Introduction

Looking at different examples of real life “communities”, one can roughly distinguish communities formed by people who are interested in the same topic and communities of people that share some kind of common environment. The first kind of communities can be called “communities of interest”. Examples for such communities are experts in a particular domain or collectors. Examples for communities of people who share some kind of common environment are “communities of practice” [Lave and Wenger 1991] or communities that share a place where they live or work (e.g. the inhabitants of a city). The latter type of communities will be called “local communities” in the rest of the paper.

Support for building and maintaining communities can be classified in classical approaches like private letters, leaflets, magazines, paper whiteboards, specialized radio and TV programs, and approaches based on networked computers (bulletin board systems, MUDs, MOOs, “community networks” [Schuler 1994]).

Both support approaches, the classical and the electronic ones, have their advantages and disadvantages. For classic media the advantages are availability, familiarity, and ease of use. For electronic media the advantages are dynamicity, speed, ease of replication, and distribution; disadvantages are barriers to usage, problems with access, and lack of availability.

It seems obvious that both strategies should be integrated with each other. Especially for local communities which have a close relationship with some kind of physical space this integration of community support systems into the physical environments is essential. We believe that electronic support for local
communities can only be successful if the access to it is broadly extended into the real places through new user interface metaphors and mixed with classical community support media, and not only accessible from home or work PCs.

In this paper we briefly present our work on combining paper artifacts and electronic information systems for community support.

2 Paper in community interaction

Some studies (see for example [Sellen & Harper, 1997]) have shown how far away organizations and offices still are from achieving the goal of the paperless office (if they will ever achieve it at all). The same observation can be made for non-work related environments such as local communities even if not sustained by formal observations.

Paper has a set of affordances, which make it such a difficult medium to replace:

- Paper is cheap.
- Paper is portable, sheets of paper can be easily folded and carried in pockets. No special device is needed to retrieve the information. The same is not true for floppy disks, while with the PDAs a step increasing portability has been made.
- Paper based artifacts are easily shareable.
- Paper can be easily annotated. The creation of additional personal layers of information on paper is not only economic and straightforward, but fits well with people’s existing work practices.
- Paper better supports the reading act, because it supports much more efficient movement to and from different parts of the same document. It affords the perception of information at-a-glance, because the documents are embodied in the physical medium of their display.

Several paper document types can be observed in local community support: information flyers, maps, newspapers, paper whiteboards, just to quote the more common ones. Given the affordances of paper described above it is neither desirable nor foreseeable that these document types will disappear in the near future.

The work described here looks at how to enhance paper based artifacts available in towns, by making them active, i.e. a means to give input and ask for output to electronic applications.
3 Technology for linking paper and the electronic world

For using paper artifacts as input and output medium of electronic information systems we need:

- A possibility to store machine readable information on paper (so that the processing device can learn what the paper artifact is about, where to look for markings, and to identify the submitting user).
- Software components for printing forms that can be automatically processed later, and components for processing scanned images and interpreting the users markings.

Additionally, the setup for producing and processing the forms should be usable by casual users without any assistance.

For storing binary information on paper, we are using Xerox DataGlyphs™. Compared to Barcodes, the most common solution for storing machine readable information on paper, glyphs have some advantages: higher density, higher fault tolerance, can have any form, can be hidden in images [Johnson et.al. 1993].

Based on DataGlyphs and on the Xerox PaperWare® toolkit [Xerox 1998] we have built a software layer that offers services for printing forms and for processing scanned images. For user feedback, single and grouped checkboxes and rectangular scan areas (that can be further processed by other tools) are supported.

Application build upon the service layer can be loaded as a kind of servlets into so-called multifunctional devices. MFDs are programmable copier-like devices with network connection. Due to their similarity to copiers users can easily deal with them. With these devices, both the individual processing of forms and the batch processing of collected forms is easily possible.

4 Usage of paper for local community support systems

With the possibility to link the real world and the electronic space through paper, dynamic information can become a real support to local communities, both enhancing the effectiveness of current paper based media, from newspapers and magazines to wall postings and restaurants' tickets, and opening the way to a new set of paper artifacts that can exploit completely the potentiality of this link.

In fact, paper-based interfaces work in two ways: as tools to manage, exchange, organize information and to trigger actions, and as a medium to exchange experience about what people see and do when they are not together, or to comment on experiences they had, or to suggest interesting things.
As a tool, paper can be used to provide services to the system, such as extracting interesting information from the communication flow or from user actions. Paper can also provide services to the final user, such as giving more information on a particular item, storing information to be sent to friends or for later retrieval.

In this case, the simplest interface can rely on existing interactive elements like checkboxes, used as automatic triggers for the system to retrieve information from a database, or to acquire information and preferences from the user, connecting the interaction on physical paper to typical functionality of recommending and collaborative systems. Moreover, checkboxes can be used as rating tools or associated to labels to categorize items that are invisible to the system, like the pictures taken during a party, or a menu of a restaurant.

This kind of interface can support a system that allows each member to have access to valuable, personalized information, but partial enough to push people to complete their own picture conversing with their friends.

But there are other ways for paper interfaces to extend the conversation both in the real and in the electronic world. An appropriate system can exploit both paper's ability to be a medium for the exchange of culture in communities of place and practice, and its link between the content and the electronic systems to connect communities of interest.

In this sense we can imagine how an article on a magazine can become a topic for discussion in a forum that is not restricted only to those connected to the electronic space, but open to all those who can access a paper interface and an MFD to print a copy of the trail of the discussion and reply directly through paper.

An ideal device to support this process is what we call an Active NewsCard. Active NewsCards are personalized postcards with dynamic content, enhanced with recognizable checkboxes and active areas. Ticking any of the checkboxes distributed in the content allows the user to ask for more information on a particular topic, on the author of the piece, or to rate the content. Blank areas are used to give the possibility to add free comments, which are scanned and saved.

Each Active NewsCard can be associated with other paper "tools" called PID Stickers, which work as personal identifications and are essentially DataGlyphs that carry the identification of the user. Attaching a PID sticker to an Active NewsCard makes the system to associate content and actions with the user, creating the conditions to produce useful information for the recommending and the collaborative systems, which are essential to give valuable services back to the user.
The Active NewsCard is a typical example of a paper interface that mixes existing characteristics of a paper medium, the actual postcards used as support for messages to friends, with functionality acquired linking it to electronic systems. This is one of the possible ways for paper interfaces to become the basis for richer artifacts that mix formal and non formal content, join different communication systems and open direct channels to the creators and editors of the information, contributing to the support of communities.

5 Conclusions

In this paper we presented and detailed the idea of using paper as link between the real world and electronic information systems for local community support. All these ideas have been developed and implemented in the EU funded project Campiello, where we are working on support for communities of tourists and local inhabitants in tourist towns [Agostini et.al. 1998, Grasso et.al. 1998]. The current status of Campiello is that we have finished first prototypes of the NewsCards described in Section 4 and are currently testing the technology in the field.

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7 References


