Collaborating on Affinity Diagrams Using Large Displays

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Abstract
Gathering and understanding user requirements is an essential part of design. Techniques like affinity diagramming are useful for gathering and understanding user data but have shortcomings such as the difficulty to preserve the diagram after its creation, problems during the process such as searching for notes, and loss of shared awareness. We propose an early prototype that solves problems in the process of creating an affinity diagram and enhances it using a large screen display in combination with individual PDAs.

Keywords
Affinity diagram, collaboration, large screen displays, CSCW.

ACM Classification Keywords
H.5.3 Group and Organization Interfaces: Collaborative computing.

Introduction
Affinity diagrams are commonly used in contextual design [7] as well as other business practices. They are used to consolidate themes from user interviews or a brainstorming session into categories. Affinity diagramming is an effective method to support the

analysis of a large amount of information and to highlight issues across user populations prior to designing a new product [7]. The process is not stringent hence allowing room for creativity in defining categories for the data. Categories are essential as they reveal the key themes present in the data.

The process of constructing an affinity diagram is typically performed using Post-it® notes and any available wall space. Qualitative data from user interviews and brainstorming is written or printed on Post-it® notes. Each note has one idea or issue, and the team works together to place similar notes close to each other on the wall in groups. Once all the notes have been placed into groups, the team creates category labels for each group and defines the relationships among groups [7].

The success of an affinity diagram depends on its two core principles. First, multiple participants should work together to create the affinity diagram to ensure the end product reflects the thought process of the whole team [7]. Interaction and shared awareness among participants is key, particularly in the creation of categories and relationships among the data. Second, participants are encouraged not to begin the process with preconceived categories for the data [7]. The categories need to emerge from discussion about groupings for the data.

This paper describes our efforts toward defining a collaborative tool for helping with the construction of affinity diagrams. Holtzblatt et al. encourage participants to "build your affinity on the wall, not in a tool" with the concern that tools would isolate participants, creating a barrier to the communication that is necessary for the grouping and categorization process [7].

However, emerging technologies offer opportunities to overcome these limitations—particularly large, pixel-dense multi-input displays. Holtzblatt et al. [7] acknowledge that we should "wait for the wall sized display so we can move things naturally, communicate simply, and not get stuck in manipulating a tool while we are trying to think."

The goal of our work is to create a tool that will maintain the benefits gained from affinity diagrams—avoiding typical technological pitfalls—while enhancing the process through benefits from large displays. The tool emulates the current process on paper with added benefits such as a search function, a public and personal space and enhanced interactions.

Background and Related Work

One of the main drawbacks of the current process is that the information contained in the affinity diagram is lost after it is initially created and reviewed. Wall space in conference rooms used to create an affinity will often need to be cleared after a certain amount of time. Notes not sticking to the wall also create a problem. Curtis et al. [3] describe constructing an affinity diagram with 1,800 Post-it® notes and printing a copy for each of five sites that used it. Digitizing the diagram can solve the cost of printing and the inconvenience caused by transporting the diagram from one place to another.

Many existing tools for creating affinity diagrams and similar structures have been created for PCs. GUNGEN [10] is a collaborative tool that provides a workspace

Figure 1. BABES, a tool for visualizing military intelligence data.

consisting of three PCs for moving and grouping notes as well as labeling the resulting hierarchy. The tool lacks a large display to enhance collaboration and increase awareness of the workspace. CDTools [1] by InContext provides support for organizing customer data into Post-it® notes and capturing the affinity after it has been built. An affinity diagram is captured by organizing notes in a list according to the hierarchy of the diagram. These types of tools support capture of information, but do not solve all the problems and needs in the current process (Table 1).

Tools for large displays have been built to support the design process. The Designers' Outpost [9] provides a tangible interface for interacting with Post-it® notes on a large screen display. Users can place Post-it notes on the large screen, draw links between notes, annotate and delete notes. TEAM STORM [5] enables designers to work on multiple sketches in parallel. Designers create sketches on their tablet PCs that can be shared with others using a large display. Hilliges et al. [6] explore the similar domain of collaborative problem solving by proposing a table display with pen based input for individual problem solving and a large screen display for collaboration. These types of tools show promise in aiding designers in early-stage brainstorming. The unique challenges of affinity diagramming, namely the categorization and grouping that are core to the process, are explored in this work.

Approach and Uniqueness

We propose a tool that digitizes and enhances the process of organizing notes and creating an affinity diagram. Our tool will use a large screen display which has the potential of becoming pervasive [2, 4]. The large screen display will provide a high visual bandwidth for sorting and organizing notes and enable participants to collaborate and have a shared awareness of the workspace.

Our tool will be designed using the large high-resolution display at Virginia Tech [11]. The high-resolution display is unique in three ways. First, it is pixel dense hence enabling a lot of detail to be rendered and providing a good overview from afar. The display has touch screens which offer a natural touch, drag and drop and throw function. And lastly, the display has bezels which create a natural division of the workspace to facilitate the creation of groups. The downside of having bezels on the display is that it creates a hindrance for movements between screens.

The high-resolution display will serve as a shared workspace and participants will have a personal workspace on individual PDAs. For the rest of this section and the next, we will refer to the large display as the 'wall' and the PDA as a participant's 'personal workspace'.

Our tool will build upon a previous tool created by the first author in collaboration with others at Virginia Tech. BABES - Brushing+Linking, Attributes, and Blobs Extension to Storyboard [8] is a tool for visualizing military intelligence data using a large screen display and a PDA (Figure 1). It is a multi-user tool that allows the user to sort intelligence data in the form of notes, into groups and to create plots and hypotheses from the groups. The user can search for notes with the same attributes and interact with the large screen display using the touch screens. We will be maintaining some features in BABES while adding others.

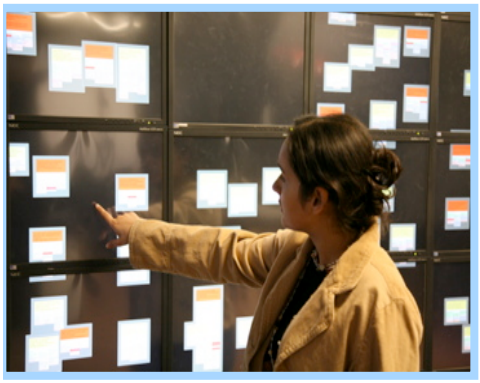

Figure 2. Using the touch screen to move notes.

With reference to the problems and needs persistent in the current process of creating an affinity diagram, the table summarizes the solutions and enhancements our tool provides (Table 1).

Problem/Need	**Solution**
Shared space to encourage awareness and natural collaboration.	Large display. Recent changes to the display are highlighted.
Avoidance of preconceived categories.	Notes are randomly divided on PDAs.
Creation of informal and formal groups.	Drag + drop of notes from PDA to wall. Bezeled workspace.
Personal workspace to encourage reflective thought.	PDA with notes semi-private from group.
Search capability for managing large note sets.	Search by brushing + linking in wall. Search in personal workspace.
Preservation of affinity diagram.	Automated saving and sharing of diagram.

Table 1. Problems and needs persistent in the current process of creating an affinity diagram and solution provided by our tool.

Participants initially have sets of notes placed on their PDAs by the facilitator. They can add more notes as required, though keeping track of more notes becomes difficult. Holtzblatt et al. [10] suggest only giving stacks of 20 notes or so to each individual at a time because "smaller piles are less intimidating".

Participants take turns reading the notes and moving them to the wall using the PDA. Moving a note to the wall involved a simple click on the 'Add' button on the PDA. Once a note is on the wall, it can be moved around the wall using the touch screen feature of the display (Figure 2). Notes are dragged around a single screen and can be "thrown" from one screen to another. We expect that the bezeled screens will be used to facilitate the grouping process. When a group of notes gets too large, participants can break it into smaller groups.

As participants are reading notes, they can create rough groups on their personal workspaces and move the groups to the wall. However, the large display and multi-person input encourages grouping on the wall—facilitating opportunistic interactions among participants.

While creating groups on the wall a participant can search for relevant notes using two options. First she can do a keyword search on all available notes on her workspace and other users' workspaces. She can search using keywords and a resulting list of notes and the workspace they belong to will be populated. If she wants to move a note from another workspace to the wall, a request is sent to the owner of the respective workspace before it is moved. She can also perform brushing + linking ('brushing' selects a search criteria, in this case the search keyword, while 'linking' highlights data that corresponds to the criteria) searches for notes currently on the wall.

Once all the notes are on the wall, colored labels can be created for each group. A participant can create a label on his PDA, add it to the wall and associate it with a position in the hierarchy.

Scenario

A group of three software developers, two usability engineers and their manager are working together to create an affinity diagram to help them understand their users' needs to design a new Internal Time and Billing system for their users' company.

Jill, a software engineer looks down at her PDA and notices that she has sets of notes. She sees a tab labeled 'Workspaces' and clicks on it. She finds the names of all the other members of the group and when she clicks on Greg's name, she sees his workspace.

John, their manager who is also acting as the facilitator for the session explains the process for creating the affinity diagram. Once he is done, he reads the first note and posts it on the wall. Jill, back on her personal workspace, clicks on the first set of notes and reads a few notes. She finds a note that is related to the first note posted on the wall, reads it aloud and posts it to the wall.

A few minutes later, Greg reads another note aloud and posts it to the same group. After everyone reads their first set of notes and decide that no other note goes into the first group, they start a second group. Greg posts one of his notes on the wall and the other members post notes to the group as well.

When Jill is left with three notes on her workspace, she clicks on another set of notes and more notes fill her workspace. She currently has two notes about 'usernames'. Before moving the two notes to the wall, she decides to search for other notes about usernames. She clicks on the 'Search' tab, does a search of workspaces using the keyword 'username' and finds that there are three more notes, all in Greg's workspace. Greg is sent a request from Jill and he agrees to move the notes to her workspace. Jill gets the three notes, and together with the other two notes that she has, she moves them to the wall. The notes are highlighted making the other participants aware of the new group.

Once all the notes are on the wall, Jill and the other participants examine each group and create an appropriate label for each one. Mike decides to move a few notes around and breaks up a group that has 30 notes into three groups.

When the affinity diagram is complete, it is electronically sent to another branch of their company that will be collaborating with them to create the product.

Results, Contributions, and Future Work

This paper describes our requirements analysis and initial design for a large-display tool for creating affinity diagrams. Early use of the tool in controlled situations shows promise for its use in actual design. Planned observational studies of users creating an affinity diagram will validate the degree to which our tool addresses the problems listed in Table 1 and will highlight other critical incidents that need to be addressed using our tool.

Key among our future challenges will be meaningful representation of the history of an affinity diagram. Currently, the brushing + linking approach can highlight diagram changes since a selected time—allowing a latecomer to see changes made that day or highlighting all notes added during a certain period of the work session. More meaningful history representation has promise to show additional data, but would make the interface more complex. Careful balance must be maintained to ensure that the technology does not create barriers to the creation of affinity diagrams, but rather enhances the designers' experience.

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