Learning from the Post-It®: Building collective intelligence through lightweight, flexible technology

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ABSTRACT
3M's Post-It® notes proven popular not only as a simple and ubiquitous reminder tool, but as a medium for collaborative brainstorming and various other conceptual activities. In this paper we analyze the properties of Post-It notes that contribute to their success and discuss how they can be enhanced in the virtual environment. We then present a collaborative tool that builds on the Post-It paradigm.

Keywords
computer-supported cooperative work, design, human factors

1. INTRODUCTION
In the workplace and in the classroom, there is an increasing need for harnessing the collective intelligence of groups to learn faster, envision new possibilities, and reveal latent knowledge. Rapid collaborative knowledge building techniques include problem identification, brainstorming, prioritizing, concept mapping, and action planning. Starting with IBIS [7], a variety of sophisticated computer based tools have been created in support of building individual and collective intelligence. One trend has been to build and investigate systems that provide support for explicit group processes but another line of thought focuses on the representational power of lightweight tools in support of multi-faceted interactions with emergent conventions (cf. [5] and [6]).

Here we introduce a networked representational paradigm that is based on the familiar Post-It® note. Software inspired by Post-Its have long been used to support individual work in desktop computing[1] and some systems for large screen displays (cf. [11]) support the posting of public information via Post-It-like widgets. Our research focuses on employing the Post-It metaphor to support emergent collaborative activity across multiple connected co-located machines. We identify the relevant characteristics of the physical Post-Its that serve to make them powerful collaboration tools. We then describe a prototype system we have built, GroupScribbles (GS), which attempts to model and enhance these characteristics in a computer medium.

2. DECONSTRUCTING THE POST-IT
When 3M first marketed the Post-It in April 1980 it was an instant success, generating some billion dollars in revenue in 1998 [3]. It can be used effectively for a remarkable range of individual or group conceptual work, such as brainstorming, prioritizing or visualization activities [8]. Properties that make Post-Its desirable for flexible collaborative work include that they are:

- Representationally neutral. Post-Its can capture diagrams and drawings as well as text. Different sizes afford different kinds of activities.
- Informal. The typical 3x3 or 3x5 inch Post-It is better suited for quick sketches or notes rather than highly finished ideas.
- Metainformatic. Post-Its can annotate other representations, including other Post-Its.
- (Re)arrangable. Post-Its can be positioned and repositioned to convey meaning.
- Unique. As physical artifacts, Post-Its cannot be in more than one place at a time, suggesting turn-taking in editing or changing.
- Shareable. A Post-It is easily passed from one person to another or stuck to a group workspace. The same note can be retracted from the group workspace for refinement or elaboration.

Of course, Post-Its (costing approximately 0.01 USD each in 2006) have physical limitations. For example, size choices are static. It might be convenient to write on a 3x3 inch note, but try viewing one from across the conference room! A unique identity is useful until you want to have multiple copies. In general, Post-It activities do not scale particularly well (the recommended number for most is 10 people [8]): as the number of participants increase, so does the effort and jostling involved in copying, handing out, collecting, and moving notes from one workspace to another. Lastly, there is the awkwardness of archiving or publishing the results of a Post-It activity.

In our research we have sought to enable high-performance synchronous, face-to-face collaborative experiences by designing a computer-based tool called GroupScribbles (GS), which borrows from the key features of Post-Its while avoiding some of their physical limitations. This work builds on prior research in classroom response systems [1], student-annotatable presentation systems [2], and the use of physical manipulatives for groupwork (e.g., CRC Cards [4]).

3. GROUPSCRIBBLES
The current GroupScribbles prototype (Figures 1) is a distributed system of stylus-based devices (e.g. Tablet PC's or PocketPC's) that communicate through a tuple space [10]. The user interface of GS typically presents the user with a two-paned window. In the lower pane is the user's personal work area, or "private board." In the private board is a "scribble pad" with **representationally**

[1] cf. http://freedownloadscenter.com/Best/sticky-download.html

neutral sheets, which capture both digital ink and typed text. To keep groupwork **informal**, These "scribble sheets" are by default roughly the same size as a 3x3 inch Post-It. A user can arbitrarily **rearrange** sheets and stick them strategically to a background image or other sheets (a **metainformatic** usage). The upper pane of GS is what makes the system **shareable**, as it contains a "public board", which is synchronized across all devices. To make a scribble sheet visible to others, the user simply drags the sheet into a public board. The reverse drag makes the item private again. These sheets are **unique** in that only one user can hold and edit an individual sheet at a time.

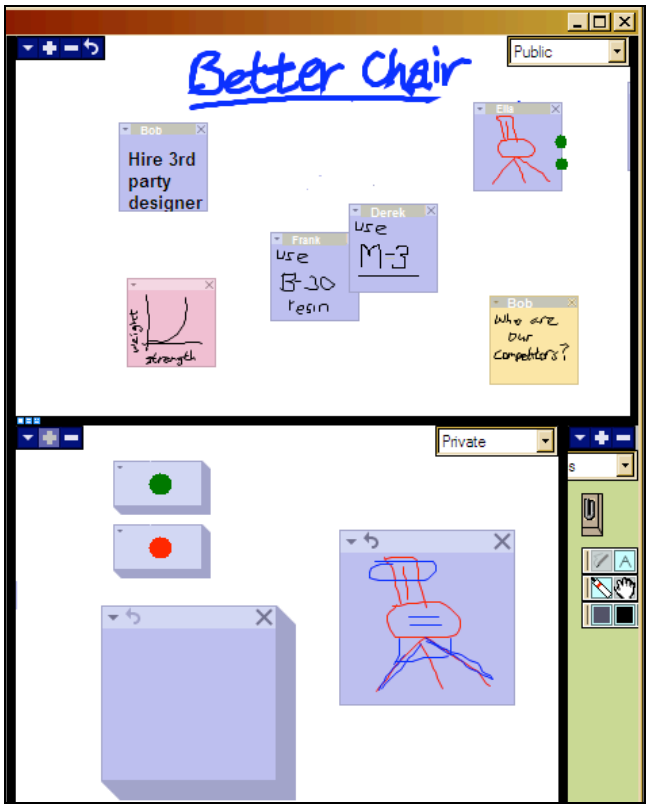

Figure 1. GroupScribbles screen shot. The lower pane in each image is private and the upper is public.

Unlike group activities with physical Post-Its, the GS public board, replicated across devices, provides all participants with a clear view of the unfolding activity. Participants can take and put items in parallel without crowding. When warranted, a participant can instantly copy any scribble sheet via a menu command.

We illustrate the use of GS with a simple group activity, called "post-up", drawn from [8]. Suppose a furniture company wants to brainstorm ways to improve its chair design. The question "how can we make a better chair?" is posed before the group. Each participant captures several ideas as words or sketches in their private space and then drags the few that are most appropriate onto the public space (Figure 1). Alice notices some common themes (e.g. materials), so she clusters related items.

Bob uses a different (tan) color note to pose a question. Cathy notices Bob's question, drags it into her private space (thereby ensuring that no-one else is working on it), composes the "answer" note, attaches it to Bob's question using a virtual paperclip, and moves the result back into the public space. Derek compliments Ella's idea by attaching a green sticker (sticker conventions were agreed-on beforehand); this idea already has a few green stickers, making it likely to be chosen as the final solution. Frank notices the cluster of ideas related to materials and incites a discussion sub-group on that topic, by creating a new shared space and inviting some participants to brainstorm within the space. George, who was absent during the session, logs in later and adds a few ideas of his own (perhaps triggering an automatic notification to other participants).

4. CONCLUSIONS

We are currently refining GS for use in classroom-based collaborative learning experiences. Our implementation efforts are currently focused on adding lightweight activity supports and automation, e.g. providing a running inventory of scribble sheets.

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