

Token-based interaction with embedded digital information

Simone Mora

Norwegian University of Science and technology
Sem Sælandsvei 7-8, Trondheim, Norway
simone.mora@idi.ntnu.no

ABSTRACT

Embedding digital information into places and objects can improve collaborative processes by allowing a piece of information to travel across different contexts of use. Yet tools for supporting the processes of information embedding, discovery and visualization are needed. This PhD-work aims at providing a conceptual framework that promote the use of (in)tangible tokens to enable information embeddedness. The framework is used to drive the design of pervasive applications to support collaboration and reflection in crisis management.

Author Keywords

Embedded information, embodied interaction, crisis management

ACM Classification Keywords

H5.2 User Interfaces: Interaction Styles. H5.3 Computer-supported collaborative work.

General Terms

Design, Experimentation, Human Factors.

INTRODUCTION

The recent years have seen a deep revolution on how digital contents are generated and shared both for work and leisure. Nowadays social networks allow anyone to record and share ideas and thoughts anywhere and anytime.

On the other side information generated in such way, on-the-move during everyday activities, is often informal and unstructured, being about activities which are a constant flow of action that has no clear starting or ending [1]. This paradigm makes sometimes difficult to reconstruct the original meaning of a piece of information when it migrates between different contexts of use; as it happens in many collaborative processes (e.g. in crisis management).

RESEARCH PROBLEM

This PhD-work investigates the design of computer

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.

TEI 2013, Feb 10-13, 2013, Barcelona, Spain.

Copyright 2013 ACM 978-1-4503-1898-3/13/02....\$15.00.

interfaces to promote collaborative, embodied and tangible interaction with information. I believe that making the interaction with digital contents physical would help to make sense of the original information context. Hence my research goals have been summarized in three research questions: (1) How information can be embedded in a physical context? (2) How designers can create tools to visualize and manipulate embedded information, being the user situated within the physical context? (3) How interaction with embedded information can support collaborative processes?

THE WORK SO FAR

To unlock and support the creation of collaborative interactions with embedded information, a conceptual framework and the design space of computer interfaces have been drafted. Two mobile applications to support crisis management work practices by exploiting information embeddedness have been designed, implemented and evaluated. Crisis management strongly rely on deployment and management of resource into spaces, therefore on-place interaction with space-embedded information has the potential to improve cooperation and reflection [5], [6].

The process of embedding information

I propose to use (in)tangible tokens embedded in the physical world in order to “transform the information into something immutable and ready to travel across boundaries of communities of practices” [2]. This could be done following a three-steps process: (1) Information is embedded into the real world using tokens. A token is a tangible or intangible object that acts as a placeholder for the information (Figure 1-left). (2) In order for the user to interact with tokens (and thus with a piece of information) a computer interface must be provided to support the actions of token-discovery (the token could be hidden or virtual), information visualization and editing. (Figure 1-right).

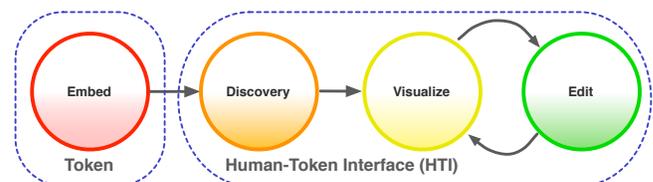


Figure 1. Token and Human-Token interfaces.

(3) Tokens are sharable. Human-Token interfaces (HTIs) can be both public or private and provide mechanisms to allow a token to be accessed by multiple users, from multiple user-interfaces, to support cooperation processes.

The design space

The design space has been drafted around two dimensions: the Token and the Human-Token interface (Figure 3).

Token	Physical	E.g.: QR Codes apps	E.g.: Augmented objects and smart devices
	Virtual	E.g.: Augmented Reality smartphone apps	E.g.: Public Displays
		Mobile	HTI Token-static

Figure 3. The design space.

The token could be physical, for example an object, a barcode, or it could be virtual like a place landmark. A Human-Token interface could be mobile, or it could be static in relation to the token. For example Durrell Bishop's Marble Answering Machine project [3] at the Royal College of Arts (Figure 4) uses marbles as tokens to embed voicemail messages. The user can listen or erase the messages by holding marbles on a dock that acts as a HTI.

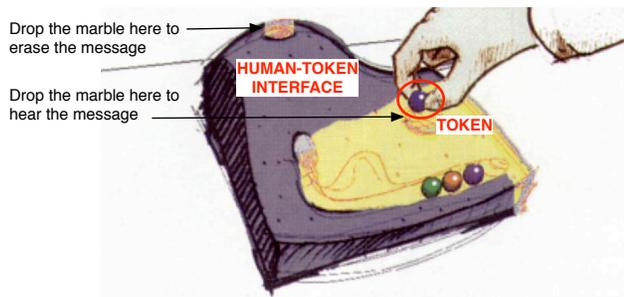


Figure 4. Durrell Bishop's answering machine, picture adapted from [3].

Applications for crisis management

Two prototypes of mobile interfaces have been designed and evaluated to demonstrate how embedded information can support the rescue work on a disaster scene. The first application, WATCHiT (Figure 5-A), is a wearable computer sewn in a wristband capable to embed virtual tokens into space. Tokens can contain sensor data or user-generated notes, and can be created by emergency workers using gestures, on the field, without interrupting the rescue work. WATCHiT features a modular design, therefore the type of information captured is tailorable plugging in sensors. A broader description of the system is available in [4]. The second application, CroMAR (Crowd Management Augmented Reality), allows for discovery and navigation of information into tokens, directly in-space via an iPad interface (Figure 5-B).



Figure 5. WATCHiT (A) and CroMAR (B).

The tokens are previously generated and embedded into space, by different agents (crowd managers, citizens, sensors), using mobile interfaces (e.g. WATCHiT). Information can be navigated by means of time, space and keywords. The information visualized is intended to support and promote processes of debriefing and reflection for emergency workers who are deployed to operate as crowd managers. In this way we can expect the reflection process to be grounded in a context that helps making sense of the information and reflect on alternative path of actions. An extended description of C. is available in [5].

ACKNOWLEDGMENTS

The work presented in this paper is co-funded by EU-ICT 7FP MIRROR project (<http://www.mirror-project.eu>).

REFERENCES

1. Abowd, G. and Mynatt, E. Charting past, present, and future research in ubiquitous computing. *ACM Trans. Comput.-Hum. Interact.* 7, 1 (2000), 29–58.
2. Bannon, L. and Bødker, S. Constructing common information spaces. In *proc. ECSCW*, (1997), 81–96.
3. Bishop, D. Durrell Bishop's Marble Answering Machine. (2006). <http://goo.gl/nmgBm>
4. Cernea, D., Mora, S., Perez, A., et al. Tangible and Wearable User Interfaces for Supporting Collaboration among Emergency Workers. In *proc. CRIWG*, (2012), 1–8.
5. Mora, S., Boron, A., and Divitini, M. *CroMAR: Mobile Augmented Reality for Supporting Reflection on Crowd Management*. *IJMHCI* 4, 2 (2012), 88-101
6. Nilsson, S., Johansson, B., and Jonsson, A. Using AR to support cross-organisational collaboration in dynamic tasks. *8th International Symposium on Mixed and Augmented Reality (ISMAR)*, (2009), 3–12.