vi. Paid Consultancies (not including legal consulting)

2006 – present	**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

2010	UMIACS APT Committee
2008 – 2012	CS Teaching Evaluation Committee
2008 – 2011	CS Department Council
2007 – 2010	Software Engineering Field Committee chair
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

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

Benjamin B. Bederson
Expert Work History

2011. Expert Witness for Irell & Manella in patent litigation case for Tivo in Microsoft Corp. v. Tivo, Inc. – Inv. No. 337-TA-761 (ITC), Case No. 2:11-cv-00134 (W.D. Wash.) Consulted on case, wrote infringement report. Attended and consulted at hearing.

2011. Fact Witness for Quinn Emanuel representing Samsung in Apple Inc. v. Samsung Electronics Co., Ltd., et al. (No. 11-cv-01846-LHK). Wrote declaration, had my deposition taken.

2011. Expert Witness for Cooley LLP representing GreatCall, Inc. in copyright litigation case against Dyna, LLC (American Arbitration Assocation – GreatCall, Inc. v. Dyna, LLC. Case #73 494 00433 10 nolg). Consulted on case, testified at hearing.

2010-2011. Expert Witness for Robins, Kaplan, Miller & Ciresi in ongoing, undisclosed patent litigation case for defendant in the area of television user interfaces.

2010-2011. Expert Witness for DiNovo Price Ellwanger & Hardy representing IA Labs CA, LLC in patent litigation case against Nintendo Co., Ltd. At al. (U.S. District Court, District of Maryland, Case 8:10-cv-00833-PJM). Consulted on case, wrote reports. Had my deposition taken. Case is ongoing.

2010. Expert Witness for Chadbourne & Parke representing Debtdomain in Fidelity Information Services, Inc. v. Debtdomain GLMS PTE Ltd. Index No. 09-cv-07589-LAK (District Court, Southern District of N.Y.). Consulted on case, wrote expert report on alleged similarity of software screens and had my deposition taken. Case is awaiting trial.

2009. Expert Witness for Paul, Hastings, Janofsky & Walker representing Gemstar in DirecTV v. Gemstar. Case No. 72 181 Y 310 09 (American Arbitration Association). Consulted on case, wrote report on functional similarity related to indemnity claim, and testified at hearing.

2009. Expert Witness for Weil, Gotshal & Manges LLP representing Yahoo! in Girafa.com v. Yahoo!, Case No. 07-87 TJW. Consulted on case, wrote non-infringement report and had my deposition taken.

2009. Fact Witness for Finnegan, Henderson, Farabow, Garrett & Dunner, LLP representing plaintiff Hillcrest in Hillcrest v. Nintendo, USITC Inv. No. 337-TA-658. Consulted on case and had my deposition taken.

Exhibit B

List of Materials Relied Upon

All documents and other evidence cited to in my report.

U.S. Patent 7,084,859.

U.S. Patent 7,844,915.

U.S. Patent 7,469,381.

The File History of the U.S. Patent 7,844,915, including references cited therein.

The File History of the U.S. Patent 7,084,859, including references cited therein.

The Re-Exam File History of the U.S. Patent 7,084,859, including references cited therein.

The File History of the U.S. Patent 7,469,381, including references cited therein.

The Re-Exam File History of the U.S. Patent 7,469,381, including references cited therein.

Microsoft Computer Dictionary (Fifth Ed. 2002).

Wayne Westerman, *Hand Tracking, Finger Identification, And Chordic Manipulation On A Multi-Touch Surface* (1999).

Bederson, B. B., & Meyer, J., *Implementing a Zooming User Interface: Experience Building Pad++ Software: Practice and Experience* (1998).

Description of Class JViewport at http://docs.oracle.com/javase/1.4.2/docs/api/javax/swing/JViewport.html.

U.S. Patent No. 6,690,387 to John Zimmerman and Jacquelyn A. Martin.

U.S. Patent Application Publication No. 2005/0012723 to Matt Pallakoff.

Jan. 13, 2012 Deposition of Bas Ording.

Aug. 9, 2011 Deposition of Bas Ording (*Apple, Inc. v. Samsung Elecs. Co.*, 5:11-CV-01846-LHK (N.D. Cal.), produced in this Investigation as 797HTC-00744844-797HTC-00745108.

Aug. 16, 2011 Deposition of Dr. Ravin Balakrishnan (*Apple, Inc. v. Samsung Elecs. Co.*, 5:11-CV-01846-LHK (N.D. Cal.), produced in this Investigation as 797HTC-00747290-797HTC-00747630.

CERTIFICATE OF SERVICE

I, Jon Tap, hereby certify that on this 18th day of January, 2012, copies of the foregoing document were served upon the following parties as indicated:

The Honorable E. James Gildea Administrative Law Judge U.S. International Trade Commission 500 E Street, SW Washington, DC 20436 Email: kenneth.schopfer@usitc.gov	☐ Via First Class Mail ☒ Via Hand Delivery (2 copies) ☐ Via Overnight Courier ☒ Via Electronic Mail

Office of Unfair Import Investigations

Lisa Kattan Office of Unfair Import Investigations U.S. International Trade Commission 500 E Street SW, Room 401 Washington, DC 20436 Email: Lisa.Kattan@usitc.gov	☐ Via First Class Mail ☒ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail

Counsel for Apple Inc.

Mark D. Fowler Aaron Wainscoat Erik Fuehrer DLA Piper LLP (US) 2000 University Avenue East Palo Alto, CA 94303 Email: 797-DLA-Apple-Team@dlapiper.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail
Tiffany Miller Robert Williams DLA Piper LLP (US) 401 B Street, Suite 1700 San Diego, CA 92101 Email: 797-DLA-Apple-Team@dlapiper.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail

Elizabeth Day Clayton Thompson David L. Alberti Yakov "Jake" Zolotorev Feinberg Day Alberti & Thompson LLP 401 Florence Street, Suite 200 Palo Alto, CA 94301 Email: 797-FeinDay-Apple-Team@feinday.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail
V. James Adduci Jonathan J. Engler Adduci Mastriani & Schaumberg LLP 1200 Seventeenth Street, N.W., Fifth Floor Washington, DC 20036 Email: Apple-12@adduci.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail
George Riley O'Melveny & Meyers Two Embarcadero Center, 28th Floor San Francisco, CA 94111 Email: griley@omm.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail
Jon Yuen Chow O'Melveny & Meyers 400 South Hope Street Los Angeles, CA 94306 Email: jchow@omm.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail
Kenneth H. Bridges Michael T. Pieja Bridges & Mavrakakis, LLP 3000 El Camino Real One Palo Alto Square Palo Alto, CA 94306 Email: kbridges@bridgesmav.com mpieja@bridgesmav.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail
James A. Shimota Bridges & Mavrakakis, LLP 200 South Wacker Drive, Suite 3080 Chicago, IL 60606 Email: jshimota@bridgesmav.com	☐ Via First Class Mail ☐ Via Hand Delivery ☐ Via Overnight Courier ☒ Via Electronic Mail

<u>/s/ Jon Tap</u>
Jon Tap