as a one-stop-shopping module able to mediate with the content providers. In this way, the MKBEEM system has to offer the following functionalities:

- Harmonise Business Rules. As the trading process implies some contracts to be agreed between the user and each content provider, the MKBEEM will try to harmonise these contractual issues depending on some parameters such as countries of each actor, preferences declared by each actor in their user profiles, etc. An e-commerce ontology will be developed in order to provide the knowledge to this process.
- Multilingual Trading. As the user and the content providers may use different languages, the MKBEEM system will act as a mediator for translating the e-commerce transactions between them.

The Mkbeem project integrates Knowledge Based processing (Knowledge Representation and Reasoning) and Human Language processing in providing multilingual e-commerce mediation services. The consortium aims at proving that the technology concept is robust for given domains, and thereby bringing advances in both technology and services. The consortium consists of the coordinator France Telecom, the user partners Ellos (Finland), SNCF (France) and FIDAL (France), and the R&D partners SEMA (Spain), UPM (Spain), NTUA (Greece), CNRS (France) and VTT.

Links:
Project home page:
http://mkbeem.elibel.tm.fr/

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The A-Book: An Augmented Laboratory Notebook for Biologists

by Wendy E. Mackay and Guillaume Pothier

We all face a growing problem: managing the relationship between physical and on-line documents. A joint effort between Project MErLIn at INRIA Rocquencourt and the Institut Pasteur in Paris is exploring how to effectively integrate the two in the a-book: a computer-augmented laboratory notebook for research biologists.

Research in ubiquitous computing and augmented reality has challenged the view that a 'computer' means a keyboard, mouse and monitor. Instead, physical objects such as paper can serve directly as the interface to the computer. This encourages new forms of human-computer interaction that are more easily integrated into current work environments.

We are exploring this approach with respect to laboratory notebooks, which provide a fertile testbed for exploring how to manage information with both physical and electronic manifestations. Our research strategy involves participatory design with two types of users: biologists and archivists. We began with videotaped observations and interviews to understand their needs and then used video brainstorming and prototyping techniques to explore the design space for augmented laboratory notebooks. We are now developing a general software architecture to support persistent data and integrate paper and on-line documents.

Field study results

Our field studies examined the use of notebooks from several user perspectives. Individual biologists use notebooks to officially record their hypotheses, procedures and experimental results. They view them as personal documents that reflect their personalities as well as their current research needs. Laboratory notebooks are multi-media documents: in addition to writing and drawing, biologists paste in photographs, computer printouts with data analyses and even the physical results of experiments, eg, gels. Notebooks may also refer to external objects, such as test tubes stored in refrigerators. Although all are heavy computer users, most biologists appreciated the simplicity and flexibility of their paper notebooks. However, they found some tasks cumbersome, such as creating indexes or searching for a specific experiment, and they rarely summarized their data in the prescribed manner. Several also expressed frustration with finding relevant information in a other colleague's notebooks.

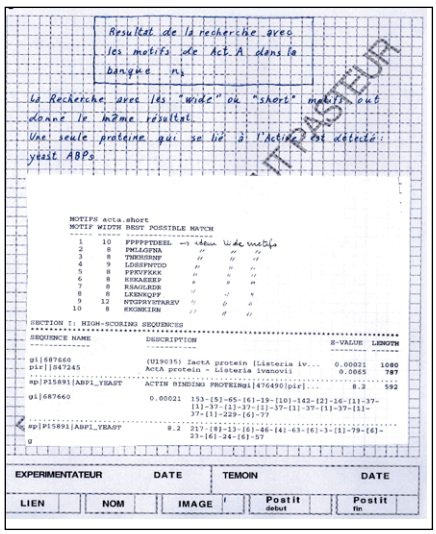

Figure 1: A-book prototype 1 captures handwriting with a CrossPad™. Menu commands are printed directly at the bottom of the page. Computer-generated research results are pasted onto the page, with hand-written comments above. The box indicates that the contents should be added to the on-line index.

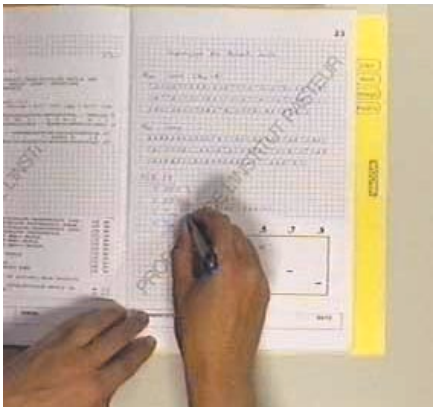

Figure 2: A-book prototype 2 captures hand-writing with a WACOM™ graphics tablet; menu commands appear on a separate sheet to the left.

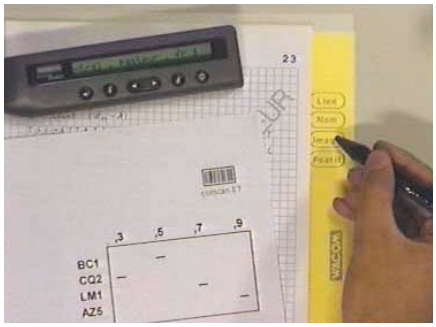

Figure 3: Adding a computer printout: the biologist reads the automatically-generated code with a Pocket Reader™ then 'presses' the image button to simultaneously insert it into the corresponding electronic page of the notebook.

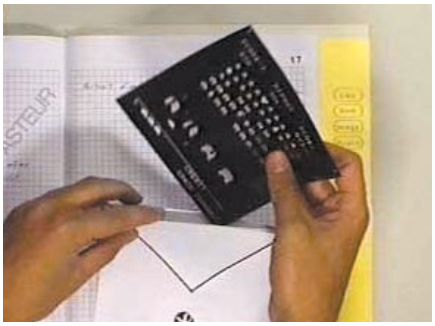

Figure 4: Adding a microscope photograph.

The Institut Pasteur strictly regulates laboratory notebooks, maintaining a staff to archive and manage them after biologists leave. From their perspective, the notebooks comprise the intellectual property of the organization: the archive staff are interested in both their research and historical value. They worry about storing paper-based data, since ink may spread over pages, media may decay, and links between notebooks and physical specimens may be lost. However, they are even more concerned with the growth of on-line data, which quickly disappears when stored in obsolete software formats on out-moded computer media.

A-book design

Our findings influenced the design of an a-book, or augmented laboratory notebook. After consulting with users, we built two working prototypes that test different technical and interaction strategies. Each prototype allows biologists to write on notebook pages as before, with ink on paper. However, the a-book simultaneously captures an electronic copy of each stroke and associates it with the correct page, providing a time-stamped, on-line record of the hand-written text. Biologists can easily specify links to on-line information, such as data results or digital photographs that are pasted into the paper notebook. If text is underlined, the a-book uses character recognition to interpret it. For example, a biologist might specify a particular web address or interpret a sequence of DNA for later analysis. Biologists can also label and categorize information for subsequent search, by drawing a box around a name, procedure, drawing or any other object. The a-book creates an on-line index and content summary and biologists can use either the paper or on-line versions to search for specific information.

Future research

We are developing a third prototype that incorporates user feedback and plan to test it with several volunteers in the summer of 2001. The new version will use a document-based software architecture that handles persistent data over long periods of time. Data, both physical and electronic, is represented as separable layers of information, each with different characteristics. For example, hand-writing, whether in ink or captured as on-line gestures, is unchangeable. However, additional layers may be added to provide annotations, explanations, or interpretations of the original text. The a-book challenges traditional views of software design and, by integrating multi-media physical and electronic information, offers a new vision for human-computer interaction.

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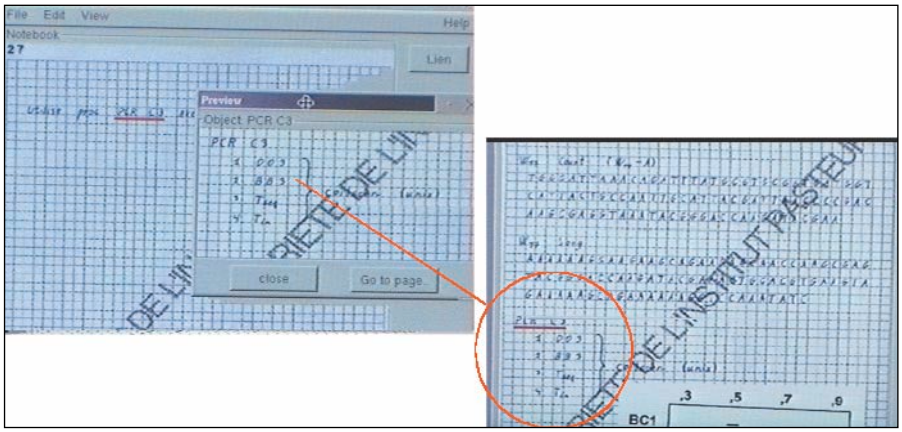

Figure 5: Following a link (the underlined PCR 3 procedure) to an associated page.