T W I S T E D   S Y S T E M S   I N C .

PRODUCT PROPOSAL

TRACTION

TEAM PROBLEM SOLVING SOFTWARE

August 9, 2015 *This edition of the Traction Product Proposal Oct 1997 (Rev U) is a historical record of the original product proposal which led to creation of Traction Software's TeamPage product, see www.TractionSoftware.com.*

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TRACTION

TEAM PROBLEM SOLVING SOFTWARE

OBJECTIVE: To build products that enable teams to log and share a record of significant events while evolving a Plan, shaping up a project, trouble-shooting a large operation, or monitoring on-going operations.

Adapted from [Douglas C. Engelbart, NLS TELECONFERENCING FEATURES IEEE COMPCON Sep 1975](#)

Twisted Systems Inc. was founded in November 1996 to build products that augment the ability of individuals and teams to collect, organize, analyze, recall, and communicate problem solving information.

Twisted Systems is a Rhode Island corporation, seeking investors and development partners.

TRACTION™ IS A TRADEMARK OF TWISTED SYTEMS, INC.

ABOUT THIS DOCUMENT

This proposal describes the market, capabilities, roots, and basic architecture of the Traction product to potential investors, development partners, customers, and employees of Twisted Systems.

WHAT'S THE POINT?

I took my first journalism course in high school. The fellow who taught it left after two years and opened a hardware store in LA. I think I was the only person he taught who went on to work as a journalist.

We learned the basics of story writing - who, what, when, where - and then learned how to write a lead. One day, the teacher wrote something like this on the board:

Mr. Charles Fenwick, principal of the Broadmoor High School, and his staff will attend the regional educator's conference in Wilmington on Thursday April 25th. Dr. Raymond White, state Secretary of Education, will keynote the conference, which will also feature an address by Dr. Marsha Newman, High School teacher of the year.

He said, "Write the lead." We sat at our desks and wrote, <u>Dr. White to keynote educator's conference</u>, <u>Fenwick to lead teachers on trip to Wilmington</u> and so on.

We turned them in. The teacher looked them over and said "No. What's the point?

Your lead is, <u>No School Thursday</u>."

At that instant, I thought "What's the point? What a wonderful question!"

<div align="right">

notes from Nora Ephron's President's Lecture Series, Brown University 24 April 1997.

</div>

Traction gives teams an easy way to coordinate themselves by recording the process of discovery and making the record accessible. It is kind of *memex* that aids *situational awareness* by providing:

- A quick way to aggregate and summarize information

- A quick way to pass references around

- An easy way to keep informed

- An effective way to eliminate email clutter

Traction makes it easy for team members to add significant items to a web newspaper, or *Newspage*. Your Traction notebook helps you organize quotes, lists, thoughts, examples and reminders, making momentarily important items easy to recall and review. Flag what you wish to publish, and Traction automatically adds the news item to fully cross-referenced front page, topical, and chronological views. You skim a Newspage, diving into detail using a web browser, rather than plowing through email. You can quote from any current or historical news item and send a tell-me-more link by email that leads to the story and the sources the item references. A *Trail Browser* shows you corrections, cross-references, and classifications of any item, and a map of all the contexts in which any item is used.

Traction is Java-based, and can work with your existing web server, browsers, email, office applications, and (optional) document management system. It's simple to install, requires no complex business process modeling or setup, and is ideally suited for use by project teams of 1 to 100 members.

TEAM PROBLEM SOLVING

> *Somewhere around your 30th responses to a response to a response in Notes, you start to wonder where all this group discussion leads. Somewhere around the fifth time a document marches by with yet more groupware annotations and digital yellow stickies attached, you wonder if it is really all that wise to have all of that group editing taking place. After all, isn't the purpose of a group to tap the greater intellect represented by all those fine thingies in the group and, once tapped, move quickly to a better decision? Shouldn't the purpose of groupware be to build more intelligence rather than more features into the product?*
>
> *While it's useful to share documents, hold ad hoc discussions and post groupwide projects, the essence of groupware may be the ability to manage a business outcome by divining a group's thought process.*
>
> *Eric Lundquist The Next Big Thing in Groupware PC Week 1 July 1996*

THE TARGET

Traction is designed for small teams who plan, conduct and troubleshoot operations that are information intensive and interdependent. The task could be: bring a new product to market, win a bid, close an investment deal, operate a refinery, prosecute a legal case, or conduct an audit.

We assume that the team is already using email, and may use Lotus Notes™ or a Document Management System. We will particularly target teams who are deluged with email and are looking for a way to reduce email traffic.

THE PROBLEM

Keeping informed in a team that uses electronic communication can be like reading the content of the New York Times in 300 unlabeled third-class envelopes - every morning.

Email is a cheap and speedy postal service. After discarding obvious junk mail, you may find yourself buried in flood of messages that do not require a response, but contain some point you wish to follow up on. Routine requests for information often require you (or every person on the distribution) to dig through previous mail, looking for the response that someone didn't get, couldn't find, or never kept - and forward it again.

Group discussion models conversation, not thought. If you want opinions on a document or proposed action, it's easy to solicit chains of responses. But a thread often resembles the transcript of a radio talk show. If you're looking for thoughts, you and every reader need to read the transcript very carefully.[1].

The web is a bazaar. Enjoy the hospitality of well-known merchants, check the guides, or search for yourself. Who knows what you may find? Search engines, Yahoo, push channels and agents deliver a

---

[1] When each reader's reaction is immediately fed back into the thread, it is difficult to avoid combining the worst attributes of a town meeting and a rowdy party, see [TSI 3]

larger volume of *potentially* useful information, but you still need to decide what *is* and *is not* relevant for your purposes and find a way to inform members of your team without swamping them.

USE MORE INFORMATION, DELIVERED DIFFERENTLY

Mark Weiser, Chief Technologist of Xerox PARC, says that the answer to information overload is *more* information, *delivered differently*. He advocates using "Calm Technology" and practices that let us attune without attending, just as you are now attuned to a fire alarm that is not ringing [MW 1].

WORKING IN THE SAME PLACE

Consider how you work as part of a small, collocated team. In a good team, everyone participates in or overhears enough of what's happening to respond appropriately to unpredictable events.

You can learn what's happening by osmosis, scribble plans on a shared whiteboard, and hold design discussions in the hall. Serendipity happens.

You can build a working vocabulary on the fly, drawing on conversations, nicknames of whiteboard pictures - anything that lets you anchor references to specific events or objects. Mention "Anne's objection from last Thursday" or "the washtub diagram" and everyone knows what you're talking about, or can quickly be reminded.

The first signal of something happening can be a raised voice: be prepared to pitch in and help, celebrate, or stay out of the way.

A message that leverages this shared context is easier to write, easier to read, and less likely to be misinterpreted - if everyone's recollection agrees.

BUT, OSMOSIS DOESN'T WORK WHEN:

- Team members work in different locations, or on different schedules

- The team gets larger

- Everyone does not have access to the same record of events

- It takes too much time and attention to keep informed

- The cost of keeping others informed exceeds the benefits (and reward)

WHAT IS TRACTION?

FOR HOLLYWOOD MOGULS

Quicken for Projects. Traction collects project news, discussion and attachments that would otherwise be broadcast in email, and builds a web *newspaper of record* that everyone can browse easily, scanning, filing and discarding email, one message at a time.

FOR BUSINESS TYPES

Traction is an *information accounting system*. Traction lets you log, categorize, aggregate, and cross-reference items to build a stable, shared Journal of significant day-to-day events. *[CP 1]*

Traction generates newspaper-like web page views automatically. Items can quote from or reference Journal items, email, web pages or other sources. You can register interest in topics or items that are important to you, and skim summaries of changes, corrections, commentary, or new items. These summaries can be presented as web page views, push channel bulletins, or email messages, with links leading back to Journal items and the quoted email, web page, or other source.

FOR ENGINEERS

Traction is a kind of *memex* built from a metadata repository attached to an HTTP server (internally, Java servlets) and an extensible family of Java applets and applications. The repository contains an append-only log with a novel form of incrementally chunked content, where-used and classification indices. It permits new entries to classify, correct, name, version, or comment on other entries or external sources using bi-directional ternary relations. See: *What's a Memex ?*

Log entries can be rapidly assembled into HTML views by an extensible family of pipelined assemblers, driven by viewspecs encoded in URL's. Traction integrates with Microsoft, Netscape and Lotus webtops by implementing drag-and-drop for quotes from mail, web pages, and news groups and providing news feeds for push channels. Traction is designed to support extensible entry types using XML and MIME encapsulation.

FOR EVERYONE ELSE

Traction is a *home page for your project* that you update by jotting items in a notepad or sending email to a Traction server rather than editing HTML files. You can check off a shared list item, perhaps with a brief comment, and it becomes a news item that team members can browse over or dive into. If it's important, flag it as a headline; a link to your comment and the revised list will be added to today's headlines. If you're interested in a particular item or topic, you can ask to receive a notice when it changes, or when an item referencing it is logged.

You can search or browse through back issues, by date or topic, and grab a URL to save a stable link to any Newspage edition, headline or item.

Traction provides a *Trail Browser* that shows corrections, cross-references, and classifications of any item in your notebook or the shared Journal, and a map of all the contexts in which an item is used.

THE OPPORTUNITY

So here's a hypothesis for you. The hypothesis is that we're on the verge of seeing project collaboration tools being widely adopted. The Web, the readable Web, is step one. That now eliminates most of the infrastructure problems for access, for letting you see it. What we don't yet have on the Web is easy capabilities for writing.

IC: Then the next step would be easily modifiable Web pages, so that you could continue a message or put up a new page saying you have a task and give the description.

Malone: Right. And at some point I think there will be enough functionality in a very widely deployed infrastructure like the Web that this stuff will take off. Will that be next year? Three years? Five years? It's hard to predict exactly, but I think it will take off at some point. Because then it will no longer be a matter of having to go though a huge installation process to get all the software on all the desks of all the people in an entire project. It will be just a matter of saying "Go to this web site." p. 13.

As communication costs fall even further, there should in many cases be a third stage, where, rather than having all the information brought to one point for centralized decision making, it's now cheap enough so that essentially everyone can have access to all the information.

What this enables is "decentralized connected" decision makers, or what we called the "cyber cowboys." It's now economically feasible to have a large number of people well enough informed so that they can make good decisions. You have the informational advantages previously available only in a centralized system, with the motivational and other advantages previously available only in decentralized systems, and so you get the best of both worlds. That's an argument for why we think empowerment is not just a fad. p.16

Thomas W. Malone, Professor of Information Systems, MIT Sloan School; Director, MIT Center for Coordination Science
IEEE Internet Computing, May/June 1997

International Data Corporation estimates the size of the Groupware market at $1.3 billion per year in 1997, growing to $2.4 billion per year by 2004. In the second quarter of 1998, Microsoft Exchange surpassed Lotus Notes in email account sales, and is rapidly becoming a direct threat to the Notes for Groupware applications. Novell's Groupwise is a fading star.

One new segment of the Groupware market has been dubbed *Teamware*. Teamware products use a web browser and a specialized application server to deliver a streamlined subset of the file sharing and threaded discussion model introduced by Lotus Notes. By cutting functionality and avoiding special clients, Teamware promises easy and low-cost deployment by project teams with little or no support from corporate IT departments. IDC estimates that the Teamware market will grow to $400 million per year by 2000. Instinctive Technology's eRoom is the early leader in the emerging Teamware market.

We believe that Lotus and Microsoft will roll over the Teamware market by fielding bundled product directly (Microsoft's Windows2000 Server) or through their value added partners (Lotus Instant! TEAMROOM).

Although Traction also uses a web browser and specialized application server, and promises easy low-cost deployment, we believe that Traction can be successfully positioned and sold as an essential add-on to users of email, groupware and line-of-business (ERP) systems.

The top five line-of-business vendors (SAP, PeopleSoft, J.D. Edwards, Baan, Oracle Applications) sold over $6 billion of software to over 20,000 business customers in 1997. Traction offers improved communication and a solution to email overload for accounting, payroll, human resources, purchasing, engineering and other workgroups using any line-of-business, groupware or standard email system.

Traction is to Groupware as a Palm Pilot is to a Personal Computer:

- Traction is streamlined and engagingly tailored to a specific task;

- It is unintimidating to turn on and use;

- It is as easy as email;

- It docks with the applications you already have;

- And can thrive with a branded look, feel and attitude.

With modest resources and bootstrapped growth, we aim for a valuation exceeding $50 million in three years or less, and sale of the company to one of the top 10 players in the email, groupware, or line-of-business markets we target. With greater resources, we aim higher.

TRACTION NOTEPAD & NOTEBOOK

> *Most of us take some notes when solving a problem, and for good reason. First, the act of writing what you know about a problem helps clarify your understanding. Second, notes help provide a structure that help you explore the problem space. By writing our thoughts down, we can selectively concentrate on different aspects of the problem, secure in our knowledge that we won't forget something important. Finally, notes provide a structure that makes it easier to compare two or more alternatives.*
>
> *A project notebook (or journal) is your repository of notes, thoughts, ideas, and sketches regarding one or more projects. It is a tool to help you in the messy process of solving a problem by providing a place to record all the things you think about during the life of a project. It supports the exploration of alternative designs and can help you when you have to backtrack to a prior solution. It is like a portable, historical whiteboard. It can be shared (via photocopying) or given away (by ripping out pages). pp. 120 - 122*
>
> *Luke Hohmann Journey of the Software Professional, Prentice Hall, 1997.*

WHAT'S A TRACTION NOTEPAD?

A simple online notepad that lets you enter, correct, name, or create a new version of one Traction Journal item at a time. A notepad can only be used when connected to a Traction Server.

WHAT CAN IT DO?

- Capture quotes, adding your own commentary and classification, while retaining a live reference to the original source.

- Log notes, checklists, and reminders.

- Log corrections, new versions or comments on other items.

- Check off list items and log the change.

- Classify items for personal use or for publication *[RE 1]* *[WEB 1]*.

WHAT'S A TRACTION NOTEBOOK?

An online notebook that you may use to enter and arrange notes, sketches, outlines, checklists, and references to items in the Traction Journal or other documents. The notebook is divided into tabbed sections and fixed-size lined, unlined or gridded pages. You can arrange items anywhere on a page, and have the notebook show live cross-reference and classification markers in the margin. Although the layout is more flexible than the notepad, you can log, classify and publish passages from your notebook directly to a Traction Journal just as easily.

The Traction notebook can be used as a personal Traction server, serving web page views to your web browser when disconnected from a team Traction server. You can attach a self-contained chunk of a team's Traction Journal (and items from its serial file) to your notebook for use when you are

disconnected. When you reconnect, your pending additions are reconciled up to the team's Traction Journal, and any updates are reconciled into your copy.

WHAT CAN IT DO?

- Capture quotes, record notes, checklists, sketches and reminders on a notebook page.

- Group pages into tabbed sections.

- Transclude views of changing documents as live or static views.

- Preserve the visual arrangement of items on notebook pages.

- Show cross-references, classifications and similar relationships as live marginalia.

- Flag items for publication via a Traction Journal.

- Classify items for personal use or for publication.

- Collect items gathered by specialized agents for your review.

- Create sections that present automatically-generated summary and classification views.

- Preserve your preferences and customization options in a special section.

- Keep serial file copies of important messages, web pages and other objects.

- Keep an append-only copy of Traction Journals up-to-date and use the copy to serve Traction Newspage views when disconnected from a team Traction server.
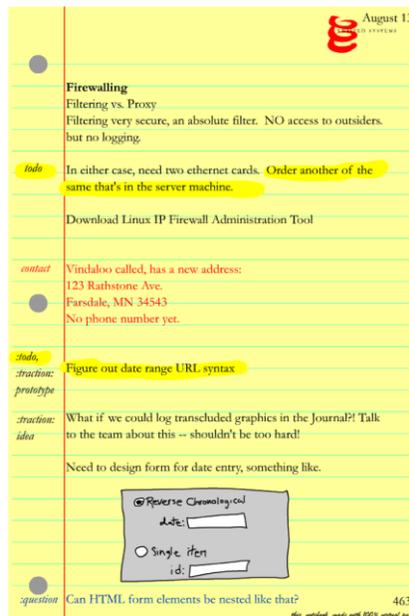
TRACTION JOURNAL

The term "journal" emerged early in the conceptualization process for two reasons:

I felt it important in many dynamic operations to keep a log (sometimes termed a "journal") that chronicles events by means of a series of unchangeable entries (for instance, to log significant events while evolving a Plan, shaping up a project, trouble-shooting a large operation. or monitoring on-going operations). These entries would be preserved in original form, serving as the grist for later integration into more organized treatments.

I also wanted something that would serve essentially the same recorded-dialogue purpose as I perceived a professional journal (plus library) to do.

Douglas C. Engelbart, NLS TELECONFERENCING FEATURES IEEE COMPCON Sep 1975

Doug Engelbart from *"As We May Think" - A Celebration of Vannevar Bush's Vision*

WHAT'S A TRACTION JOURNAL?

A Traction Journal records a stable, time-ordered sequence of entries from you and other team members. *Data* entries contain plain text, HTML, XML or other MIME-encapsulated data. You can log entries for your own use, or share them with a project team. *Metadata* entries correct, name, version, classify, comment on, or associate other Journal entries.

For example, you might log a note containing important news and classify it as a headline item. Later, you notice that it contains a typo in a customer's telephone number. You can log a correction that allows Traction views to:

- Show the corrected note in place of the original content.

- Clearly indicate that the item has been corrected.

- Provide a link from the correction to the original item.

- Add a description to the Newspage's *Corrections* column.

- Show a summary of corrections to headline items posted within the past six months.

A Journal entry can classify other entries using a set of hierarchical keywords that are shared by everyone on a project team. You can also invent keywords to organize information viewed in your personal notebook or Newspages. You can easily reclassify items and see only the new organization, the original organization, or both.

A Journal entry can also associate many other items by storing references to them in a list that can itself be named, classified, and versioned.

A Traction Journal is managed by a Traction Team Server, or the Personal Server built into a Traction Notebook. A Traction server accepts new entries using the HTTP form protocol, and delivers Journal data as HTML views. It can also deliver Journal items to Trail Browsers or custom components using protocol that is suitable for rapid generation of automatically cross linked views.

WHAT CAN IT DO?

- Record items from various sources (Notepad, email, Notebook, Trail Browser) in a form that can be readily organized and served as trails or Newspage views.

- Record items as personal or project entries.

- Record items for review, reference, and extended dialog.

- Record items that correct, name, classify, comment on or associate other items.

- Save copies of messages, web pages, and important documents in a *serial file* that is cataloged in the Journal. Serial file copies are stored with the Journal or in a separate ODMA repository.

- Segment a Journal into chronological chunks (a month, quarter, or a year of entries) that can be copied, archived and searched easily.

- Serve topical, chronological and special-purpose views of Journal data using standard HTTP or rmi protocols.

- Use reporters and other agents to examine the content of each entry the Journal receives, and insert stable links in each HTML view it delivers.

- Respond to requests for views received by email or other channels.

TRAIL BROWSER

> *The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square rigged ships.*
>
> <u>*Vannevar Bush,* As We May Think, *Atlantic Monthly, July 1945*</u>

WHAT'S A TRAIL BROWSER?

A Trail Browser is an application (or applet) that maps connections among items in your Traction Notebook or Journal. It visualizes the timelines, categories, corrections, names and cross-references recorded in the Journal when you want to explore any of these relationships. The Trail Browser can also create new associations.

For example, if you recall a Newspage item that mentioned a travel planner product, you could scan a headline view, or use a Trail Browser to search for items that mention 'travel'. The Trail Browser shows you a list of titles.

If the list is long, you could narrow the field by:

- Adding additional qualifiers,

- Showing the text surrounding each 'travel' hit,

- Exploring lists, categories, or relationships associated with any of the 'travel' hits. You recall that the travel planner was mentioned in a brief note on customer sales; choosing the `customer:sales` category shown with the 'travel' hit list narrows the candidates to a few items.

Alternatively, you could start by exploring the `customer:sales` category and narrow the field by searching for 'travel' or items that were also categorized as headline news.

When you find the item, you can read its content, and see all of the categories, corrections, lists, names, and remarks which reference the item.

At any time, you can save the contents of a hit list or other Trail Browser panels as a new Journal item that you can log, categorize, and edit like any other. A cross-reference to this new association can be shown in the margin of any view that contains an item mentioned in the association.

WHAT CAN IT DO?

- Show items that are associated by name, category, time, or reference.

- Show how and where each item is used and what other items are associated with it.

- Classify items by category.

- Name items you wish to recall.

- Log new associations as landmarks for recall and subsequent use.

- Monitor changes to items and associations that interest you.

- Find Journal entries by name, content search, timeline search, or relationship.

- Log the state of the Trail Browser as a new entry, so you can return to a particular exploration.

SEE ALSO: *WHAT'S A MEMEX ?*

TRACTION NEWSPAGE

> *The future of design in information technologies lies not in developing means of increasingly full re-presentation, but rather in allowing increasing amounts to be underrepresented; not by increasing what is said, but rather by helping people to leave more unsaid.*
>
> *The newspaper does not just report news; it makes news. The underlying paper has a significant role in that making. First, only certain items can fit within the bounds that the paper provides. In general, what gets in is news; what does not is not news. Second, the circulation of unchanging newsprint through a society (ensuring that the same item is available to everyone at roughly the same time) turns those items into <u>social facts</u> - common to a broad readership. Politicians are disturbed to find their scandalous behavior splashed under the headline not because the story is news to them, but because it has become front-page news to 100,000 other people. The newspaper has been described as a "1-day best-seller" - and, as with other best-sellers, the point is that everyone is reading it. It is the collective selection, presentation, and circulation of information that turns information into news*
>
> [John Seely Brown & John Duguid, Keeping it Simple, in Bringing Design to Software, Terry Winograd, ACM Press 1996.](#)

WHAT'S A TRACTION NEWSPAGE?

A Traction Newspage is a time-slice of a Traction Journal, presented as hierarchical family of web pages using a simple, newspaper-like format. The Newspage is generated automatically based on the content and classification of the items in the time-slice, typically as a daily or weekly edition.

The front page shows:

- Your Newspage's masthead and edition.

- Titles of items categorized as `headline` and `brieflyNoted,` linked to corresponding items in the edition's Topical view.

- An Event Summary, which lists categories containing news, and the title and lead paragraphs of items published in the edition.

- Links to next and previous editions, related projects, and archive views (covering intervals longer than a single edition).

- Optional links to regularly published Sections containing titles, or title and lead paragraph summaries of categories you select for publication.

- A search form.

The Traction Newspage does not provide any editorial oversight, and is intended for use by small workgroups who wish to share information among themselves. The Traction Newsdesk adds the ability to gather material from more than one Journal, control layout on a per-edition basis, review content before it is published, and add new headlines or summaries to any item.

Newspage templates allow members to choose from several layouts, including basic HTML (no frames) and Frame/Table based layouts. The masthead, section topics, edition interval and special fixed pages can be added to the templates.

WHAT CAN IT DO?

- Chunk events by time and topic to aid dissemination, recall, and use of project information.

- Show fully cross-referenced front page, chronological, topical, or "what's new" views of time-slices from a Traction Journal.

- Provide an appropriate place for recording and publishing a shared record of significant events *[SH 1]*.

- Provide personal as well as project Newspage views.

- Use templates to pour generated HTML into Newspage layouts designed for basic HTML, Frames, Dynamic HTML with Style sheets, or layout packages like FutureTense Texture™ and I-Publish™.
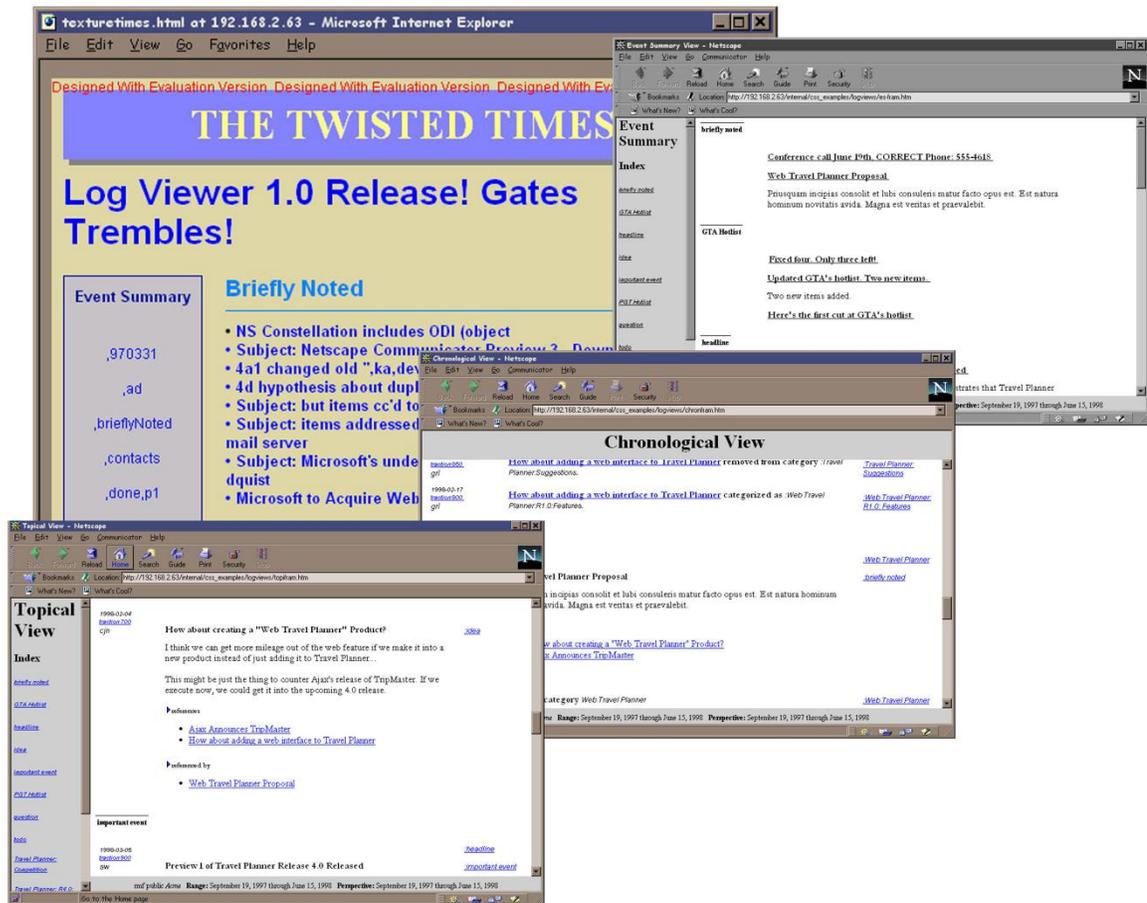
FINDING THE MOMENTARILY IMPORTANT ITEM

A newspaper's familiar and regular organization allows readers to skim the headlines and sections of interest, browsing into the detail of any momentarily important item.

Rather than reading email from every fire alarm that *didn't* ring yesterday, read the headline and story about the false alarm in the server room last night - and the revised software build schedule. Or scan the software build column to review check-in notices and dive into one of last night's build logs based on a brief note attached by the buildmeister.

THE NEWSPAPER DOES NOT JUST REPORT NEWS, IT MAKES NEWS - JOHN SEELY BROWN

A newspaper gives everyone access to a shared record of significant events. Daily or weekly editions deliver news in chunks that everyone sees at about the same time and uses for reference.

When you meet someone in the hall, and they ask "Did you read what Anne said?" you pick up a pointer to the marketing note on Anne's objection, even if you don't normally read marketing news. "It is the collective selection, presentation, and circulation of information that turns information into news" *[JSB 1]*

Although you are a software engineer, an item in the Briefly Noted column catches your eye. It describes a sale to a customer in the travel and leisure business. You read the story and find a quote from the customer that suggests a clever improvement to a feature you are working on. You flag the quote in your notebook. Later, you grab the quote and use the Trail Browser to find the salesman who logged it and send a brief email asking him to arrange a phone call, providing a link to the quote, Newspage story, and your notes.

TRACTION NEWSDESK

WHAT'S A TRACTION NEWSDESK?

A Traction Newsdesk collects material from one or more Journals and combines them with new headlines, graphics, and other material to build an online newspaper with fine control over the layout and content of each edition.

The Newsdesk helps you publish a Newspage that requires dedicated effort. The additional effort lets you create a publication that is appropriate for broad internal or external distribution, rather than self-coordination within a small team.

The Newsdesk allows you to exercise editorial control by choosing the items to be published (or headlined) in an edition. You can write new headlines and summaries, move items from section to section, insert graphics, and design the look and layout for daily and special sections.

You can design *columns* as places that combine authored and automatically-generated content that addresses recurring themes. For example:

- A 'Buildmeister' column could use a Reporter agent that automatically collects software build logs and allows engineers to add brief notes that point out exceptional items. Items gathered from build logs could be individually flagged for publication, corrected, or rejected.

- A 'Test Plans' column could combine links to current plans, news on significant changes to the plans, notes on normal items, and headlines on exceptional items discovered by team members. The raw material for the column would be gathered from Traction Journals. Authored material can include live references to Journal items and quotes leading to the original sources.

A Newspage can be an interactive directory of plans, news and the record of discovery for a large project with many specialized groups working in parallel. For example:

- A Request for Proposals can require lengthy technical, cost, and management responses, produced by specialized teams on a tight schedule. Discovering a new approach requires quick analysis and adjustment of the cost and management responses.

- An RFP Newspage could be divided into corresponding sections, with subsections for teams working on airframe, propulsion, electrical, software or other .topics.

- Each section could contain portions of the work in progress, with notes describing problems, opportunities and cross-dependencies as they are discovered. Quotes from Newpage items lead back to the RFP or work in progress.

- A new technical approach could be introduced as brief note, and be promoted to a headline news as its potential significance is recognized.

- By reading the newspage, members of distant teams can keep in touch with events that may never affect them directly, or may snowball into a major effort.

- The familiar structure of a newspaper helps you to understand and explore the work of a group you do not deal with regularly, or are joining as a new member.

Newsdesk editions can be served directly, or exported and stored within enterprise web management systems such as Inso's DynaBase™.

WHAT CAN IT DO?

- Collect items from one or more Journals.

- Group items into Sections using agents to help assemble the content. Flag individual items for publication, rewrite, or rejection.

- Add new headlines, summaries and graphics.

- Create recurring columns that combine automatically-generated and authored material.

- Review sensitive material, corrections and event summaries.

- Serve live Newspage views.

- Export a Newspage edition as a collection of web pages.

REPORTERS, ASSISTANTS & GATEWAYS

WHAT'S A REPORTER?

A Traction Reporter is a kind of agent that is programmed to scan, analyze and summarize items within a Journal and create new Notebook or Newsdesk items for your review. Reporters can also use Gateways to examine items whose representation lives outside a Traction Journal.

For example, a Reporter could be directed to examine incoming mail messages and log daily summary items cross-referencing email that mentions particular categories or Journal items.

WHAT'S AN ASSISTANT?

A Traction Assistant implements responses to internal or external requests for information or action. It is a Java object that can be installed within a Notebook, Newsdesk, or Server as a wrapper for extensions written in Java, PERL, or Emacs Lisp.

For example, an Assistant could be programmed to service Majordomo requests for a particular Newspage view by generating an HTML view and sending it to the requester as a MIME-encapsulated message.

WHAT'S A GATEWAY?

A Traction Gateway maps external objects into the Traction Journal schema and vice versa. Gateways allow Reporters to scan and analyze the content of files and databases outside the Journal as well as objects *referenced by* Journal items.

For example, a software company may use problem tracking database such as DDTS to store defect reports and enhancement requests. A Traction Gateway could be written to map DDTS identifiers to Traction Journal *surrogates*, so that references to particular defects could be classified and referenced like native Journal items.

A Traction Reporter could then be programmed to scan a list of open DDTS items periodically, and to log a summary of changes to the content of any monitored item.

WHAT CAN THEY DO?

- Add specialized capabilities to Traction Notebooks, Newsdesks and Servers.

- Extract and summarize information from within a Traction Journal, external database, or other news source.

- Build summary sections within Traction Notebooks and Newsdesks that can be saved for your own use or flagged for publication in a Traction Journal.

STANDARDS BASED, EXTENSIBLE ARCHITECTURE

JAVA

The Traction Server is written in Java using the servlet interface, and is packaged with the freely distributed Acme Java server. The servlet interface allows Twisted Systems to deliver other Java or server specific packaging without substantial redesign.

The reference implementations of Traction Notepad, Notebook and Trail Browser components are pure Java. Until Java library support stabilizes, we will supply platform or application specific editions, as required to meet performance targets and deliver drag-and-drop (or other important UI capabilities) when working within Microsoft Internet Explorer™, Netscape Communicator™, or Lotus Notes™ frameworks.

HTTP FORM AND SOCKET INTERFACE

The Traction notepad uses the Traction Server's HTTP form interface to edit one Journal entry at a time. The Traction Trail Browser and Notebook can use socket-level (or RPC) interfaces as well as the standard HTTP interface to retrieve Journal entries and relations directly without rendering them into HTML.

PLATFORM AND APPLICATION SPECIFIC INTEGRATION

The forms interface makes it simple add Notepad alternatives for specialized item types.

- A new time and billing logger could present a window where team members note the time spent on different projects or tasks. The logger would use the forms interface to add a time and billing item to the Traction Journal. After a time-and-billing item is logged, it could be corrected, classified, referenced and rendered into HTML like any other entry.

Twisted Systems (or system integrators) could add Traction logging and journal interfaces to Microsoft Outlook™, Lotus Notes™, or Emacs.

- A panel could be added to Microsoft Outlook that adds an entry to the Traction Journal whenever you drag an Outlook appointment, note or other object into the panel.

- New editions of Notepad, Notebook and Trail Browser applications could be written to match Network Computer or HotJava Views conventions.

Because the Traction Server and its Newspage views are platform and application independent, team members can use their preferred interfaces and editors while sharing the Traction Journal.

FLEXIBLE VIEW ASSEMBLERS

Traction implements multithreaded Java View Assemblers that provide pipelined iterators over database views of the Traction Journal. View Assemblers also translate data into HTML or other rendering formats. System Integrators can build specialized types of View Assemblers, or subclass and specialize existing View Assemblers.

XML AND EXTENSIBLE ITEM TYPES

The Traction Journal defines metadata item types that represent bi-directional ternary relationships such as classification, naming, versioning, and correction. Other item types are containers for HTML or other data representations.

We expect to use this capability to add item types that record and deliver XML data to HTML rendering and other applications. System integrators can derive specialized item types to store a record of correlated events within the Traction Journal.

- Time and billing, or office pegboard status can be stored as XML data in new item types.

- Item types may have specialized logging and delivery interfaces. For example, time and billing records could be accumulated and exported to Excel. Pegboard data could show an office map, with In, Out, Busy lights for everyone on the team.

- Specialized item types are stored, corrected, versioned, and cross-referenced like all others, so billing records, trips, vacations, and other activities can be correlated with all other items in the Traction Journal.

The metadata capabilities of the Traction Journal, combined with its ability to wrap and deliver XML and other typed data, make the Traction Server itself a valuable product, particularly for Network Computing applications.

SURROGATES

The Traction Journal supports metadata entries for surrogates — objects maintained outside the Traction Journal, but whose name, location and cataloging data is recorded for reference. Gateways can be added to map the representation of surrogates into a form which can be read and indexed.

For example, surrogates can be maintained for entries of interest in a DDTS problem tracking database, or Lotus Notes application. Journal entries can refer to these surrogates in any context where an original email, web page or other source is maintained, including inverse relations. That is, given tsi00234 as a DDTS identifier for a problem report, Traction can show all the contexts in which this surrogate is used.

SERIAL FILE

The Traction Serial file is an ODMA (Object Data Management Association) compatible repository implemented by Traction or any ODMA compatible Document Management System.

The Traction implementation is a simple filesystem-based repository that can preserve reference copies of objects as attachments to the Traction Journal entries that reference them. By choosing a different Gateway, Traction users can preserve reference copies in Lotus Notes or any other system that implements the ODMA protocol.

The serial file can also be used to construct and maintain a symbolic catalog to correspondence, reports and other physical objects that are never converted into electronic form, but are referenced using surrogates (such as filing data/item number) that can be use to find the original item.

NEWSPAGE TEMPLATES

Newspage templates map the content of any Newspage edition into a particular delivery form. Templates use View Assemblers to extract data from a Traction Journal, transform it into HTML (or other rendering formats), and pour it into layout containers.

The content of the same edition can be delivered in basic HTML, framed HTML, Netscape Netcaster™, CDF or other formats. Specialized Templates can be developed and installed to deliver editions as FutureTense Texture™, I-Publish™, Microsoft Front Page™ or other forms.

REPORTERS, ASSISTANTS, GATEWAYS

Reporters, Assistants and Gateways are plug-in extensions that allow system integrators or IS groups to add the ability to extract, analyze and summarize information stored in Traction Journals or external sources.

An optional Traction Software Developer's Kit (SDK) provides Java interfaces to Traction View Assemblers, Journals and other objects used to construct new Reporters, Assistants, Gateways and Newspage Templates.

SYSTEM REQUIREMENTS

All platforms and packages require JDK 1.1 or better.

Traction Notepad   Windows 95, Windows NT 4.0 Edition
Java Edition

Traction Notebook   Windows 95, Windows NT 4.0 Edition
Java Edition

Traction Newspage   Minimum: Any HTML 2.0 Browser including Netscape, Microsoft, Lynx.
Frames, Java, CSS, Dynamic HTML are required for some Templates

Traction Team Server   Servlet integration with Microsoft, Netscape, Apache, Sun servers
Standalone Java Edition includes Acme Server.

Traction Newsdesk   Windows 95, Windows NT 4.0 Edition
Java Edition

PACKAGING AND PRICING

Traction Team Server: Includes Traction Journal, Traction Newspage and unlimited Traction Notepad licenses, any Edition	$5,000 (25 Users, 25 Project slots)
Traction Starter Kit	$1,500 (5 Users, 1 Project slots)
Traction Notebook	$200/each (includes Personal Server)
Traction Newsdesk	$25,000/each
Traction Gateways	$1,000/typical (for all servers at a site)
Traction SDK	$10,000 (with license to redistribute add-ons)

- Volume discounts, site licenses, and several Team Server / Notebook / Newsdesk packages are available.

- No charge for web access to FAQ's and patches.

- Maintenance Contract, includes new releases and telephone support: 15% of purchase price per year, $1,000/site minimum;

- Telephone or email support with follow-up: $50 / incident, or Maintenance contract.

- Prices are provided for planning only, and are subject to change.

TRACTION - FREQUENTLY ASKED QUESTIONS

1)   What products is Twisted Systems Inc. developing?

2)   What are the product requirements?

3)   Why is Twisted Systems developing this software?

4)   How does Traction work?

5)   What is Team Problem Solving?

6)   What's a Memex?

7)   Does Traction replace email?

8)   How does Traction work with email?

9)   Does Traction replace Lotus Notes?

10) Does Traction work with my existing web server?

11) What if I don't already have a web server?

12) What other products does Traction work with?

13) How big a team can Traction support?

14) Can Traction items be saved in a secure form?

BACKGROUND

&

REFERENCES

WHAT'S A MEMEX?

Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and to coin one at random, "memex" will do. A memex is a device in which an individual stores all his books, records and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.

<div align="right">

Vannevar Bush, As We May Think, *Atlantic Monthly, July 1945*

</div>

The memex was a publishing system that would hold everything that is written, and allow each new user to add connections -- Bush called them trails -- to connect and clarify the material that's already stored.

<div align="right">

Theodor Holm Nelson, Literary Machines, *Edition 87.1*

</div>

Vannevar Bush introduced his invention in an article for Atlantic Monthly in the closing days of World War II. Bush was a distinguished engineer and administrator, Dean of the School of Engineering at MIT, President of the Carnegie Institute and Chairman of the President's National Defense Research committee. In 1941, Franklin Roosevelt appointed Bush the first Director of the Office of Scientific Research and Development. In that role, Bush coordinated all federally funded Defense research in World War II, directing the efforts of 6,000 scientists.

For fifty years, *As We May Think* has served as a springboard for a remarkable collection of people and systems, see *"As We May Think" - A Celebration of Vannevar Bush's Vision.* Traction was inspired by the vision of Vannevar Bush, and the pioneering work of Douglas Engelbart, Ted Nelson, and Andy van Dam. They set they invented and used memex class systems we wish to acknowledge, learn from, and build upon.

In particular, we believe Douglas Engelbart's Open Hyperdocument System [DCE 4] sets the standard for the memex class products, based on over two decades of his remarkable research and experience.

from *"As We May Think" - A Celebration of Vannevar Bush's Vision*

The memex is one of several tools that Bush proposed to augment the intellectual abilities of human beings.

Bush's memex users could (if it were built):

- Store of the content of a research library in a device the size of a desk. The memex would project selected material on either of two screens.

- Copy new material, using the platen on the left of the desk, store, and name it.

- Assign a name and store a copy of a particular arrangement of items shown on one or more screens (create a trail). Items copied into a trail can be written on.

- Store names in a personal codebook, such that "tapping a few keys" projects the head of any trail.

- Whenever any item that participates in an association is shown, show other items that participate in the same association by tapping a button below the code space.

- When numerous items have been joined to form a trail, page through them exactly as though the physical items had been gathered together from widely separated sources and bound together to form a new book.

- Record a trail and send it to a colleague with a compatible memex.

> *By hypertext I mean non-sequential writing -- text that branches and allows choices to the reader, best read at an interactive screen. 0/2*
>
> *A piece of writing -- say a sheet of typed paper on the table -- looks alone and independent. This is quite misleading. Solitary it may be, but it may also be a part of a literature.*
>
> *By the term "a literature" we are not necessarily talking about belles lettres or leather-bound books. We mean it in the same sense as "the scientific literature," or that graduate-school question, "Have you looked in the literature?"*
>
> *A literature is a system of interconnected writings. We do not offer this as our definition, but as a discovered fact. And almost all writing is part of some literature.*
>
> *These interconnections do not exist on paper except in rudimentary form, and we have tended not to be aware of them. We see individual documents, but not the literature, just as people see other individuals but not the society or culture that surround them.*
>
> *The way people read and write is based in large part on these interconnections.*
>
> *A person reads an article. He or she says to himself or herself, "Where have I seen something like that before? Oh, yes --" and the previous connection is brought mentally into play. 2/9*
>
> *…users may create newly published documents out of old ones indefinitely, making whatever changes seem appropriate without damaging the originals. This is done by inclusion links [transclusion]. 2/45*
>
> *[Theodor Holm Nelson, Literary Machines, Edition 87.1](#)*

Ted Nelson coined the word *hypertext* in 1965. In 1972, he described the Xanadu™ hypertext system, which he envisioned as a universal archive and publishing system - "A literary system of authorship, ownership, quotation and linkage" [THN 3 3/2]

Xanadu™ hypertext system users could:

- Search, read, and publish to a universally accessible, distributed repository.

- Link to or quote from any fragment of any version of any document in the literature, and maintain the relationship as the document evolves.

- Create original or derivative works, *transcluding* material from any source, based on a intellectual property concept of *transcopyright*, which provides authoritative attribution and a (micro) royalty for each fragment of original material transcluded and presented in a different context.

- Create *transparallel* views of any material, showing alternative versions or related material in linked, parallel windows to permit intercomparison of content and relationships.

Upon submission to a specified Journal, the item is automatically given a number and is stored permanently in a central location. A full bibliographical citation will be generated and installed in library-like, computer-held catalogs. For each individual in the distribution list, a short citation will be delivered into his AUGMENT Mail box. One of the elements in this citation is a link pointing to the centrally stored Journal document. Using this link, a recipient may employ a simple Jump Link command to gain immediate access to the Journal document, and can study it or copy all or parts of it into working files. 8E

General access to the data base of Journal documents is through an on-line catalog. Searches through the cataloged citations can retrieve citations by author, accession number, title word, or key-word descriptor. 8H

Subcollections for special groups or activity themes may be optionally maintained. Descriptors assigned at the time a document is submitted can classify it as belonging to a given "conference"; but such initial classifications needn't be restrictive, since at any later time a document may be published (in the Journal) which lists a set of documents and/or of passages, from among the entire prior collection of Journal items, which are deemed to be relevant to a given theme. 8I

Or, a dynamic collection may be maintained by an interested party, in shared files, as a list of citations with links pointing directly to the items (documents or passages) in the Journal. 8J

No one is able to modify the centrally held Journal document -- these documents are considered to be just as permanent a record as one that has been published and put into a library. If Journal documents are not accessed for a given period of time, they are removed from on-line storage and archived on tape. Later, if given the Journal accession number, AUGMENT operations will retrieve the item from archive tapes, just as a library would retrieve from its stacks if a little-used document had been removed from the open shelves. 8K

The central storage of dialogue entries represents the recorded dialogue, including replies and cross-reference links -- essentially a network of interrelated submissions. 8L

The Journal systems provide central storage for the same reasons that libraries do: it is too costly for each individual to maintain his or her own collection; and there is need for assurance that a specified document may be provided in unaltered form. 8M

These Journal provisions encourage freer use by authors of commentary on prior entries, since an author knows that every reader has a simple means for accessing any of the earlier documents that may be cited. 8N

A new participant, entering into an established dialog process, may simply be given a relevant set of citations to be brought completely into the picture. 8O

Often, a passage in an earlier Journal document which was originally submitted as relevant only to a given theme or issue, will later be discovered by someone to be relevant to another, current issue. In this case, a new document may be entered into this newer "dialog network" that points out this relevance and provides a citation link to this old document, which now has become linked into the new dialog.

Douglas C. Engelbart, Collaboration Support Provisions in Augment, Tymshare Inc. 25 Oct 83
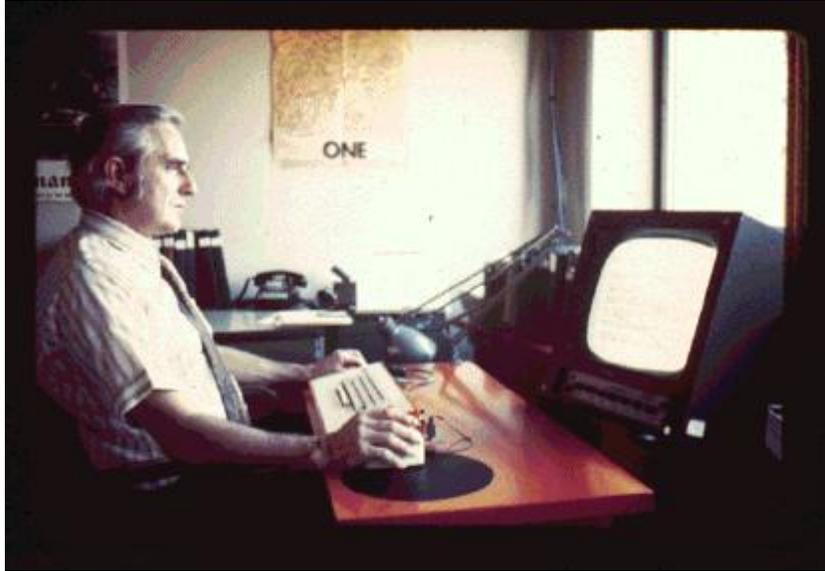
Doug Engelbart from "As We May Think" - A Celebration of Vannevar Bush's Vision

Radar technician Doug Engelbart read Bush's *As We May Think* in a hut in the South Pacific at the end of WW II. In 1963 he formed a seminal research group at Stanford Research Institute, focused on the use of computers to help individuals and groups deal with 'complexity and urgency'. In the course of his work he invented the mouse, interactive real-time collaboration, outline processing, and the first operational hypertext creation and navigation tools, NLS (oNLineSystem) and Augment.

Augment users can:

- Create documents as explicitly structured files containing hierarchically organized nodes containing text, graphics, or link data.

- Store documents of any size in a shared, archival journal, with a catalog entry.

- Symbolically address any element of a message, memo, data record or document recorded in the journal (hard copy items can also be assigned accession numbers).

- Create live views of any section of a document in one or more windows, using *viewspecs* that specify outline numbering, level expansion, elision and *sequence generators* like the 'include link' which causes cited passages to be transcluded in place.

> *The web is essentially a way of defining a context or database in which a typically large set of related block, link, keyword, and path information is stored. The web allows individual users, groups of users, or, in the extreme, an entire campus to create a shared web of materials from different applications. Two webs might exist that reference the same documents but have an entirely different set of links. For example, the English Department might have a web referencing all of the Shakespearean tragedies along with links pertaining to color imagery in those plays, while the Religious Studies Department might have a web referencing those same plays with links pertaining to religious symbolism.*
>
> N. Yankelovich, N. Meyrowitz, & A. van Dam, Reading and Writing the Electronic Book, IEEE Computer, October 1985

Intermedia was the fourth hypertext system designed and developed under the direction of Prof. Andries van Dam at Brown University from 1967 though 1994. Intermedia was not a single application, but a framework of spreadsheet, word processing and graphic tools and other tools "that allow authors to make links between standard types of documents created with heterogeneous applications." [NY 1].

Intermedia users could:

- Select source and destination blocks in disparate documents, and create keyworded links connecting the blocks.

- Create a path that travels through a particular set of links

- Graph a and navigate a history of travel through Intermedia sessions.

- Generate and navigate a variety of *maps* of the information web:

    - A *global map* showing document-to-document links

    - A *tracking map*, updated to show the current document and its document or block level links

    - A view in which a document's map, rather than its content, is shown.

I remember my mistrust of categories and hierarchies, not for its metaphysical value (if any), but because it provides a fine orientation for building information systems. Because if you are not falsely expecting a permanent system of categories or a permanent stable hierarchy, you realize your information system must then deal with an ever-changing flux of new categories, hierarchies and other arrangements which all have to coexist; it must be a tolerant system which allows them to cohabit comfortably, helps track their variations and disparities, and is forever ready to accommodate new arrangements on top of those already present. 1/23-24

There is nothing wrong with categorization. It is, however, by its nature transient: category systems have a half-life, and categories begin to look fairly stupid after a few years. (Indeed, simple categorizations of computer articles in computer bibliographies fifteen years ago have already begun to look stupid). The army designation of "Pong Balls, Ping" has a certain universal character to it. 2/49

How can we avoid categorical decay in our system? Keep the categories <u>out of the system level</u>. Categories are <u>user</u> business; let users publish categorical directories and collect royalties for their use.

Anyone may publish his or her own document lists, categorized in any way he or she imagines, and have users bounce through them in search of whatever they think they may find. 2/50

<u>*Theodor Holm Nelson*, Literary Machines, *Edition 87.1*</u>

Webs, categories, subcollections, recorded dialogs, trails and codebooks are all *user business*. Unlike a traditional database or library catalog, a memex builds maps that become part of the literature itself, subject to criticism, reuse, or replacement.

Doug Engelbart: … So, moving your way around those thought vectors in concept space - I'd forgotten about that.

Alan Kay: You said that, right?

Doug Engelbart: I must have, its so good. [[laughter]] It's to externalize your thoughts in the concept structures that are meaningful outside and moving around flexibly and manipulating them and viewing them. It's a new way to operate on a new kind of externalized medium…

Doug Engelbart, Alan Kay from"As We May Think" - A Celebration of Vannevar Bush's Vision
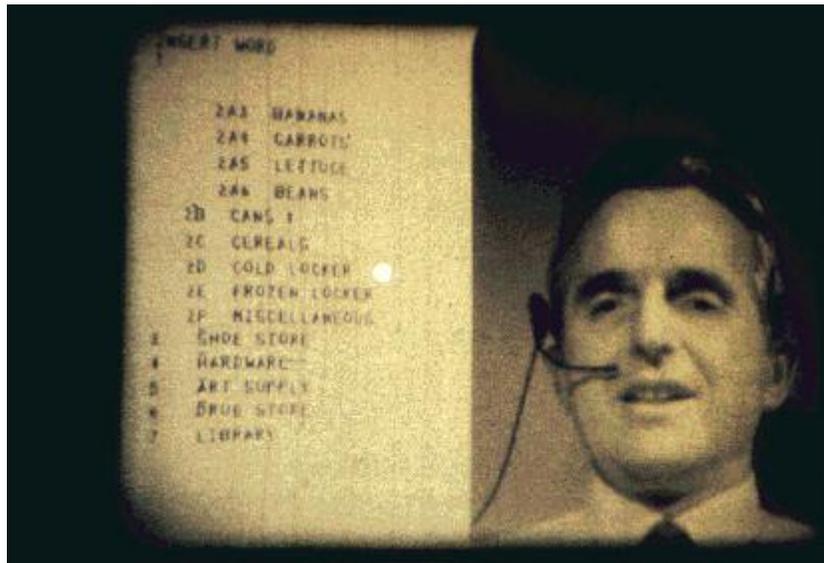
Doug Engelbart 1967 from"As We May Think" - A Celebration of Vannevar Bush's Vision

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AS WE MAY THINK

[AWMT 1] Selected quotes from Vannevar Bush, "As We May Think", July 1945 *Atlantic Monthly*. Quotes referenced in earlier sections of this document are highlighted, and link back to the context in which they are cited. Numbered sections are from the HTML edition.

For the full text of *As We May Think* see http://www.isg.sfu.ca/~duchier/misc/vbush/

For information on *"As We May Think" - A Celebration of Vannevar Bush's Vision, Oct 1985, Brown/MIT Symposium*, see [AWMT 2-4]

SECTION 1

The investigator is staggered by the findings and conclusions of thousands of other workers -- conclusions which he cannot find the time to grasp, much less remember, as they appear.

Professionally, our methods of transmitting and reviewing the results of research are generations old and by now are totally inadequate for their purpose. Mendel's concept of the law of genetics was lost to the world for a generation because his publication did not reach the few who were capable of grasping and extending it; and this sort of catastrophe is undoubtedly being repeated all about us, as truly significant attainments become lost in the mass of the inconsequential.

The difficulty seems not to be so much that we publish unduly in view of the extent and variety of present-day interests, but rather that publication has been extended far beyond our present ability to make real use of the record.

The summation of human experience is being expanded at a prodigious rate, and the means we use for threading through the consequent maze to the momentarily important item is the same as was used in the days of square rigged ships.

SECTION 2

[library of a million book reduced to the volume of a matchbox; total human record in a moving van] Mere compression, of course, is not enough; one need not only make and store a record, but also be able to consult it, and this aspect of the matter comes later. Even the great modern library is not generally consulted; it is nibbled by a few.

SECTION 5

So much for the manipulation of ideas and their insertion into the record. Thus far we seem to be worse off than before - for we can enormously extend the record; yet even in its present bulk we can hardly consult it. This is a much larger matter that merely the extraction of data for the purposes of scientific research; it involves the entire process by which may profits by his inheritance of acquired knowledge. The prime action of use is selection, and here we are halting indeed. There may be millions of fine thoughts, and the account of the experience on which they are based, all encased within stone walls of acceptable architectural form; but if the scholar can get at only one a week by diligent search, his syntheses are not likely to keep up with the current scene.

Selection, in this broad sense, is a stone adze in the hands of a cabinet maker.

SECTION 6

The real heart of the matter of selection, however, goes deeper that a lag in the adoption of mechanisms by libraries, or a lack of development of systems for their use. Our ineptitude in getting at the record is largely caused by the artificiality of our systems of indexing. When data of any sort are placed in storage, they are filed alphabetically or numerically, and information is found (when it is) by tracing down from subclass to subclass. It can only be in one place, unless duplicates are used; one has to have rules as to which path will locate it, and the rules are cumbersome. Having found one item, moreover, one has to emerge from the system and re-enter on a new path.

The human mind does not work that way. It operates by association. With one item in its grasp, it snaps instantly to the next that is suggested by the association of thoughts, in accordance with some intricate web of trails carried by the cells of the brain. It has other characteristics, of course; trails that are not frequently followed are prone to fade, items are not fully permanent, memory is transitory. Yet the speed of action, the intricacy of trails, the detail of mental pictures, is awe-inspiring beyond all in nature.

Man cannot hope fully to duplicate this mental process artificially, but he certainly ought to be able to learn from it. In minor ways, he may even improve, for his record will have relative permanency. The first idea, however, to be drawn from the analogy concerns selection. Selection by association, rather than by indexing, may yet be mechanized. One cannot hope thus to equal the speed and flexibility with which the mind follows an associative trail, but it should be possible to beat the mind decisively in regard to the permanence and clarity of the items resurrected from storage.

Consider a future device for individual use, which is a sort of mechanized private file and library. It needs a name, and to coin one at random, "memex" will do. A memex is a device in which an individual stores all his books, records and communications, and which is mechanized so that it may be consulted with exceeding speed and flexibility. It is an enlarged intimate supplement to his memory.

SECTION 7

All this is conventional, except for the projection forward of present day mechanisms and gadgetry. It at affords an immediate step, however to associative indexing, the basic idea of which is a provision whereby any item may be caused at will to select immediately and automatically another. This is the essential feature of the memex. The process of tying two items together is the important thing.

When the user is building a trail, he names it, inserts the name in his code book, and taps it out on his keyboard. Before him are the two items to be joined, projected onto adjacent viewing positions. At the bottom of each there are a number of blank code spaces, and a pointer is set to indicate one of these on each item. The user taps a single key, and the items are permanently joined. In each code space appears the code word. Out of view, but also in the code space, is a inserted a set of dots for photocell viewing; and on each item these dots by their positions designate the index number of the other item.

Thereafter, at any time, when one of these items is in view, the other can be instantly recalled by merely tapping a button below the corresponding code space. Moreover, when numerous items have been thus joined together to form a trail, they can be reviewed in turn, rapidly or slowly, by deflecting a lever like that used for turning the pages of a book. It is exactly as though the physical items had been gathered together from widely separated sources and bound together to form a new book. It is more than this, since any item can be joined into numerous trails….

And his trails do not fade. Several years later, his talk with a friend turns to the queer ways in which a people resist innovations, even of vital interest. He has an example, in the fact that the outraged Europeans failed to adopt the Turkish long bow. In fact he, he has as trail on it. A touch brings up the code book. Tapping a few keys projects the head of the trail. A lever runs through it at will, stopping at interesting items, going off on side excursions. It is an interesting trail, pertinent to the discussion. So he sets a reproducer in action, photographs the whole trail out, and passes it to his friend for insertion in his own memex, there to be linked to the more general trail.

SECTION 8

Whole new forms of encyclopedia will appear, ready-made with a mesh of associative trails running through them, ready made to be dropped into a memex, and there amplified. The lawyer has at his touch the associated opinions and decisions of his whole experience and of the experience of friends and authorities. The patent attorney has on call the missions of issued patents, with familiar trails to every point of his client's interest. The physician, puzzled by a patient's reactions, strikes the trail established in studying an earlier similar case, and runs rapidly through analogous case histories, with side references to the classics for pertinent anatomy and histology. The chemist, struggling with the synthesis of an organic compound, has all the chemical literature before him in his laboratory, with trails following the analogies of compounds, with side trails to their physical and chemical behavior.

The historian, with a vast chronological account of a people, parallels it with a skip trail which stops only at the salient items, and which can follow at any time contemporary trails which lead him all over civilization at a particular epoch. There is a new profession of trail blazers, those who find delight in the task of establishing useful trails through the enormous mass of the common record. The inheritance from the master becomes, not only his additions to the world's record, but for his disciples the entire scaffolding by which they were erected.

OPEN HYPERDOCUMENT SYSTEM (OHS)

From [DCE 4] Douglas Engelbart, Toward High-Performance Organizations: A Strategic Role for Groupware, Bootstrap Institute, June 1992 (AUGMENT,132811,) see http://www.bootstrap.org/augment-132811.htm - 8

My early assumption, amply borne out by subsequent experience, is that the basic supporting technology for future high-performance knowledge work will be an integrated system based upon multi-media hyperdocuments. 7A

Furthermore, there will be critical issues of interoperability within and between our organizations and their knowledge domains. The ever-greater value derived from online, interactive work within a hyperdocument environment will require a significantly higher degree of standardization in document architecture and usage conventions than heretofore contemplated. 7B

It is inevitable that this service be provided by an "open system" of hyperdocuments and associated network and server architectures. The basic arguments for this Open Hyperdocument System (OHS) are presented in Ref-5; and the hyperdocument system features described below are assumed by me to be strong candidates for requirements for the eventual OHS whose evolution will be so critical to the productivity of industries and nations. 7C

Following is a brief general description of the system design that has evolved from the conceptual orientation described in this paper, through the experience of many years and trial events. Please note that the term "system" is very important here. 7D

Shared Files/Documents - the most fundamental requirement. Generalized file sharing is to be available across the entire global domain in which any online collaborative working relationship is established (e.g., world-wide). 7E

Mixed-Object Documents - to provide for an arbitrary mix of text, diagrams, equations, tables, raster-scan images (single frames or live video), spread sheets, recorded sound, etc. - all bundled within a common "envelope" to be stored, transmitted, read (played) and printed as a coherent entity called a "document." 7F

Explicitly Structured Documents - where the objects comprising a document are arranged in an explicit hierarchical structure, and compound-object substructures may be explicitly addressed for access or to manipulate the structural relationships. 7G

Global, Human-Understandable, Object Addresses - in principle, every object that someone might validly want/need to cite should have an unambiguous address, capable of being portrayed in a manner as to be human readable and interpretable. (E.g., not acceptable to be unable to link to an object within a "frame" or "card.") 7H

View Control of Objects' Form, Sequence and Content - where a structured, mixed-object document may be displayed in a window according to a flexible choice of viewing options - especially by selective level clipping (outline for viewing), but also by filtering on content, by truncation or some algorithmic view that provides a more useful portrayal of structure and/or object content (including new sequences or groupings of objects that actually reside in other documents).

Editing on structure or object content directly from such special views would be allowed whenever appropriate. 7I

The Basic "Hyper" Characteristics - where embedded objects called links can point to any arbitrary object within the document, or within another document in a specified domain of documents - and the link can be actuated by a user or an automatic process to "go see what is at the other end," or "bring the other-end object to this location," or "execute the process identified at the other end." (These executable processes may control peripheral devices such as CD ROM, video-disk players, etc.) 7J

Hyperdocument "Back-Link" Capability - when reading a hyperdocument online, a worker can utilize information about links from other objects within this or other hyperdocuments that point to this hyperdocument - or to designated objects or passages of interest in this hyperdocument. 7K

Link Addresses That Are Readable and Interpretable by Humans - one of the "viewing options" for displaying/printing a link object should provide a human-readable description of the "address path" leading to the cited object; AND, the human must be able to read the path description, interpret it, and follow it (find the destination "by hand" so to speak). 7L

Personal Signature Encryption - where a user can affix his personal signature to a document, or a specified segment within the document, using a private signature key. Users can verify that the signature is authentic and that no bit of the signed document or document segment has been altered since it was signed. Signed document segments can be copied or moved in full without interfering with later signature verification. 7M

Hard-Copy Print Options to Show Addresses of Objects and Address Specification of Links - so that, besides online workers being able to follow a link-citation path (manually, or via an automatic link jump), people working with associated hard copy can read and interpret the link-citation, and follow the indicated path to the cited object in the designated hard-copy document. 7N Also, suppose that a hard-copy worker wants to have a link to a given object established in the online file. By visual inspection of the hard copy, he should be able to determine a valid address path to that object and for instance hand-write an appropriate link specification for later online entry, or dictate it over a phone to a colleague. 7N1

Hyperdocument Mail - where an integrated, general-purpose mail service enables a hyperdocument of any size to be mailed. Any embedded links are also faithfully transmitted - and any recipient can then follow those links to their designated targets that may be in other mail items, in common-access files, or in "library" items. 7O

The Hyperdocument "Journal System" - an integrated library-like system where a hyperdocument message or document can be submitted using a submittal form (technically an email message form), and an automated "clerk" assigns a catalog number, stores the item, notifies recipients with a link for easy retrieval, notifies of supercessions, catalogs it for future searching, and manages document collections. Access is guaranteed when referenced by its catalog number, or "jumped to" with an appropriate link. Links within newly submitted hyperdocuments can cite any passages within any of the prior documents, and the back-link service lets the online reader of a document detect and "go examine" any passage of a subsequent document that has a link citing that passage. 7P

Access Control - Hyperdocuments in personal, group, and library files can have access restrictions down to the object level. 7Q

External Document Control (XDoc) - (Not exactly a "hyperdocument" issue, but an important system issue here.) Documents not integrated into the above online and interactive environment (e.g. hard-copy documents and other records otherwise external to the OHS) can very effectively be

managed by employing the same "catalog system" as for hyperdocument libraries - with back-link service to indicate citations to these "offline" records from hyperdocument (and other) data bases. OHS users can find out what is being said about these "XDoc" records in the hyperdocument world. 7R

The overview portrayal in Figure-11 shows the working relationships between the major system elements described above. Note the shared catalog service that supports use of the Journal and External Document services. 7S

ANNOTATED REFERENCES

[AD 1] Ashley Dunn "Seeing the Forest for the Trees of Data", New York Times, CyberTimes, 23 Oct 1996, http://www.nytimes.com/library/cyber/surf/1023surf.HTML

> *It has taken millennia for humans to master the previous eras of knowledge accumulation and distribution. The next era hinges on the ability to associate the billions of loose threads of data into a usable form.*
>
> *There are two fundamental perceptions about omniscience that seem to flow through these representations - persistence and perspective. What they suggest is that knowing all requires a presence in both space and time*
>
> *These two facets of omniscience [a presence in both space and time] are, in many ways, the fundamental issues of the Information Age. They are the keys to unlocking what Vannevar Bush call the record of knowledge.*
>
> <div align="right">*Ashley Dunn CyberTimes,* Seeing the Forest for the Trees of Data*, 23 Oct 1996*</div>

[AWMT 2] *"As We May Think" - A Celebration of Vannevar Bush's Vision, Brown/MIT Vannevar Bush Symposium*, Oct 95, http://www.cs.brown.edu/research/graphics/HTML/info/vannevar_bush.HTML

For speaker abstracts, slides, biographies and photographs from the Bush Symposium, see http://www-eecs.mit.edu/AY95-96/events/bush/r1.HTML

For a downloadable Macintosh or Windows Memex animation commissioned for the Bush Symposium, see http://www.dynamicdiagrams.com/design/memex/model.htm

For a printed summary of the Bush Symposium, see ACM *Interactions*, March 1996, pp. 46-66.

[CP 1] Charles Petrie, From The Editor in Chief: Webword, *IEEE Internet Computing*, May/Jun 1997, pp. 4-5

> *People are messy, especially when they are busy and productive. Some of us, at least, throw papers on any horizontal surface and forget detail and dates. That's why the value of computers has always been as an organizing prosthetic.*
>
> *At first we thought the computer was just a fast calculator, and this image still fogs our vision of what computers could be. One thing they could be are bookkeepers for our lives…*
>
> *Where is my pocket coordinator? The one telling me that Jack the architect just changed the balcony design, reminding me I ordered the steel for the original design and should check out the changes. The one telling me one of my suppliers added a component relevant to our new prototype. The one telling me of a change to the aircraft engine that lets me go back to a previously impossible fuselage design. The one that simply says I have to change my shipping procedure because of a change in company policy.*

> *The alert reader will notice that these are all bookkeeping tasks. Track the inventory plans and plane designs: if one changes make the proper adjustments and notify the affected person. Just like processing order entry. Bookkeeping, that's all it is.*
>
> *If this is all bookkeeping, and computers are so valuable for bookkeeping, then why don't we have these systems? …I don't know what we're waiting on, do you?*
>
> *Maybe we're still waiting for the same reason T.J. Watson said "The world only needs three computers." It's easy to underestimate the power of simple ideas. Because the secondary and tertiary effects are hard to see. Because new systems are hard to get started. Because we're slow to change.*
>
> *We're on the edge of the next computer revolution. Computers made modern airlines, banks, and government possible, all though better bookkeeping. Computer-based coordination of distributed projects is the Next Big Thing.*
>
> <div align="right"><u><i>Charles Petrie, Stanford Center for Digital Reseach,Editor in Chief, IEEE Internet Computing, May/June 1997.</i></u></div>

[DCE 1] Douglas Engelbart, *NLS Teleconferencing Features*, IEEE COMPCON Sep 1975, see http://www.bootstrap.org/augment-33076.htm

[DCE 2] Douglas Engelbart. *Collaboration Support Provisions in Augment*, Tymshare Inc., 25 Oct 1983, see http://www.bootstrap.org/oad-2221.htm

[DCE 3] Douglas Engelbart, *The Strategic Pursuit of Collective IQ*, Bush Symposium, October 1995, see http://www-evat.mit.edu/bush/talk2/index.HTML

[DCE 4] Douglas Engelbart*, Toward High-Performance Organizations: A Strategic Role for Groupware*, Bootstrap Institute, June 1992 (AUGMENT,132811,) see http://www.bootstrap.org/augment-132811.htm#8 see quote on Open Hyperdocument System (OHS).

[DCE 5] For information on Douglas Engelbart's Bootstrap Institute and related publications, see http://www.bootstrap.org/ and http://www.bootstrap.org/biblio.htm

 [DG 1] Don Gentner & Jakob Nielsen, "The Anti-Mac Interface", *CACM* August 1996, see http://www.acm.org/cacm/AUG96/antimac.htm

[EL 1] Eric Lundquist, "The Next Big Thing in Groupware", *PC Week*, 1 July 1996, see http://www.pcweek.com/opinion/0701/01last.HTML

[JG 1] Jonathan Grudin "Five factors contributing to groupware failure" in *The Art of Human Interface Design*, Brenda Laurel Editor, pp. 172-173, Addison Wesley, 1990

> *1. Groupware applications often fail because they require that some people do additional work, and those people are not the ones who perceive a direct benefit from the use of the application.*
>
> *2. Groupware may lead to activity that violates social taboos, threatens existing political structures, or otherwise demotivates users who are crucial to its success.*

3. Groupware may fail if it does not allow for the wide range of exception handling and improvisation that characterizes much group activity.

4. We fail to learn from experience because these complex applications introduce almost insurmountable obstacles to meaningful, generalizable analysis and evaluation.

5. The groupware development process fails because our intuitions are especially poor for multi-user applications.

Jonathan Grudin in The Art of Human Interface Design*, Brenda Laurel Editor, pp. 172-173, Addison Wesley, 1990*

[JSB 1] John Seely Brown & John Duguid, "Keeping it Simple", in *Bringing Design to Software*, Terry Winograd, ACM Press 1996.

[LH 1] From Luke Hohmann *Journey of the Software Professional*, Prentice Hall, 1997.

There is empirical evidence supporting the use of notes. Adelson and Soloway [1985] found that expert designers write down aspects of their mental processes and refer to these notes at appropriate times during problem solving. Especially important were notes taken to "remind" the expert of potential problems with a proposed solution (e.g. constraints and invariants of the problem domain). The same study found that designers working in unfamiliar problem domains took fewer notes, presumably because they didn't know where the potential trouble spots existed. …

Luke Hohmann Journey of the Software Professional*, Prentice Hall, 1997.*

[LS 1] Lee Sproull, *Information Is Not Enough: Computer Support for Productive Work*, Bush Symposium, October 1995, see http://www-evat.mit.edu/bush/talk9/index.HTML

[MW 1] Mark Weiser, "Software Engineering for People", ICSE 1997 Boston, see http://sandbox.parc.xerox.com/weiser/icse/

[NY 1] N. Yankelovich, N. Meyrowitz, & A. van Dam, "Reading and Writing the Electronic Book", *IEEE Computer*, October 1985

[RE 1] Robert Emerson, Rachel Fretz, & Linda Shaw *Writing Ethnographic Fieldnotes,* The University of Chicago Press, 1995.

In open coding the ethnographer reads field notes line-by-line to identify and formulate any and all ideas, themes, or issues they suggest, no matter how varied and disparate.

In focused coding the fieldworker subjects field notes to fine-grained line by line analysis on the basis of topics that have been identified as of particular interest.

Robert Emerson, Rachel Fretz, & Linda Shaw Writing Ethnographic Fieldnotes. 1995

[RTK 1] R. T. Kouzes, J. D. Myers, & W. A. Wulf, "Collaboratories: Doing Science on the Internet", *IEEE Computer,* Aug 96, http://www.wvu.edu/~research/DOE/IEEEcollaboratory.HTML

> *Facilitating collaboration among a widely distributed scientific community is highly complex. Although a collaboratory is potentially nothing less than the village square of the Information Age, it is a synthetic place requiring social adaptation…*
>
> *Asserting the social acceptability of a synthetic 'place' does not make it so, of course. Thus in addition to purely technical issues, the research agenda for creating collaboratories must address fundamental psychosocial questions as well…*
>
> *Collaboratory developers must consider psychosocial issues such as autonomy, trust, sense of place, and attention to ritual. Autonomy, which describes how an organization is governed or regulated, is implemented through informal communications, acquaintances, and associations. Collaboratory developers must embed autonomy into the virtual organization in a considered manner. Trust, which is established among collaborators through shared experience, is implemented over time through informal means such as meeting face to face and working together in the same place. In a collaboratory, trust will have to be established through some special means. A sense of place, which allows people to be comfortable in their surroundings, provides security so that people can feel creative. If a collaboratory can harness some of the design strategies that have been so successful in physical group settings, it can also create a sense of place and purpose among its dispersed members that will engender an enduring sense of affiliation and cooperation toward its goals. The mechanisms of ritual, which moderate our interpersonal interactions, must find a place in the synthetic surroundings of a collaboratory.*
>
> *Technology solutions abound, but often fail to find a human problem to solve. Groupware applications, like those for meeting scheduling, group decision support, joint authorship, and distributed management, have had mixed success. The failure of groupware to gain wider acceptance is due to its primitive technology and its insensitivity to social and political issues in the workplace.*
>
> R.T. *Kouzes et al.* Collaboratories: Doing Science on the Internet*, IEEE Computer Aug 1996*

[SH 1] S. Harrison, P. Dourish *Re-Place-ing Space: The Roles of Place and Space in Collaborative Systems*, Proc. ACM Conf. Computer-Supported Cooperative Work CSCW 96, Boston MA, Nov 1996. see http://www.research.apple.com/personal/dourish/place.HTML

> *We argued that features of space have been exploited by system developers in the attempt to regain the sense of appropriate behavioral framing which we observe and encounter in the real world. However, in everyday action, this appropriate behavioral framing comes not from a sense of space, but from a sense of place. Our key principle describes the relationship between the two: <u>Space is the opportunity: place is the understood reality.</u>*
>
> *Physically, a place is a space which is invested with understandings of behavioural appropriateness, cultural expectations, and so forth. We are located in 'space', but we act in 'place'. Furthermore, 'places' are spaces that are valued. The distinction is rather like that between a 'house' and a 'home'; a house might keep out the wind and the rain, but a home is where we live.*

> *A conference hall and a theatre share many similar spatial features (such as lighting and orientation); and yet we rarely sing or dance when presenting conference papers, and to do so would be regarded as at least slightly odd (or would need to be explained). We wouldn't describe this behaviour as 'out of space'; but it would most certainly be 'out of place'; and this feeling is so strong that we might try quite hard to interpret a song or a dance as part of a presentation, if faced with it suddenly.*
>
> *It is a sense of place, not space, which makes it appropriate to dance at a Grateful Dead concert, but not at a Cambridge college high table; to be naked in the bedroom, but not in the street; and to sit at our windows, peering out, rather than at other people's windows, peering in. Place, not space, frames appropriate behaviour.*
>
> *Conversely, the same location--with no changes in its spatial organisation or layout--may function as different places at different times. An office might act, at different times, as a place for contemplation, meetings, intimate conversation and sleep. So a place may be more specific than a space. A space is always what it is, but a place is how it's used.*
>
> *S. Harrison, P. Dourish* Re-Place-ing Space: The Roles of Place and Space in Collaborative System *CSCW 96, Nov 1996*

[TD 1] DeMarco T. and Lister L. *Peopleware: Productive People and Teams*, Dorset House 1987

[THN 1] Theodor H. Nelson, "A File Structure for the Complex, the Changing and the Indeterminate," Proceedings, Association for Computing Machinery, 1965.

[THN 2] Theodor H. Nelson, "A Conceptual Framework for a Man-Machine Everything," IFIP Proceedings, National Spring Joint Computer Conference, 1973.

[THN 3] Theodor H. Nelson, *Literary Machines*, Edition 87.1.

[THN 4] Theodor H. Nelson. For information on Ted Nelson's projects and publications, see http://www.xanadu.net/

[TSI 1] Twisted Systems, Inc. *Traction Business Plan*, Confidential. 1997.

[TSI 2] Twisted Systems, Inc. *Traction Requirements*, Confidential, 1997.

[TSI 3] Newsgroup joke, grl log, :tsi0003, 29 Apr 1997

Q	*How many internet mail list subscribers does it take to change a light bulb?*
A	*1,331*
1	*to change the light bulb and to post to the mail list that the light bulb has been changed*
14	*to share similar experiences of changing light bulbs and how the light bulb could have been changed differently.*
7	*to caution about the dangers of changing light bulbs.*
27	*to point out spelling/grammar errors in posts about changing light bulbs.*

53	*to flame the spell checkers*
156	*to write to the list administrator complaining about the light bulb discussion and its inappropriateness to this mail list.*
41	*to correct spelling in the spelling/grammar flames.*
109	*to post that this list is not about light bulbs and to please take this email exchange to alt.lite.bulb*
203	*to demand that cross posting to alt.grammar, alt.spelling and alt.punctuation about changing light bulbs be stopped.*
111	*to defend the posting to this list saying that we are all use light bulbs and therefore the posts **are** relevant to this mail list.*
306	*to debate which method of changing light bulbs is superior, where to buy the best light bulbs, what brand of light bulbs work best for this technique, and what brands are faulty.*
27	*to post URLs where one can see examples of different light bulbs*
14	*to post that the URLs were posted incorrectly, and to post corrected URLs.*
3	*to post about links they found from the URLs that are relevant to this list which makes light bulbs relevant to this list.*
33	*to concatenate all posts to date, then quote them including all headers and footers, and then add "Me Too."*
12	*to post to the list that they are unsubscribing because they cannot handle the light bulb controversy.*
19	*to quote the "Me Too's" to say, "Me Three."*
4	*to suggest that posters request the light bulb FAQ.*
1	*to propose new alt.change.lite.bulb newsgroup.*
47	*to say this is just what alt.physic.cold_fusion was meant for, leave it here.*
143	*votes for alt.lite.bulb.*

[TWM 1] Thomas W. Malone, "Free on the Range: Tom Malone on the Implications of the Digital Age," *IEE Internet Computing*, May/June 1997, pp. 8-20. See http://computer.org/internet/xtras/malone9703.htm

[WEB 1] William E. Blundell, *The Art and Craft of Feature Writing*, Plume/Penguin, 1988.

[describes a focused coding technique he uses to index the content of interviews and source documents for a story under six key categories - history, scope, reasons, impacts, contermoves, future]

If an item might be useful in more than one section - a quote, say, that addresses not only the scope of a development, but also the reason behind it - I'll log that snippet in both places. At the end, I can see how much material I've got and, thanks to the coding, the nature of the material as well: figures, quotes, factual observations, illustrations from life.

That's nice, but why do this? Few interviews contain as much worthwhile material as the one hooked up above, but I won't kid you, indexing is hard, time-consuming work. I hate doing it. I do it anyway because I hate even more what happens when I don't.

Confusion happens. Multiple drafts happen… My research is a formless, intimidating heap, so I dodge out for a two-hour two-margarita lunch, hoping all the confusion evaporates while I'm gone. It never does…

Indexing eliminates most of this wasted time and pain by giving me an ordered picture of my story elements. Just as proper shaping of a story idea focuses reporting on the most promising areas and makes the story doable, so indexing shapes the reported material and makes the writing doable. There are other advantages too.

The very act of logging in details helps plant them in my less-than-leakproof memory. With greater command of my material, comes more sureness in writing; I'm able to remember accurately exact numbers, quotes and incidents, and when I can't my notations refresh me. So I write off my index, mainly. Only later, after I have roughed out the piece, will I check what I have written against the original source material. Usually, I don't have to make substantive changes.

Writing off the index maintains spontaneity. When the work is going well and the Muse is whispering the right words into my ear, I don't want to break the enchantment by fumbling through a pile of papers for some vaguely remembered figure (do I really have it or just think I do?) on artichoke exports. I may find it, but by then the magic is gone.

William E. Blundell, The Art and Craft of Feature Writing, *Plume/Penguin, 1988.*