DartMail: Digital Information Transfer through Physical Surrogates

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One of the principle activities in group interaction is exchanging information between collaborators. People swap business cards and vacation photos, workers forward potentially interesting documents to each other, and co-authors exchange evolving versions of a paper. Computers system equivalents allow people to store and forward digital documents by email, file transfers, web links, a shared file server, or some other data base management and electronic access system.

Yet these conventional methods of transferring information assume the exchange of *either* electronic *or* physical information. This view is limiting, since physical and electronic information can be linked in a single exchange (Ishii, 2003). For example, consider how digital vacation photos relate to a hand-written paper letter describing the vacation. Both are interlinked, but we would normally send them separately. If instead we associate the digital information to the letter, the recipient could retrieve and view the electronic pictures as they read it.

Using technologies such as RFID tags, people can easily attach a tag to a physical item, where the tag identifies any electronic information associated with that item. When the physical item is exchanged, the recipient can then swipe the tag over a reader to view this associated information.

This video illustrates our ideas through DartMail, a humorous account of how 'handles' can be quickly created, attached to a physical medium, and exchanged. Its primary interface is a physical, RFID-tagged rubber dart. Exchange is accomplished in three rapid steps.

1. *Associating the RFID dart with digital data.* The person passes the dart over the RFID reader to raise an on-screen dialog. The person then drags a file or textual information (such as a web link) onto it.

2. *Information transfer.* The person hunts down his or her colleague, and shoots the dart at that colleague.
3. *Information retrieval*. The receiver simply passes the dart over another RFID reader, which automatically "opens" the associated information in the appropriate application.

DartMail is built atop two toolkits. Using Phidgets (Greenberg & Fitchett, 2001), the RFID mechanism raises an event containing the RFID tag ID whenever a tag is passed over the reader. Using the shared distributed data structure of the Collabrary (Boyle & Greenberg, 2002), the application checks to see whether anyone (anywhere) has associated information to this ID. If it has, the information is retrieved and opened in the appropriate application. If it hasn't, the person can drop items onto the raised dialog, which are copied into the shared data structure as a pointer (e.g., to files) or as content (e.g., as text or a web link).

DartMail's design is fully intended to be tongue-in-cheek. However, its underlying idea is quite serious. RFID tags can be embedded in a variety of physical form factors, e.g., business cards (for electronic resume exchanges), paper bookmarks (for web page exchange), photo frames (for photo exchange), executive summaries (for full document exchange) and so on. Thus, both digital and physical information can be transferred through the many rich ways we now exchange physical items: as a hand-delivered gift, as a mailed paper letter, as a paper document distributed to a group, and so on.

We are not the first to associate physical handles to electronic information. We were heavily inspired by MediaBlocks (Ullmer, Ishii & Glas, 1998), where information is attached to wooden blocks which can then be used to manipulate that information, and by WebStickers (Ljungstrand, Redström & Holmquist, 1999), which uses printed barcodes to associate URL's with items.

DartMail is amusing and enjoyable to use. People within our laboratory have used it to transmit casual information (e.g., links to silly web pages, altered images). Additionally, DartMail often attracts the attention of others, prompting informal watercooler-like conversations, something a purely digital method would not do.

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