Annotation in the Wild:
Benefits of Linking Paper to Digital Media

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ABSTRACT

This work presents the design of ALT, a prototype system that supports learning activities on the move by enabling users to annotate and sketch on paper in collaboration with a remote peer. Initial observations of learners interacting with ALT during an informal learning event show that paper annotation combined with synchronous communication technology shifts learners to use annotation as a basis for discussion and more personal interpretation of the information available.

Keywords

Computer Supported Collaborative Learning, informal learning, annotation, interaction design

INTRODUCTION

Annotation and sketching is commonplace when people are engaged in learning activities. Highlighting, marking, scribbling and taking notes help learners to personalize the information they need to acquire, easing assimilation of its contents [2] and providing external support to their memory. Current annotation practices, at work or in educational contexts [1], are mainly based on paper copies of documents [5], whilst free-form annotation systems seem to be the most used one by learners on the move [4], due to practical reasons. However, since more computer support is available today for sharing annotations with remote peers this has open up investigation on how annotations can benefit learning beyond their personal use [3]. How should we design new technologies that best support learners' needs for producing and using annotations across different environments and conditions? What are the main benefits of sharing notes that we could capitalize on to encourage learning? Are there learning situations where synchronous *vs* asynchronous annotation sharing makes a difference? We started with designing a prototype system, called ALT, which learners could use on the move to synchronously share annotations and sketches made on paper with a remote peer.

The rationale for this design project consisted in the lack of systems providing this interaction functionality; something that we speculate might discourage a more intense sharing of annotation during learning events. Also, we aimed at smoothing the transition from paper to digital annotations so as to make them more easily available across different environments and learning situations. We observed adult learners' interaction with ALT during an informal learning event, where they could produce and share annotations while accessing information conveyed in textual or graphical forms. Preliminary results indicate that free-form annotation with ALT fostered an intense process of inquiry over the information made available, enhancing more interpretation than memorization of its contents.

THE ALT SYSTEM

The ALT prototype takes the form of a book which combines the display and processor technology from a laptop computer and pen input from a graphic tablet, as shown in Fig. 1.
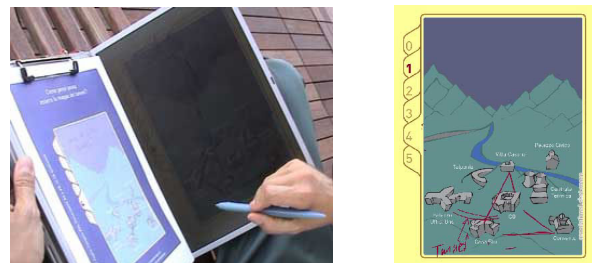
Fig.1. The ALT prototype with an annotated worksheet

A software program (written in *Macromedia Director*) enables two users to synchronously and remotely collaborate on a document by sharing an A4 sized annotation space, one sheet at a time. The system runs over an 802.11b wireless network and the environment is controlled by a *Shockwave* multi-user server application. Learners can download and print different worksheets from a shared network archive, clip the paper worksheet to the left side of the ALT book and freely annotate it by using an ink pen. On both the paper and digital version of each worksheet is a tab area that needs to be ticked so as to inform the system and the peer about which page they

are currently using. Annotations made on paper sheets are displayed on the shared annotation space (right side of the book) as soon as each of the learners produces them on paper. Marks from the different users are displayed in different colors. Annotations can be deleted or saved for subsequent reuse.

METHOD AND FINDINGS

To evaluate the ALT prototype we involved 10 pairs of adults to take part to an informal learning scenario, where they could use ALT as a collaborative annotation tool to explore an unfamiliar, cross-shaped building and its surrounding area, to learn more about the spatial layout, history and architecture of the place visited. The activity was known to be quite challenging for newcomers, so that learners could rely on informative worksheets we had disseminated in the environment to guide their exploration. Informative worksheets containing either textual or graphical descriptions of the place were collected, annotated or sketched by participants in remote collaboration, for an overall duration of the activity of about 1 hour. Video recording and shadowing of learners' activity by two different researchers were carried out to uncover interesting aspects of annotation that came up during the exploration. Both authors independently coded the type and content of the annotations produced, following the scheme already applied in [3].

Table 1 below shows the results of our initial analysis where we found 24 out of a total of 92 annotations (26%) consisting of highlights, underlines and circles on the information provided, 61.95% (57 out of 92) being textual notes, among which 21 (22.82%) comprised a sketch associated with some text. Compound annotations, consisting of an anchor associated with a note or symbol, were 10 out of 92 (10.86%).

Annotation Type	Frequency
Underline/highlight/circle	24 (26.08%)
Textual notes (sketch + text)	57 (61.95%)
Compound (anchor + note/symbol)	10 (10.86%)

Table 1: Types of annotations produced by learners

These initial data show that learners used ALT far more as a tool for collaboration than as a support for personal annotation. The high percentage of textual notes produced combined with our qualitative analysis of their content points to ALT capacity for shifting learners to a more personal interpretations of the information provided instead of focusing on rephrasing or summarizing the material being read. Learners seemed to capitalize on simultaneous and remote collaboration as a way of sharing experiences and thoughts throughout the exploration as soon as they arose, preventing them from being forgotten because of a change in their mind-set. In out-of-class learning situations this ALT affordance could be valuable and, currently, add to the support provided by asynchronous annotation systems already available. Our

shadowing of learners' behaviors revealed also that collaborative annotation sharing sustained interest and motivation for the learning activity, facilitating an earlier emergence of questions, difficulties and discussion about the information read. Although anchors or symbols used by learners were not always directly intelligible to their peer, simultaneous communication provided an easy means of overcoming possible misunderstandings. Frequent revisiting of notes written on the worksheets was observed, showcasing learners' engagement and reliance on the annotations previously made.

IMPLICATIONS FOR FUTURE WORK

Results of this first evaluation of ALT point to encourage the use of synchronous annotation systems in learning situations that can be enriched by information found in the surrounding environment and when collaboration with one or more peers, sense making or engagement with the learning activity are crucial. However, many other issues need to be addressed: are our findings going to hold when learners need to study longer documents and/or share annotations with more peers? Are collaborative annotations compatible with personal ones or should they be kept and processed separately? How can we design new technologies that enable learners to customize their way of annotating (according to their contextual needs) and to fully take advantage of the annotations already stored into the system?

A step forward would consist in integrating key aspects of ALT (like pen input and synchronous annotation on the move) with the functionalities already supported by most commonly used Web based systems (WebAnn, for example). This may benefit learners by enabling them to opt for the interaction model that best fulfils their contextual learning conditions or preferences, prompting them to use and produce more annotations as a valid support for learning.

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