IN THE UNITED STATES COURT

FOR THE DISTRICT OF DELAWARE

LEADER TECHNOLOGIES, INC., a Delaware corporation,	)	**CIVIL ACTION**
Plaintiff and Counterdefendant,	)	**No. 1:08-cv-00862-JJF**
v.	)	
FACEBOOK, INC., a Delaware corporation,	)	
Defendant and Counterclaimant.	)	

DEFENDANT FACEBOOK, INC.'S CLAIM CONSTRUCTION BRIEF

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I. INTRODUCTION

The fundamental purpose of claim construction is to interpret the claims as a matter of law so as to assist the trier of fact in understanding the scope of the patent. In line with this purpose, the constructions proposed by Facebook are straightforward and are derived directly from the intrinsic evidence and supported by a computer dictionary commonly relied upon by persons of ordinary skill in the art. By contract, Leader Technologies, Inc. ("LTI") has adopted an approach of seeking to leave the trier of fact in the dark as to the meaning of its claims. LTI repeatedly acknowledges that one of ordinary skill in the art would adopt specific definitions for the disputed claim terms, but then stays mum as to what those definitions are. LTI cites previous few passages from its own patent to supports its arguments and repeatedly attempts to walk away from its own specification. This approach assists no one; instead, it guarantees confusion and, most likely a need to return repeatedly to the Court for guidance. Facebook respectfully submits that its straightforward approach of providing constructions that are directly supported by the patent specification is the correct one, and will be most helpful to the trier of fact.

II. PROCEDURAL HISTORY

LTI is currently asserting 27 claims from the single patent in this case. On December 3, 2009, in order to streamline this case prior to claim construction. Consequently, the Court ordered both parties to "agree to a set of representative claims or submit a proposal to the Court by December 4, 2009. . . ." Dec. 3, 2009 Minute Order. The parties did not reach agreement, so Facebook proposed a representative set of claims including independent claims 1 and 9 and dependent claims 4, 5, 10 and 12. *See* D.I. 177 at 1. LTI, by contrast, refused to select representative claims or make any proposals. *See* D.I. 176. If the Court were to now adopt the set of representative claims proposed by Facebook, the number of claim terms that would need to be construed would drop from 41 to 19. In fact, the Court could completely ignore all of the

below proposed constructions and arguments for "workspace," "web," "interrelated," "interrelationship," "locating," "change in access of the user," "in response to which," "tagged," "indexing," "remote location," "portable wireless device," "ordering," "ordering information," "arrangements," "traversing," "generating," "change information," "many-to-many functionality," "relational storage methodology" and "file storage pointers."

III. BACKGROUND OF THE '761 PATENT

When Michael McKibben and Jeffrey Lamb applied for what became U.S. Patent No. 7,139,761 ("the '761 patent") in December 2003, they were not concerned with social networking or with anything about keeping people "in touch" with each other. In fact, there is no mention of social networking anywhere in the '761 patent. They instead told the Patent Office that their alleged invention "is related to management and storage of electronic information," and more particularly, "to new structures and methods for creating relationships between users, applications, files, and folders." '761 patent, Col. 1:20-24.[1] Even the title declares that the patent is concerned with a way to store and manage information: "Dynamic Association of Electronically Stored Information With Iterative Workflow Changes."

The Background of the '761 patent adamantly claims that existing methods of organizing data are "limited and fragmented" and "wholly inadequate" (col. 1:47-48, 51-53) because they relied on users themselves to make decisions about the categorization and placement of their documents and communications. They complained that "[t]he recipient must do all of the work of organization and categorization of the communications rather than the system itself do [sic] that work. Automation of the organization of communications is non-existent." Col. 1:54-58. "File context," they explained, "is limited to the decision made by the user about the folder in

[1] Unless otherwise noted, all citations in this brief to columns ("col.") refer to the '761 patent, which is attached as Exhibit 3 to the Declaration of Paul Andre in Support of Plaintiff Leader Technologies, Inc.'s Opening Claim Construction Brief ("Andre Decl.") (D.I. 180).

which the file should be stored. The user decision does not adequately represent or reflect the true context of the file given that the file may contain information that could reasonable [sic] be stored in multiple folders." Col. 2:29-34. The applicants believed the best way to address these perceived deficiencies was to free the user from the task of organization by creating "a communications tool that associates files generated by applications with individuals, groups and topical context *automatically*." Col. 3:2-4 (emphasis added).

The '761 patent purports to disclose a system in which data created by a user is automatically linked or tethered to the *user*. As explained in the Summary of the Invention:

> The data management tool includes a novel architecture where the highest contextual assumption is that there exists an entity that consists of one or more users. The data storage model first assumes that files are associated with the user. Thus, data generated by applications is associated with an individual, group of individuals, and topical content, and not simply with a folder, as in traditional systems.

Col. 3:25-31. The summary goes on to describe a system in which a user enters a personal "workspace environment," which the patent refers to as a "board," then creates documents and files within that board using one or more applications. Col. 3:32-43. "Data created within the board is immediately associated with the user," and this tethering "is captured in a form of metadata and tagged to the data being created." Col. 3:44-45, 47-48. "The metadata automatically captures the context in which the data was created as the data is being created." Col. 3:48-50.

Once the data has been created and the metadata tethered to the user, the user can then move to another workspace (or board) and access the same data from that new location. Critically, the system responds to the user's movement by *automatically* making the data available in the new location. "As a user creates a context, or moves from one context to at least one other context, the data created and applications used previously by the user automatically

follows the user to the next context. The change in user context is captured dynamically." Col. 4:1-5; *see also* col. 7:46-49 ("As users create and change their contexts, the data (e.g., files) and applications automatically follow, the shifts in context being captured dynamically in the context data."). The user is therefore freed from making decisions about how or where its data is stored, and from manually updating the metadata when she moves to a new location. All of that is now left to the system, which ensures that a user's documents and applications automatically "follow" the user as it moves from place to place.

The three basic steps described above (1-user creates data in a first workspace, 2-user moves to a second workspace, and 3-the system dynamically associates the data with the second workspace) are reflected in each independent claim. Claim 1, for example, reads,

> 1. A computer-implemented network-based system that facilitates management of data, comprising:
>
> a computer-implemented context component of the network-based system for capturing context information associated with user-defined data created by user interaction of a user in a first context of the network-based system, the context component dynamically storing the context information in metadata associated with the user-defined data, the user-defined data and metadata stored on a storage component of the network-based system; and
>
> a computer-implemented tracking component of the network-based system for tracking a change of the user from the first context to a second context of the network-based system and dynamically updating the stored metadata based on the change, wherein the user accesses the data from the second context.

A helpful way to think about what the '761 patent allegedly covers is through use of an example and analogy. Suppose a user creates a document (user-defined data) by opening Microsoft Word or Outlook (the application) while sitting at her desk at work, typing up the document (creating it) and then storing it in a folder (storage component). If she were then to go home and decide she needs the same document, she would have to remember where she filed the

document and then either go back there herself to retrieve it, or send someone else to get it by providing them with the title of the file and a map of where they could find it. But according to LTI, this process relies too heavily on the user's faulty memory and the oft-times random decisions the users make about where and how to store information. After all, the user could forget where it was. Or the user may have mislabeled the file so that the other person retrieving it could not find it, even with a map. LTI's proposed solution to these purported problems of having to rely on the user's description and memory was to take control away from the user. *See generally* '761 pat., Background of the Invention.

Instead of relying on the user to remember in which folder a document is stored or with which application it was created, the system disclosed in the '761 patent ensures that the data and the application used to create it would "immediately" be associated with that user upon creation. *See* col. 3:44-50; col. 9:50-56. That data and application then follow the user wherever she goes, so that they are always readily accessible without the user having to remember anything. *See* col. 4:1-5. In essence, under the system disclosed in the '761 patent, the user wears a backpack containing all the data she creates and all the information about that data (metadata). For example, say the user opens Microsoft Word (the application) and types a document (creates the user-defined data). As soon as that document is created, the document is automatically shoved into the backpack the user is wearing. *See* col. 9:50-56 ("Data created while the user is in the board is immediately associated with the user. . . ."). Now when the user goes home, the document and application go with her. However, not only does the backpack accompany her, it also makes note of the change in her location, *i.e.*, the fact that she is now "at home" instead of "in the office." *See* col. 4:1-5 ("As a user creates a context, or moves from one context to at least one other context, the data created and applications used previously by the user automatically

follows the user to the next context. The change in user context is captured dynamically."). The benefit obtained, according to the applicants, is that the user did not have to do anything: she created her document and it followed her home, noting automatically (in metadata) the change in the user's location without any user interaction whatsoever.

Every embodiment described in the specification and claimed in the patent contains this idea of tethering the user to the information she creates and the application she used to do so. All but one of the embodiments and claims of the '761 patent follow the backpack analogy above. The only exception claim 17, which follows a variant "breadcrumb" analogy. In that analogy, the system essentially lays a trail of information (metadata) between the data and the user, a trail which commences at the moment the data is created and follows the user throughout her navigation through the system. In each location the user enters, her data is tethered to her by the string of "breadcrumbs" laid in each of the locations the user has visited. *See* claim 17 (". . . generating and processing data in the user environments . . . creating an association of the data *with the second user environment*. . . ."") (emphasis added). Thus, the user will always know exactly the single path to retrace (traverse) backwards in order to find the information. *See* claim 17 (". . . traversing the different arrangements of user environments . . . to locate the data associated with the user environments.") This alternative method of organizing data is firmly rooted in the '761 patent's central theme: the user cannot be relied upon to remember all the locations of all of her data, and therefore must be tethered to her data in order to facilitate finding it later. Whether by "backpack" or by "breadcrumbs," the central focus and purpose of the system in the '761 patent is to follow, track and record everything the user does, including moving, without user intervention.

IV. APPLICABLE LAW

Claim construction is a pure question of law for the Court. *Markman v. Westview*

Instruments, Inc., 52 F.3d 967, 977-78 (Fed. Cir. 1995) (en banc), *aff'd*, 517 U.S. 370 (1996). It is the Court's role to determine the appropriate construction of claims, and it is improper for the parties to present claim construction evidence, including expert testimony, to the jury. *See American Patent Dev. Corp., LLC v. Movielink, LLC*, 637 F. Supp. 2d 224, 230 (D. Del. 2009) (Farnan, J.) (citing *O2 Micro Int'l Ltd. v. Beyond Innovation Tech. Co.*, 521 F.3d 1351, 1361-63 (Fed. Cir. 2008)).

Claims in a patent are generally given "the meaning that the term would have to a person of ordinary skill in the art in question at the time of the invention, i.e., as of the effective filing date of the patent application." *Phillips v. AWH Corp.*, 415 F.3d 1303, 1312-13 (Fed. Cir. 2005) (en banc). When construing the claims of a patent, a court considers the literal language of the claim, the patent specification and the prosecution history. *Markman*, 52 F.3d at 979-80.

Federal Circuit law is equally clear that the patent specification is critically important in interpreting disputed claim language. As the court reaffirmed in *Phillips*, the specification is "always highly relevant to the claim construction analysis. Usually, it is dispositive; it is the single best guide to the meaning of a disputed term." 415 F.3d at 1315 (quoting *Vitronics Corp. v. Conceptronic, Inc.*, 90 F.3d 1576, 1582 (Fed. Cir. 1996)).

Although a claim term is generally given the meaning that a person of ordinary skill in the art would attach to it, this analysis cannot take place without regard to the patent specification. "Importantly, the person of ordinary skill in the art is deemed to read the 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." *Phillips*, 415 F.3d at 1313; *id.* at 1321 ("Properly viewed, the 'ordinary meaning' of a claim term is its meaning to the ordinary artisan after reading the entire patent."). Additionally, "the specification may reveal a special definition

given to a claim term by the patentee that differs from the meaning it would otherwise possess. In such cases, the inventor's lexicography governs." *Id.* at 1316.

A court may also consider extrinsic evidence, including expert testimony, dictionaries and learned treatises, in order to assist it in understanding the underlying technology, the meaning of terms to one skilled in the art and how the invention works. *Id.*, at 1318-19; *Markman*, 52 F.3d at 979-81. However, extrinsic evidence is considered less reliable and less useful in claim construction than the patent and its prosecution history. *Phillips,* 415 F.3d at 1318-19 (discussing "flaws" inherent in extrinsic evidence and noting that extrinsic evidence "is unlikely to result in a reliable interpretation of patent claim scope unless considered in the context of the intrinsic evidence").

V. LTI'S REQUEST THAT THE COURT ABDICATE ITS LEGAL RESPONSIBILITY TO CONDUCT CLAIM CONSTRUCTION SHOULD BE REJECTED

As to all but five of the more than 40 terms at issue in these claim construction proceedings, LTI offers no construction whatsoever. LTI and its expert instead urge the Court to give each of these terms its "plain and ordinary meaning," but do not identify what that so-called plain and ordinary meaning actually is. A refusal to construe these terms, or to select a representative set of claims, would virtually ensure that the parties will attempt to present claim construction evidence at trial.

It is an elementary principle of claim construction that "[w]ords of a claim are generally given their ordinary and customary meaning." *O2 Micro Int'l Ltd.*, 521 F.3d at 1360 (citing *Phillips*, 415 F.3d at 1312-13). One of the primary purposes of claim construction is to *identify* that meaning so it can be provided to the trier of fact. *Id.* at 1359 ("A claim construction order always dictates how the court will instruct the jury regarding a claim's scope."). LTI's assertion that the terms of the '761 patent should be given their "plain and ordinary meaning," without

actually identifying what that meaning is, represents nothing more than an empty statement of law that is unhelpful to the trier of fact.

The Federal Circuit's decision in *O2 Micro* is instructive. There the district court refused to construe the phrase "only if" from the patent-in-suit because it felt the phrase needed no construction. The district court's refusal did not end the dispute, and the parties presented evidence as to the meaning of that phrase to the jury. *Id.* at 1362. The Federal Circuit criticized the district court for its refusal to construe the disputed claim language, holding that "[w]hen the parties raise an actual dispute regarding the proper scope of these claims, the court, not the jury, must resolve that dispute." *Id.* at 1360. "In this case," the court held, "the 'ordinary' meaning of a term does not resolve the parties' dispute, and claim construction requires the court to determine what claim scope is appropriate in the context of the patents-in-suit." *Id.* at 1361.

LTI's request that this Court provide no construction for dozens of claim terms will simply force the parties to renew their arguments at trial, inviting the jury to come up with its own constructions of these terms. This Court acknowledged this problem in *American Patent Development Corp., LLC v. Movielink, LLC, supra*, 637 F. Supp. 2d 224 (D. Del. 2009) (Farnan, J.), by recognizing that by refusing to resolve claim construction issues as a matter of law, it would be "inevitable that the parties would attempt to present this evidence at trial and thus argue claim construction to the jury. The Court cannot allow this." *Id.* at 230 (citing *O2 Micro*, 521 F.3d at 1361-63).

VI. ARGUMENT

Facebook's arguments regarding each of the disputed claim terms is provided in the sections below. Facebook has grouped terms and phrases into discrete sections, each section covering terms that relate to each other in a way that warrants parallel consideration. The groupings below are based on, for example, terms that describe a common mechanism in the

claims, terms that all derive from a single claim, or terms that share one or more common elements. Facebook has also indicated all of the claims that contain each term/phrase. Finally, Facebook has emphasized in bold the only terms that the Court will need to construe if Facebook's set of representative claims is chosen and ordered.

A. "Application," "Workspace," "Web," "Context," "Environment"

Claim Term	Facebook's Construction	LTI's Construction
application (Claims 2, **4**, **9**, **12**, 17, 20, 21, 22, 23, 26, 28, 30, 34)	a computer program designed to accomplish a specific task	*None offered*
workspace (Claims 2, 3, 21, 22, 23, 24, 25, 26, 28, 29, 30, 33, 34, 35)	a collection of data and application functionality related to a user-defined topic	*None offered*
web (Claim 3)	a collection of interrelated boards/workspaces	*None offered*
context (Claims **1**, **4**, **5**, 6, 7, 8, 10, 23, 27)	a collection of interrelated webs	environment
environment (Claims **4, 9**, 11, **12,** 13, 14, 15, 16, 17)	collection of interrelated contexts	*None offered*

The terms "application," "workspace," "web," "context" and "environment" appear in one or more of the independent claims of the '761 patent. They collectively make up a group of interlocking terms that define the computing constructs in which a user creates data and to which the user can later move. The specification teaches that each of these terms are represented at different hierarchical "levels" within the architecture of the claimed system, with "application" at the lowest level and "environment" at the highest.

Figure 9 of the '761 patent depicts a hierarchical "stack" showing how applications,

workspaces (which are synonymous with "boards"), webs and contexts interrelate:

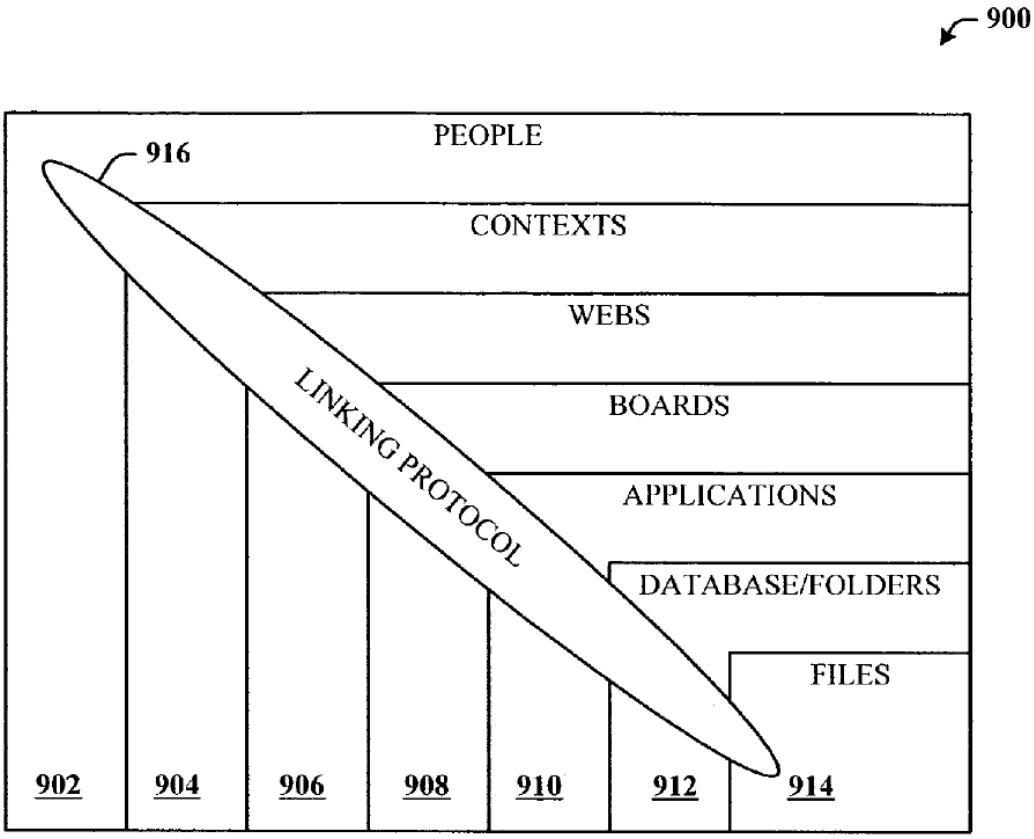

FIG. 9

Figure 9 is explained in the '761 specification as follows:

> The structure starts at high level with the user at a user level **902**. The user level **902** is next associated with a context level **904** that defines all contexts in which the user can be included. Under the context level **904** is the web level **906** that associates one or more of the webs with one or more of the contexts of the context level **904**. A boards level **908** underlies the webs level **906** and provides associations of the many boards with one or more of the webs. An applications level **910** facilitates associating one or more applications with a board designated at board level **908**.

Col. 12:10-20. Facebook's constructions of the five terms addressed in this section derive directly from the interrelationships and the hierarchical structure described in the specification.

As shown above, LTI's approach to these terms amounts to simply ignoring all of them

except "context," which LTI circularly defines as "environment," a separate term for which it offers no construction whatsoever. As shown below, Facebook's positions are the only positions consistent with the claims, specification and principles of claim differentiation. For ease of reference, Facebook will address these terms beginning at the lowest level of "application" and ending with the highest level of "environment."

1. "Application"

The non-controversial term "application" is generally understood as a computer program designed to accomplish a specific task. *See, e.g.*, Microsoft Computer Dictionary 31 (5th ed. 2002) (Weinstein Decl. Ex. A) ("**application** *n.* A program designed to assist in the performance of a specific task, such as word processing, accounting, or inventory management.") (emphasis in original). Facebook's proposed construction of "application" will assist the jury in understanding how that term is used in the claims. Because LTI has proposed no alternative construction, Facebook's construction should be adopted.

2. "Workspace"

Facebook's definition of "workspace" captures the explicit definition of that term provided in the '761 specification. The '761 patent makes clear that the term "workspace" is a synonym for "board." *See* Col. 3:32-34 ("This *workspace* is called a *board*, and is associated with a user context."); Col. 3:41-43 ("Moreover, thereafter, the user can then move to shared *workspaces* (or *boards*), and access the same data or other data."). The '761 patent, acting as its own lexicographer, explicitly defines board as follows: "As used herein, a 'board' is defined as a collection of data and application functionality related to a user-defined topic." Col. 7:49-51. This is exactly the construction that Facebook has proposed.

LTI's argument that the specification only uses the term "board" to describe one type of workspace ("personal workspace") is belied by the language quoted above, which shows that the

specification uses boards to describe both personal and shared workspaces. LTI's other argument is nonsensical since a topic is a collection of data. Because LTI has proposed no alternative construction, Facebook's construction should be adopted.

3. "Web"

As explained above, a "web" sits at a higher level than a workspace/board. The term "web" is also explicitly defined in claim 3. *See* Claim 3 ("the context component is associated with a *web*, which is a collection of interrelated workspaces . . ."). This definition is consistent with the definition in the specification, which uses the term "board" and "workspace" interchangeably. *See* Col. 7:58-59 ("As used herein, the term 'web' refers to a collection of interrelated boards."). Because the claims use the term "workspaces" in place of the term "board," the Court should construe "web" as "a collection of interrelated workspaces."

4. "Context"

The specification does not provide any explicit definition for the term "context," but its meaning is easily derived based on its relationship to the other terms to be construed. Sitting directly above "webs," the specification is clear that contexts are used to organize the interrelated webs that sit beneath them. *See* Fig. 9; col. 12:10-20 ("Under the context level **904** is the web level **906** that associates one or more of the webs with one or more of the contexts of the context level **904**."). The Court should therefore construe the term "context" to mean "a collection of interrelated webs."

LTI's assertion that the '761 patent uses the terms "context" and "environment" interchangeably is unsupported by the intrinsic evidence and is contrary to the doctrine of claim differentiation. The portion of the specification quoted by LTI does not use these terms interchangeably, but instead refers to them as two different computing constructs, both of which are distinct from a third construct, "workspace:" "The user automatically enters into a *user*

workspace **or** a *first context* 104 (also denoted CONTEXT.sub.1) **or** *environment*." Col. 6:28-30 (emphasis added). The use of the term "or," and the inventor's assignment of "context" (but not "environment" or "workspace") to a specific element of Figure 1 (104), confirms that the three terms are indeed used to identify distinct constructs.

Moreover, claim 1 refers to a first and second "context," whereas claim 9 refers to a first and second "environment." Had the inventors intended for "context" and "environment" to have the same meaning, they could have simply used one or the other in both claims 1 and 9. Instead, the inventors chose to reference a first and second "context" in claim 1 and a first and second "environment" in claim 9. Under the doctrine of claim differentiation, the inventors' use of two different terms in these claims indicates that the terms should have different meanings. *See Andersen Corp. v. Fiber Composites, LLC*, 474 F.3d 1361, 1370 (Fed. Cir. 2007).

5. "Environment"

The specification uses the term "environment" to refer to the highest level in which a user can operate: the "computing environment." Col. 17:57 – Col. 18:2. That the "environment" is the highest level construct is reinforced by Figure 21, which provides an example computing "environment" (2100) in which the invention is carried out. This is also consistent with the plain meaning of "environment" found in well-known computing dictionaries. *See, e.g.*, Microsoft Computer Dictionary 195 (5th ed. 2002) (Weinstein Decl. Ex. A) ("**environment** *n.* 1. The configuration of resources available to the user. *Environment* refers to the hardware and the operating system running on it.") (emphasis in original). In the context of Figure 9 and the claims, the most logical construction of "environment" is "collection of interrelated contexts."

Accordingly, each of Facebook's proposed constructions relating to each of these five interlocking terms should be adopted.

B. "Metadata," "Context Information," "Change Information," "Change in access of the user"

1. "Metadata"

Facebook's Proposed Construction	LTI's Proposed Construction
A stored item of information associated with the user's data that identifies at least the context, user workspace or user environment in which the user and the data currently reside (Claims **1**, 8, **9**, 17, 21, 22, 23, 24, 28, 29, 31 and 32)	*None offered*

Facebook has proposed a definition of "metadata" that comports with the way in which it is used throughout the claims, specification and file history of the '761 patent. LTI's assertion that a computer scientist could assign a plain meaning to the term in a vacuum is neither helpful nor the proper exercise. *See Phillips*, 415 F.3d at 1321 ("Properly viewed, the 'ordinary meaning' of a claim term is its meaning to the ordinary artisan after reading the entire patent.").

The '761 patent is first and foremost about linking data to a user and keeping track of the user's location within the system – be it a context, user workspace or user environment – and recording these facts as "metadata" that can be updated as the user moves from one location to another. *See*, '761 patent, Background *supra*. The purpose of "metadata" is to store information related to the (a) user to whom the data is tied, and (b) the user's location (since that is where the data will be). Every piece of intrinsic evidence confirms this.

First, the specification repeatedly states that "data created while the user is in the board is *immediately associated with the user, the current workspace*, any other desired workspace that the user designates, and the application. This association is captured in a form of *metadata*. . . ." Col. 9:50-54 (emphasis added); col. 3:44-50; s*ee also* col. 3:48-50; col. 9:54-56 ("[t]he *metadata* automatically captures the *context* in which the data was created as the data is being created.")

(emphasis added); col. 4:1-4 ("when the user "moves from one context to at least one other context, the data created and applications used previously by the user *automatically follow the user to the next context*."). Hence, the "metadata" is "stored information associated with the user's data that identifies at least the context, user workspace or environment in which the data currently reside."

The file history further supports Facebook's proposed construction. During prosecution of the application that resulted in the '761 patent, the examiner rejected the proposed claims as obvious over U.S. Published Appl. No. 2003/0217096 to Samuel J. McKelvie in view of U.S. Patent No. 6,421,678 to Brian Smiga. In attempting to distinguish their invention from the prior art, the Applicants argued:

> In contrast, the subject invention is much more than a messaging architecture as taught in McKelvie and the natural language processing system of Smiga. The instant invention captures, dynamically, context information of a workspace and *stores that information in the form of metadata, which is further associated with data* (e.g., files, documents, ...). *The metadata allows the tracking and capture of user interactions through one or more workspaces*.

May 5, 2006 Amendments and Remarks at 15 (LTI 000610) (emphasis added) (Andre Decl. Ex. 4). The Applicants went on to describe an example of how the purported invention could be used in which a user enters a first workspace, moves to a second workspace, and the metadata correspondingly records where both the user and data currently reside:

> When a user logs in to a system that employs the tool, the user enters into a personal or user workspace environment. . . *Context information associated with the workspace is automatically stored in the database as metadata, and the metadata is further associated with data that is created in the workspace*. Accordingly, any data created by the user in the workspace can be searched via the metadata.
>
> Moreover, thereafter, the user can then move (or login) to a different workspace, such as a shared workspace (or shared board) that accommodates multiple users, for example, and the user can then access the same data created by the user in the

> first workspace and/or new data that was created in the shared workspace. *The fact that the user is now in the shared workspace, and that s/he accessed the same data created in the personal (or first) workspace, is recorded as additional information stored in the metadata of the same data created in the personal workspace*.
>
> * * *
>
> Again, this *context* information of the single workspace and/or shared workspaces and *any movement of a user or users between the workspaces is automatically captured and stored in the metadata, and the metadata is further associated with data that is created in the workspaces*.

Id. at 15-16 (LTI 000610-11) (emphasis added). Thus, the file history also supports Facebook's construction of "metadata."

LTI's only quibbles with Facebook's proposed construction appear to be (a) that Facebook's definition includes the phrase "an item" of information and (b) that metadata can include more than what Facebook has included in its definition. Both of these complaints are without merit. The use of "an item of" information is simply intended to assist the jury in understanding that each grouping of metadata is associated with a specific piece of user-defined data. As to LTI's other concern, Facebook acknowledges that metadata could theoretically contain information beyond the identification of the context, user workspace or user environment in which the user and the data currently reside. The inclusion of the words "at least" in Facebook's definition makes this abundantly clear. Facebook's proposed construction simply captures the elements that the claims, specification, patent and file history acknowledge, over and over, *must* be recorded in the metadata—the identification of the location (*i.e.* context, user workspace or user environment) in which the user and the data currently reside.

Mr. Vigna's conclusory declaration offers nothing to contradict Facebook's construction. He states merely that there is a plain and ordinary meaning associated with the term "metadata." As explained in Dr. Greenberg's declaration, what constitutes "metadata" depends heavily on the system in which it is stored and utilized. *See* Greenberg Decl. ¶¶20-21. Each system uses

"metadata" for fundamentally different purposes. *Id*. As to the system disclosed in the '761 patent, it uses metadata for recording where at least the data and user currently reside.

2. "Context information"

Facebook's Proposed Construction	LTI's Proposed Construction
Data that identifies at least a specific context (Claims **1**, **4**, **5**, 6, 8, **10**)	*None offered*

As discussed above, the purpose of the metadata is to store information related to the (1) user and (2) the user's location. "Context information" is one type of information captured in the metadata, *i.e.*, data identifying a context, which is one level of location, at any given time.

The intrinsic evidence supports Facebook's proposed construction. The specification explains that, "[t]he metadata automatically captures the *context in which the data was created* as the data is being created." Col. 3:48-50 (emphasis added); col. 9:54-56. Furthermore, the specification states that, "[t]he system 100 also includes a context component 110 in association with the first context 104 to monitor and generate *context data 112 associated with data operations of the user in the first context 104*." Col. 6:48-51 (emphasis added).

Contrary to LTI's assertions, Facebook's proposed construction is not at odds with dependent claim 4 of the '761 patent. As a dependent claim, claim 4 is necessarily narrower than its associated independent claim, claim 1. Therefore, "context information" as used in claim 1 (the only independent claim in which it appears) must necessarily include information beyond what is required by dependent claim 4. Facebook's use of the phrase "at least" in its proposed construction accounts for the fact that other information may be included. However, the specification is clear that the essential element of context information is an identification of a context. Dependent claim 4 may require "context information" to include additional pieces of data, but it cannot take away what it must include.

3. "Change information," "change in access of the user" and "based on the change"

Claim Term	Facebook's Construction	LTI's Construction
change information (Claim 23)	data that records the movement of a user from one user workspace to another	*None offered*
change in access of the user (Claim 23)	movement of a user from the first workspace to the second workspace to facilitate access in the second workspace	*None offered*
based on the change (Claim **1)**	In response to the user's movement from the first context to the second context	*None offered*

The term "change information" and the related phrase "change in access of the user" are recited only in independent claim 23. "Based on the change" appears in claim 1. "Change information," another type of information captured by the metadata recited in claims 1 and 23, is data that records a user's movement between two workspaces in the claimed system. The tracking of "change information," and its recordation in the metadata are either triggered by a "change in access of the user" or are "based on the change." *See* claims 1, 23.

LTI concedes that change information is, as claim 23 states, "associated with a change in access of the user from the first user workspace to a second user workspace. . . ." LTI appears only to take issue with Facebook's alleged "importation" of the concept of movement. The simple fact is that a user makes a "change in access" from one by workspace to another *by movement*. The specification acknowledges this: "[a]s a user . . . *moves* from one context to at least one other context, the data created and applications used previously by the user automatically follows the user to the next context. *The change in a user context is captured dynamically*." Col. 4:1-5 (emphasis added). The file history similarly states:

> the user can then *move* (or login) to a different workspace, such as a shared workspace (or shared board) that accommodates multiple users . . . . *The fact that the user is now in the shared workspace . . . is recorded as additional information stored in the metadata* . . . .

***

> Again, this context information of the single workspace and/or shared workspaces and *any movement of a user or users between the workspaces is automatically captured and stored in the metadata*, and the metadata is further associated with data that is created in the workspaces."

Andre Decl. Ex. 4 at 16 (LTI 000611) (emphasis added). The intrinsic evidence therefore makes clear that "change information" and "change in access of the user" are both associated with movement of a user from a first to a second user workspace, as Facebook has proposed.

C. "Dynamically"

Facebook's Construction	LTI's Construction
automatically and in response to the preceding event (Claims **1**, **9**, 17, 21, 22, 23)	*None offered*

The term "dynamically" is used multiple times in each independent claim of the '761 patent at issue. LTI offers no construction of its own, but concedes in its opening brief that "dynamically" can be interpreted as "automatically." D.I. 179 at 25. LTI's point is helpful, but is only half correct. To understand what "dynamically" means, one must also understand its precondition, i.e. how the automatic action is triggered. As shown below, the term "dynamically" is used throughout the claims as an adjective to describe an action that occurs (a) automatically and (b) in response to the event that preceded it.

The specification uses the word "dynamically" in a way that makes clear that the word means more than just "automatically." Nowhere in the claims or specification does the '761 patent identify an action taking place "dynamically" without such action being in response to the preceding action by the user, such as the creation of data or the change of a user from one context, workspace or user environment to another. For example, the specification states that: "*As a user creates a context*, or moves from one context to at least one other context, the data

created and applications used previously by the user *automatically* follows the user to the next context. The change in user context is captured *dynamically*." Col. 4:1-5 (emphasis added). "As users create and change their contexts, the data (e.g., files) and applications automatically follow, the shifts in context being captured *dynamically* in the context data." Col. 7:46-49. In each case, the dynamically-captured change is triggered automatically by the preceding act, *i.e.*, the user having created a context or moved from one context to another.

Another example is found in the independent claims of the '761 patent that require that the system "dynamically" associate metadata with the data created by the user in the first context, user environment or workspace. *See* '761 patent, Claim 1 ("*dynamically* storing the context information in metadata associated with the user-defined data"); claims 9, 21 ("*dynamically* associating metadata with the data"); claim 17 ("data of a user environment is *dynamically* associated with the user environment in metadata"); claim 23 ("*dynamically* storing the context data as metadata"). The specification describes this dynamic association as follows: "Data created within the board *is immediately associated* with the user, the user's permission level, the current workspace, any other desired workspace that the user designates, and the application. This association is captured in a form of metadata and tagged to the data being created. The metadata *automatically* captures the context in which the data was created *as the data is being created*." Col. 3:44-48 (emphasis added). This is the essence of what it means for an event to occur "dynamically" within the '761 patent – an event occurs automatically (i.e. capturing the context in which the data is created) in response to a preceding act (i.e., the data being created by a user).

The file history also establishes conclusively that "dynamically" means more than just "automatically." During prosecution of the application that resulted in the '761 patent, the PTO

issued a Final Rejection against all claims. In response to several examiner interviews and with the consent of the Applicants, the examiner made substantial amendments to all independent claims. The claim that became claim 1 of the '761 patent, for example, was amended to strike out the word "automatically" from the second claim element and replace it with "dynamically." *See* Notice of Allowability with Examiner's Amendment, Andre Decl. Ex. 4 at 3 (LTI 000647) ("automatically updating the stored metadata based on the change," changed to "dynamically"). Earlier in the prosecution, the applicants amended two other independent claims to replace the word "automatically" with "dynamically." *See* Amendments to Claims, May 5, 2006, Andre Decl. Ex. 4 at claim 26 (LTI 000602) (changing "automatically associating metadata with the data" to "dynamically"), and claim 40 (LTI 000604) (same change). The result of these amendments was that each occurrence of "automatically" in each independent claim was replaced with "dynamically." This confirms what the examiner and the applicants understood to be the case – that there is more to dynamically than just automatically. Facebook's construction captures the meaning the examiner relied upon to allow the claims and thus should be adopted.

D. "Accesses [the data]" "Employs the data"

1. "Accesses [the data]"

Claim Term	Facebook's Construction	LTI's Construction
accesses [the data from the second context/user workspace] (Claims **1**, 23)	retrieves information in the second context or user workspace as distinct from uploading, adding or creating it	*None offered*
[the data is] accessed [from the second user environment] (Claim 17)	the information is retrieved in the second user environment, as distinct from uploading, adding or creating it	*None offered*

Independent claims 1, 17 and 23 generally recite a system or method in which (a) a user

creates data in a first location (i.e. context, user environment or workspace); (b) the user moves to a second location; then (c) the user *accesses* the user-created data from the second location and; (d) the metadata is updated as a result of (b) or (c), depending on the claim. The key concept captured by Facebook's construction is that in order for the user-created data to be "accessed" from a second location, it must already exist in that location.

Facebook's construction is consistent with the plain meaning as understood to persons of ordinary skill in the art. *See* Greenberg Decl. ¶21. Data that does not exist, or that is not available to a user, cannot be "accessed" by the user. It must instead be created, added or uploaded. The act of "accessing" data necessarily excludes the acts of creating, adding or uploading. Indeed, claims 1, 17 and 23 recite the act of accessing "*the* data" from a second location, referring back to the same data in the claims that the user created in the first location.

This common sense understanding is fully supported by the intrinsic record. As explained in the Background section of this brief, a key concept disclosed in the '761 patent is that data is tethered to a user (*i.e.* put into her "backpack") such that the user is not required to manually upload or to add that data to multiple locations. *See supra* Section III. The tethered data instead automatically "follows" the user upon moving from one location (*i.e.* context, user environment, user workspace) to another: "As a user creates a context, or moves from one context to at least one other context, the data created and applications used previously by the user *automatically follows* the user to the next context. The change in user context is captured *dynamically*." Col. 4:1-5 (emphasis added). The user's data is thus available for access in a second location without the user having to manually create, add or upload the data in the second.

LTI claims that "accesses" and "accessed" as used in the claims of the '761 patent should be given their plain and ordinary meaning, but does not identify what this ordinary meaning is.

The examples cited by LTI in an attempt to criticize Facebook's construction, in fact, confirm that "access" excludes adding, uploading or creating data. The specification states, for example, that "[v]arying levels of access can be provided to the *uploaded* data." Col. 11:30-31 (emphasis added). The data obviously cannot be accessed unless it was already uploaded. The specification also mentions the ability to "obtain access to any data in any form (e.g., documents and files) *created* by the applications," col. 3:39-40, reaffirming that the data must have been created previously before it could be accessed. Therefore, the exclusion of uploading, adding or creating is supported by the intrinsic evidence, not "imported" by Facebook.

2. "Employs [the application and data]"

Claim Term	Facebook's Construction	LTI's Construction
employs [at least one of the application and the data from the second environment] (Claim **9**)	uses at least one of the application and the data that is already in the second user environment, as distinct from uploading, adding or creating them	*None offered*
employs [the application and data from the second user workspace] (Claim 21)	uses the application and data that is already in the second user workspace, as distinct from uploading, adding or creating them	*None offered*

Claims 9 and 21 conclude with a requirement that the user "employs" an application and data from the second user environment or workspace, respectively. This is essentially a slight variation on the requirement that the user "access" the data from the second location as recited in claims 1 and 23 and discussed above. For the same reasons as discussed above in connection with "access" and "accessed," the act of "employing" an application or data necessarily excludes the acts of creating, adding or uploading. Employs generally means "uses." Thus, data or an application that does not exist, or that is not available to a user in a second location, cannot be

"employed" or used by the user from that location unless it already exists there.

E. "Context Component," "Tracking Component," "Storage Component"

1. "Component"

The term "component" does not appear by itself in the claims. Rather, it is always preceded by one of the three different that identify the type of "component" claimed in the patent ("context component," "tracking component," "storage component"). Construing "component" by itself would be unhelpful because each of the three "components" performs a fundamentally different function from the other two. Moreover, the specification explicitly defines the term "component" in such a broad and amorphous fashion as to render it almost entirely meaningless. *See* Discussion of "tracking component" below. Each of the three components recited in the claims should therefore be construed separately as shown below.

2. "Tracking Component"

The term "tracking component" appears in independent claims 1 and 23. The "functions" listed below come verbatim from the language of claims 1 and 23.

Facebook's Construction	LTI's Construction
Means-plus-function element governed by 35 U.S.C. § 112, ¶ 6 **Functions (as to claim 1)**: Tracking a change of the user from the first context to a second context of the network-based system and dynamically updating the stored metadata based on the change. **Functions (as to claim 23)**: Tracking change information associated with a change in access of the user from the first user workspace to a second user workspace, and dynamically storing the change information on the storage component as part of the metadata. **Structure**: Because the specification discloses no algorithm to carry out the recited function, claims 1 and 23 are invalid. (Claims **1**, 23, 24)	*None offered.*

A claim term may be a means-plus-function term under 35 U.S.C. § 112 ¶ 6 even though it does not include the word "means." The lack of the word "means" raises a rebuttable presumption that § 112 ¶ 6 does not apply. *See Massachusetts Inst. of Tech.& Elecs. for Imaging, Inc. v. Abacus Software*, 462 F.3d 1344, 1353 (Fed. Cir. 2006). That presumption can be overcome, however, if it is demonstrated that "the claim term fails to 'recite sufficiently definite structure' or else recites 'function without reciting sufficient structure for performing that function.'" *Id*. (internal quotes & citations omitted). The Federal Circuit has expressly held, for example, that generic terms such as "'mechanism,' 'means,' 'element,' and 'device,' typically do not connote sufficiently definite structure to avoid means-plus-function treatment." *Welker Bearing Co. v. PHD, Inc.*, 550 F.3d 1090, 1096 (Fed. Cir. 2008) (alterations omitted).

The term "tracking component" easily overcomes any presumption against means-plus-function treatment. Outside the patent, the term "component" is a generic term that does not connote any definite structure to one of ordinary skill in the art. *See* Greenberg Decl. at ¶26. Reading the term together with the modifying term "tracking" provides no additional structural identification, either. *Id*. The patent specification makes the term even less definite by explicitly defining "component" as encompassing anything – or everything – in any computer system:

> As used in this application, the terms "component" and "system" are intended to refer to a computer-related entity, either hardware, a combination of hardware and software, software, or software in execution. For example, a component may be, but is not limited to being, a process running on a processor, a processor, an object, an executable, a thread of execution, a program, and/or a computer. By way of illustration, both an application running on a server and the server can be a component. One or more components may reside within a process and/or thread of execution and a component may be localized on one computer and/or distributed between two or more computers.

Col. 5:54-65. The applicants, acting as their own lexicographer, adopted this breathtakingly broad definition of "component" that leaves one of ordinary skill in the art guessing as to the

infinite combinations of hardware, software, computers and other structures that may perform the function of the claimed "tracking component." This is clearly the polar opposite of the "sufficiently definite structure" required to avoid means-plus-function treatment. *See Welker Bearing Co.*, 550 F.3d at 1096. Thus, there can be no doubt that "tracking component" is a means-plus-function element governed by 35 U.S.C. § 112 ¶ 6.

Once a claim term is determined to be a means-plus-function limitation, its construction is limited to covering the corresponding structures disclosed in the specification and equivalents thereof. *See* 35 U.S.C. § 112 ¶ 6. In *WMS Gaming v. International Game Tech.*, 184 F.3d 1339, 1349 (Fed. Cir. 1999), the Federal Circuit held that "[i]n 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." A failure by the specification to disclose such an algorithm renders the claim indefinite. *See Aristocrat Techs. Austl. Pty Ltd. v. Int'l Game Tech.*, 521 F.3d 1328, 1337-38 (Fed. Cir. 2008); *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1367 (Fed. Cir. 2008) ("Consequently, a means-plus-function claim element for which the only disclosed structure is a general purpose computer is invalid if the specification fails to disclose an algorithm for performing the claimed function." (citation omitted)).

The specification discloses no algorithm for performing functions which the patent claims are performed by the "tracking component." It does not, for example, disclose any algorithm for "tracking a change of the user from the first context to a second context" (claim 1) or for "tracking change information associated with a change in access of the user from the first user workspace to a second user workspace" (claim 23). Greenberg Decl. at ¶26. The specification devotes only a single sentence to the tracking component, which at best merely

restates these functions without disclosing any algorithm for carrying them out. *See* Col. 7:1-4. Claims 1 and 23, and all claims depending from them, are thus invalid as indefinite.

3. "Context Component"

The term "context component" likewise appears in independent claims 1 and 23. For the same reasons discussed above in connection with "tracking component," the term "context component" is a means-plus-function element that must be limited to the algorithm disclosed in the specification for carrying out the recited functions. *See WMS Gaming*, 184 F.3d at 1349.

Facebook's Construction	LTI's Construction
Means-plus-function element governed by 35 U.S.C. § 112, ¶ 6 **Functions (as to claim 1)**: Capturing context information associated with user-defined data created by user interaction of a user in a first context of the network-based system and dynamically storing the context information in metadata associated with the user-defined data. **Functions (as to claim 23)**: Defining a first user workspace of the web-based server, assigning one or more applications to the first user workspace, capturing context data associated with user interaction of a user while in the first user workspace, and for dynamically storing the context data as metadata on a storage component of the web-based server. **Structure**: Because the specification discloses no algorithm to carry out the recited function, claims 1 and 23 are invalid. (Claims **1**, 2, 3, **5**, 23, 25, 28, 29, 35)	*None offered*

Like the "tracking component" discussed above, the specification discloses no algorithm for performing the functions performed by the claimed "context component." Greenberg Decl. at ¶26. It does not provide any algorithm for "capturing context information associated with user-defined data created by user interaction of a user in a first context of the network-based system." The specification either says nothing about these functions, or simply restates them

without identifying any algorithm for carrying them out. *See* Col. 6:59-7:39. Claims 1 and 23, and all claims that depend from them, are thus invalid as indefinite under 35 U.S.C. § 112 ¶ 2.

4. "Storage Component"

Facebook's Construction	LTI's Construction
Means-plus-function element governed by 35 U.S.C. § 112, ¶ 6 **Function**: Storing user-created data and metadata (claims 1 and 9), storing "ordering information" (claim 17), and storing metadata (claim 23). **Structure**: Because the specification discloses no algorithm to carry out the recited function, claims 1, 17 and 23 are invalid. (Claims **1**, **9**, 17, 23)	*None offered*

The term "storage component" appears in independent claims 1, 9, 17 and 23 to identify where certain information should be stored. LTI complains that Facebook's proposed construction limits the term to a physical component of "memory," whereas the specification defines a "component" as any combination of hardware, software and/or other structures. *See* Col. 5:54-65; *see also* discussion of "tracking component," *supra*. The specification's broad definition of "component" appears to support LTI's position that "storage component" can include software, including an implementation entirely in software. Facebook therefore withdraws its construction of this term.

LTI's arguments, however, confirm that the term "storage component" suffers from the same infirmities as do the terms "tracking component" and "context component," both discussed above. In light the broad definition of "component" in the specification, the term "storage component" must likewise be construed as a means-plus-function element that must include the algorithm disclosed in the specification. *See WMS Gaming*, 184 F.3d at 1349.

The function performed by the "storage component" differs slightly based on the claim in which it appears. The "storage component" performs the functions of storing user-created data and metadata (claims 1 and 9), storing "ordering information" (claim 17), and storing metadata (claim 23). However, the specification discloses no algorithm for performing any of these functions. The specification refers briefly to a "data storage system" that includes "a number of storage methodologies . . . for handling and processing data," col. 11:25-26 , but does not describe those methodologies in any detail. The specification merely identifies theoretical capabilities of these purported "methodologies," without disclosing any algorithm by which they can be carried out. Col. 11:25-37; s*ee also* Greenberg Decl. ¶26. Because the specification fails to disclose an algorithm for performing the claimed function, claims 1, 9, 17 and 23 (and any claims that depend from them) are invalid as indefinite under 35 U.S.C. § 112 ¶ 2. *See Aristocrat Techs. Austl. Pty Ltd.*, 521 F.3d at 1337-38; *Net MoneyIN, Inc.*, 545 F.3d at 1367.

F. "Ordering," "Ordering Information," "Arrangements," "Traversing" (Claim 17)

Claim Language	Facebook's Construction	LTI's Construction
ordering	placing into a fixed sequence	organizing
ordering information	data that specifies a particular order in which user environments must be traversed[2]	*None offered*
arrangement	a specifically-ordered set of items	*None offered*
traversing	navigation by the user according to a specific path or route	searching

The terms "ordering," "ordering information," "arrangements" and "traversing" all

[2] Facebook has since refined its construction of "ordering information" to make it more consistent with the other three terms to be construed from claim 17. Facebook's construction is the one reflected in the chart above, not the one appearing in LTI's opening brief.

appear exclusively in independent claim 17 as follows (shown in bold underlining)

> 17. A computer-implemented method of managing data, comprising computer-executable acts of:
>
> generating a plurality of user environments in a web-based system;
>
> **ordering** two or more of the plurality of user environments according to different **arrangements** of the user environments;
>
> ***
>
> storing in a storage component **ordering information** related to the **ordering** of the two or more of the plurality of user environments; and
>
> **traversing** the different **arrangements** of the user environments with one or more of the applications based on the **ordering information** to locate the data associated with the user environments.

As discussed above in Section III of this brief, claim 17 differs from other independent claims only insofar as the claimed method records and relies upon information *about the sequence* in which a user has accessed his data (*i.e.* the trail of breadcrumbs left by the movements). As shown above, the claim calls for the "ordering" of user environments according to "different arrangements," and then allows "traversing the different arrangements . . . based on the ordering information." Only Facebook's constructions capture the notion of sequence and movement back along the same "path" to locate the document.

In everyday usage, as well as to one of ordinary skill in the art, "ordering" items occurs when those items are placed in a fixed sequence. *See* Greenberg Decl. at ¶22. Ordering items alphabetically, for example, would be understood as placing those items in an alphabetical sequence. If there was no fixed sequence, then the items could not be considered ordered.

LTI's proposed construction of "ordering" as "organizing" is little more than an attempt to rewrite the claims and is at war with the plain and ordinary meaning of the term. LTI's definition of "ordering" does not require that items be placed in any sequence. LTI's

construction also makes no sense because something can be "organized" without being in order. For example, if someone places all of his blue socks in one pile and all white socks in another, the socks have been "organized" but nobody would assert that they were in order. *See* Greenberg Decl. at ¶22.

This common sense interpretation derives directly from the surrounding claim language. As shown above, claim 17 requires storage of "*ordering information*" relating to the ordering of "*arrangements*" of user environments, and concludes with "*traversing*" the arranged user environments "*based on the ordering information.*" This language clearly implies a relationship between environments that is based on placement into a fixed sequence, i.e. ordered so the user can track the exact path back to find the right information.

The '761 patent specification further supports this view. The only portion of the '761 specification that discusses the subject matter of claim 17 in any detail describes a "routing algorithm" (referred to in the patent as a "webslice") that defines sequential arrangements in which user environments may be placed:

> The disclosed system has associated therewith a routing algorithm, referred to herein as a "webslice." A webslice is a relationship rule that defines a relationship between a web and one or more boards of that web. If the web changes (e.g., a board is added), and meets the criteria of the rule, the content will be on the new board as well. For example, the rule can include a web ID, a starting board ID, and "transversal" data (i.e., the relationship rule), in the following format:
>
> webslice (target board)=<webID; starting board ID; transversal data>.
>
> Thus, if a system includes two webs, W1 and W2, where web W1 includes five boards: A (the starting board), B, C, D, and E, with each subsequent board a child to the previous board (i.e., B is child of A, C is child of B, etc.), the webslice data "slicing" to board E will be similar to the following:
>
> webslice (board E)=<W1; board A: A→B→C→D→E>.
>
> * * *

> Thus, by using at least three basis entities for the webslice (i.e., the web ID, the starting board ID, and the transversal data), the boards associated with a given content can be ascertained.

Col. 8:59-9:8; col. 9:30-34. This illustration shows how parent-child relationships establish the sequence of the various boards (i.e., A→B→C→D→E) via "ordering information" that defines the relationships between the boards (i.e. A is the parent of B, B is the parent of C, and so forth). Facebook's constructions of "ordering," "ordering information" and "arrangements" are consistent with this intrinsic evidence and should therefore be adopted.

The Court should also adopt Facebook's construction of "traversing." As shown above, claim 17 requires "*traversing* the different arrangements of the user environments with one or more of the applications *based on the ordering information*," which indicates that "traversing" requires the environments to be navigated according to a specific path or route as defined by their ordering. In other words, to get from A to E, a user would pass through B, C then D. This is consistent with the plain meaning of "traversing" as understood in the computer science field. The *Microsoft Computer Dictionary* for example, defines "traverse" as "to access *in a particular order* all of the nodes of a tree or similar data structure." Weinstein Decl. Ex. A (emphasis added). This is consistent with how one of ordinary skill in the art would understand "traversing." *See* Greenberg Decl. at ¶23.

LTI's construction improperly attempts to rewrite claim 17 by transforming "traversing" into "searching." There is no basis for such a construction. Nothing in the specification or claims equates the act of traversing with searching. Moreover, other claims of the '761 patent and other portions of the specification specifically discuss the act of searching as an art distinct from traversing. *See* '761 patent, claim 6 ("*search* and association criteria set by the user") (emphasis added), col. 3:50-53 ("Additionally, the data content is indexed to facilitate *searching*

for the content in number of different ways in the future by the user or other users.") (emphasis added). Had the applicants of the '761 patent intended "traversing" to be synonymous with "searching," they certainly could have drafted claim 17 and the specification accordingly. However, when the applicants wanted to describe the act of searching, they used that word. And when they wanted to describe the act of navigating through a series of items according to a specific path based on their ordering, they used the word "traverse." Accordingly, Facebook's construction of "traverse" should be adopted.

G. Remaining Terms (File Storage Pointers, Association, Capturing, Create or Created, Generating, Indexing, Locating/Locate, Portable Wireless Device, Remote Location, Relational Storage Methodology, Relationship, Tagged, Updating)

The remaining terms for which Facebook seeks construction should not be controversial and, indeed, LTI could have stipulated to numerous of these "plain meaning" constructions. Instead, LTI has taken the position that each of these terms should be left with no construction, apparently based on their misconception that terms that can be readily understood by a lay jury and thus should not be subject to claim construction. This is wrong.

1. "Created/create" and "locating/locate"

Claim Language	Facebook's Construction	LTI's Construction
created/create (Claims **1**, 7, 8, **9**, 17, 21, 22, 23, 24, 29)	Brought/to bring into existence	*None offered*
locating/locate (Claims 3, 15, 17, 18, 19)	Finding/find	*None offered*

In its brief, LTI does not contest Facebook's proposed construction of the terms "created/create" and "locating/locate." Facebook's constructions should therefore be adopted.

2. "Associated/Association/Associating"

Claim Language	Facebook's Construction	LTI's Construction
associated/association/ associating (Claims **1**, 2, 3, **5**, 7, **9**, 11, **12**, 17, 18, 20, 21, 22, 23, 25, 26, 30, 32, 34))	Linked or linking	*None offered*

In the context of software, and read in light of the claims of this patent, "associated" is generally understood by one skilled in the art to mean "linked." Weinstein Decl. Ex. A. That the term "link" is used in the specification in connection with a "communications link" is irrelevant simply because of the presence of modifier "communications."

3. "Capturing"

Claim Language	Facebook's Construction	LTI's Construction
capturing (Claims **1**, **5**, **10**, 23, 25, 28)	obtaining	*None offered*

"Capturing" is readily understood by one reasonably skilled in the art as "obtaining." This is yet another example of a term that LTI has refused to construe because it is widely used in the field. However, such use may not be known to a lay person juror. For example, a juror may understand "capturing" to mean "to take prisoner." Furthermore, the fact that the specification uses "obtaining" for user actions and "capturing" for computer system actions only supports the need for a construction here. Facebook's construction is consistent with the definition provided by a dictionary used by one skilled in the art. Weinstein Decl. Ex. A.

4. "File Storage Pointers"

Claim Language	Facebook's Construction	LTI's Construction
file storage pointers (Claim 34)	information that identifies the specific folders in which specific files are located	*None offered*

LTI admits in its brief that "file storage pointers" is "not generally known to lay persons," D.I. 179 at 27, but inexplicably offers no construction to assist the jury in understanding the meaning of this term. On this basis alone, Facebook's proposed constructionshould be adopted. LTI's rationale for rejecting Facebook's proposed construction is non-sensical.

5. "Generating"

Claim Language	Facebook's Construction	LTI's Construction
generating (Claims 17, 35)	creating	*None offered*

"Generating" is yet another example of a term that is known by those of ordinary skill in the art but may not be known to lay jurors. The term "generating" is used only in claim 17 of the '761 patent. *See* Claim 17 ("*generating* a plurality of user environments in a web-based system," "providing a plurality of applications for *generating* and processing data in the user environments") (emphasis added). One of reasonable skill in the art would clearly understand the term as synonymous with "creating;" LTI has offered no evidence that the term should have some any other meaning. The basis for LTI's argument that "something can be generated without being created," D.I. 179 at 28, is unclear in light of LTI's failure to provide even a single example. Facebook's proposed construction of this term should therefore be adopted.

6. "Many-To-Many Functionality"

Claim Language	Facebook's Construction	LTI's Construction
many-to-many functionality (Claim 32)	claim term is indefinite	Two or more users able to access two or more data files

The fundamental problem with "many-to-many functionality" is that there is no way for one of ordinary skill in the art to determine what the two "manys" refer to. LTI's construction assumes that many-to-many refers to many users accessing many data files, but there is no support for this construction. Claim 32 is clear that the metadata facilitates the claimed "many-to-many functionality," and there is nothing in the specification to suggest that the metadata has anything to do with whether multiple different users can access multiple data files. Claims 32 depends from independent claim 23, which requires only one user and mentions no data files.

LTI relies upon the specification's examples of "one-to-many" and "many-to-one" relationships, but those examples compound the ambiguity by suggesting the "one" and the "many" refer to the number of individual users sending and/or receiving communications, not a number of data files. D.I. 179 at 12 (quoting col. 2:36-44). The "many-to-many" could just as easily refer to many applications or many workspaces. One of ordinary skill in the art is simply left guessing. The Court should therefore declare this claim invalid.

7. "Portable Wireless Device"

Claim Language	Facebook's Construction	LTI's Construction
portable wireless device (Claim 16)	device that can communicate with a computer network over a wireless communications medium	*None offered*

LTI proposes no construction of this term and argues that Facebook's proposed

construction is incorrect because it requires a wireless communication device to be able to communicate *with a computer network*. Claim 16, the only claim in which this term appears, clearly contemplates communication with a computer network when it recites "[t]he method of claim **9**, further comprising accessing *the user environment* via a portable wireless device." As discussed, *supra*, environments are computing environments. That telephonic networks are discussed in the specification and as applications in claim 30 is inapposite.

8. "Relational Storage Methodology"

Claim Language	Facebook's Construction	LTI's Construction
relational storage methodology (Claim 31)	storing items in a database based on their relationships to each other	*None offered*

This term appears only in claim 31. *See c*laim 31 ("The system of claim **23**, wherein the storage component stores the data and the metadata according to at least one of a relational and an object storage methodology."). LTI's assertion that this term does not appear in any claim is belied by the claim language itself – the claim clearly contemplates either a "relational storage methodology" or "an object storage methodology."

This term, while understandable by one of ordinary skill in the art, is unlikely to be easily understood by a lay juror. LTI does not dispute Facebook's proposed construction but instead would leave the jury with no construction for this rather technical term. This should not be allowed, and Facebook's proposed construction should be adopted.

9. "Relationship Data"

Claim Language	Facebook's Construction	LTI's Construction
relationship data (Claim 25)	information defining a connection between two or more things	*None offered*

During the meet and confer process, Facebook proposed that the term "relationship" be construed on its own. Having considered LTI's position in its brief, Facebook agrees that this term should be construed as part of the larger phrase "relationship data." Facebook's proposed construction will help the jury understand how this term is understood, and LTI has offered no alternative construction. Facebook's proposed construction should therefore be adopted.

10. "Remote Location"

Claim Language	Facebook's Construction	LTI's Construction
remote location (Claim 15)	a place different from the web-based computing platform	*None offered*

This term appears only in dependent claim 15. *See* claim 15 ("The method of claim 9, further comprising locating the user environment from *a remote location* using a URL address.") (emphasis added). LTI's only dispute with Facebook's construction is its mistaken belief that Facebook's proposed construction imports a "physical location" limitation into the term. Facebook's proposed construction does not contain any such limitation. Because LTI does not provide any alternate construction, Facebook's proposed construction should be adopted.

11. "Tagged"

Claim Language	Facebook's Construction	LTI's Construction
tagged (Claim 8)	attached	*None offered*

The term "tagged" appears only in claim 8, which recites that context information is

"*tagged* to the user-defined data via the metadata when the user-defined data is created." The word "tagged," while understandable to one of ordinary skill in the art, will not be so easily understood by a lay juror. The Court should construe this term as simply "attached." The specification consistently uses the term "tagged" in connection with the preposition "to" such that the clear meaning of the term can only be "attached." *See* col. 3:44-50. LTI has failed to offer any alternative construction of this technical term, and therefore Facebook's construction should be adopted.

12. "Updating"

Claim Language	Facebook's Construction	LTI's Construction
updating (Claims **1, 9**)	modifying existing data to make current	*None offered*

Facebook's proposed construction of "updating" is pulled directly from a dictionary used by those skilled in the art. Weinstein Decl. Ex. A ("To change a system or data file to make it more current."). There is no support, either intrinsic or extrinsic, for LTI's proposal that updating can be "creating." Facebook's proposed construction should therefore be adopted.

13. Remaining Terms

Facebook withdraws its request for construction of "user interaction," "user defined data," "indexing" "search and association criteria," "interrelated," "in response to which" and "interrelationship" at this time.

VII. CONCLUSION

Facebook respectfully requests that the Court adopt its proposed constructions.

Dated: December 23, 2009 BLANK ROME LLP

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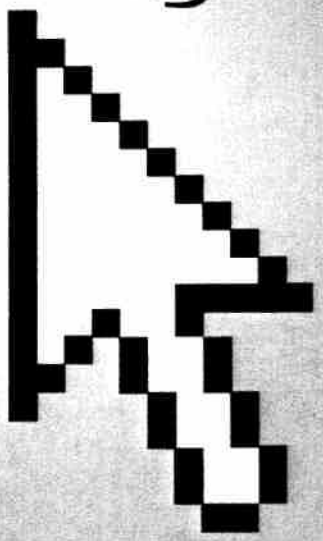
EXHIBIT A

Microsoft Computer Dictionary

Fifth Edition

- *Fully updated with the latest technologies, terms, and acronyms*
- *Easy to read, expertly illustrated*
- *Definitive coverage of hardware, software, the Internet, and more*



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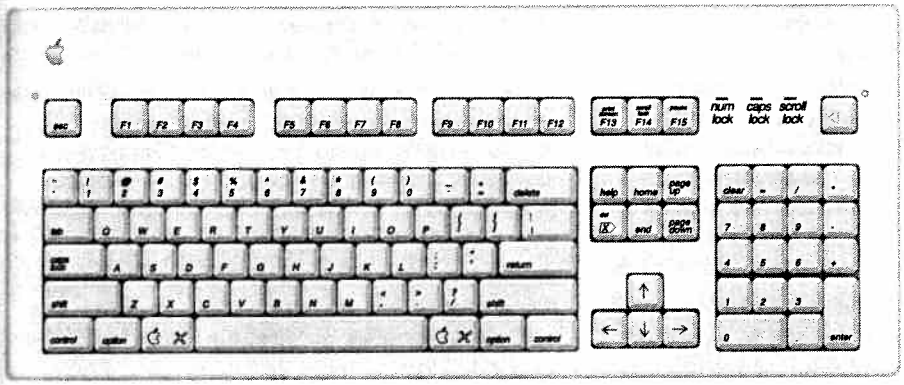


Apple Extended Keyboard.

Apple Filing Protocol *n. See* AFP.

Apple key *n.* A key on Apple keyboards labeled with an outline of the Apple logo. On the Apple Extended Keyboard, this key is the same as the Command key, which functions similarly to the Control key on IBM and compatible keyboards. It is generally used in conjunction with a character key as a shortcut to making menu selections or starting a macro.

Apple Macintosh *n. See* Macintosh.

Apple Newton *n. See* Newton.

AppleScript *n.* A script language developed by Apple Computer, Inc., for Macintosh computers running under the Mac OS to execute commands and automate functions. *See also* script.

AppleShare *n.* A file server software developed by Apple Computer, Inc., that works with the Mac OS and allows one Macintosh computer to share files with another on the same network. *See also* file server, Mac OS.

applet *n.* A program that can be downloaded over the Internet and executed on the recipient's machine. Applets are often written in the Java programming language and run within browser software, and they are typically used to customize or add interactive elements to a Web page.

AppleTalk *n.* An inexpensive local area network developed by Apple Computer, Inc., for Macintosh computers that can be used by Apple and non-Apple computers to communicate and share resources such as printers and file servers. Non-Apple computers must be equipped with AppleTalk hardware and suitable software. The network uses a layered set of protocols similar to the ISO/OSI reference model and transfers information in the form of packets called frames. AppleTalk supports connections to other AppleTalk networks through devices known as bridges, and it supports connections to dissimilar networks through devices called gateways. *See also* bridge, frame (definition 2), gateway.

AppleTalk Phase 2 *n.* The extended AppleTalk Internet model designed by Apple Computer, Inc., that supports multiple zones within a network and extended addressing capacity.

AppleWorks *n.* A suite of productivity applications, formerly known as ClarisWorks, distributed by Apple Computer, Inc., and shipped on the iMac computer. AppleWorks/ClarisWorks is an integrated product that includes support for word processing, spreadsheets, databases, drawing, painting, charting, and the Internet.

appliance *n.* **1.** *See* server appliance. **2.** *See* information appliance. **3.** A device with a single or limited purpose with functionality. This functionality is similar to a simple consumer appliance.

appliance server *n.* **1.** An inexpensive computing device used for specific tasks including Internet connectivity or file-and-print services. The server is usually easy to use but does not possess the capabilities or software of a typical server for general office use. **2.** *See* server appliance.

application *n.* A program designed to assist in the performance of a specific task, such as word processing, accounting, or inventory management. *Compare* utility.

application binary interface *n.* A set of instructions that specifies how an executable file interacts with the hardware

processor. Advantages of using an assembly language include increased execution speed and direct programmer interaction with system hardware. *See also* assembler, compiler, high-level language, low-level language, machine code.

assembly listing *n.* A file created by an assembler that includes the statements of an assembly language program, the machine language generated by the assembler, and a list of the symbols used in the program. *See also* assembler, assembly language.

assertion *n.* A Boolean statement used in a program to test a condition that, if the program is operating correctly, should always evaluate as true; otherwise the program will typically terminate with an appropriate error message. Assertions are used for debugging programs and for documenting how a program should operate.

assignment operator *n.* An operator used to assign a value to a variable or data structure. *See also* assignment statement, operator (definition 1).

assignment statement *n.* A programming language statement used to assign a value to a variable. It usually consists of three elements: an expression to be assigned, an assignment operator (typically a symbol such as = or :=), and a destination variable. On execution of the assignment statement, the expression is evaluated and the resulting value is stored in the specified destination. *See also* assignment operator, expression, variable.

associate *vb.* To inform the operating system that a particular file name extension is linked to a specific application. When a file is opened that has an extension associated with a given application, the operating system automatically starts the application and loads the file.

Association Control Service Element *n.* An Open Systems Interconnection (OSI) method to establish a call between two applications by checking the identities and contexts of the application entities and performing an authentication security check. *Acronym:* ACSE.*See also* ISO/OSI reference model.

Association for Computing Machinery *n.* A membership society founded in 1947 and devoted to the advancement of knowledge and technical proficiency of information processing professionals. *Acronym:* ACM.

Association of C and C++ Users *n.* An organization of people interested in the programming language C and its variants. Members of the association include professional programmers, manufacturers and vendors of compilers, and nonprofessional programming enthusiasts. *Acronym:* ACCU.

associative storage *n.* A memory-based storage method in which data items are accessed not on the basis of a fixed address or location but by analysis of their content. *Also called:* content-addressed storage.

associativity *n. See* operator associativity.

asterisk *n. See* *.

asymmetrical transmission *n.* A form of transmission used by high-speed modems, typically those that operate at rates of 9600 bps or more, that allows simultaneous incoming and outgoing transmission by dividing a telephone line bandwidth into two channels: one in the range of 300 to 450 bps and one at a speed of 9600 bps or more.

asymmetric digital subscriber line *n. See* ADSL.

asymmetric digital subscriber loop *n. See* ADSL.

asymmetric modem *n.* A modem that transmits data to the telephone network and receives data from the network at different speeds. Most commonly, an asymmetric modem will have a maximum download speed substantially higher than its upload speed. *See also* modem.

asynchronous *adj.* Pertaining to, being, or characteristic of something that is not dependent on timing. For example, asynchronous communications can start and stop at any time instead of having to match the timing governed by a clock.

asynchronous chip *n.* A microprocessor chip that does not need to operate in sync with a system clock. Asynchronous chip operations do not need to be timed to clock speed and draw power only when operations are in progress. This allows asynchronous chips the potential for greater computational speed and lower power consumption than traditional chips.

asynchronous communications *n.* Computer-to-computer communications in which the sending and receiving computers do not rely on timing as a means of determining where transmissions begin and end. *Compare* synchronous communications.

asynchronous device *n.* A device whose internal operations are not synchronized with the timing of any other part of the system.

asynchronous operation *n.* An operation that proceeds independently of any timing mechanism, such as a clock.

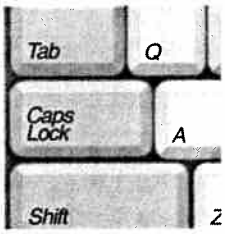
capacitance *n.* The ability to store an electric charge. Capacitance is measured in farads. A capacitance of 1 farad will hold 1 coulomb of charge at a potential of 1 volt. In practical use, a farad is an extremely large amount of capacitance; typical capacitors have values of microfarads (10^{-6}) or picofarads (10^{-12}). *See also* capacitor.

capacitor *n.* A circuit component that provides a known amount of capacitance (ability to store an electric charge). A capacitor typically consists of two conductive plates separated by an insulating (dielectric) material. If other factors remain constant, capacitance increases as the plates are made larger or brought closer together. A capacitor blocks direct current but passes alternating current to an extent that depends on its capacitance and on the frequency of the current. *See also* capacitance.

capacity *n.* The amount of information a computer or an attached device can process or store. *See also* computer.

caps *n.* Short for capital letters. *Compare* lowercase.

Caps Lock key *n.* A toggle key that, when on, shifts the alphabetic characters on the keyboard to uppercase. The Caps Lock key does not affect numbers, punctuation marks, or other symbols. See the illustration.



Caps Lock key.

capstan *n.* On a tape recorder, a polished metal post against which a turning rubber wheel (called a pinch roller) presses to move a length of magnetic tape placed between the wheel and the post. The capstan controls the speed of the tape as it moves past the recording head. *See also* pinch roller.

capture *vb.* In communications, to transfer received data into a file for archiving or later analysis.

capture board *n. See* video capture card.

capture card *n. See* video capture card.

Carbon *n.* Code name for the Application Program Interfaces (API) and shared libraries used to write applications for Macintosh OS X. Since Macintosh OS X is an entirely different system rather than an update of the previous Macintosh OS, Carbon bridges the gap between the systems, allowing developers to rewrite their programs to OS X without rewriting the code for the entire application. Carbon allows OS X native applications to run under earlier versions of the Macintosh OS without modification but with OS X advantages.

carbon copy *n. See* cc.

carbonize *vb.* To update a Macintosh application for OS X. Although older versions of Macintosh applications will run under OS X, only those that have been carbonized will be able to use OS X–specific advantages.

carbon ribbon *n.* A ribbon used with impact printers, especially daisy-wheel printers, and with typewriters for highest-quality output. A carbon ribbon is made of a thin strip of Mylar coated on one side with a carbon film. Characters printed with a carbon ribbon are extremely crisp and free from the fuzziness that can be associated with an inked cloth ribbon. *Also called:* film ribbon, Mylar ribbon. *See also* daisy-wheel printer. *Compare* cloth ribbon.

card *n.* **1.** A printed circuit board or adapter that can be plugged into a computer to provide added functionality or new capability. These cards provide specialized services, such as mouse support and modem capabilities, that are not built into the computer. *See also* adapter, board, printed circuit board. **2.** In programs such as the HyperCard hypertext program, an on-screen representation of an index card on which information can be stored and "filed" (saved) for future reference. *See also* hypertext. **3.** A manila card about 3 inches high by 7 inches long on which 80 columns of data could be entered in the form of holes punched with a keypunch machine. The punched holes corresponded to numbers, letters, and other characters and could be read by a computer that used a punched-card reader. *Also called:* punched card. *See also* card reader (definition 2).

card cage *n.* An enclosure area for holding printed circuit boards (cards). Most computers have an area with protective metal and mounting brackets where cards are installed. The term originally came from an external box that held rack-mounted cards or peripherals and resembled a cage.

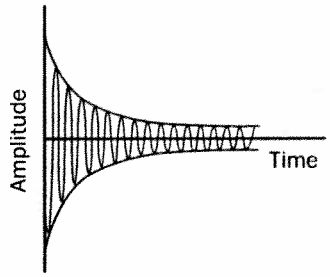
carder *n.* A person who engages in online credit card fraud. Specifically, a carder steals credit card numbers, either to purchase merchandise (often computer-related) from Web-based stores or to trade the stolen numbers with like-minded individuals—again, over the Internet. Carders

entry *n.* **1.** A unit of information treated as a whole by a computer program. **2.** The process of inputting information.

entry point *n.* A place in a program where execution can begin.

enumerated data type *n.* A data type consisting of a sequence of named values given in a particular order.

envelope *n.* **1.** In communications, a single unit of information that is grouped with other items, such as error-checking bits. **2.** The shape of a sound wave, caused by changes in amplitude. See the illustration.



Envelope.

envelope delay *n.* In communications, the difference in travel times of different frequencies in a signal. If the frequencies reach their destination at different times, signal distortion and errors can result. *Also called:* delay distortion.

environment *n.* **1.** The configuration of resources available to the user. *Environment* refers to the hardware and the operating system running on it. For example, Windows and Macintosh are called windowing environments because they are based on screen regions called windows. **2.** In microcomputing, *environment* refers to a definition of the specifications, such as command path, that a program operates in.

EOF *n. See* end-of-file (definition 1).

EOL *n.* Acronym for **e**nd **o**f **l**ine. A control (nonprinting) character that signals the end of a data line in a data file.

EOT *n. See* end-of-transmission.

EPIC *n.* **1.** Short for **E**xplicitly **P**arallel **I**nstruction **C**omputing. A technology developed jointly by Intel and Hewlett-Packard as the foundation of the 64-bit instruction set architecture incorporated in IA-64, the basis of the Merced chip. EPIC technology is designed to enable IA-64 processors to execute instructions efficiently and extremely quickly. Core elements include explicit parallelism based on software identification of instructions that the processor can execute concurrently; improved execution of branch paths; and earlier loads from memory. *See also* IA-64, Merced. **2.** Short for **E**lectronic **P**rivacy **I**nformation **C**enter. A public-interest research center based in Washington, D.C., dedicated to directing public attention toward civil liberties and online privacy related to electronic communication, cryptography, and related technologies.

epitaxial layer *n.* In semiconductors, a layer that has the same crystal orientation as the underlying layer.

EPP *n.* Acronym for **E**nhanced **P**arallel **P**ort, a high-speed port for peripheral devices other than printers and scanners—that is, for devices such as external drives. Specified in the IEEE 1284 standard, EPP describes bidirectional parallel ports that provide data throughput of 1 Mbps or more, as opposed to the 100 Kbps to 300 Kbps typical of the older, de facto standard Centronics ports. *See also* IEEE 1284, input/output port. *Compare* ECP.

EPP IEEE standard *n.* An IEEE standard relating to the Enhanced Parallel Port (EPP) protocol. This protocol was originally developed by Intel, Xircom, and Zenith Data Systems as a means to provide a high-performance parallel port link that would still be compatible with the standard parallel port. This protocol capability was implemented by Intel in the 386SL chip set (82360 I/O chip), prior to the establishment of the IEEE 1284 committee and the associated standards work. The EPP protocol offered many advantages to parallel port peripheral manufacturers and was quickly adopted by many as an optional data transfer method. A loose association of about 80 interested manufacturers was formed to develop and promote the EPP protocol. This association became the EPP Committee and was instrumental in helping to get this protocol adopted as one of the IEEE 1284 advanced modes. *See also* communications protocol, IEEE 1284, parallel port.

EPROM *n.* Acronym for **e**rasable **p**rogrammable **r**ead-**o**nly **m**emory. A nonvolatile memory chip that is programmed after it is manufactured. EPROMs can be reprogrammed by removing the protective cover from the top of the chip and exposing the chip to ultraviolet light. Though EPROMs are more expensive than PROM chips, they can be more cost-effective if many changes are required. *Also called:* reprogrammable read-only memory (RPROM). *See also* EEPROM, PROM, ROM.

.eps *n.* The file extension that identifies Encapsulated PostScript files. *See also* EPS.

from the common language runtime. *See also* managed code.

unmoderated *adj.* Of, pertaining to, or characteristic of a newsgroup or mailing list in which all articles or messages received by the server are automatically available or distributed to all subscribers. *Compare* moderated.

unmount *vb.* To remove a disk or tape from active use. *Compare* mount.

unpack *vb.* To restore packed data to its original format. *Compare* pack.

unpopulated board *n.* A circuit board whose sockets are empty. *Compare* fully populated board.

unread *adj.* **1.** Of, pertaining to, or being an article in a newsgroup that a user has not yet received. Newsreader client programs distinguish between "read" and "unread" articles for each user and download only unread articles from the server. **2.** Of, pertaining to, or being an e-mail message that a user has received but has not yet opened in an e-mail program.

unrecoverable error *n.* A fatal error—one that a program is unable to recover from without the use of external recovery techniques. *Compare* recoverable error.

unreliable protocol *n.* A communications protocol that makes a "best effort" attempt to deliver a transmission but does not provide for verifying that the transmission arrives without error.

unroll *adj. See* inline (definition 1).

unset *vb.* To make the value of a bit position equal to 0. *Compare* set (definition 1).

unshielded cable *n.* Cable that is not surrounded with a metal shield. If the wires in an unshielded cable are not at least twisted around each other in pairs, the signals they carry have no protection from interference by external electromagnetic fields. Consequently, unshielded cable should be used only over very short distances. *Compare* coaxial cable, ribbon cable, twisted-pair cable, UTP.

unshielded twisted pair *n. See* UTP.

unshielded twisted-pair wiring *n. See* UTP.

unsolicited commercial e-mail *n. See* spam.

unsubscribe *vb.* **1.** In a newsreader client program, to remove a newsgroup from the list of newsgroups to which one subscribes. *See also* newsgroup. **2.** To remove oneself as a recipient on a mailing list. *See also* mailing list.

untar[1] *n.* A utility, available for systems in addition to UNIX, for separating the individual files out of an archive assembled using the UNIX *tar* program. *Compare* tar[1].

untar[2] *vb.* To separate the individual files out of an archive assembled with the UNIX *tar* program. *Compare* tar[2].

unzip *vb.* To uncompress an archive file that has been compressed by a program such as compress, gzip, or PKZIP.

up *adj.* Functioning and available for use; used in describing computers, printers, communications lines on networks, and other such hardware.

UPC *n.* Acronym for **U**niversal **P**roduct **C**ode. A system of numbering commercial products using bar codes. A UPC consists of 12 digits: a number system character, a five-digit number assigned to the manufacturer, a five-digit product code assigned by the manufacturer, and a modulo 10 check digit. *See also* bar code.

update[1] *n.* A new release of an existing software product. A software update usually adds relatively minor new features to a product or corrects errors (bugs) found after the program was released. Updates are generally indicated by small changes in software version numbers, such as *4.0b* from *4.0*. *See also* version number. *Compare* release[1].

update[2] *vb.* To change a system or a data file to make it more current.

update query *n.* A database query that changes a set of records according to search conditions or criteria.

upflow *n.* In the data warehousing process, the stage during which stored information is checked for completeness, summarized, and readied for distribution. *See also* data warehouse[2]. *Compare* downflow, inflow, metaflow.

upgrade[1] *n.* The new or enhanced version of a product.

upgrade[2] *vb.* To change to a newer, usually more powerful or sophisticated version.

uplink *n.* The transmission link from an earth station to a communications satellite.

upload[1] *n.* **1.** In communications, the process of transferring a copy of a file from a local computer to a remote computer by means of a modem or network. **2.** The copy of the file that is being or has been transferred.

IN THE UNITED STATES COURT

FOR THE DISTRICT OF DELAWARE

LEADER TECHNOLOGIES, INC., a Delaware corporation,	)	**CIVIL ACTION**
Plaintiff and Counterdefendant,	)	**No. 1:08-cv-00862-JJF**
v.	)	
FACEBOOK, INC., a Delaware corporation,	)	
Defendant and Counterclaimant.	)	

DECLARATION OF MARK WEINSTEIN IN SUPPORT OF DEFENDANT FACEBOOK, INC.'S CLAIM CONSTRUCTION BRIEF

I, Mark Weinstein, declare:

1. I am an attorney with Cooley Godward Kronish LLP, of counsel in this action for defendant Facebook, Inc. I make this declaration in support of Facebook's Claim Construction Brief. I have personal knowledge of the facts contained within this declaration, and if called as a witness, could testify competently to the matters contained herein.

2. Attached hereto as Exhibit A is a true and correct copy of relevant sections of the *Microsoft Computer Dictionary* (5th Ed. 2002).

I declare under penalty of perjury that the foregoing is true and correct. Executed on December 23, 2009 in Palo Alto, California.

Mark Weinstein

IN THE UNITED STATES COURT

FOR THE DISTRICT OF DELAWARE

LEADER TECHNOLOGIES, INC., a Delaware corporation,	**CIVIL ACTION**
Plaintiff and Counterdefendant,	**No. 1:08-cv-00862-JJF**
v.	
FACEBOOK, INC., a Delaware corporation,	
Defendant and Counterclaimant.	

DECLARATION OF DR. SAUL GREENBERG, PH.D. IN SUPPORT OF DEFENDANT FACEBOOK, INC.'S CLAIM CONSTRUCTION BRIEF

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Palo Alto, CA 94306

Dated: December 23, 2009

I, Saul Greenberg, Ph.D, hereby declare as follows.

1. I have been retained by defendant Facebook, Inc. ("Facebook") as a consultant in connection with the above referenced case and I have been asked to provide this declaration. I have personal knowledge of the facts set forth below, and if called as a witness, could and would competently testify thereto.

2. I earned a Ph.D. in Computer Science from the University of Calgary in 1989, an M.Sc. in Computer Science from the University of Calgary in 1984, a Diploma of Education from McGill University in 1978, and a B.Sc. in Microbiology and Immunology from McGill University in 1976. My CV is attached to this Declaration as Exhibit A.

3. I am currently a Full Professor in the Department of Computer Science at the University of Calgary. I am also an Adjunct Professor in both the Department of Psychology at the University of Calgary and the Department of Computer Science at the University of Saskatchewan. I hold a joint National Science and Engineering Research Council ("NSERC") and an Informatics Circle of Research Excellence ("iCORE") Industrial Research Chair in the area of Interactive Technologies. I am very familiar with work done in the area of interactive technologies, and frequently collaborate with colleagues located in the United States and throughout the world. I also organize, attend and give presentations at international conferences, including conferences organized by the Association of Computing Machinery ("ACM").

4. I am also an expert in Computer Science and Human Computer Interaction ("HCI"). Generally speaking, HCI is a discipline that covers the requirements, design, implementation and evaluation of computational systems for human use. I have worked full time in the field of Computer Science and Human Computer Interaction since 1988, and I have studied and researched within this area full time since 1981.

5. For the purposes of this declaration, I have reviewed the following documents: (1) U.S. Patent No. 7,139,761 ("'761"); (2) Plaintiff Leader Technologies, Inc.'s Opening Claim Construction Brief ("LTI Brief"); (3) the Declaration of Giovanni Vigna in Support of Plaintiff Leader Technologies, Inc.'s Opening Claim Construction Brief ("Vigna Decln"); and (4) the file history for the '761 Patent. This declaration is based upon my review of the above documents, my knowledge of the field, and my 21+ years of experience educating and training people skilled in the art at the level described by Professor Vigna.

6. Dr. Vigna opines that the appropriate standard for one of ordinary skill in the art with regard to the '761 patent is "someone who holds a bachelors degree in computer science, computer engineering, electrical engineering, or the like," and that if such formal education was lacking that it could also be "someone who had several years of experience in the computer industry" [¶2, Vigna Decln]. For the purposes of this declaration only, I will accept Dr. Vigna's standard for one of ordinary skill in the art with regard to the '761 patent. However, it is unclear what Dr. Vigna means by "several years of experience in the computer industry," as this could include (for example) a computer sales clerk with no programming or implementation experience. For the purposes of this declaration, therefore, I will assume that Dr. Vigna means that the training received over these several years of experience is at least equivalent to a bachelors degree in Computer Science.

7. Dr. Vigna opines

> "Generally, the claims of the '761 Patent are clear and straight forward. ..."
> [¶3, Vigna Decln]

I disagree. I have thoroughly studied the '761 patent and read the specification several times. I personally found the claims of the patent very difficult to understand, and my expertise is considerably above Dr. Vigna's description of one of ordinary skill in the art. After reading and

rereading both the claims and the specification, it is my opinion is that: the claims of '761 patent are not clear and straightforward; and they would not be understandable by one skilled in the art without a construction by the court. Additional reasons are provided below.

8. Dr. Vigna then opines

> "… Most of the terminology used in the claims is used in the same manner as it is used in everyday language and is not unique to the computer industry. ..." [¶3, Vigna Decln]

I disagree. Specifically, Dr Vigna lists the following specific terms that he claims have no special meaning in computer science outside of their normal everyday use, e.g., "accesses" and "accessed" [¶5, Vigna Decln], "arrangements" [¶7, Vigna Decln], "associated", "association" and "associating" [¶8, Vigna Decln], "based on change" [¶9, Vigna Decln], "capturing" [¶10, Vigna Decln], "change in access of the user" [¶11, Vigna Decln], "created" and "create" [¶15, Vigna Decln], "employs" [¶17, Vigna Decln], "generating" [¶20, Vigna Decln], "in response to which" [¶21, Vigna Decln], "interrelated" [¶23, Vigna Decln], "interrelationship" [¶24, Vigna Decln], "locating" and "locate" " [¶25, Vigna Decln], "relationship" [¶31, Vigna Decln], "updating" " [¶37, Vigna Decln], and opines that those skilled in the art would use the everyday meaning of these terms.

9. I disagree with Dr. Vigna's opinion above, and his specific opinions regarding each of these terms. In my opinion, these terms as used in the claims have highly technical nuances that must be clearly defined if the '761 patent claims are to be understood. Both non-technical people (e.g., jury members) as well as those skilled in the art would not correctly understand the meaning and scope of these claims if they attempted to interpret the words in these claims by their meaning in everyday language. That is, the normal everyday usage of these terms is not helpful in understanding the precise meaning, scope, and limitations of the

claims as set forth in the ’761 patent. Rather, these terms do have special technical meanings as defined by the way they are described and used in the claims and specification. Specific examples will be provided shortly.

10. Dr. Vigna further opines :

> “… For the terms that are unique to the computer industry, the terms are readily understood by anyone who has a rudimentary understanding of computer science.” [¶3, Vigna Decln]

I disagree. Dr Vigna lists the following specific terms as those that he claims have a known usage in the computer science field: “application(s)” [¶6, Vigna Decln], “change information” [¶12, Vigna Decln], “context” [¶13, Vigna Decln], “context information” [¶14, Vigna Decln], “dynamically” [¶16, Vigna Decln], “environment” [¶18, Vigna Decln], “file storage pointers” [¶19, Vigna Decln], “indexing” [¶22, Vigna Decln], “metadata” [¶26, Vigna Decln], “ordering” [¶27, Vigna Decln], “ordering information” [¶28, Vigna Decln], “portable wireless device” ” [¶29, Vigna Decln], “relational storage methodology” ” [¶30, Vigna Decln], “remote location” ” [¶32, Vigna Decln], “search and association criteria” [¶33, Vigna Decln], “storage component” [¶34, Vigna Decln], “tagged” [¶35, Vigna Decln], “traversing” ” [¶36, Vigna Decln], “user interaction” ” [¶39, Vigna Decln], “user defined data” ” [¶39, Vigna Decln], “web” ” [¶40, Vigna Decln], and “workspace” ” [¶41, Vigna Decln], and opines that these terms are used in a manner which is consistent with this usage.

11. I disagree with Dr. Vigna’s opinion above, and his specific opinions regarding each of these terms. The above-listed terms as used in the ’761 claims would not be understood correctly by those with a rudimentary understanding of computer science for several reasons. First, some of these terms used in the ’761 claims would be either unfamiliar or at best vaguely understood by those skilled in the art. My opinion on this point is based on my 21 years of teaching and evaluating computer science students (seniors and graduates) who would qualify

under Dr. Vigna's definition of one of ordinary skill in the art. Second, of those terms that would be familiar to those of ordinary skill in the art, the meaning of those terms varies based on the specific system or technical implementation in question, which may differ from the system described in the '761 patent. Specific examples are provided below. The precise meaning and limitations of these terms from the '761 patent can only be understood if they are interpreted in light of the patent claims and specification.

12. The pervasive flaw throughout Dr. Vigna's declaration is that his opinions appear to be based on analyzing the terms of the '761 patent in a vacuum without regard to the '761 claims and specification in which they appear. I have been informed that, for claim construction purposes, a person of ordinary skill in the art is one who has read not just the claim term in the context of the claim in which it appears, but also in the context of the entire patent including the specification. There is nothing in Dr. Vigna's declaration to suggest any awareness of this principle, as he does not cite or discuss the specification or surrounding claim language to support his opinions.

13. Dr. Vigna's discussion of the claim term "**web**" provides an instructive example of this problem. Dr. Vigna claims that the term "web" would not be construed to include the concept of boards or workspaces. [¶40, Vigna Decln] The '761 patent, however, explicitly and unequivocally defines the term "web" in this fashion. ['761, Col. 7:58-59 ("As used herein, the term "web" refers to a collection of interrelated boards.")]. No person of ordinary skill in the art who had read the '761 specification would agree with Dr. Vigna's opinion on this issue.

14. In his declaration, Dr. Vigna opines that constructions of the specific terms as construed by Facebook are contrary to their ordinary meaning to a person of ordinary

skill in the art. His opinions typically use a variant of the phrase "the term *x* is a term which has a known usage in the computer field and would be readily understood by a person of ordinary skill." Tellingly, as to all but one of the 39 terms he discusses, Dr. Vigna *never* actually identifies this ordinary meaning or so-called "known usage." He instead opines in the negative, i.e., that whatever the meaning is, one of ordinary skill would not adopt the meaning provided by Facebook. Arguments supporting these negative opinions are rarely provided.

15. Dr. Vigna's failure to identify these so-called ordinary meanings supports my opinion that the claim terms need construction by the court if they are to be understood to a person of ordinary skill in the art. Similarly, Dr. Vigna's omission in providing arguments justifying why one of ordinary skill would not adopt Facebook's proposed constructions also support my opinion that the claim terms need construction by the court. If Dr. Vigna himself cannot define these terms, then we should not expect a person of ordinary skill in the art, let alone a lay jury, to be able to do so either. If Dr. Vigna cannot articulate his reasoning for rejecting Facebook's proposed constructions, we cannot expect a person of ordinary skill to understand why those meanings are inapplicable.

16. Examples supporting my opinions follow. I do not cover all terms here. Rather, this sampling is meant to illustrate how I arrived at the opinions above when considering all of the terms under dispute.

17. Dr. Vigna opines that the term "**accesses**" and "**accessed**" have no special meaning in computer science outside of their normal everyday use, where one of ordinary skill in the art would understand them to have their plain ordinary meaning. [¶5, Vigna Decln]. However, Dr. Vigna does not define what this ordinary meaning is, nor what a person of ordinary skill would understand this term to mean in the context of the '761 patent. Instead of

providing this meaning, Dr. Vigna opines in the negative, i.e., that Facebook's proposed construction unnecessarily limits the meaning of these terms. Facebook's proposed construction specifically addresses how one accesses or has accessed the data in question in the '761 patent, i.e., that accessing the data is distinct from uploading, adding or creating it. Now consider Dr. Vigna's specific opinions. First, he opines (without providing any reasoning) that one skilled in the art would not understand these terms to exclude uploading, adding, or creating. I disagree. In general, if computer programmers speak of "accessing" data, then they are speaking about a computational capability that allows them to read (or retrieve) existing data. Data that does not exist cannot be accessed. This meaning is consistent with the everyday meaning of "access." Thus, in my opinion, the terms "accesses [the data]" and "[the data is] accessed" exclude this act of creation, i.e., contrary to Dr. Vigna's opinion, accessing does not involve uploading, adding, or creating data, and thus is distinct from them. Second, Dr. Vigna opines that one of ordinary skill in the art would not interpret these terms to refer to "the second context" or "the second user environment," again without providing any reasoning. I disagree, as this is exactly how the terms are used in the claims. For example, Claim 1 states: "wherein the user accesses the data from the second context".

18. Dr. Vigna opines that the term "**change information**" has a known usage in the computer field and would be readily understood by a person of ordinary skill in the art. [¶12, Vigna Decln]. I disagree. The particular term "change information" does not have a known technical usage that can be readily understood. In my opinion, a person of ordinary skill in the art would first have to consider the everyday meaning of this term, and then how it is used in the specific context of the '761 patent to understand its technical meaning. The everyday meaning by itself is insufficient, for it does not define precisely what particular information defines a change,

nor does it define precisely what information is being compared in order to determine its differences from one state to another. Dr. Vigna's opinion does not provide guidance. He does not define what this usage is, nor what a person of ordinary skill would understand this term to mean in the context of the '761 patent. Turning to the '761 patent, I note that 'change information' only appears in the second element of Claim 23.

> "A computer-implemented system that facilitates management of data, comprising:
>
> a computer-implemented context component of a web-based server for defining a first user workspace of the web-based server, assigning one or more applications to the first user workspace, capturing context data associated with user interaction of a user while in the first user workspace, and for dynamically storing the context data as metadata on a storage component of the web-based server, which metadata is dynamically associated with data created in the first user workspace; and
>
> a computer-implemented tracking component of the web-based server for tracking *change information* associated with a change in access of the user from the first user workspace to a second user workspace, and dynamically storing the *change information* on the storage component as part of the metadata, wherein the user accesses the data from the second user workspace."
> ['761, Col. 23:20, emphasis added]

For one skilled in the art to understand the precise meaning of change information, one would have to deconstruct this claim in light of both elements. In particular, the first element describes a user in a first user workspace, where context data is captured when a user is interacting in a first user workspace. The second element then describes the user moving from this first user workspace to a second user workspace, i.e., "a change in access of the user from the first user workspace to a second user workspace". That is, the change in access from the first workspace to the second workspace tracks the movement from the first to the second workspace. Dr. Vigna disputes this meaning, but provides no explanation.

19. Dr. Vigna opines that the term "**dynamically**" has a known usage in the computer field and would be readily understood by a person of ordinary skill in the art. [¶16,

Vigna Decln]. Again, Dr. Vigna does not actually identify what this usage is, nor what a person of ordinary skill would understand this term to mean. He opines that Facebook's proposed construction of "dynamically" as "automatically and in response to the preceding event" would not be understood to include the concept of "in response to a preceding event," but he does not provide reasons for his opinion. I disagree with Dr. Vigna. In my opinion, the precise meaning of the term "dynamically" can only be ascertained via the '761 patent itself. There appears to be no dispute that for something to occur "dynamically," it must also occur automatically. However, this is insufficient: to understand what is meant by dynamically, we need to understand its precondition, i.e., how the automatic action is triggered. Fortunately, the '761 patent does describe what triggers this automatic activity, and this nuance is crucial in understanding what "dynamically" means within the '761 patent scope. Consider how the '761 patent describes the triggers in these particular cases.

> "As a user creates a context, or moves from one context to at least one other context, the data created and applications used previously by the user automatically follows the user to the next context. The change in user context is captured dynamically." ['761, Col. 4:1]

And again:

> "As users create and change their contexts, the data (e.g., files) and applications automatically follow, the shifts in context being captured dynamically in the context data." ['761, Col. 7:46]

That is, the dynamically captured change is triggered automatically by a preceding event, in this case the user creating or moving from one context to another. I note that this description is consistent with Facebook's construction.

20. Dr. Vigna opines that the term "**metadata**" has a known usage in the computer field and would be readily understood by a person of ordinary skill in the art. In contrast to other terms, Dr. Vigna does opine about the definition of metadata: "metadata is a

broad term for a type of data and generally refers to 'data about data'" [¶26, Vigna Decln]. He then opines that that Facebook's construction of metadata − "a stored item of information associated with a user's data that identifies at least the context, user workspace or user environment in which the user and the data currently reside" − is contrary to how one skilled in the art would understand the term, as they would not require that metadata be narrowed to the identifying information. I disagree. Dr. Vigna's broad definition is not useful if one skilled in the art is to understand the scope of the term "metadata" as used in the '761 patent.

21. Indeed, one of ordinary skill in the art would understand that the precise meaning of "metadata" depends on the particular system or implementation that employs it. For example, consider the meaning of metadata within a variety of systems. Most computational systems record very specific metadata describing the specific attributes of the data elements it stores. For primitive data, metadata may include the data's type (e.g., integer, floating point, string, object type) and its length in bits or bytes. For objects, metadata may include the various object properties and methods (including their names). For data stored as files, metadata may include its location, its creator, various dates describing when that file was created, last modified, and last accessed, and permissions for access control. For data that is a digital video file, metadata may include its title, author, summary of contents, and its length in seconds. For data as digital photographs, metadata (which is sometimes displayed to the end user on the camera or on digital photo editing software) may include the date/time the photo was created, the format (e.g., jpeg), camera settings such as aperture and exposure time, GPS information indicating where the photo was taken, and so on. What should be clear from the above examples is that Dr. Vigna's broad meaning of metadata as 'data about data' simply denotes a class; each specific instance of metadata use demands a more precise meaning if it is to be understood. Indeed, the

'761 patent does describe the specific meaning of the term "metadata" as used in all the independent claims, which is consistent with Facebook's construction. For example:

> "Data created within the board is immediately associated with the user, the user's permission level, the current workspace, any other desired workspace that the user designates, and the application. This association is captured in a form of metadata and tagged to the data being created. The metadata automatically captures the context in which the data was created as the data is being created." ['761, Col. 3:44]

Facebook's construction adds clarity and removes ambiguity of what exactly is meant by "metadata" within the context of the '761 patent, i.e., that metadata at least includes the context, user workspace or user environment in which the user and the data currently reside. Thus construction of metadata by the court is needed, as otherwise the definition of the term "metadata" as proposed by Dr. Vigna is too vague.

22. Dr. Vigna opines that the term "**ordering**" has a known usage in the computer field, and that a person of ordinary skill in the art would *not* interpret "ordering" to require "items to be placed in a fixed sequence" [¶27, Vigna Decln]. Dr. Vigna also opines that a person of ordinary skill in the art would *not* interpret "**ordering information**" to mean, within the context of this patent "data that specifies a particular path or route by which user environments must be traversed" (he gives the specific reason that one of ordinary skill would not limit the term to require user environments) [¶28, Vigna Decln] . I note that Dr. Vigna does *not* define what a person of ordinary skill would understand either of these terms to mean. Indeed, Dr. Vigna's statement seems to imply that ordering would *not* require items to be in order, which is a contradiction. I disagree with Dr. Vigna's opinion. In my opinion, "ordering" would be understood to place items in a fixed sequence. This meaning is consistent with both the everyday and technical meaning of "ordering." For example, ordering items alphabetically (whether manually or by computer) would be understood to place items in a fixed alphabetic

sequence; if there was no fixed sequence, then the items would not be considered ordered. Similar examples include organizing by size, numeric value, length, and so on. In all cases, the exact meaning of the fixed ordered sequence is provided by context, i.e., by the items being placed in order (e.g., alphabetic, numeric, etc.). Consider "ordering information" in this context. In Claim 17, the '761 patent uses the term "ordering information" within its elements as follows:

> "storing in a storage component *ordering information* related to the ordering of the two or more of the plurality of user environments; and traversing the different arrangements of the user environments with one or more of the applications based on the *ordering information* to locate the data associated with the user environments." ['761, Col.22:31].

The elements specify that this "ordering information" relates to the ordering of two or more user environments. Yet unlike numbers or alphabetic lists, no specific guidance is given by the term "ordering information" on how to order these user environments into a fixed sequence: it is unclear as to what this ordering information actually is. Thus the term "ordering information" must be construed from the surrounding description. In this case, the last element describes ordering information in a manner consistent with Facebook's construction, i.e., "data that specifies a particular path or route by which user environments must be traversed". This meaning is reaffirmed by the place in the '761 specification where ordering is specifically discussed, where the order described is of the 'boards' contained within a 'web', and that this ordering describes a particular traversal path or route through them:

> "The system facilitates the use of an array of applications that act independently of the boards from which they were launched, and those boards are capable of being ordered in a myriad of collections of relationships (i.e., webs). The applications can traverse the webs to the boards associated with the information." ['761, Col.12:67]

Construction of "ordering" and "ordering information" is warranted, as their meanings are otherwise ambiguous in light of Dr. Vigna's opinion. Without a construction by the court, the term "ordering information" would be indefinite: the '761 patent would not teach how

information is ordered, and without knowing this ordering one would not know if one has infringed.

23. Dr. Vigna opines that the term "**traversing"** does not fit Facebook's proposed construction: "navigation by the user according to a specific path or route." Yet Dr. Vigna does not define what traversing means or how it would be understood by a person of ordinary skill in the art. Instead, he only states that one of ordinary skill in the art would not understand this term to require or include the concept that a specific path or route be used. [¶36, Vigna Decln] I disagree. In Computer Science education typical of one of ordinary skill in the art, students are continually taught about traversing data structures, where traversing means following a specific path or route through that structure in a systematic way. For example, linked lists are traversed sequentially from node to node. Binary tree traversal has several very specific methods that defines the specific path or route through the tree, e.g., pre-order traversal, in-order traversal, and post-order traversal. The term "traversing" as used in claim 17 also implies that a specific path or route must be followed:

> "A computer-implemented method of managing data, comprising computer-executable acts of: generating a plurality of user environments in a web-based system; *ordering two or more of the plurality of user environments* according to different arrangements of the user environments; providing a plurality of applications for generating and processing data in the user environments, data of a user environment is dynamically associated with the user environment in metadata that corresponds to the data; creating an association of the data with a second user environment when the data is accessed from the second user environment; dynamically storing the association of the data and the second user environment in the metadata; *storing in a storage component ordering information related to the ordering of the two or more of the plurality of user environments; and traversing the different arrangements of the user environments* with one or more of the applications based on the ordering information to locate the data associated with the user environments." ['761, Claim 17, Col. 22:12]

Of special note is that the term "traversing" is used within the context of ordered user environments, i.e., that "traversing the different arrangements of the user environments"

necessarily means that one is traversing through the specific path or route as determined by the order of the user environments. Construction of "traversing" is warranted, as its meaning is otherwise ambiguous in light of Dr. Vigna's opinion.

24. Dr. Vigna opines that the term "**web**" has a known usage in the computer field and would be readily understood by a person of ordinary skill in the art. Again, he does not define what this usage is. I assume that Dr. Vigna is arguing that one skilled in the art would understand "web" as a synonym for the World Wide Web. Yet the specification of the '761 patent specifically defines and applies the term 'web' to a much different meaning.

> "As used herein, the term "web" refers to a collection of interrelated boards." ['761, Col 7:58]

I note that "board" is a construct unique to the '761 patent. Furthermore, the '761 patent *never* uses "web" synonymously with 'World Wide Web', nor does it even mention the term "World Wide Web". Rather, their description and use of the term "web" describes and defines it as a component of a workflow system.

> "…there is illustrated a system 300 employing a board 302 and a web 304 in accordance with the present invention. … Boards and *webs are used to automate workflow processes and define relationships between data and applications*." ['761, Col 7:40, emphasis added]

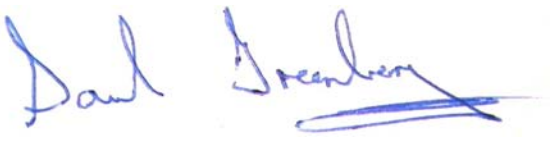
25. Dr. Vigna opines that the term "**workspace**" has a known usage in the computer field and would be readily understood by a person of ordinary skill in the art. [¶41, Vigna Decln]. I disagree. Dr. Vigna does not actually identify what this usage is, nor what a person of ordinary skill would understand this term to mean. The term "workspace" as generally understood has varied meanings in the computer field, and as such is ambiguous and thus does not have an accepted technical usage that can be readily understood. The '761 specification itself makes clear that the term "workspace" has a very specialized meaning and that the term is synonymous with the term "board." ['761, Col. 3:32-34 ("This workspace is called a board, and

is associated with a user context."); Col. 3:41-43 ("Moreover, thereafter, the user can then move to shared workspaces (or boards), and access the same data or other data.")]. As I noted earlier, the term "board" is a construct unique to the '761 patent. The specification explicitly defines "board," as "a collection of data and application functionality related to a user-defined topic." ['761, Col. 7:49-51] One of ordinary skill in art after consulting the '761 specification would also apply this definition to "workspace".

26. In addition, many of the claim terms of the '761 patent include the term "**component**," specifically "**context component**," "**tracking component**" and "**storage component**." These terms likewise do not have any ordinary or known meaning to those of ordinary skill in the art. One of ordinary skill in the art would regard the term "component" by itself as a generic term that identifies no specific or definite structure. Reading the term together with the modifying terms "context," "tracking," or "storage" provides no additional structural identification either. It is unclear whether each "component" is embodied hardware, software or some unidentified combination of hardware and software. This is consistent with the '761 specification, which defines "component" in this fashion. ['761, Col. 5:54-65]. Moreover, the specification does not disclose any algorithm for performing the functions of the context component, tracking component or storage component that are recited in the claims.

I declare under penalty of perjury that to the best of my knowledge the foregoing is true and correct as to the facts stated and my opinions as expressed.

Executed this 23rd day of December 2009.

By: 

Saul Greenberg, Ph.D.

EXHIBIT A

Curriculum Vitae

Saul Greenberg

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Contents

Last updated December 2009. Information is relatively complete, but minor errors and/or omissions may occur due to the constant stream of activities.

Executive Summary

Saul Greenberg is a Full Professor in the Department of Computer Science at the University of Calgary. He holds the NSERC/iCORE/Smart Technologies Industrial Chair in Interactive Technologies, and a University Professorship - a distinguished University of Calgary award recognizing research excellence. He received the CHCCS Achievement award in May 2007, and was also elected to the prestigious ACM CHI Academy in April 2005 for his overall contributions to the field of Human Computer Interaction.

Research Overview

While he is a computer scientist by training, the work by Saul Greenberg and his talented students typify the cross-discipline aspects of Human Computer Interaction, Computer Supported Cooperative Work, and Ubiquitous Computing. His many research contributions are bound by the common thread of situated interaction, which considers how computer technology fits within the fabric of people's day to day activities. This includes how such technology blends naturally in the flow of people's work practices, how people socialize and work together through technology, and how that technology fits within people's physical environment. He and his crew are well known for various significant contributions to the field, all necessary to pursue the broad goal of situated interaction:

- Articulation of design-oriented social science theories that serve as a requirements specification.
- Innovative and seminal system designs based on observations of social phenomenon.
- Toolkits enabling rapid prototyping of innovative groupware and ubiquitous appliances.
- Refinement of evaluation methods.

Education

- PhD Computer Science, 1989, The University of Calgary
- MSc Computer Science, 1984, The University of Calgary
- Diploma of Education, 1978, McGill University
- BSc Microbiology and Immunology, 1976, McGill University

Appointments and Employment

- Full Professor in Computer Science, University of Calgary
- Adjunct Professor / Scientist in Dept Psychology (Calgary), Dept Computer Science (Saskatchewan) and TRLabs (Calgary)
- Independent consultant applying Human Computer Interaction to contract work (1989 - present)
- Course instructor in Continuing Education, University of Calgary, Many times since 1991
- Researcher (post-doctorate position), Alberta Research Council, 1988-1990
- Software designer and research assistant at various times
- Teacher for High School and Wilderness School, Montreal, 1978-1980

Publications

Dr. Greenberg is listed as the 5th most frequent author in the HCI Bibliography, and his uncorrected H-number is 51 according to Harzing's Publish or Perish.

15 books, 37 articles in refereed journals, 98 refereed full conference papers, 31 fully refereed videos, 35 refereed short conference papers, 17 refereed or invited book chapters (excludes reprints), 5 edited journals/proceedings/video proceedings, 15 other invited publications, 22 refereed/invited workshops, 52 non-refereed publications, 27 theses, and 25 independent papers produced by people under my supervision.

Teaching and Supervision

Dr. Greenberg teaches undergraduate and graduate courses in the Department of Computer Science. As an independent consultant, he has also taught external courses for continuing education and for industry. He has received a teaching award, and has been nominated twice for other awards. Student evaluations consistently rate him as well above our department's norm.

He currently supervises 7 graduate students (including a visiting student), 1 post-doctorate fellow, and 1 research associate. He has supervised 4 Postdoctoral Fellows, 4 PhD, and 20 MSc students to successful conclusions. He regularly participates as an advisor and/or an examiner in PhD supervisory committees, thesis defences, candidacy examinations and PhD transfer committees.

Major Recent Grants

Dr. Greenberg holds a joint NSERC/iCORE Research Chair worth $2,000,000 (Fall 2006 - 2011), an NSERC Discovery Grant worth almost $50,000 yearly, and was a theme leader of the recently completed $5,500,000 NSERC NECTAR Research Networks Grant. He is also a member of the recently awarded $5,000,000 / 5 year SURFNET NSERC Strategic Network Grant (beginning 2010). Various industries have funded his research in the past, e.g., Smart Technologies, Inc., Microsoft Research, and Intel.

Major Service Roles

Academic

- Editorial board member for the International Journal of Human Computer Studies and the CSCW Journal
- Extensive affiliation with ACM SIGCHI Conference on Human Factors in Computing Systems, including Papers Chair, Associate Chair of the technical papers program committee (several times), regular member of the technical papers and video review committee, member of the Doctorial Colloquium
- Extensive affiliation with ACM CSCW Conference on Computer Supported Cooperative Work, including: Program Co-Chair (twice), Associate Chair of the technical papers program committee (several times); and Co-chair and Chair of the video program committee.
- Served on technical program committees for many other conferences
- Refereed for many well known journals related to Human Computer Interaction

Grants

- Panel member of the EPSCRC International Review of ICT in the UK (2006-2007)
- Chaired the NSERC GSC-330 Grant Selection Committee, 2002 - 2003

University

- Associate Department Head / Graduate Director, 2003-2006
- Co-chair, Ethics Committee Faculty of Science / Management, 1997 - 2005
- Member, myriads of other committees over time

Brief Bio / Research Overview

Saul Greenberg is a Full Professor in the Department of Computer Science at the University of Calgary. He holds the NSERC/iCORE/Smart Technologies Industrial Chair in Interactive Technologies, and a University Professorship - a distinguished University of Calgary award recognizing research excellence. He received the CHCCS Achievement award in May 2007, and was also elected to the prestigious ACM CHI Academy in April 2005 for his overall contributions to the field of Human Computer Interaction.

While he is a computer scientist by training, the work by Saul Greenberg and his talented students typify the cross-discipline aspects of Human Computer Interaction, Computer Supported Cooperative Work, and Ubiquitous Computing. His many research contributions are bound by the common thread of *situated interaction*, which considers how computer technology fits within the fabric of people's day to day activities. This includes how such technology blends naturally in the flow of people's work practices, how people socialize and work together through technology, and how that technology fits within people's physical environment.

Dr. Greenberg is a prolific author (he is listed as the 5th most frequent author in the HCI Bibliography) with a high impact factor (his uncorrected H-number is 51 according to Harzing's Publish or Perish). He and his crew are well known for various significant contributions to the field, all necessary to pursue the broad goal of situated interaction.

- **Articulation of design-oriented social science theories** that serve as a requirements specification. For example, his team's work on the nuances of awareness in distributed groupware has been used extensively by others as the theoretical foundation behind their work.

- **Innovative and seminal system designs** based on observations of social phenomenon. For example, his team's work on digital surfaces (large, interactive digital wall and tables) led to the notion of mixed-presence groupware that let multiple co-located groups work with each other across distance. Another example is the commercialized Teamrooms system, and the later Notification Collage and Community Bar systems; these developed notions of room metaphors and of sidebars as a means to allow a group to stay aware of each other and easily move into real-time interaction.

- **Toolkits enabling rapid prototyping of innovative groupware and ubiquitous appliances**. For example, Phidgets are a hardware/software toolkit that lets designers rapidly build computer-controlled physical interfaces. They have been commercialized, and have become the de-facto standard for teaching and for prototyping such systems. Earlier, the Groupkit groupware toolkit was the first such system that allowed developers to rapidly create and experiment with distributed groupware.

- **Refinement of evaluation methods**, where a plethora of methods have been developed to help researchers and developers rapidly evaluate the systems they were building. Examples include discount usability methods specific to groupware, and debates about the limits of usability evaluation as a testing method.

Dr. Greenberg is also known for his strong commitment in making his tools, systems, and educational material readily available to other researchers and educators.

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Education

Ph.D. (Computer Science)

University of Calgary
Department of Computer Science / Faculty of Science

- Dissertation: Tool use, reuse and organization in command-driven interfaces
- Supervisor: Dr. Ian H. Witten
- May, 1989

M.Sc. (Computer Science)

University of Calgary
Department of Computer Science / Faculty of Science

- Thesis: User modeling in interactive computer systems
- Supervisor: Dr. Ian H. Witten
- May, 1984

Diploma of Education

McGill University
Faculty of Education

- April, 1978

B.Sc. (Microbiology & Immunology)

McGill University
Faculty of Science

- April, 1976

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Appointments and Employment

Current

Full professor
Department of Computer Science
University of Calgary, Calgary, Canada
- 1997 - present: Full professor
- 1993 - 1997: Associate professor
- 1990 - 1993: Assistant professor
- 1989 - 1990: Adjunct professor

Independent consultant
Saul Greenberg Consulting
709 Larch Place, Canmore, Canada
- consulting, contract projects and staff training in areas related to interactive technologies
- 1989 - present

Adjunct professor
Department of Psychology
University of Calgary, Calgary, Canada
- 1998 - June 30, 2010

Adjunct professor
Department of Computer Science
University of Saskatoon, Saskatoon, Canada
- 1999 - 2009

Adjunct scientist
TR Laboratories
Calgary, AB Canada
- 2001 – present

Past

Senior artist / researcher
Media & Visual Arts Department
Human Centered Interface Project-ASRA & Code Zebra project
Banff Center, Banff, Canada
- 2002-2004

Visiting professor
Universite du Paris-Sud
Orsay, France
- 2003 (October)

Visiting professor
Faculty of Technology
Middlesex University, London, UK
- 1996 - 2002

Course instructor
Faculty of Continuing Education
University of Calgary, Calgary, Canada
- 1991-1998 (occasional)
- taught various courses in telecommunication and graphical user interface design

Industrial researcher
Head of the Learning and Collaboration Group
Alberta Research Council
6815 8 St NE, Calgary, Canada
- 1988-1990

- Held as part of NSERC Post-doctorate research grant
- Responsibilities included establishing a working foundation in collaboration technologies; exploring fundamental research issues and the design of computer systems that support collaborative work; and technology transfer of collaboration technologies to industry. The position was partially funded by an NSERC Industrial Research Fellowship.

Sessional instructor Department of Computer Science
University of Calgary, Calgary, Canada
- winter, 1990

Instructor Advanced Programming Techniques for the Knowledge Engineering Project
University of Calgary, Calgary, Canada
- July 1987

Research associate For various people, departments, and projects
- 1980-1989
- many duties, mostly including software design

Teacher For a regular high school and for a wilderness school for juvenile delinquents.
- 1978-1980

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Teaching and Supervision

I teach undergraduate and graduate courses in the Department of Computer Science. As an independent consultant, I have also taught external courses for continuing education and for industry. I have received a teaching award, and have been nominated twice for other awards. Student evaluations consistently rate me as well above our department's norm.

I currently supervise 7 graduate students (including a visiting student), 1 post-doctorate fellow, and 1 research associate. I have supervised 4 Postdoctoral Fellows, 4 PhD, and 20 MSc students to successful conclusions. I regularly supervise a good number of graduate students and research employees. I regularly participate as an advisor and/or an examiner in PhD supervisory committees, thesis defences, candidacy examinations and PhD transfer committees.

Teaching Awards

- 1997 Faculty of Science Award of Excellence in Teaching "for consistently outstanding contributions in teaching"
- 1996 Graduate Teaching Award: Honourable Mention. Presented by GSA Graduate Student Association.

Student Surveys

- Received 7 / 7 and 6.7 /7 ratings for overall instructions for two undergraduate courses taught in 2002.

Courses Taught

Undergraduate

- CPSC 441 Computer communications
- CPSC 481 Human computer interaction I
- CPSC 502 Honors project supervised many students
- CPSC 547 Technology of office information
- CPSC 581 Human computer interaction II
- CPSC 503 Honours Project (as project Advisor / Examiner)
- COOP 511 Student COOP Internship (as overall Advisor / Grader)
- INTERN 503 Student Internship (as overall Advisor / Grader)
- Other courses: numerous guest lectures

Graduate

- CPSC 601.13 Computer supported cooperative work
- CPSC 601.48 Heuristic evaluation
- CPSC 601.56a Media spaces and casual interaction
- CPSC 601.56b Physical user interfaces
- CPSC 681 Research methods in human computer interaction
- CPSC 699 Research methodologies in computer science
- CPSC 701.81 Ubiquitous, Domestic and Tangible Computing
- CPSC 781 Computer Supported Cooperative Work
- SENG 609.05 Graphical user interfaces: design and usability
- SENG 609.06 Special topics in human computer interaction: Real time groupware
- COSC 814: Computer supported cooperative work at the University of Canterbury, NZ with Dr. A. Cockburn
- Other courses: numerous guest lectures

Continuing Education

- Graphical User Interfaces (GUIs): Design and Usability
  taught through the Faculty of Continuing Education and through Saul Greenberg Consulting
- Data Communications: Technical Aspects

taught through the Faculty of Continuing Education

Current Graduate Student and Other Supervision

Postdocs and Research Associates
- Miguel Nacenta, since April 2009
- Roberto Diaz, RA

PhD Students
- Marquardt, Nicolai, PDF, since fall 2008

MSc Students
- Au Yeung, Tim since winter 2007
- Bertram, Dane since fall 2007
- He, Helen since fall 2007 (co-supervised)
- Saulnier, Paul since 2009 (co-supervised)
- Sun, Yibo since fall 2007
- Wang, Miaosen, since fall 2009

Visiting Students
- Till Ballendat, LMU, Munich, since October 2009

Completed Graduate Student and Other Supervision

Postdocs and Research Associates
- Stephen Voida, PDF, December 2007 - October 2009
- Amy Voida, PDF, December 2007 - October 2009
- Carman Neustaedter, PDF (2007) - now a Researcher, Kodak Research
- Jeremy Birnholtz, PDF co-supervision (2007) - now a Professor
- Mark Watson, Research Associate (2007)
- Chester Fitchett, Research Assistant (2002) - now CEO of Phidgets, Inc.

PhD Students
- Edward Tse (2007), now an Alberta Ingenuity Industrial Researcher, SMART Technologies, Inc.
- Carman Neustaedter (2007) - Researcher (Kodak research)
- Michael Boyle (2005)- now a Software Developer, SMART Technologies, Inc.
- Carl Gutwin (1997) - now a Tier II Chair, Assoc. Prof, U. Saskatchewan

MSc Students
- Rob Diaz-Marino (2008)
- Michael Nunes (2008)
- Kimberly Tee (2007) - now a Usability Engineer, SMART Technologies, Inc.
- Stephanie Smale (2007)
- Katherine Elliot (2006) - now an Interaction Designer, SMART Technologies, Inc.
- Gregor McEwan (2006) - now a Researcher, National ICT, Australia
- Edward Tse (2005) - continued to PhD
- Anthony Tang (2005) - continued to PhD
- Michael Rounding (2004) - now an Interaction Designer, SMART Technologies, Inc.
- Carman Neustaedter (2003) - - continued to PhD
- Charlotte Tang (2003) - continued to PhD
- Chester Fitchett (incomplete, 2002) - Founder and President, Phidgets Inc., Calgary
- James Tam (2002) - now an Instructor II, University of Calgary
- Kevin Baker (2002) - Human Factors Engineer, Greenley and Associates
- Sean Kaasten (2001) - Interaction Designer (various: General Dynamics Calgary, Microsoft)
- Donald Cox (1998) - Usability engineer (various: IBM Canada, In Context)
- Theodore O'Grady (1996) - Systems architect (various: Teamwave Software Ltd)

- Linda Tauscher (1996) - Director, NetStart Consulting
- Douglas Schaffer (1995) - Quality Assurance Leader, Schlumberger/Merak
- Mark Roseman (1993) - Founder and chief technology officer, TeamWave Software Ltd which has since been bought out by Sonexis Inc (Boston).

Research Assistants and Interns

- Numerous, ranging from current undergraduates hired for part-time work, to graduates in a temporary but full time capacity, to post-graduates.
- e.g., Rob Diaz-Marino, Eileah Trotter, Zin Wang, Mark Watson, Anand Agarawala, Brian de Alwis, Ralph Bohnet, etc.
- NSERC USRA: Edward Tse (2001, 2002), Katherine Elliot (2003), Charlotte Tang (2001)

Student Research Visitors and Interns

- Numerous, ranging from current undergraduates hired for part-time work, to graduates in a temporary but full time capacity. Most visits range from a month to up to a year.
- e.g., Till Ballendat (2009, LMU, Munich), Ricardo Jota (2009), Jason Alexander (2008, PhD, U Canterbury),

Graduate Committee and Examiner Involvement

Excludes students I supervise directly. This is a partial list

PhD Committees

- J. Young, PhD candidacy committee, Computer Science, Dec 2008
- R. Holmes, PhD examination committee, Computer Science, 2008
- T. Apted, PhD examination committee, School of Information Technology, University of Sydney, Nov. 2008
- M. Dork, PhD transfer committee, 2008
- R. Holmes, PhD supervisory committee/examiner, Computer Science, 2005-2008
- S. Junuzovic, PhD supervisory committee, Univ. North Carolina, 2008 -
- G. Ramos, PhD examination committee, University of Toronto, 2007
- N. Romero, PhD supervisory committee/examiner, Univ. TU/e - Tech. Univ. Eindhoven, Netherlands, 2007-08
- U. Heinrich, PhD supervisory committee, Computer Science, 2007 -
- P. Neumann, PhD supervisory committee, Computer Science, 2006 -
- J. Eagan, PhD supervisory committee/examiner, Computer Science, Georgia Inst. Technology, 2005-08
- N. Roussel, Habilitation appraiser, Univ. du Paris Sud, France, 2007
- N. Nova, PhD thesis examiner, Ecole Polytechnique Federale de Lausanne, Switzerland, 2007
- R. Holmes PhD supervisory committee, Computer Science, 2006
- C. Tang, PhD supervisory committte, Computer Science, 2006
- M. Hancock, PhD supervisory committee, Computer Science, 2006 -
- J. Young, PhD supervisory committee, Computer Science, 2006 -
- C. Latulipe, PhD examination committee, Computer Science, U. Waterloo, 2006
- G. Phillip, PhD examination committee, Computer Science, Queens U., 2006
- M. Hong Tran, PhD examination committee, Computer Science, 2006
- S. Scott, PhD examination and supervisory committee, Computer Science, 2005
- A. L. Moran y Solares, PhD examination committee, Computer Science, 2005
- J. Rowan, PhD supervisory committee, Georgia Tech, Computer Science 2003-
- G. Ho, PhD examination and supervisory committee, Psychology 2005
- C. Smith, PhD candidacy committee, Computer Science 2004
- J. McGrenere, PhD examination committee, U Toronto 2002
- R. Flores-Mendez, PhD supervisory committee, Computer Science 2002
- X. Liang, PhD supervisory examination committee / examiner, Computer Science 2002
- P. Boechler, PhD thesis examiner, Psychology, University of Alberta 2002
- A. Wei Tien, PhD external examiner, Information Technology, Bond University (Australia), 2000
- R. Kremer, PhD supervisory committee / examiner, Computer Science 1997
- B. Harrision, PhD thesis examiner, Industrial Engineering, University of Toronto,

1996
- Y. Leung, PhD thesis examiner, Computer Science, Massey University (NZ), 1995
- L. Chen, PhD candidacy examiner, Computer Science, 1995
- Y. Sun, PhD thesis examiner, Computer Science, University of Alberta, 1994
- M. Hammel, PhD candidacy examiner, Computer Science, 1993
- Y. Liu, PhD candidacy examiner, Computer Science, 1993
- S. Branskat, PhD supervisory and transfer committee, Computer Science 1993
- K. Ferguson, PhD candidacy examiner, Computer Science, 1992

MSc Committees

- C. Guo, MSc Examiner, Computer Science, 2008
- D. Polanski, MDP committe member and thesis examiner, EVDS, 2007
- C. Hudson, MSc thesis examiner, Psychology, 2007
- J. Stromer, MSc thesis examiner, Psychology, 2007
- S. Chisholm, MSc thesis examiner, Psychology, 2006
- D. Polanski, MDP committee, EVDS, 2006
- M. Gong, MSc thesis, Computer Science, 2003
- G. Lu MSc thesis examiner, Computer Science, 2000
- R. McCuaig MDP committee member, EVDS, 1998
- B. Johnson MA thesis examiner, Psychology, 1998
- J. Chugh MA thesis examiner, Psychology, 1998
- A. Guy MSc thesis examiner, Computer Science, 1998
- D. Herlea MSc thesis examiner, Computer Science, 1997
- K. Hotz PhD thesis examiner, Computer Science, University of Manitoba, 1996
- E. Pedro MDP thesis examiner, Environmental Designs, 1996
- S. Chander MSc incomplete
- S. Brandenburg MSc incomplete, 1996
- E. Lowe MSc thesis examiner, Computer Science, 1994.
- C. Wang MSc thesis examiner, Computer Science, 1993
- C. Schock MSc thesis examiner, Computer Science, 1993
- M. Sharp MSc thesis examiner, Computer Science, 1992
- C. Dong MSc interim supervisor,
- B. Olson MBA thesis examiner, MIS, 1992
- N. Malcom MSc thesis examiner, Computer Science, 1991
- D. Freedman MSc thesis examiner, Computer Science, 1991
- L. Mercer MSc thesis examiner, Computer Science, University of Regina, 1991

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External Presentations

This is a partial list. Presentations associated with conference publications are not listed, and some presentations are not noted.

Plenary / Keynote talks

- CLIHC & LA-Web Joint Latin American Conf. On HCI and Latin Web Congress, Nov. 2009
- HCI Educators, March 2007
- Interaaction, 2006
- ACM UIST Conference (Survey), 2004
- Australasian User Interface Conference (AUIC), 2004
- CRIWG Conference on Groupware, 2003
- Graphics Interface, May, 2002
- Engineering for Human-Computer Interaction, May 2001
- MICON Conference (Mitel), August 2001
- Microsoft Research Summit, 2001
- Groups collaborating on computers: Perspectives from Social Psychology and Computer Science (Switzerland), 2000
- Australian Conference on Human Computer Interaction (OZCHI), 1996, 1999
- NEC Symposium on Human-Centric Multimedia, August 1998
- Brazilian Symposium on Computers in Education 97

University Departmental Seminars

- MIT Massachusetts Institute of Technology, Computer Science and AI Laboratory, December 2008
- University of Washington, Distinguished Lecture Series, January 2007
- University of Avairo, Portugal, 2007
- University of Lisbon Portugal, 2007
- University of British Columbia, Distinguished Lecture Series in Computer Science, 2003
- University du Paris-Sud, France, 2003
- University of Michigan, School of Information, February, 1999.
- University of Calgary, Department of Psychology (Brown Bag Seminar), Spring 1998.
- University of York, Department of Computer Science, Spring 1996
- University of Calgary, President's 1996 Celebration of Excellence, 1996
- University of Waikato (NZ), Department of Computer Science, Winter, January and June 1995.
- University of Canterbury (NZ), Department of Computer Science, March and June 1995.
- University of Otago (NZ), Department of Computer Science, May 1995.
- Massey University (NZ) , Department of Computer Science, April 1995
- Lincoln University (NZ) , Department of Computer Science, April 1995
- University of British Columbia, Faculty of Commerce, Summer, 1994.
- Simon Fraser University, Department of Computer Science, Summer, 1994
- Brigham Young University, Utah, Spring, 1994.
- University of Guelph, Department of Computer Science, Summer 1994 and Winter 1990.
- York University (UK), Fall 1991.
- University of Toronto, Dynamics Graphics Group, Winter 1990.

Panels, Workshops, Demonstrations and other Academic Events

Excludes conference paper presentations

- CLIHC & LA-Web Joint Latin American Conf. On HCI and Latin Web Congress panel on Social & Cultural Issues in Web and HCI, November 2009

- ACM UIST Panel on Evaluating User Interface Systems Research, November 2007
- Cadius – Professional Group on Human Computer Interaction (Madrid, Spain), 2006
- Microsoft Research Seminar Series, 2001
- ACM CAPCHI Special Interest Group (Ottawa), 2001
- Introduction to Douglas Engelbart's ACM Turing Award Presentation, ACM CSCW Conference, November, 1998
- Workshop on Handheld CSCW, November, 1998
- Banff New Media Institute - many times e.g.:
    - Intimate Technologies / Dangerous Zones, April 2002
    - Banff Human Generosity Project, 2001
    - Living Architectures: Designing for Immersion and Interaction, 2000
    - Curating and Conserving New Media at the Symposium, May 1998
    - Out of the Box Symposium, September, 1998 (Invited Speaker)
- ACM CHI'97 Workshop on Awareness in Collaborative Systems, Spring, 1997
- CSCL Panel on Computer Supported Cooperative Work and Learning, Indiana, Fall 1995.
- Formal Demonstrations at CSCW 1994 and CSCW 1992.
- CSCW Workshop on Group Drawing and Writing Tools, Toronto, Fall 1992.
- CHI Workshop on HCI and Users with Special Needs, New Orleans 1991.
- ECSCW Implementor's Workshop on CSCW Applications, Amsterdam, 1991.

Industrial Seminars / Professional Groups

- Smart Technologies
- Metso Automation
- Smart Developers Conference, February 2002
- Microsoft Research Summit, August 2001
- Microsoft Research, Winter 2002
- Microsoft Research, March, 1999
- Chevron Laboratories, La Habra, USA, August 1998
- Intel Research Workshop, Intel Corporation, Portland USA, February, 1997
- NorTel (Northern Telecom), Ottawa, February, 1997
- Intel Architecture Group, Intel Corporation, Portland USA, Spring, 1996
- NorTel (Northern Telecom), Ottawa, Spring, 1996
- Smart Technologies, Calgary, 1998 and 1996
- Intel Architecture Group, Intel Corporation, Summer, 1994
- Palliser District Convention, Alberta Teacher's Association, 1992. ~300 people
- Convention '91: Calgary City Teachers Convention, Calgary, Winter 1991.
- CASS/Alberta Education Zone 5 Summer Workshop '91, Fairmont, BC. 1991.
- Alberta Telecommunications Research Centre, Fall 1990.
- Alberta Research Council, 1988 and 1989

Community Presentations

- Radio interviewe for CBC national program SPARK (various times)
- Radio interviewe for CBC provincial program The Eye Opener (various times)
    - Shad Valley Summer Computer Program, 1991, 1992, 1998.

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Major Awards and Grants

Individual Awards of Distinction

NSERC/iCore/SMART Industrial Co-Chair in Interactive Technologies
- Awarded to the Greenberg/Carpendale team, 2006-2012 (see below)

CHCCS Achievement Award
- For his overall contributions to the field of Human Computer Interaction
- May 2007

CHI Academy
- Elected to the ACM CHI Academy for his overall contributions to the field of Human Computer Interaction
- April, 2005

University Professorship
- Endowed Program
- University of Calgary award for excellence in research
- 2006 - 2011, $145,000 over 5 years (~24,000/year)

Current Individual Grants

NSERC Discovery Grant
- An Embodied Groupware Environment
- 248,500 total over 5 years, 2004-2009 ($49,700 / year)

University Professorship
- University of Calgary
- $129,000 (26,000 / year for 5 years)
- 2006 - 2011

Current Shared Grants

iCORE / Smart Technologies Chair in Interactive Technologies
NSERC / Smart Technologies Chair in Interactive Technologies
- iCORE Industrial Chair Establishments Grant
- NSERC Industrial Research Chairs Program
- $2,000,000 over 5 years (50%), Fall 2006 - Summer 2012 (400,000 / year (50%))

NSERC Strategic Networks Grant
- Digital Surface Software Application Network (SURFNET)
- Frank Maurer PI + 12 others
- $5,000,000 + industrial contributions over 5 years (~5%), March 1 2010 - 2015

Past Individual Grants

NSERC Operating Grants

- $200,200 total over 5 years (1998-2003), $40,425 / year (99-03) and $38,500 / year (1998)
- $60,000 total over 3 years (1994-1998), $20,000/ year
- $60,000 total over 3 years (1991-1994), $20,000/year
- $11,896 total over 1 year (1990)

NSERC Research Tools and Instruments Grant
- Input and Object Tracking for Large Displays, Domestic Environments, and Robotic Interfaces
- $90,747.
- Saul Greenberg, PI., with Sheelagh Carpendale and Ehud Sharlin
- April 1, 2007 - March 21, 2008

NSERC Equipment Grant
- $84,947 (2003-2004): An embodied groupware environment
- $44,624 (1998-1999): A usability laboratory
- $49,726 (1991-1992), with I. Witten PI

Mitsubishi Electric Research Laboratories (MERL)
- $1852. unrestricted one-time gift

TR Laboratories, Canada
- $36,000 in student scholarships ($24,000 in 2004, 12,000 in 2005)

Microsoft Research
- $235,000 (approx value in CDN)
- (US25K in 2001; US50K + ~20K Equipment/Software in 2000; US58K in 1999)

Microsoft Inc
- Project Neptune Shell Group
- $74,000 for 1999 ($45K US)

Intel Research Council Grant
- $US 195,000 total over 3 years, 1995-1998; $US 65,000/year, renewed on an annual basis
- ~$US 30,000 of equipment

Equipment Donations by Industry
- **SMART Technologies, Inc.**: Two Plasma Overlay Enhancements (4-camera) (2005) - Value ~$9,000. LightRaise (2002) and 72" Rear Projection Smart Board (1998) - Value ~$26,000.
- **Mitshubishi Research Laboratories (MERL) USA**: Two DiamondTouch displays (2002 and 2003), Value ~$16,000 (5K US each)
- **3Com**: Several Palm Pilots, Value ~$1,200. (~2000)

STEP Grant
- ~$3,000 (partial funding for Summer Student), May 1 - August 31, 1998

Summer Career Placement (SCP 2000)
- $2,380 (partial funding for Summer Student), Human Resources Canada

The University of Calgary Faculty of Science Research Fellowship
- Teaching and service relief for one semester, September to December, 1996

The University of Canterbury Erskine Fellowship
- NZ 11,000 plus travel grant for ~$NZ 4,600, March-May, 1995

University of Calgary Starter Grant
- $4,000, 1990

Past Shared Grants

NSERC Research Networks Grant
- Network for Effective Collaboration Technologies Thorugh Advanced Research
- Smart Technologies and Microsoft Research as Major Industrial Sponsors
- $5,500,000 over 5 years (10%), 2004 - 2009 ($1,100,000 / year (~10%))

Innovation and Science Research Investments Program (ASRA & AIS)
- PACE: Prototyping Advanced Collaborative Environments
- Hewitt (PI), Greenberg, Montgomerie, Anderson, Bruno, Finley, Bosch.
- 250,000 over 2 years (10%), 2003 - 2004 (125,000 / year)

Alberta Software Engineering Consortium
- Alberta Science and Research Authority (ASRA)
- Paul Sorenson P.I.
- $1,800,000 over 3 years (6%) 2000-2002, ($600,000 each year)

TeleLearning Institute Pilot Study
- Office of Learning Technologies (Ontario, Canada) with Tom Carey (PI) and others
- $95,000 (4.7%), 1997 - 1998

NSERC Infrastructure Grant
- $198,000 over 3 years, 1994 - 1997, B. Gaines (PI)
- $279,303 over 3 years, 1991 - 1994, I. Witten (PI)

NSERC Strategic Operating Grant
- $360,000 over three years, 1992 - 1995, R. Baecker (PI)

NSERC Strategic Equipment Grant, (with R. Baecker and others) - University of Toronto,
- $93,101, 1992, R. Baecker (PI)

Other Awards, Grants and Scholarships Prior to Joining University of Calgary Faculty

- NSERC Industrial Research Fellowship (Postdoctorate), $24,000/year for two years, 1989-1990
- Honorary Izaak Walton Killam Scholarship, 1988
- Province of Alberta Graduate Fellowship, 1987
- NSERC Postgraduate Scholarship, $11,600/year for three years, 1984-1986

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Academic Service

This is a partial list of my academic service over the years. Aside from my formal roles (some of them providing considerable service), I typically review about 50-70 papers per year. I also satisfy about 40-70 letters of appraisal per year, ranging from tenure and faculty promotion applications, to award nominations, to grant applications, and to faculty job applications.

Grant committees

- EPSCR International Review of ICT Research within the UK
  2006-2007: Panel member

- NSERC National Science and Engineering Research Council
  2005: Chair, NSERC Industrial Chair Review Committee
  2002-2003: Chair, Computing & Information Sciences Committee GSC-330
  2001-2002: Member, Computing & Information Sciences Committee GSC-330
  every year since 1992: Referee, operating grants

- Member, Scientific Advisory Board, NSERC Nectar Research Networks Grant (2004 - 2008)

- Refereed grants for:
  New Zealand FRC (various years)
  United Kingdom EPSRC/ESRC (various years)
  NATO (1993)

Journal affiliations

- ACM Transactions on Computer-Human Interaction, ACM Press
  Associate Editor, editorial board 2009 -

- International Journal of Human Computer Studies, Academic Press
  Member, advisory board since 2009
  Associate Editor, editorial board 1988 - 2009

- Journal of Computer Supported Cooperative Work, Klewar Press
  Member, editorial board since its conception.
  Member, advisory board since its conception.

- Cognitive Technologies Journal (PMI)
  Member, editorial board since 1998

- Chair, ACM TOCHI Editor Selection Committee
  Formed a committee to solicit, interview and recommend to serve as the new Editor in Chief for ACM TOCHI journal (2003)

- SIGCHI Publications Board
  Former member, (~1998 - 2006)

- Canadian Artificial Intelligence
  Past section editor (1989).

Journal refereeing

- AACE Webnet '97 World Conference of the WWW, Internet, and Intranet

- ACM Computing Surveys
- ACM TOCHI Transactions on Computer Human Interaction
- ACM TOIS Transactions on Information Systems
- Applied Ergonomics
- Automated Software Engineering Journal
- Behaviour and Information Technology
- Computers and Industrial Engineering: An International Journal
- Computing Surveys
- Distributed Systems Engineering Journal
- Human Computer Interaction
- IBM Systems Journal
- IEEE/ACM Transactdions on Networking
- IEEE Computer
- IEEE Computer Graphics & Applications
- IEEE Internet Computing
- IEEE Multimedia
- Interacting with Computers
- International Journal of Human Computer Studies
- Journal of Collaborative Computing
- Journal of Computer Supported Cooperative Work
- Journal of Digital Information
- Journal of Group Decision and Negotiation
- Journal of Management Information Systems
- Personal Technologies
- Software Practice and Experience
- Usenix Computing Systems

Conference affiliations

- ACM SIGCHI Conference on Human Factors in Computing Systems:
  Program co-chair, Technical Papers / Notes program committee (2009)
  Associate Chair, Technical Papers Program Committee (2004, 2002, 1998, 1994,)
  Member, Technical Papers / Review Committee / Reviewer (every year since 1990)
  Member, Doctorial Consortium (1999)
  Member, Video Program Committee (1990, 1993, 1996, 1998)
  Technical Area Coordinator for computer supported cooperative work (1990)

- ACM CSCW Conference on Computer Supported Cooperative Work:
  Program Co-chair, Technical Papers Committee (2006)
  Program Co-chair, Technical Papers Committee (1998)
  Associate Chair, Technical Papers Committee (1996)
  Video Co-chair (1994), Refereed Technical Video Program
  Video Chair (1992), Refereed Technical Video Program
  Member, Technical Video Review Committee (1996, 1998)
  Member, Technical Papers and Panels committee (1992, 1994)
  Member, CSCW Doctorial Colloquium (2002, 1994)
  Workshop Organizer (2000, 1992)
  Reviewer, every conference

- European CSCW Conference on Computer Supported Cooperative Work
  North American Liason, 1998-1999
  Member, Technical Program Committee (2003, 2001, 1999, 1997)

- Technical Program Committee Membership for other conferences include:
  14th International Conference on Distributed Computing Systems (1994)
  ACM Group International Conference on Supporting Group Work (2001)
  ACM International Workshop on Intelligent User Interfaces (1993)
  ACM Conference on Organizational Computing (1993)
  ACM Conference on Office Information Systems (1990)

ACM Symposium on User Interface Software and Technology (2005)
Active Web Workshop (1999)
Collab Tech (2005)
CRIWG International Workshop on Groupware Technologies (2004)
Design and CSCW Workshop (2006)
Graphics Interface (1997)
IEEE 9th International WetICE Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises (2001, 2000)
IFIP Interact'99 Conference (1999)
Interaccion Spanish Conference on Human-Computer Interaction (2007)
OzCHI Australian Conference on Human Computer Interaction (1997)
Symposium on Applications and the Internet (SAINT 2002), IEEE
Symposium on Human Machine Systems (ISA'2000)

- Refereed for a variety of other conferences in various roles, including:
  ACM CHI Conference on Human Factors in Computing Systems (every year since 1990)
  ACM DIS (2008)
  ACM Group (various years)
  ACM ITS Conference on Interactive Tables and Surfaces (2009)
  ACM SIGCHI Conference on Universal Usability (2000)
  ACM Symposium on User Interface Software and Technology (most years since 1991)
  Graphics Interface (most years since 1991)
  DCNEt '2000
  Handheld CSCW workshop, 1998
  IEEE Hawaii International Conference on System Sciences (1992)
  EEE Tabletop Conference 2005
  Next Generation CSCW Systems Workshop, 1996
  Pervasive (2010)
  OzCHI Australian Conference on Human Computer Interaction (1996)

Other contributions

- Regularly referee a large number of tenure and promotion cases.
- Successful sponsor for Dr. I.H. Witten as an ACM Fellow (1995)
- Regularly referee a variety of book and journal proposals.
- Member of the Association for Computing Machinery (ACM)

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University Service

Faculty Level

- Member, Research Develoment and Policy Committee (RPDC), 2009 -
- Co-chair, Ethics Committee Faculty of Science / Management, 1997 - 2005
  -I formed this committee and laid out the guidelines for studies involving human subjects, in accordance with university prototocols.
- Member, Faculty of Graduate Studies Council, 2003-2006
- Reviewer, Conjoint Faculties Research Ethics Board
- Member, Task Force on the Tri-Council Guidelines, 1998-1999
  -also member, subcommittee for web-based research
- Member, RCMP: Research Critical Mass Panel, Faculty of Science, 1994.

Department Level

- Member, Hiring Committee, 2008 - 2009
  -Evaluate applicants for several entry-level professorial positions in Computer Science
- Associated Department Head / Graduate Director, 2003 - 2006
  -Managed the graduate program in Computer Science, comprising ~160 graduate students
- Member, Academic Awards Committee (2003 - 2007)
  -Deciding on grants / awards for graduate students
- Member, Department of Computer Science CHAMPS committee (~2003)
  -advices the Head of the Department on various matters regarding Strategic Areas within Computer Science
- Member, Hiring Committee, 2001-2002
  -an intensive year of interviews and resume reading in this period of massive departmental expansion
- Member, Review Committee / Advisory Committee on the Headship of the Department of Computer Science (2001)
  -Review and recommend candidates for department head
- Internship Representative/Cooperative Education, 1991-2000
  -The Department of Computer Science typically contributes one of the largest body of students (excepting Engineering) to the Coop/Internship Program at the University of Calgary. Managing the large number of applicants is a significant effort, and much time has been spent defining and streamlining both the administrative and academic components of the program.
- Member, Appointments Selection Committee (1997-1999)
  -This committee is responsible for new faculty appointments.
- Member, Strategic Committee (1999)
  -This committee is responsible for planning and setting strategic directions to influence the major department expansion.
- Member, Graduate Committee (various years)
  -This group sets various policies, and evaluates applications and scholarships related to graduate students

- Member, "Increment" Committee
  -This three-person team reviewed year end reports by Department faculty and recommended increments.

- Member, Heads Advisory Committee (1995-1996, 2003 - 2006)
  -This group advises the head of department on both short and long term issues.

- Member, Computer Resources Uses and Development Committee, 1998, 1994
  -Computing resources are especially important to the Department of Computer Science. This committee, which met for the first time in summer '93, is responsible for overseeing the use and development of computing resources.

- Target '92 and '98 Representative
  -The Target Programpurpose is to attract high caliber Canadian students to the computer science graduate programs of Western Canadian universities. The top 2 undergraduates from each Canadian University are invited to attend I prepared and presented a multi-media show to the students, which was well received. A simpler in-house presentation was done in 1998.

Other services

- Invited and hosted many national and international speakers to the departmental
- Worked on the department planning document
- Co-coordinator of the KSI Seminar Series (1991-1992)
- Regularly review graduate applications for the Graduate Committee
- Presented at the University of Calgary's President's 1996 Celebration of Excellence
- Presented at the University of Calgary 25th Anniversary Open House

Hosted Department Visitors (extended stays)

- R. Jota (IST/Technical University of Lisbon) for 1 year visit (2009)
- T. Ballendat (Ludwig Maximilian University, Munich) for 4 month visit (2009-2010)
- S. Viller (University of Queensland Ipswich, Australia for 4 month visit (2007)
- A. Cockburn (University of Canterbury, NZ) for 4 month visit (1998-1999)
- H. Kuzuoka (Tsukuba University) for a 1 year visit (1997-1998)
- T. Urnes (York University, Toronto) for a 3 week visit to the department
- S. Brewster (University of York, UK) for a 3 week visit to the department
- A. Cockburn (University of Stirling, UK) for several visits to the deparment
- R. Potter (University of Maryland, USA) for a 1 month visit to the department

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Publications

5 books, 37 articles in refereed journals, 98 refereed full conference papers, 31 fully refereed videos, 35 refereed short conference papers, 17 refereed or invited book chapters (excludes reprints), 5 edited journals/proceedings/video proceedings, 15 other invited publications, 22 refereed/invited workshops, 52 non-refereed publications, 27 theses, and 25 independent papers produced by people under my supervision.

A. Books, Monographs and Proceedings Authored and Edited

1. Greenberg, S., Hudson, S., Hinckley, K., Ringel Morris, M. and Olson, D. (2009)
Proceedings of the 27th International Conference on Human Factors in Computing Systems (ACM CHI 2009). Papers and Notes, 2390 pages ACM Press, New York, NY, April 4-9.

2. Baecker, R., Grudin, J., Buxton, B. and Greenberg, S. (1995)
Readings in Human Computer Interaction: Towards the Year 2000, Second edition. 950 pages. Morgan-Kaufman, San Francisco, USA. ISBN 1-55860-246-1.

3. Greenberg, S., Hayne, S. and Rada, R. (1995)
Groupware for Real-Time Drawing: A Designer's Guide. 248 pages. McGraw-Hill Book Company Europe, Berkshire, England. ISBN 0-07-707899-3. L

4. Greenberg, S. (1993)
The Computer User as Toolsmith: The Use, Reuse, and Organization of Computer-Based Tools. 187 Pages. Cambridge University Press, Cambridge. ISBN 0-521-40430-4.

5. Greenberg, S. (1991)
Computer supported cooperative work and groupware. 423 pages. Academic Press, London, UK. ISBN 0-12-299220-2.

B. Articles in Refereed Journals

1. Voida, A. and Greenberg, S. (2010)
Console Gaming Across Generations: Exploring Intergenerational Interactions in Collocated Console Gaming. Universal Access in the Information Society Journal - JUAICS. Springer.

2. Neustaedter, C., Brush, A.J. and Greenberg, S. (2009)
'The Calendar is Crucial': Coordination and Awareness through the Family Calendar. ACM Transactions on Computer Human Interactions - ACM TOCHI, 6(1):6:1 - 6:48, April.

3. Nunes, M., Greenberg, S. and Neustaedter, C. (2009)
Using Physical Memorabilia as Opportunities to Move into Collocated Digital Photo Sharing. International Journal of Human Computer Studies-IJHCS (Special Issue on Collocated Social Practices Surrounding Photos, Eds: S. Linley, A. Durrant, D. Kirk and A. Taylor), 67:1087-1111, December.

4. Pawson, M. and Greenberg, S. (2009)
Extremely Rapid Usability Testing. Journal of Usability Studies, 4(3):124-135, May.

5. Tee, K., Greenberg, S. and Gutwin, C. (2009)
Artifact Awareness through Screen Sharing for Distributed Groups. International Journal of Human Computer Studies - IJHCS, 67:677-702, September (on-line: April 18).

6. Gutwin, C., Greenberg, S., Blum, R., Dyck, J., Tee, K. and McEwan, G. (2008)
Supporting Informal Collaboration in Shared-Workspace Groupware. Journal of Universal Computing (JUCS), 14(9):1411-1434, May.

7. Greenberg, S. (2007)
Toolkits and Interface Creativity. Journal Multimedia Tools and Applications (JMTA), 32(2):139-159. Springer, February.

8. Tse, E., Greenberg, S., Shen, C. and Forlines, C. (2007)
Multimodal Multiplayer Tabletop Gaming. ACM CIE Computers in Entertainment, 5(2) ACM Press, April.
   - Reprinted from Proc. 3rd Inter' Workshop on Pervasive Gaming Applications (PerGames'2006) pages 139-148.

9. Greenberg, S. (2006)
Creating Stories Over Distance. THEN Journal: Technologies, Humanities, Education, & Narrative, Issue 4, September. Commentary.

10. Neustaedter, C., Greenberg, S. and Boyle, M. (2006)
Blur Filtration Fails to Preserve Privacy for Home-Based Video Conferencing. ACM Transactions on Computer Human Interactions - ACM TOCHI, 13(1):1-36, March.

11. Tam, J. and Greenberg, S. (2006)
A Framework for Asynchronous Change Awareness in Collaborative Documents and Workspaces. International Journal of Human Computer Studies - IJHCS, 64(7):583-598. Elsevier.

12. Boyle, M. and Greenberg, S. (2005)
The Language of Privacy: Learning from Video Media Space Analysis and Design. ACM Transactions on Computer-Human Interaction - ACM TOCHI, 12(2):328-370. ACM Press, June.

13. Tang, A., Boyle, M. and Greenberg, S. (2005)
Display and Presence Disparity in Mixed Presence Groupware. Journal of Research and Practice in Information Technology - JRPIT, 37(2):71-88, May.
   - Reprinted from Proceedings Fifth Australasian User Interface Conference, Volume 28 in the CRPIT Conferences in Research and Practice in Information Technology Series, Dunedin, NZ, January, Australian Computer Society Inc., pages 73-82.

14. Kruger, R., Carpendale, M.S.T., Scott, S.D. and Greenberg, S. (2004)
Roles of Orientation in Tabletop Collaboration: Comprehension, Coordination and Communication. Computer Supported Cooperative Work: The Journal of Collaborative Computing, 13(5-6):501-537. Kluwer Press.

15. Cockburn, A., Greenberg, S., Jones, S., McKenzie, B. and Moyle, M. (2003)
Improving WEB Page Revisitation: Analysis, Design and Evaluation. IT&Society, 3(1):159-183, B. Shneiderman, J. Lazar, M. Ivory (Eds): Special Issue on Web Navigation Skills, SIQSS, Stanford, Winter.

16. Pinelle, D., Gutwin, C. and Greenberg, S. (2003)
Task Analysis for Groupware Usability Evaluation: Modeling Shared-Workspace Tasks with the Mechanics of Collaboration. ACM Transactions on Human Computer Interaction - ACM TOCHI, 10 (4):281-311, Special issue on multiple and collaborative tasks, December.

17. Gutwin, C. and Greenberg, S. (2002)
A Descriptive Framework of Workspace Awareness for Real-Time Groupware. Computer Supported Cooperative Work: The Journal of Collaborative Computing, 11(3-4):411-446, Kluwer Academic Press.

18. Greenberg, S. (2001)
Context as a Dynamic Construct. Human-Computer Interaction, 16(2-4):257-268. Lawrence Erlbaum Associates Inc.

19. Cockburn, A. and Greenberg, S. (2000)
Issues of Page Representation and Organisation in Web Browser's Revisitation Tools. Australian Journal of Information Systems (AJIS), 7(2):120-127, May.
    - Reprinted from Proceedings of the Australian Conference on Human Computer Interaction - OZCHI'99 , November 28-30, Wagga Wagga Australia.

20. Greenberg, S., Fitzpatrick, G., Gutwin, C. and Kaplan, S. (2000)
Adapting the Locales Framework for Heuristic Evaluation of Groupware. Australian Journal of Information Systems (AJIS), 7(2):102-108, May.
    - Reprinted from Proceedings of the Australian Conference on Human Computer Interaction - OZCHI'99, November 28-30, Wagga Wagga Australia.

21. Greenberg, S. and Kuzuoka, H. (2000)
Using Digital but Physical Surrogates to Mediate Awareness, Communication and Privacy in Media Spaces. Personal Technologies, 4(1):182-198. Elsevier, January.

22. Greenberg, S. (1999)
Designing Computers As Public Artifacts. International Journal of Design Computing: Special Issue on Design Computing on the Net (DCNet'99) University of Sydney, November 30 - December 3.

23. Greenberg, S., Boyle, M. and LaBerge, J. (1999)
PDAs and Shared Public Displays: Making Personal Information Public, and Public Information Personal. Personal Technologies, 3(1):54-64, March. Springer-Verlag.

24. Gutwin, C. and Greenberg, S. (1999)
The Effects of Workspace Awareness Support on the Usability of Real-Time Distributed Groupware. ACM Transactions on Computer-Human Interaction (TOCHI), 6(3):243-281, September.

25. Cockburn, A. and Greenberg, S. (1998)
The Design and Evolution of TurboTurtle, a Collaborative Microworld for Exploring Newtonian Physics. International Journal of Human Computer Studies, 48(6):777-801. Academic Press.

26. Tauscher, L. and Greenberg, S. (1997)
How People Revisit Web Pages: Empirical Findings and Implications for the Design of History Systems. International Journal of Human Computer Studies - IJHCS, 47(1):97-138. Academic Press.

27. Greenberg, S. (1996)
Teaching Human Computer Interaction to Programmers. ACM Interactions, 3(4):62-76. ACM Press, July-August.
    - Earlier much shorter version in ACM SIGCHI Bulletin, 28(2), pp. 5-6, April, ACM Press.

28. Roseman, M. and Greenberg, S. (1996)
Building Real Time Groupware with GroupKit, A Groupware Toolkit. ACM Transactions on Computer Human Interaction - ACM TOCHI, 3(1):66-106. ACM Press, March.

29. Schaffer, D., Zuo, Z., Greenberg, S., Bartram, L., Dill, J., Dubs, S. and Roseman, M. (1996)
Navigating Hierarchically Clustered Networks Through Fisheye and Full-Zoom Methods. ACM Transactions on Computer-Human Interaction - ACM TOCHI, 3(2):162-188. ACM Press, June.

30. Hayne, S., Pendergast, M. and Greenberg, S. (1994)
Implementing Gesturing with Cursors in Group Support Systems. Journal of Management Information Systems (JMIS), 10(3):43-61, Winter.

31. Greenberg, S. and Witten, I. H. (1993)
Supporting Command Reuse: Mechanisms for Reuse. International Journal of Man Machine Studies, 39(3):391-425, September. Also as report 1993-497-2, January.

32. Greenberg, S. and Witten, I. H. (1993)
Supporting Command Reuse: Empirical Foundations and Principles. International Journal of Man Machine Studies, 39(3):353-390, September. Also as report 1993-496-1, January.

33. Greenberg, S., Roseman, M., Webster, D. and Bohnet, R. (1992)
Human and technical factors of distributed group drawing tools. Interacting with Computers, 4(1):364-392. Butterworth-Heinemann.
    - Reprinted in S. Greenberg, S. Hayne, and R. Rada (eds) (1995). Groupware for Real-Time Drawing: A Designer's Guide, p37-62, McGraw-Hill.
    - Also reprinted in Baecker, Grudin, Buxton and Greenberg, S. (eds.) (1995). Readings in Human Computer Interaction: Towards the Year 2000, Morgan-Kaufman.

34. Witten, I. H., Thimbleby, H. W., Coulouris, G. and Greenberg, S. (1991)
Liveware: A new approach to sharing data in social networks. International Journal of Man Machine Studies, 34(3):337-348, March.

35. Greenberg, S. and Chang, E. (1990)
Computer support for real time collaborative work. Congressus Numerantium, 75:247-262.
    - Reprinted from Proceedings of the Conference on Numerical Mathematics and Computing, Sept 28-30, Winnipeg, Manitoba, 1989.

36. Greenberg, S. and Witten, I. H. (1985)
Adaptive personalized interfaces: A question of viability. Behaviour and Information Technology, 4 (1):31-45, January. Earlier version as report 1984-152-4, April.

37. Witten, I. H., Cleary, J. and Greenberg, S. (1984)
On frequency-based menu-splitting algorithms. International Journal of Man Machine Studies, 21 (2):135-148, August.

C. Full Papers in Refereed Conference/Symposium Proceedings

1. Bertram, D., Voida, A., Greenberg, S. and Walker, R. (2010)
Communication, Collaboration, and Bugs: The Social Nature of Issue Tracking in Small, Collocated Teams. In Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'2010. ACM Press, 10 pages, February.

2. Greenberg, S., Voida, S., Stehr, N. and Tee, K. (2010)
Artifacts as Instant Messaging Buddies. In Proceedings of the Hawaii International Conference on System Sciences - HICSS'2010, 11th Persistent Conversation Minitrack, Digital Media and Content. IEEE Computer Society, January 5-8.

3. He, H.A., Greenberg, S. and Huang, E.M. (2009)
One size does not fit all: Applying the Transtheoretical Model to Energy Feedback Technology Design. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI '2010. ACM Press. 10 pages, April.

4. Marquardt, N., Talor, A., Villar, N. and Greenberg, S. (2009)
Rethinking RFID: Awareness and Control for Interaction with RFID Systems. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI '2010. ACM Press. 10 pages, April.

5. Marquardt, N., Gross, T., Carpendale, S. and Greenberg, S. (2010)
Revealing the Invisible: Visualizing the Location and Event Flow of Distributed Physical Devices. In Proceedings of the Fourth International Conference on Tangible, Embedded and Embodied Interaction - TEI'10. (Cambridge, MA, USA), ACM Press, 8 pages, January 25-27.

6. Voida, A., Carpendale, S. and Greenberg, S. (2010)
The Individual and the Group in Console Gaming. In Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'2010. ACM Press, 10 pages, February.

7. Alexander, J., Cockburn, A., Fitchett, S., Gutwin, C. and Greenberg, S. (2009)
Revisiting Read Wear: Analysis, Design, and Evaluation of a Footprints Scrollbar. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'09. ACM Press, 10 pages plus video figure, April 4-9.

8. de Alwis, B., Gutwin, G. and Greenberg, S. (2009)
GT/SD: Performance and Simplicity in a Groupware Toolkit. In Proceedings of the ACM SIGCHI Symposium on Engineering Interactive Computing Systems - ACM EICS'09. ACM Press, 10 pages, July 14-17.

9. Marquardt, N., Nacenta, M., Young, J., Carpendale, S., and Greenberg, S. and Sharlin, E. (2009)
The Haptic Tabletop Puck: Tactile Feedback for Interactive Tabletops. In Proceedings of Interactive Tabletops and Surfaces - ITS'09. (Banff, Canada), ACM Press, pages 93-100, November 23-25.

10. Marquardt, N., Nacenta, M., Young, J., Carpendale, S., and Greenberg, S. and Sharlin, E. (2009)
The Haptic Tabletop Puck: The Video. In DVD Proceedings of Interactive Tabletops and Surfaces - ITS'09. (Banff, Canada), ACM Press, November 23-25

11. Tang, A., Lanir, J., Greenberg, S. and Fels, S. (2009)
Supporting Transitions in Work: Informing Large Display Application Design by Understanding Whiteboard Use. In Proceedings of the ACM International Conference on Supporting Group Work - ACM GROUP'09. ACM Press, pages 149-158, May 10-13.

12. Voida, A. and Greenberg, S. (2009)
Wii All Play: The Console Game as a Computational Meeting Place. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'09. ACM Press, 10 pages, April 4-9.

13. Voida, S. and Greenberg, S. (2009)
WikiFolders: Augmenting the Display of Folders to Better Convey the Meaning of Files. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'09. ACM Press, 10 pages, April 4-9.

14. Au Yeung, T., Carpendale, S. and Greenberg, S. (2008)
Preservation of Art in the Digital Realm. In Proceedings of iPRES2008: The Fifth International Conference on Digital Preservation. (London), British Library, 8 Pages, Sept 29-30.

15. Birnholtz, J.P., Mak, C., Greenberg, S. and Baecker, R. (2008)
Attention By Proxy? Issues in Audience Awareness for Webcasts to Distributed Groups. In Proc. ACM Conference on Human Factors in Computing Systems - ACM CHI'08. (Florence, Italy), ACM Press, pages 103-106, April 5-10.

16. Greenberg, S. and Buxton, B. (2008)
Usability Evaluation Considered Harmful (Some of the Time). In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'08. (Florence, Italy), ACM Press, pages 111-120, April 5-10.
    - Honorable Mention (Best paper nominee).

17. Nunes, M., Greenberg, S. and Neustaedter, C. (2008)
Sharing Digital Photographs in the Home through Physical Mementos, Souvenirs, and Keepsakes. In Proceedings of the ACM Conference on Designing Interactive Systems - ACM DIS'08. (Cape Town, South Africa), ACM Press, pages 250-260, February 25-27.

18. Tang, A., Greenberg, S. and Fels, S. (2008)

Exploring Video Streams Using Slit-Tear Visualizations. In Proceedings of Advanced Visual Interfaces (AVI'08). (Napoli, Italy), pages 191-198, May 28-30.

19. Tse, E., Greenberg, S., Shen, C., Forlines, C. and Kodama, R. (2008)
Exploring True Multi-User Multimodal Interaction over a Digital Table. In Proceedings of the ACM Conference on Designing Interactive Systems - ACM DIS'08. (Cape Town, South Africa), ACM Press, pages 109-118, February 25-27.

20. Voida, A., Voida, S., Greenberg, S. and He, H.A. (2008)
Asymmetry in Media Spaces. In Proc. ACM Conference on Computer Supported Cooperative Work - ACM CSCW'08. (San Diego, CA), ACM Press, 10 pages, Nov. 8-12. CSCW Honorable Mention (Best Paper Nomineee).

21. Cockburn, A., Gutwin, C. and Greenberg, S. (2007)
A Predictive Model of Menu Performance. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'07. ACM Press, pages 627-636, Apr 28-May 3. Full paper plus published video figure, duration 4:03.

22. Elliot, K., Neustaedter, C. and Greenberg, S. (2007)
StickySpots: Using Location to Embed Technology in the Social Practices of the Home. In Proceedings of the 1st Int'l Conference on Tangible and Embedded Interaction - TEI'07. ACM Press, pages 79-86, Feb 15-17.

23. Elliot, K., Watson, M., Neustaedter, C. and Greenberg, S. (2007)
Location-Dependent Information Appliances for the Home. In Proceedings of Graphics Interface - GI'07, pages 151-158, May 28-30.

24. Marquardt, N. and Greenberg, S. (2007)
Distributed Physical Interfaces with Shared Phidgets. In Proc. 1st International Conference on Tangible and Embedded Interaction. (Baton Rouge, Louisiana, USA), ACM Press, pages 13-20, February 15-17.

25. Neustaedter, C., Brush, A.J. and Greenberg, S. (2007)
A Digital Family Calendar in the Home: Lessons from Field Trials of LINC. In Proc. Graphics Interface, pages 199-206, May 28-30.
    - Received the Michael A.J. Sweeney Award for Best Student Paper.

26. Nunes,M., Greenberg, S., Carpendale, S. and Gutwin, C. (2007)
What Did I Miss? Visualizing the Past through Video Traces. In Proceedings of the European Conference on Computer Supported Cooperative Work - ECSCW'07. (Limerick, Ireland), pages 1-20, September 24-28.

27. Romero, N., McEwan, G. and Greenberg, S. (2007)
A Field Study of Community Bar: (Mis)-matches between Theory and Practice. In Proc ACM Group 2007. (Sanibel Island, Florida, USA), ACM Press, pages 89-98, November 4-7.

28. Tse, E., Hancock, M. and Greenberg, S. (2007)
Speech-Filtered Bubble Ray: Improving Target Acquisition on Display Walls. In Proc 9th Int'l Conf. Multimodal Interfaces (ACM ICMI'07). (Nagoya, Japan), ACM Press, pages 307-314, November 12-15.

29. Tse, E., Shen, C., Greenberg, S. and Forlines, C. (2007)
How Pairs Interact Over a Multimodal Digital Table. In Proc. ACM CHI Conference on Human Factors in Computing Systems. ACM Press, pages 215-218, April 27 - May 3. Tech Note.

30. Tse, E., Greenberg, S., Shen, C., Barnwell, J., Shipman, S. and Leigh, D. (2007)
Multimodal Split View Tabletop Interaction Over Existing Applications. In Proc Tabletop'07 - 2nd IEEE Tabletop Workshop. (Rhode Island, USA), pages 129-136, October 10-12.

31. Greenberg, S. and Boyle, M. (2006)

Generating Custom Notification Histories by Tracking Visual Differences between Web Page Visits. In Proceedings of Graphics Interface - GI'06. (Quebec City, Canada), pages 227-234, June 7-9.

32. Hancock, M., Miller, J., Greenberg, S. and Carpendale, S. (2006)
Exploring Visual Feedback of Change Conflict in a Distributed 3D Environment. In Proceedings of Advanced Visual Interfaces - AVI'06. (Venezia, Italy), ACM Press, pages 209-216, May 23-26.

33. McEwan, G., Greenberg, S., Rounding, M. and Boyle, M. (2006)
Groupware Plug-ins: A Case Study of Extending Collaboration Functionality through Media Items. In Proceedings of 2nd International Conference on Collaboration Technologies - CollabTech 2006. (Tsukuba, Japan), IPSJ SIG Groupware and Network Services, pages 42-47, July 13-14.
    - Best paper nominee.

34. Neustaedter, C., Elliot, K. and Greenberg, S. (2006)
Interpersonal Awareness in the Domestic Realm. In Proceedings of OZCHI. (Sydney, Australia), pages 15-22, November 20-24.

35. Smale, S. and Greenberg, S. (2006)
Transient Life: Collecting and sharing personal information. In Proceedings of OZCHI'06. (Sydney, Australia), pages 31-38, November 20-24.

36. Tang, A., Neustaedter, C. and Greenberg, S. (2006)
VideoArms: Embodiments for Mixed Presence Groupware. In N. Bryan-Kinns, A. Blanford, P. Curzon and L. Nigay (Eds.) People and Computers XX - Engage (Proceedings of HCI 2006). Springer, September.

37. Tee, K., Greenberg, S. and Gutwin, C. (2006)
Providing Artifact Awareness to a Distributed Group through Screen Sharing. In Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW 2006, pages 99-108, November 4-8.

38. Tse, E., Greenberg, S. and Shen, C. (2006)
GSI DEMO: Multiuser Gesture / Speech Interaction over Digital Tables by Wrapping Single User Applications. In Proceedings of the Eighth International Conference on Multimodal Interfaces - ICMI'06. (Banff, Canada), ACM Press, pages 76-83, November 2-4.

39. Tse, E., Shen, C., Greenberg, S. and Forlines, C. (2006)
Enabling Interaction with Single User Applications through Speech and Gestures on a Multi-User Tabletop. In Proceedings of Advanced Visual Interfaces - AVI'06. (Venezia, Italy), ACM Press, pages 336-343, May 23-26.

40. Boyle, M. and Greenberg, S. (2005)
Rapidly Prototyping Multimedia Groupware. In Proceedings of the 11th International Conference on Distributed Multimedia Systems - DMS'05. (Conference held in Banff, Alberta, Canada), Knowledge Systems Institute, Illinois, USA, September 5-7.

41. Elliot, K., Neustaedter, C. and Greenberg, S. (2005)
Time, Ownership and Awareness: The Value of Contextual Locations in the Home. In Beigl, M. and Intille, S. and Rekimoto, J. and Tokuda, H. (Eds.) Ubicomp 2005: Ubiquitous Computing, 7th International Conference on Ubiquitous Computing, pages 251-268. Springer, Conference held in Tokyo, Japan, September 11-14.

42. McEwan, G. and Greenberg, S. (2005)
Supporting Social Worlds with the Community Bar. In Proceedings of the Conference on Supporting Group Work - ACM GROUP'05. (Sanibel Island, Florida), ACM Press, pages 21-30, November 6-9.

43. Smale, S. and Greenberg, S. (2005)
Broadcasting Information via Display Names in Instant Messaging. In Proceedings of the Conference on Supporting Group Work - ACM GROUP'05. (Sanibel Island, Florida), ACM Press, pages 89-98,

November 6-9.

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53. Kaasten, S., Greenberg, S. and Edwards, C. (2002)
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Heuristic Evaluation of Groupware Based on the Mechanics of Collaboration. In Engineering for Human-Computer Interaction (EHCI 2001, 8th IFIP International Conference, Toronto, Canada, May), pages 123-139. Lecture Notes in Computer Science: LNCS 2254, Springer-Verlag.

55. Greenberg, S. and Fitchett, C. (2001)
Phidgets: Easy Development of Physical Interfaces through Physical Widgets. In Proceedings of the

14th Annual ACM Symposium on User Interface Software and Technology - ACM UIST'01. (Orlando, Florida), ACM Press, pages 209-218, November 11-14.
- Best paper award.

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The Notification Collage: Posting Information to Public and Personal Displays. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'01. ACM Press, pages 515-521. See also video shown at the conference. Earler version as Report 2000-667-19, September.

57. Steves, M.P., Morse, E., Gutwin, C. and Greenberg, S. (2001)
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58. Zanella, A. and Greenberg, S. (2001)
Reducing Interference in Single Display Groupware through Transparency. In Proceedings of the Sixth European Conference on Computer Supported Cooperative Work (ECSCW 2001). (Bonn, Germany), Kluwer, pages 339-358, September 16-20.

59. Boyle, M., Edwards, C. and Greenberg, S. (2000)
The Effects of Filtered Video on Awareness and Privacy. In Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'00. ACM Press, pages 1-10, December 2-5.

60. Cox, D. and Greenberg, S. (2000)
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61. Gutwin, C. and Greenberg, S. (2000)
The Mechanics of Collaboration: Developing Low Cost Usability Evaluation Methods for Shared Workspaces. In IEEE 9th International Workshop on Enabling Technologies: Infrastructure for Collaborative Enterprises - WET-ICE'00. (held at NIST,Gaithersburg, MD USA), June 14-16.
- Best Paper Award.

62. Cockburn, A., Greenberg, S., McKenzie, B., Jasonsmith, M. and Kaasten, S. (1999)
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63. Greenberg, S. and Cockburn, A. (1999)
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64. Johnson, B. and Greenberg, S. (1999)
Judging People's Availability for Interaction from Video Snapshots. In Proceedings of the Hawaii International Conference on System Sciences. (Distributed Group Support Systems Minitrack), IEEE Press, January.

65. Kuzuoka, H. and Greenberg, S. (1999)
Mediating Awareness and Communication through Digital but Physical Surrogates. In Proceedings of the SIG-HI of Information Processing Society of Japan, October 15.

66. Gutwin, C. and Greenberg, S. (1998)
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67. Herlea, D. and Greenberg, S. (1998)

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68. Roseman, M. and Greenberg, S. (1997)
Simplifying Component Development in an Integrated Groupware Environment. In Proceedings of the ACM Symposium on User Interface Software and Technology - ACM UIST'97. (Banff, Alberta, Canada), ACM Press, pages 65-72, October 14-17.

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70. Greenberg S., Gutwin, C. and Cockburn, A. (1996)
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71. Greenberg, S., Gutwin, C. and Cockburn, A. (1996)
Using Distortion-Oriented Displays to Support Workspace Awareness. In A. Sasse, R.J. Cunningham, and R. Winder (Eds.) People and Computers XI (Proceedings of the HCI'96), pages 299-314, London, August 20-23.

72. Greenberg, S., Gutwin, C. and Roseman, M. (1996)
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Workspace Awareness in Real-Time Distributed Groupware: Framework, Widgets, and Evaluation. In A. Sasse, R.J. Cunningham, and R. Winder (Eds.) People and Computers XI: Proceedings of the HCI'96, pages 281-298. Springer-Verlag, London, August 20-23.

74. Gutwin, C., Roseman, M. and Greenberg, S. (1996)
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76. Tauscher, L. and Greenberg, S. (1996)
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TurboTurtle: A Collaborative Microworld for Exploring Newtonian Physics. In Proceedings of the 1st Conference on Computer Supported Collaborative Learning - CSCL'95. (Bloomington, Indiana), Lawrence Erlbaum Associates, pages 62-66, October 17-20.

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80. Greenberg, S. (1994)
Real Time Groupware on the Information Highway. In Proceedings of the Canadian Multimedia Conference. (Calgary, Canada), Nov 7-9.

81. Greenberg, S. and Marwood, D. (1994)
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83. Hayne, S., Pendergast, M. and Greenberg, S. (1993)
Gesturing through Cursors: Implementing Multiple Pointers in Group Supports Systems. In Proceedings of the Hawaii International Conference on System Sciences (HICSS'93), 4. (Hawaii), IEEE Press, pages 4-12, January.
    - Awarded Best Paper.
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Prototyping an Intelligent Agent through Wizard of Oz. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'93. (Amsterdam, The Netherlands), ACM Press, pages 277-284, May.

85. Roseman, M. and Greenberg, S. (1993)
Building Flexible Groupware Through Open Protocols. In Proceedings of the ACM Conference on Organizational Computing Systems (ACM COCS'93). (Milpitas, California), pages 279-288.

86. Schaffer, D., Zuo, Z., Bartram, L., Dill, J., Dubs, S., Greenberg, S. and Roseman, M. (1993)
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87. Greenberg, S., Roseman, M., Webster, D. and Bohnet, R. (1992)
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    - Reprinted in Greenberg, S., Hayne, S. and Rada, R. (eds) (1995). Groupware for Real-Time Drawing: A Designer's Guide, p37-62, McGraw-Hill.

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    - Earlier version presented at ACM CSCW 1990 Workshop on Groupware Implementation in Computing Systems and Social Systems, Los Angeles, October 7, 1990.

90. Greenberg, S. and Bohnet, R. (1991)

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91. Greenberg, S. (1990)
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92. Greenberg, S. and Witten, I. H. (1988)
Directing the user interface: How people use command-based systems. In Proc. IFAC 3rd Man Machine Systems Conference. (Oulou, Finland), June 14-16.

93. Greenberg, S. and Witten, I. H. (1988)
How users repeat their actions on computers: Principles for design of history. In Proc. ACM SIGCHI Conference on Human Factors in Computing Systems (ACM CHI'88). (Washington), ACM Press, pages 171-178, May 15-19.

94. Witten, I. H., MacDonald, B. A. and Greenberg, S. (1987)
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95. Greenberg, S., Peterson, M. and Witten, I. H. (1986)
Issues and experiences in the design of a window management system. In Proc. Canadian Information Processing Society Edmonton Conference. (Edmonton, Alberta), pages 33-44, October 21-23.

96. Greenberg, S. and Witten, I. H. (1985)
Interactive end-user creation of workbench hierarchies within a window interface. In Proc. Canadian Information Processing Society National Conference. (Montreal, Quebec), pages 408-416, June 3-5.

97. Greenberg, S. and Witten, I. H. (1984)
Comparison of menu displays for ordered lists. In Proc. Canadian Information Processing Society National Conference. (Calgary, Canada), pages 464-469, May 9-11.

98. Witten, I. H., Greenberg, S. and Cleary, J. (1983)
Personalizable directories: A case study in automatic user modelling. In Proc. Graphics Interface (GI'83). (Edmonton, Alberta), pages 183-190.

D. Videotapes in Refereed Video Publications

1. Diaz-Marino, R. and Greenberg, S. (2010)
The Proximity Toolkit and ViconFace: The Video. ACM CHI Video Showcase, ACM.

2. Greenberg, S. and Nunes, M. (2009)
Sharing Digital Photographs in the Home by Tagging Memorabilia. In Video Showcase, DVD Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'09. (Boston, USA), ACM Press, April 4-9. Video and extended abstract, duration 4:20.

3. Tang, A., Greenberg, S. and Fels, S. (2009)
Exploring Video Streams using Slit-Tear Visualization. In Video Showcase, DVD Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'09. (Boston, USA), ACM Press, April 4-9. Video and extended abstract, duration 4:28.

4. Elliot, K., Neustaedter, C. and Greenberg, S. (2007)
Location-Dependant Domestic Information Appliances. In Adjunct Proceedings of the 5th International Conference on Pervasive Computing - PERVASIVE'07, May 13-16. Video plus 4 page paper, duration 4:44.

5. Young, J., Young, N., Greenberg, S. and Sharlin, E. (2007)
Feline Fun Park: A Distributed Tangible Interface for Pets and Owners. In Adjunct Proceedings of the 5th International Conference on Pervasive Computing - PERVASIVE'07. (Toronto, Canada),, May 13-16. Video plus 4 page paper, duration 1:13.

6. Young, J., McEwan, G., Greenberg, S. and Sharlin, E. (2007)
Moving a Media Space into the Real World through Group-Robot Interaction. In Adjunct Proceedings of the 5th International Conference on Pervasive Computing - PERVASIVE'07. (Toronto, Canada),, May 13-16. Video plus 4 page paper, duration 1:50. Earlier version as Report 2006-827-20, March.

7. Diaz-Marino, R. and Greenberg, S. (2006)
Cambience: A Video-Driven Sonic Ecology for Media Spaces. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press. Video and two page paper, duration 3:52.

8. Elliot, K., Neustaedter, C. and Greenberg, S. (2006)
Sticky Spots: A Location-Based Messaging System for the Home. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press, November. Video and two page paper, duration 4:55.

9. Greenberg, S. and Tse, E. (2006)
SDGToolkit in Action. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press, November. Video and two page paper, duration 7:14.

10. Neustaedter, C., Brush, A.J. and Greenberg, S. (2006)
LINC, An Inkable Digital Family Calendar. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press, November. Video and two page paper, duration 3:34.

11. Nunes, M., Greenberg, S., Carpendale, S. and Gutwin, C. (2006)
Timeline: Video Traces for Awareness. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press, November. Video and two page paper, duration 4:44.

12. Tee, K., Greenberg, S., Gutwin, C. and McEwan, G. (2006)
Shared Desktop Media Item: The Video. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006, November. Video and two page paper, duration 4:00.

13. Tse, E., Greenberg, S. and Shen, C. (2006)
Motivating Multimodal Interaction Around Digital Tabletops. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press, November. Video and two page paper, duration 3:25.

14. McEwan, G. and Greenberg, S. (2005)
Community Bar. In Video Proceedings of the European Conference on Computer Supported Cooperative Work - ECSCW'05. (Paris),, September 18-22. Video and two page paper, duration 5:04.

15. Tang, A., Pattison, E. and Greenberg, S. (2005)
DartMail: Digital Information Transfer through Physical Surrogates. In Video Proceedings of the European Conference on Computer Supported Cooperative Work - ECSCW'05. (Paris),, September 18-22. Video and two page paper, duration 4:39.

16. Agarawala, A., Greenberg, S. and Ho, G. (2004)
The Context-Aware Pill Bottle and Medication Monitor. In Video Proceedings / Proceedings Supplement of the UBICOMP 2004 Conference. ((September 7-10, Nottingham, England)),, May. Video and two page paper, duration 3:58.

17. Diaz-Marino, R., Tse, E. and Greenberg. S. (2004)
The Grouplab DiamondTouch Toolkit. In Video Proceedings of the ACM CSCW Conference on Computer Supported Cooperative Work - ACM CSCW'04. (Chicago, Illinois), ACM Press, November 6-10. Video and abstract, duration 3:12.

18. Elliot, K. and Greenberg, S. (2004)
Building Flexible Displays for Awareness and Interaction. In Video Proceedings and Proceedings Supplement of the UBICOMP 2004 Conference. (Nottingham, England), September 7-10. 6 minute video and two page paper.
    - The same paper also appears in Ubicomp Workshop on Ubiquitous Display Environments, held at UBICOMP 2004.

19. Tang, A., Neustaedter, C. and Greenberg, S. (2004)
VideoArms: Supporting Remote Embodiment in Groupware. In Video Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'04. (Chicago, Illinois), ACM Press, November 6-10. Video and abstract, duration 5:20.

20. Tse, E. and Greenberg. S. (2004)
SDG Toolkit. In Video Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'04. (Chicago, Illinois), ACM Press, November 6-10. Video and abstract, duration 3:55.

21. Neustaedter, C. and Greenberg, S. (2003)
The Design of a Context-Aware Home Media Space: The Video. In Video Proceedings of the Fifth International Conference on Ubiquitous Computing - UBICOMP'03. Video plus two page paper.

22. Wong, N., Carpendale, S. and Greenberg, S. (2003)
EdgeLens: An Interactive Method for Managing Edge Congestion in Graphs (The Video). In Video Proceedings of IEEE Symposium on Information Visualization - INFOVIS 2003. IEEE Press. Duration 3:36.

23. Neustaedter, C., Greenberg, S. and Carpendale, S. (2002)
IMVis: Instant Messenger Visualization. In Video Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'02. ACM Press, page 6, November 20-24. Video plus one page paper.

24. Kuzuoka, H. and Greenberg, S. (1999)
Mediating Awareness and Communication through Digital but Physical Surrogates. In Video Proceedings of the ACM Conference on Human Factors in Computing Systems (7 minute video) and Extended Abstracts Proceedings of the ACM Conference on Human Factors in Computing Systems (two page summary) - ACM CHI'99, May 15-20.

25. Gutwin, C. and Greenberg, S. (1998)
Focus and Awareness in Groupware. In Video Proceedings of the ACM Conference on Computer Supported Cooperative Work - ACM CSCW'98. ACM Press, November 14-18. Video and abstract, duration 7:25.

26. Roseman, M. and Greenberg, S. (1997)
A Tour of TeamRooms. In Video Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'97. (Atlanta, Georgia), ACM Press, March 22-27. Video (8.4 minutes) and two page summary.

27. Greenberg, S., Gutwin, C. and Cockburn, A. (1996)
Applying Distortion-Oriented Displays to Groupware. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'96. (Boston, USA), ACM Press. Video and two page summary, duration 9:18.

28. Greenberg, S. and Roseman, M. (1996)
GroupWeb: A Groupware Web Browser. In Video Proceedings of ACM Conference on Computer

Supported Cooperative Work - ACM CSCW'96. ACM Press. Video plus 2 page paper, duration 7:41.

29. Gutwin, C., Greenberg, S. and Roseman, M. (1996)
Staying Aware in Groupware Workspaces. In Video Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'96. (Boston, USA), ACM Press. 7:36 minute video and two page summary.

30. Greenberg, S. and Roseman, M. (1994)
GroupKit. In ACM SIGGRAPH Video Review: Special Edition of the ACM CSCW '94 Technical Video Program, 106, November. Duration 10:15. Abstract appears in CSCW'94 Technical Program.

31. Greenberg, S., Bohnet, R., Roseman, M. and Webster, D. (1992)
GroupSketch. In ACM SIGGRAPH Video Review: Special Edition of the ACM CSCW '92 Technical Video Program, 87. ACM Press, November. Video and 2 page paper.

E. Short Papers, Posters or Demonstrations in Fully Refereed Conference Proceedings

1. Lapides, P., Sharlin, E. and Greenberg, S. (2009)
HomeWindow: An augmented reality domestic monitor. In Adjunt Proc. Human Robot Interaction (Late Breaking Abstracts) - HRI'09. (San Diego, California), 2 pages, March 11-13.

2. Marquardt, N., Young, J., Sharlin, E. and Greenberg, S. (2009)
Situated Messages for Asynchronous Human-Robot Interaction. In Adjunt Proc. Human Robot Interaction (Late Breaking Abstracts) - HRI'09. (San Diego, California), 2 pages, March 11-13.

3. Saulnier, P., Sharlin, E. and Greenberg, S. (2009)
Using Bio-electrical Signals to Influence the Social Behaviours of Domesticated Robots. In Adjunt Proc. Human Robot Interaction (Late Breaking Abstracts) - HRI'09. (San Diego, California), 2 pages, March 11-13.

4. Guo, C., Boyd, J., Greenberg, S. and Sharlin, E. (2007)
Monitoring the Home Environment using a Domestic Robot. In Adjunt Proc. Graphics Interface - GI. (Montreal, Canada),, May 28-30.

5. Xin, M., Sharlin, E., Costa Sousa, M., Greenberg, S. and Samavati, F. (2007)
Purple Crayon - From Sketches to Interactive Environment. In Proceedings of the International Conference on Advances in Computer Entertainment Technology - ACE'07. (Salzburg), ACM Press, pages 208-211, June 13-15. Short paper with accompanying video, duration 9:32.

6. Diaz-Marino, R. and Greenberg, S. (2006)
Demonstrating How to Construct a Sonic Ecology for Media Spaces through Cambience. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006.

7. Isenberg, T., Neumann, P., Carpendale, S., Nix, S. and Greenberg, S. (2006)
Interactive Annotations on Large, High-Resolution Information Displays. In Conference Compendium of IEEE VIS, IEEE InfoVis, and IEEE VAST, pages 124-125. IEEE Computer Society, November. Two page paper and poster.

8. Neustaedter, C., Brush, A.J. and Greenberg, S. (2006)
A Demo of Family Calendaring using LINC. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006.

9. Nunes, M., Greenberg, S., Carpendale, S. and Gutwin, C. (2006)
Demonstrating Timeline: Video Traces for Awareness. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006.

10. Tee, K., Greenberg, S., McEwan, G. and Gutwin, C. (2006)
Sharing Desktops with the Community Bar. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006.

11. Tse, E., Greenberg, S. and Shen, C. (2006)
Multi User Multimodal Tabletop Interaction over Existing Single User Applications. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006.

12. Tse, E., Greenberg, S. and Shen, C. (2006)
Exploring Interaction with Multi User Speech and Whole Handed Gestures on a Digital Table. In Demonstration and short paper, Adjunct Proceedings ACM UIST 2006.

13. Young, J., McEwan, G., Greenberg, S. and Sharlin, E. (2006)
Aibo Surrogate - A Group-Robot Interface. In Demonstration and short paper, Adjunct Proceedings ACM CSCW 2006.

14. Tee, K., Carpendale, S. and Greenberg, S. (2005)
Interactive Poster: Visualizing Online Interaction. In IEEE Symposium on Information Visualization: Poster published in IEEE Information Visualization Symposium Compendium - Infovis'2005, Minneapolis, October 23-25.

15. Diaz-Marino, R.A., Tse, E. and Greenberg, S. (2003)
Programming for Multiple Touches and Multiple Users: A Toolkit for the DiamondTouch Hardware. In Companion Proceedings of ACM Conference on User Interface Software and Technology - ACM UIST'03. 2-page paper plus poster.

16. Kruger, R., Carpendale, S. and Greenberg, S. (2002)
Collaborating over Physical and Electronic Tables. In Poster in ACM Conference on Computer Supported Cooperative Work - ACM CSCW'02, November.

17. Tang, C. and Greenberg, S. (2002)
VisStreams: Visualizing Temporal Multimedia Conversations. In Poster Presentation at Graphics Interface - GI'02, May. 2 page paper plus poster.

18. Tse, E. and Greenberg, S. (2002)
SDGToolkit: A Toolkit for Rapidly Prototyping Single Display Groupware. In Poster in ACM Conference on Computer Supported Cooperative Work - ACM CSCW'02, November. 2 page paper plus poster presented at the conference.

19. Kaasten, S. and Greenberg, S. (2001)
Integrating Back, History and Bookmarks in Web Browsers. In Extended Abstracts of the ACM Conference of Human Factors in Computing Systems - ACM CHI'01, pages 379-380. ACM Press.

20. Zanella, A. and Greenberg, S. (2001)
Avoiding Interference through Translucent Interface Components in Single Display Groupware. In Extended Abstracts of the ACM Conference of Human Factors in Computing Systems - ACM CHI'01, pages 375-376. ACM Press.

21. Cox, D., Chugh, J.S., Gutwin, C. and Greenberg, S. (1998)
The Usability of Transparent Overview Layers. In Summary Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'98, Late-breaking short paper. ACM Press, pages 301-302.

22. Cox, D. and Greenberg, S. (1998)
Dealing with Heuristic Evaluation Data. In Proceedings of the UPA '98 Usability Professionals' Association Conference, Poster Presentation.

23. Cockburn, A. and Greenberg, S. (1996)
Children's Collaboration Styles in a Newtonian MicroWorld. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96. ACM Press, pages 181-182.

24. Greenberg, S. (1996)
Peepholes: Low Cost Awareness of One's Community. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96, pages 206-207, April 13-17.

25. Greenberg, S. (1996)
A Fisheye Text Editor for Relaxed-WYSIWIS Groupware. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96, pages 212-213, April 13-17.

26. Greenberg, S. and Roseman, M. (1996)
GroupWeb: A WWW Browser as Real Time Groupware. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96, pages 271-272.

27. Gutwin, C. and Greenberg, S. (1996)
Workspace Awareness for Groupware. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96, pages 208-209, April 13-17.

28. Gutwin, C., Greenberg, S. and Roseman, R. (1996)
Supporting Awareness of Others in Groupware. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96, page 205, April 13-17.

29. Gutwin, C. and Roseman, R. (1996)
A Usability Study of Workspace Awareness Widgets. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'06, pages 214-215, April 13-17.

30. Gutwin, C., Roseman, R. and Greenberg, S. (1996)
Workspace Awareness Support With Radar Views. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96, pages 210-211, April 13-17.

31. Roseman, M. and Greenberg, S. (1996)
TeamRooms: Groupware for Shared Electronic Spaces. In ACM Conference on Human Factors in Computing System, Companion Proceedings - ACM CHI'96. ACM Press, pages 275-276.

32. O'Grady, T. and Greenberg, S. (1994)
A Groupware Environment for Complete Meetings. In ACM Conference on Human Factors in Computing Systems, Conference Companion Proceedings - ACM CHI'94. (Boston), ACM Press, pages 307-308.

33. Schaffer, D. and Greenberg, S. (1993)
Sifting Through Hierarchical Information. In Proceedings of ACM INTERCHI Conference on Human Factors in Computing Systems -- Adjunct Proceedings, April 24-29. (Amsterdam, The Netherlands), ACM Press, pages 173-174.

34. Greenberg, S. and Bohnet, R. (1992)
GroupSketch Demonstration. In Demonstration track of the ACM CSCW'92 Conference on Computer Supported Cooperative Work. Appended is Muller, M. and Salasco, A. (eds) CSCW'92 Demonstrations, a synopsis of demonstrations, published in Proc CSCW'92, p11-13.

35. Greenberg, S. and Thimbleby, H. (1992)
The weak science of human-computer interaction. In Proceedings of the CHI '92 Research Symposium on Human Computer Interaction. (Monterey, California).

F. Refereed or Invited Chapters in Books

1. Boyle, M., Neustaedter, C. and Greenberg, S. (2009)
Privacy Factors in Video-based Media Spaces. In Media Space: 20+ Years of Mediated Life. (S. Harrision, Ed.), Springer, pages 97-122.

2. Greenberg, S., McEwan, G. and Rounding, M. (2009)
Reflecting on Several Metaphors of MUD-based Media Spaces. In Media Space: 20+ Years of Mediated Life. (S. Harrision, Ed.), Springer, pages 425-440.

3. Greenberg, S., Neustaedter, C., Elliot, K. (2009)
Awareness in the Home: The Nuances of Relationships, Domestic Coordination and Communication. In Awareness Systems: Advances in Theory, Methodology and Design. (P. Markopoulos and B. de Ruyter and W. Mackay, Ed.), Springer-Verlag, July.

4. Greenberg, S. (2009)
Embedding A Design Studio Course in A Conventional Computer Science Program. In Creativity and HCI: From Experience to Design in Education. (Kotze, P., Wong, W., Jorge, J., Dix, A. and Alexandra Silva, P., Ed.), Springer, pages 23 - 41. Selected Contributions from HCIEd, March 29-30, 2007, Aveiro, Portugal.

5. Greenberg, S. (2008)
Observing Collaboration: Group-Centered Design. In HCI Remixed: Reflections on Works That Have Influenced the HCI Community. (T. Erickson and D. W. McDonald, Ed.). Cambridge, Mass, MIT Press, pages 111-118.

6. Greenberg, S. (2005)
Collaborative Physical User Interfaces. In Communication and Collaboration Support Systems. (K. Okada, T. Hoshi and T. Inoue, Ed.). Amsterdam, The Netherlands, IOS Press, pages 24-42, June. ISBN: 1-58603-514-2.

7. Greenberg, S. (2004)
Working through Task-Centered System Design. In The Handbook of Task Analysis for Human-Computer Interaction. (Diaper, D. and Stanton, N., Ed.), Lawrence Erlbaum Associates, pages 49-66.

8. Gutwin, C. and Greenberg, S. (2004)
The Importance of Awareness for Team Cognition in Distributed Collaboration. In Team Cognition: Understanding the Factors that Drive Process and Performance. (E. Salas and S. M. Fiore, Ed.). Washington, APA Press, pages 177-201.

9. Greenberg S. and Roseman, M. (2003)
Using a Room Metaphor to Ease Transitions in Groupware. In Sharing Expertise: Beyond Knowledge Management. (M. Ackerman, V. Pipek, V. Wulf, Ed.). Cambridge, MA, MIT Press, pages 203-256, January.

10. Greenberg, S. and Roseman, M. (1999)
Groupware Toolkits for Synchronous Work. In Computer-Supported Cooperative Work (Trends in Software 7). (M. Beaudouin-Lafon, Ed.), John Wiley & Sons Ltd, pages 135-168.

11. Greenberg, S. (1997)
Collaborative Interfaces for the Web. In Human Factors and Web Development. (C. Forsythe, E. Grose and J. Ratner, Ed.), LEA Press, pages 241-254. ISBN 0-8058-2823-0.

12. Roseman, M. and Greenberg, S. (1997)
Building Groupware with GroupKit. In Tcl/Tk Tools. (M. Harrison, Ed.), O'Reilly Press, pages 535-564, September.

13. Greenberg, S., Darragh J. J., Maulsby D. and Witten I. H. (1995)
Predictive Interfaces: What will they think of next? In A. D. N. Edwards (Ed.), Extra-Ordinary Human Computer Interaction: Interfaces for Users with Disabilities. Cambridge, Cambridge University Press, pages 103-140.

14. Greenberg, S., Witten, I. H. and Finlay, J. (1993)
Software Personalization. In A. Ralston and E. D. Reilly (Eds.) Encyclopaedia of Computer Science, pages 1240-1241. Van Nostrand Reinhold, New York.

15. Witten, I. H. and Greenberg, S. (1993)
User Interfaces. In A. Ralston and E. D. Reilly (Eds.) Encyclopaedia of Computer Science, pages 1411-1414. Van Nostrand Reinhold, New York.

16. Greenberg, S. (1991)
An annotated bibliography of computer supported cooperative work. In Computer Supported Cooperative Work and Groupware. (Greenberg, S., Ed.), Academic Press, pages 359-413.
    - Published earlier in ACM SIGCHI Bulletin 23(3), pp. 29-62,July, 1991.

17. Witten, I. H. and Greenberg, S. (1985)
User interfaces for office systems. In Oxford Surveys in Information Technology. (P. Zorkoczy, Ed.), Oxford University Press, pages 69-104.

G. Edited Collections (Journals / Conference / Symposium / Video Proceedings)

1. Inkpen, K., Greenberg, S., Mandryk, R., Scott, S. and Zanella, A. (2000)
Proceedings ACM CSCW 2000: Workshop on Shared Environments to Support Face-to Face Collaboration. see On-line proceedings, Philadelphia, Pennsylvania, USA, December. Workshop held at the ACM CSCW 2000 conference.

2. Harrison, B. and Greenberg, S. (1994)
CSCW '94 Formal Video Program. In ACM Conference on Computer Supported Cooperative Work - ACM CSCW'94. (Chapel Hill, North Carolina), ACM Press, pages 9-10. Summary of videos published in Harrison, B. and Greenberg, S. (Eds), ACM SIGGRAPH Video Review (an optional supplement of Computer Graphics). Volume 106, ACM Press. Special Edition of the CSCW '94 Technical Video Program. Videotape.

3. Greenberg, S. (1992)
The CSCW '92 Formal Video Program. In ACM Conference on Computer Supported Cooperative Work - ACM CSCW'91. ACM Press. Summary of videos published in Greenberg, S. (Ed), ACM SIGGRAPH Video Review (an optional supplement of Computer Graphics, Volume 87, ACM Press. Special Edition of the CSCW '92 Technical Video Program, Videotape.

4. Greenberg, S. and Hayne, S. (1992)
Proceedings of the Workshoop on Group Drawing and Writing Tools. Workshop held at the ACM CSCW Conference, Toronto, October 31.

5. Greenberg, S., (Guest Editor) (1991).
International Journal of Man Machine Studies: Special Issue on Computer supported cooperative work and groupware. February, Volume 34(2) and March, Volume 34(3).
    - Subsequently revised and republished as Greenberg, S. ed (1991), Computer Supported Cooperative Work and Groupware, Academic Press.

H. Other Invited Publications

1. Greenberg, S. (2009)
Promoting Creative Design Through Toolkits. In Proceedings of the Latin-American Conference on Human-Computer Interaction (CLIHC'09) CPS, pages 92-93, November 9-11. Invited keynote

2. Greenberg, S. (2006)
Reconsidering HCI in the Age of Social, Ubiquitous and Domestic Computing. In Proceedings of VII Congreso Internacional de Interacional de Interaccion Persona-Ordenadorion - Interraccion'06. AIPO-Asociacion Interaccion Persona-Ordenador, 4 pages, November 13-17.

3. Greenberg, S., Mark, G., Fussell, S. and Inkpen, K. (2006)
From the Papers and Notes Chairs. In Proceedings of ACM Conference on Computer Supported Cooperative Work - ACM CSCW'06. ACM Press, v-vi.

4. Greenberg, S. (2004)
Physical User Interfaces: What they are and how to build them. In ACM UIST'04 Symposium on User Interface Software and Technology, page 161, Santa Fe, New Mexico, October 24–27.

5. Greenberg, S. (2004)
Enhancing Creativity with (Groupware) Toolkits. In Proc Fifth Australasian User Interface Conference, Volume 28 in the CRPIT Conferences in Research and Practice in Information Technology Series. (Dunedin, NZ), Australian Computer Society Inc., page 3, January. Abstract of Keynote Presentation.

6. Greenberg, S. (2003)
Enhancing Creativity with Groupware Toolkits. In Proceedings of the 9th International Workshop on Groupware - CRIWG'03, pages 1-9. Springer-Verlag, Autrans, France, September 28 - October 2. Invited keynote talk.

7. Greenberg, S. (2002)
Rapid Prototyping of Physical User Interfaces (invited presentation). In Proceedings of Graphics Interface (GI'02) Distributed by ACM and Morgan-Kaufmann, May.

8. Greenberg, S. (2001)
Supporting Casual Interaction between Intimate Collaborators. In M.R. Little and L. Nigay (Eds.) Engineering for Human-Computer Interaction (EHCI 2001, 8th IFIP International Conference, Toronto, Canada, May), page 3. Lecture Notes in Computer Science: LNCS 2254, Springer-Verlag.

9. Greenberg, S. (1999)
The Ebb and Flow of Collaboration in Groupware - Invited Plenary. In Proceedings of the Australian Conference on Human Computer Interaction - OZCHI'99. (Wagga Wagga, Australia),, November 28-30.

10. Greenberg, S. and Gutwin, C. (1998)
From Technically Possible to Socially Natural Groupware. In Proceedings of the 9th NEC Research Symposium: The Human-Centric Multimedia Community. (Nara, Japan),, August 31-September 1.

11. Crow, D., Parsowith, S., Bowden Wise, G. [with Paul Dourish, Saul Greenberg, Jonathan Grudin and Yvonne Rogers] (1997)
Students: The Evolution of CSCW - Past, Present and Future Developments. ACM SIGCHI Bulletin, 29(2), April.

12. Greenberg, S. and Roseman, M. (1992)
Support for group work. IEEE Potentials, 11(2):20-22. IEEE Press, April.

13. Greenberg, S. (1991)

Computer supported cooperative work and groupware: An introduction to the special edition. International Journal of Man Machine Studies, 34(2):133-143, February. Also describes IJMMS 34(3). Republished in a revised form in Greenberg, S. ed (1991), Computer Supported Cooperative Work and Groupware, Academic Press, p1-10.

14. Greenberg, S. (1989)
The 1988 conference on computer-supported cooperative work: Trip report. ACM SIGCHI Bulletin, 21 (1):49-55, July. Republished in Canadian Artificial Intelligence, No 19, April.

15. Greenberg, S. and Masrani, R. (1988)
Iconic interfaces for office systems based on video games. Canadian Artificial Intelligence, 17, October.

I. Papers in Refereed or Invited Workshops

1. He, H.A. and Greenberg, S. (2009)
Motivating Sustainable Energy Consumption in the Home. In ACM CHI Workshop on Defining the Role of HCI in the Challenges of Sustainability. (Workshop held at the ACM CHI Conference), 5 Pages, April. Also in: ACM CSCW Workshop on Designing for Families (Workshop held at the ACM CSCW Conference), November, 2008.

2. Saulnier, P., Sharlin, E. and Greenberg, S. (2009)
Using brain-robot interfaces for controlling implicit social patterns. In Workshop on Brain Machine Interfaces for Neuroprostheses and Robot Control, held at the IEEE International Conference on Robotics and Automation. (Kobe, Japan), 3 pages plus poster, May 12.

3. Greenberg, S. and McEwan, G. (2006)
Reflecting on Several Metaphors for Media Spaces. In CSCW'06 Workshop on Media Space - Reflecting on 20 Years - A workshop held at ACM CSCW'06. Steve Harrison, Organizer.

4. Nunes, M., Greenberg, S., Carpendale, S. and Gutwin, C. (2006)
Video Traces. In Karahalios, K. and Viegas, F. (Eds.) ACM CHI 2006 Workshop on Social Visualization: Exploring Text, Audio, and Video Interactions. On-line proceedings. Includes video shown at the workshop.

5. Greenberg , S. (2005)
HCI Graduate Education in a Traditional Compute Science Department. In ACM CHI 2005 Workshop on Graduate Education in Human-Computer Interaction. Organized by Beaudouin-Lafon, M., Foley, J., Grudin, J., Hudson, S., Hollan, J., Olson, J. and Verplank, B., April.

6. McEwan, G. and Greenberg, S. (2005)
Community Bar Places for Collaboration. In Luigina Ciolfi, Geraldine Fitzpatrick and Liam Bannon (Eds.) Workshop Proceedings Settings for Collaboration: The Role of Place, held in conjunction with ECSCW'2005, Paris, September 18. Poster included with paper.

7. McEwan, G. and Greenberg, S. (2005)
Community Bar: Designing for Awareness and Interaction. In Workshop on Awareness systems: Known Results, Theory, Concepts and Future Challenges - held at ACM CHI'05. Organized by Panos Markopoulos, de Ruyter, Boris, and Mackay, Wendy, April.

8. Neustaedter, C., Elliot, K. and Greenberg, S. (2005)
Understanding Interpersonal Awareness in the Home. In Workshop on Awareness systems: Known Results, Theory, Concepts and Future Challenges - held at ACM CHI'05. Organized by Panos Markopoulos, de Ruyter, Boris, and Mackay, Wendy, April.

9. Tang, A. and Greenberg, S (2005)
Supporting Awareness in Mixed Presence Groupware. In Workshop on Awareness systems: Known Results, Theory, Concepts and Future Challenges - held at ACM CHI'05. Organized by Panos

Markopoulos, de Ruyter, Boris, and Mackay, Wendy, April. Also compiled in Report 2005-772-03.

10. Neustaedter, C. and Greenberg, S. (2003)
Balancing Privacy and Awareness in Home Media Spaces. In Workshop on Ubicomp Communities: Privacy as Boundary Negotiation. Held as part of the 5th International Conference on Ubiquitous Computing - UBICOMP'2003. (Seattle),, October 12.

11. Boyle, M. and Greenberg, S. (2002)
GroupLab Collabrary: A Toolkit for Multimedia Groupware. In Workshop on Network Services for Groupware, Held at ACM Conference on Computer Supported Cooperative Work - ACM CSCW'02. (J. Patterson, Ed.), November 17.

12. Neustaedter, C. and Greenberg, S. (2002)
Supporting Coherence with a 3D Instant Messenger Visualization. In Workshop on Discourse Architectures, held at that ACM CHI Conference on Human Factors in Computing Systems - ACM CHI'02.

13. Fitchett, C. and Greenberg, S. (2001)
The Phidget Architecture: Rapid Development of Physical User Interfaces. In UbiTools'01 Workshop on Application Models and Programming Tools for Ubiquitous Computing - Held at UBICOMP'01 Conference.

14. Greenberg, S. and Fitchett, C. (2001)
Phidgets: Incorporating Physical Devices into the Interface. In Proceedings of the Workshop on Building the Ubiquitous Computing User Experience. (Held at ACM CHI'01, Seattle), (M. Newman, K. Edwards and J. Sedivy, Ed.).

15. Rounding, M. and Greenberg, S. (2000)
Using the Notification Collage for Casual Interaction. In Workshop on Shared Environments to Support Face-to-Face Collaboration, held at ACM Conference on Computer Supported Cooperative Work - ACM CSCW'00. (Philadelphia, Pennsylvania, USA), December.

16. Zanella, A. and Greenberg, S. (2000)
Using Translucent Interface Components to Lessen Interference Effects in Single Display Groupware. In Workshop on Shared Environments to Support Face-to-Face Collaboration, held at ACM Conference on Computer Supported Cooperative Work - ACM CSCW'00. (Philadelphia, Pennsylvania, USA), December.

17. Greenberg, S. and Kuzuoka, H. (1999)
Bootstrapping Intimate Collaborators. In Issues of Use in CSCW Technology Design: A Workshop at the Australian Conference on Computer Human Interaction - OZCHI'99. (Wagga Wagga, Australia), (Robertson, T. and Fitzpatrick, G. and Greenberg, S., Ed.), November 27.

18. Kaasten, S. and Greenberg, S. (1999)
Designing an Integrated Bookmark / History System for Web Browsing. In History Keeping in Computer Applications: A Workshop. (Maryland, USA),, December 3.
http://www.cs.umd.edu/hcil/about/events/history-workshop/.

19. Greenberg, S. and Boyle, M. (1998)
Moving Between Personal Devices and Public Displays. In Workshop on Handheld CSCW, held at ACM Conference on Computer Supported Cooperative Work - ACM CSCW'98, November 14. Also available as Report 98/630/21, August.

20. Greenberg, S. and Johnson, B. (1997)
Studying Awareness in Contact Facilitation. In ACM CHI'97 Workshop on Awareness in Collaborative Systems. (Atlanta, Georgia), (Susan E. McDaniel and Tom Brinck, Ed.), March 22-27.

21. Gutwin, C. and Greenberg, S. (1997)
Workspace Awareness. In ACM CHI'97 Workshop on Awareness in Collaborative Systems. (Atlanta,

Georgia), (Susan E. McDaniel and Tom Brinck, Ed.), March 22-27.

22. Tauscher, L. (1996)
Supporting World Wide Web Navigation Through History Mechanisms. In CHI 96 Workshop: HCI and the Web, Vancouver, BC, April.

J. Papers / Videos in Non-Refereed Publications

Research reports that have been published elsewhere in its original or revised form are not listed.

1. Ghanam, Y., Shouman, M., Greenberg, S. and Maurer, F. (2009)
Object-Specific Interfaces in Smart Homes. Research report 2009-937-16, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, August.

2. Jota, R., Nacenta, M.A., Jorge, J.A., Carpendale, S. and Greenberg, S. (2009)
A Comparison of Ray Pointing Techniques for Very Large Displays. Research report 2009-942-21, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, September.

3. Marquardt, N., Jota, R., Greenberg, S. and Jorge, J. (2009)
The Continuous Interaction Space: Integrating Gestures Above a Surface with Direct Touch. Research report 2009-925-04, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, April.

4. Greenberg, S., Stehr, N. and Tee, K. (2008)
Artifacts as Instant Messenger Buddies. Research report 2008-896-09, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada.

5. Nunes, M., Greenberg, S. and Neustaedter, C. (2008)
Using Physical Memorabilia as Opportunities to Move into Collocated Digital Photo Sharing. Research report 2008-919-32, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada.

6. Tang, A., Lanir, J., Greenberg, S. and Fels, S. (2008)
Uncovering Activity and Patterns in Video using Slit-Tear Visualizations. Research report 2008-08, Department of Computer Science, University of British Columbia (UBC), Vancouver, BC, Canada, July 31.

7. Tang, A., Lanir, J., Greenberg, S. and Fels, S. (2008)
Supporting Transitions in Work: Informing Groupware Design by Understanding Whiteboard Use. Research report TR-2008-04, Department of Computer Science, University of British Columbia, Vancouver, BC., Canada V6P 1Z4, April.

8. Tee, K., Greenberg, S. and Gutwin, C. (2008)
Artifact Awareness through Screen Sharing for Distributed Groups. Research report 2008-898-11, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, June.

9. Tse, E., Greenberg, S., Shen, C., Forlines, C. and Kodama, R. (2008)
Designers Environment. Research report iLab-2008-1, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 2:53.

10. Greenberg, S., Brush, A.J., Carpendale, S., Diaz-Marino, R., Elliot, K., Gutwin, C., McEwan, G., Neustaedter, C., Nunes, M., Smale,S. and Tee, K. (2007)
Collected Posters from the Nectar Annual General Meeting. Research report 2007-887-39, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, December.

11. Guo, C., Greenberg, S., Boyd, J. and Sharlin, E. (2007)
Aibo Monitor. Research report iLab-2007-1, Grouplab, Dept. Computer Science, University of Calgary.

12. Tang, A., Greenberg, S. and Fels, S. (2007)
Exploring Video Streams using Slit-Tear Visualizations. Research report 2007-886-38, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, December. Paper and Video.

13. Tse, E., Hancock, M. and Greenberg, S. (2007)
Speech-Filtered Bubble Ray: Improving Target Acquisition on Display Walls. Research report iLab-2007-2, Grouplab, Dept. Computer Science, University of Calgary.

14. Elliot, K., Neustaedter, C. and Greenberg, S. (2006)
Sticky Spots and Flower Pots: Two Case Studies in Location-Based Home Technology Design. Research report 2006-830-23, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, April.

15. Greenberg, S. and Boyle, M. (2006)
Custom Notification. Research report iLab-2006-1, Grouplab, Dept. Computer Science, University of Calgary. Duration 6:54.

16. Diaz-Marino, R., Carpendale, S. and Greenberg, S. (2005)
Lyric Text. Research report iLab-2005-1, Grouplab, Dept. Computer Science, University of Calgary. Video and 2-page paper, duration 3:42.

17. Elliot, K. and Carpendale, S. (2005)
Awareness and Coordination: A Calendar for Families. Research report 2005-791-22, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, May.

18. Tse, E. and Greenberg, S. (2005)
Supporting Lightweight Customization for Meeting Environments. Research report 2005-784-15, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, April. Paper and video, video report, duration 4:34.

19. Rounding, M. and Greenberg, S. (2004)
The Notification Collage. Research report iLab-2004-1, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 1:44.

20. Boyle, M. and Greenberg, S. (2003)
Grouplab Collabrary Toolkit: Rapid Prototyping Toolkit for Multimedia Groupware. Research report iLab-2003-3, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 1:18.

21. Greenberg, S. and Carpendale, S. (2003)
Multiple Lenses in Single Display Groupware. Research report iLab-2003-6, Grouplab, Dept. Computer Science, University of Calgary, May. Video report, duration 0:48.

22. McEwan, G. and Greenberg, S. (2003)
SideNC. Research report iLab-2003-4, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 0:41.

23. Tang, A., Kratt, D., Carpendale, S. and Dunning, A. (2003)
Sensing and Visualising Physiological Arousal. Research report iLab-2003-2, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 1:28.

24. Tang, C., McEwan, G. and Greenberg, S. (2003)
VisStreams: Visualizing Temporal Multimedia Conversations. Research report iLab-2003-1, Grouplab, Dept. Computer Science, University of Calgary. Presented publicly in Tang's Graphics Interface presentation.

25. Greenberg, S. (2002)
Real Time Distributed Collaboration. Research report Grouplab, Department of Computer Science,

University of Calgary, Calgary, Alberta, Canada.

26. Boyle, M. and Greenberg, S. (2001)
A Privacy-Preserving Reactive Media Space. Research report iLab-2001-3, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 1:40.

27. Kaasten, S. and Greenberg, S. (2001)
Integrating History, Bookmarks and Back. Research report iLab-2001-2, Grouplab, Dept. Computer Science, University of Calgary, June. Video report, duration 4:41.

28. Rounding, M. and Greenberg, S. (2001)
Notification Collage. Research report iLab-2001-01, Grouplab, Dept. Computer Science, University of Calgary. Presented publicly in Greenberg and Rounding's ACM CHI 2001 presentation.

29. Boyle, M. and Greenberg, S. (2000)
Balancing Awareness and Privacy in a Video Media Space Using Distortion Filtration. In Proceedings of the Western Computer Graphics Symposium 2000. (Panorama Mountain Village, BC, Canada),, March 26-29. Also collected in Report 2000-652-04, March.

30. Greenberg, S., Ho, G. and Kaasten, S. (2000)
Contrasting Stack-Based and Recency-Based Back Buttons on Web Browsers. Research report 2000-666-18, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, August. This version was updated in January 2002, original report is also available.

31. Kaasten, S. and Greenberg, S. (2000)
Designing an Integrated Bookmark / History System for Web Browsing. In Proceedings of the Western Computer Graphics Symposium 2000. (Panorama Mountain Village, BC, Canada), March 26-29. Also collected in: GroupLab at Skigraph, Report 2000-652-04, March.

32. Rounding, M., Greenberg, S. and Carpendale, S. (2000)
Awareness Projected: Moving Awareness to a Public Space. In Proceedings of the Western Computer Graphics Symposium 2000. (Panorama Mountain Village, BC, Canada), March 26-29. Also collected in: GroupLab at Skigraph, Report 2000-652-04, March.

33. Tam, J., Greenberg, S. and Maurer, F. (2000)
Change Management. In Proceedings of the Western Computer Graphics Symposium 2000. (Panorama Mountain Village, BC, Canada),, March 26-29. Also collected in Report 2000-652-04, March.

34. Tam, J., McCaffrey, L., Maurer, F. and Greenberg, S. (2000)
Change Awareness in Software Engineering Using Two Dimensional Graphical Design and Development Tools. Research report 2000-670-22, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, October.

35. Zanella, A. and Greenberg, S. (2000)
A Single Display Groupware Widget Set. In Proceedings of the Western Computer Graphics Symposium 2000. (Panorama Mountain Village, BC, Canada),, March 26-29. Also collected in Report 2000-652-04, March.

36. Cockburn, A. and Greenberg, S. (1999)
Beyond the 'Back' Button: Issues of Page Representation and Organisation in Graphical Web Navigation Tools. Research report 1999-640-03, Dept of Computer Science, University of Calgary, Calgary, Alberta, Canada.

37. Cockburn, A. and Greenberg, S. (1999)
Beyond the Back Button. Research report iLab-1997-2, Grouplab, Dept. Computer Science, University of Calgary. Video report, duration 6:35.

38. Kuzuoka, H. and Greenberg, S. (1998)

Mediating Awareness and Communication through Digital but Physical Surrogates. Research report 98-631-22, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada. See also companion 7 minute video of the same title, published at CHI 1999.

39. Gutwin, C. and Greenberg, S. (1997)
Interactive Fisheye Views for Groupware. Research report Grouplab, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada.

40. Gutwin, C. and Greenberg, S. (1997)
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K. Theses

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3. Marquardt, Nicolai (2008)
Developer Toolkit and Utilities for Rapidly Prototyping Distributed Physical User Interfaces. Diplom Thesis, Bauhaus-University Weimar, Faculty of Media, Media Systems Science, Germany, March 10. *Part of this work was done during a research internship at the University of Calgary.*

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11. Boyle, M. (2005)
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L. Independent papers (produced by people supervised by Greenberg)

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2. Clawson, J., Voida, A., Patel, N. and Lyons, K. (2008)
Mobiphos: A collocated-synchronous mobile photo sharing application. In Proc. Conference on Human-Computer Interaction with Mobile Devices and Services - MobileHCI 2008. (Amsterdam, The Netherlands), ACM Press, September 2-5.

3. Goecks, J., Voida, A., Voida, S. and Mynatt, E. (2008)
Charitable Technologies: Opportunities for Collaborative Computing in Nonprofit Fundraising. In Proc. ACM Conference on Computer Supported Cooperative Work - ACM CSCW'08. (San Diego, CA), ACM Press, 10 pages, Nov. 8-12.

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Reflecting on Domestic Displays for Photo Viewing and Sharing. In Workshop on Collocated Social Practices Surrounding Photos - held at ACM CHI'08. Organized by Sian Lindley, Abigail Durrant, Dave Kirk, and Alex Taylor, April.

5. Voida, S., Mynatt, E. and Edwards, W.K. (2008)
Re-framing the Desktop Interface Around the Activities of Knowledge Work. In Proc. ACM Symposium on User Interface Software and Technology - ACM UIST'08. (Monteray, CA), ACM Press, 10 pages, October 19-22.

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"LINC-ing" the Family: The Participatory Design of an Inkable Family Calendar. In Proceedings of the ACM Conference on Computer-Human Interaction - ACM CHI'06. (Montreal, Quebec), ACM Press, pages 141-150, April 24-27. *This work was done while Neustaedter was an MSR intern.*

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Informing the Design of Direct-Touch Tabletops. IEEE Computer Graphics and Applications - IEEE CG&E, 26(5):36-46. IEEE Press, September.

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Multimodal Co-located Collaboration. In UIST Doctorial Consortium, Adjunct Proceedings of ACM UIST 2006. See also minute madness video presented at the conference.

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Understanding Sequence and Reply Relationships within Email Conversations: A Mixed-Model Visualization. In Proceedings of the ACM Conference on Human Factors in Computing Systems - ACM CHI'03. ACM Press, April 5-10. Earlier version as Microsoft Research Report MSR-TR-2002-102, September 2002. This research was done at Microsoft Research.

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Buddy Bugs: A Physical User Interface for Windows Instant Messenger. In Proceedings of Western Computer Graphics Symposium - Skigraph'02, March. Note that iLab-2002-1 video was aslo shown during the conference talk.

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The Effects of Capture Conditions on the CAMSHIFT Face Tracker. Research report 2001-691-14, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, December.

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Ubiquitous Awareness Spaces. Research report 2001-682-05, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, February.

21. McCaffrey, L. (1998)
Representing Change in Persistent Groupware Environments. Research report GroupLab, Department of Computer Science, University of Calgary, Calgary, Alberta, Canada, January.

22. Roseman, M. (1996)
Managing Complexity in TeamRooms, a Tcl-Based Internet Groupware Application. In Proceedings of the 1996 Tcl/Tk Workshop. Usenix Press.

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Mega-Widgets in Tcl/Tk: Evaluation and Analysis. In Proceedings of the 1995 Tcl/Tk Workshop. (Toronto), Usenix Press, July 6-8.

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When is an Object Not an Object?. In Proceedings of the 1995 Tcl/Tk Workshop. (Toronto), Usenix Press, July 6-8. Also as Report 1995-553-5, March.

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M. Software and Research Data made available to other researchers

Good science requires replication, validation, and continuation of research by others. Because of the complexity of software, I believe that it is critical to provide other researchers with toolkits for rapidly prootyping innnovative software, copies of significant research applications, and any of the usage data collected. Asampling of software is listed below. This list is by no means complete. Most software has been used by others. For example, the various toolkits we created have been used all around the world by a quite diverse set of researchers. The usage data (listed last) has been used as a central part of both a PhD and a Masters thesis at other Canadian universities. TeamRooms and Phidgets have been commercialized.

1. Proximity Toolkit, a system and API for gathering proxemic information
2. .NetworkingGT, a new version of .Networking built upon the GT network layer
3. Shared Phidgets, a new version of Phidgets that handles distributed devices
4. Phidgets, a rapid prototyping toolkit for physical user interfaces
5. SDG Toolkit, for rapidly prototyping Single Display Groupware
6. DiamondTouch Toolkit, for rapidly prototyping applications on the DiamondTouch Surface
7. .Networking, for rapidly prototyping distributed applications
8. Community Bar groupware sidebar
9. Community Bar Media items for rapidly building groupware multimedia items for the above system
10. EasyImages for video capture as bitmap frames and basic image processing of frames and images
11. Collabrary, for rapidly prototyping distributed multimedia applications
12. Souvenirs domestic appliance for photo-sharing in the home
13. TimeLine, an interactive visualization of long video sequences in a single screen
14. TeamRooms, a groupware environment based on virtual rooms.
15. GroupKit. A groupware toolkit.
16. Data collection of client side web-browser use, capturing people's Web navigation patterns
17. Concurrency control management software for groupware.
18. GroupSketch and XGroupSketch. Two groupware drawing programs.
19. Share. A terminal sharing system with flexible floor control.
20. GIC. A graphical front end for a concurrent version control system.
21. Data collected of 168 people using Unix for 4 months.

Last updated October, 2008 by Saul Greenberg