Leveraging sensing-based interaction for supporting reflection at work: the case of crisis training

Simone Mora
Outline

- Problem domain
- Research questions
- Theoretical underpinning
- Research methodology
- Technology tools
- Contributions
- Conclusions and future work
During 1992-2012 disasters have affected 4.4 billion people and caused USD 2 trillion in damage worldwide

Source: The UN Office for Disaster Risk Reduction
Crisis Training approaches

Problem:
Maximising learning outcomes from experience-based training events
Research questions

What are the opportunities introduced by combining reflective learning theories with sensing-based interfaces for supporting crisis training?

I. How sensing-based interfaces can be designed to enable unobtrusive experience collection during crisis work?

II. How sensing-based interfaces can be designed to trigger and support reflection activities?

III. How sensing-based interfaces for supporting reflection can be rapidly prototyped?
Reflective learning

Sharing of work experience + Reflection = New knowledge


- New perspectives
- Change in behaviour
- Readiness
- Commitment

Computer supported reflective learning

Plan and do work
Plan work
Do work
Monitor work

Initiate reflection
Set objective
Involve others
Plan session

Conduct reflection session
Make related experiences available
Reconstruct or envision work experience
Understand meaning
Articulate meaning
Critique experience
Reach a resolution
Check applicability of reflection outcome

Apply outcome
Decide on change to work (e.g. what, who)
Decide how to make the change
Decide whether further reflection is needed

Data
Empirical data
Validation of theories
Technology tools

Frame
Reflection Theory
Evaluation framework

Legend:
- EU-IST/FP7 2010-2014
- Empirical data
- Validation of theories
- Technology tools
- Reflection Theory
- Evaluation framework

Sensing-based interaction and tangible user interfaces

Tangible interaction denote system that rely on embodied interaction, physical representation of data and embeddedness in the real space (Hornecker and Buur 2006)

CSCW LEARNING

EMBODIED EMBEDDED INTUITIVE PLAYFUL
Methodology overview

[Hevner, Alan R (2007). “A three cycle view of design science research”.]
Exploratory studies

METHODS:
- Observations
- Shadowing
- Video
- Interviews
Prototypes

- **Exploratory field studies**
  - Prototypes: F1, F2, F3, F4, F5, F6

- **Design cycle**
  - Prototypes: D1, D2
  - Formative Evaluations: G1, G2, G3, G4

- **Rigor cycle**
  - Papers: P1, P4, P5, P6

- **Relevance cycle**
  - Field evaluations

2010 2011 2012 2013 2014
Evaluation studies

**METHODS:**

- **QUESTIONNAIRES**
- **INTERVIEWS**
- **OBSERVATIONS**
To interact with W. I had to shift my sight away from the rescue work.

I believe that after some usages I will interact with W. without shifting attention.

W. empowered me to capture data without interrupting the rescue work.

To interact with W. I had to shift my hands away from the rescue work.

To interact with W. I had to shift my sight away from the rescue work.

Evaluation studies

<table>
<thead>
<tr>
<th>ID</th>
<th>Question</th>
<th>All (N=35)</th>
<th>At least 5 years of experience (N=18)</th>
<th>Less than 5 years of experience (N=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA2</td>
<td>WATCHiT helped me to reflect on experiences</td>
<td>4.06 (0.59)</td>
<td>4.28 (0.46)</td>
<td>3.73 (0.59)</td>
</tr>
<tr>
<td>CA6</td>
<td>WATCHiT helped me to reconstruct a work experience</td>
<td>4.29 (0.52)</td>
<td>4.39 (0.50)</td>
<td>4.13 (0.52)</td>
</tr>
<tr>
<td>CA7</td>
<td>WATCHiT helped me by capturing my reflection outcomes</td>
<td>4.15 (0.56)</td>
<td>4.18 (0.53)</td>
<td>4.07 (0.59)</td>
</tr>
<tr>
<td>CA12</td>
<td>WATCHiT helped me by providing accurate information about my work</td>
<td>4.03 (0.51)</td>
<td>4.22 (0.55)</td>
<td>3.80 (0.41)</td>
</tr>
<tr>
<td>CA40</td>
<td>WATCHiT provided relevant content for reflection</td>
<td>4.29 (0.52)</td>
<td>4.44 (0.62)</td>
<td>4.07 (0.27)</td>
</tr>
<tr>
<td>CA41</td>
<td>WATCHiT guided me through the reflection process</td>
<td>3.91 (0.61)</td>
<td>4.00 (0.59)</td>
<td>3.80 (0.68)</td>
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Table X. Means and standard deviations for app specific questions

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HAPTIC FEEDBACK TAG

Graph showing temperature and node usage over time.
"I'm trapped in my car #panic!"
@marco via twitter

Next tweet containing #panic (1 of 10+)

0.7 Km

"Agent Dokes in sector 5 needs an ambulance"

Noise level 95 dB↑

CCTV Video

Yesterday (Oct. 27th)

14:00 16:00 18:00 20:00 22:00 24:00

RE-CREATE EXP
PHYSICAL EXPLORATION

TIMELINE NAVIGATION

MULTIPLE LAYERS

RADAR & MAPS

REFLECTION OUTCOMES EDITOR
NAVIGATE

MANAGE INFORMATION UNDER STRESS

CALM, MOVE OR RESTRAIN CITIZENS
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Papers


Instantiation of CSRL model

Design of tools for experience-capture

Novel sensing-based interaction techniques

Challenges in building prototypes

Conference Journal Submitted Contribution
Contribution I

Implementation and evaluation of MIRROR Computer Supported Reflective Learning (CSRL) theory
Contribution II

Knowledge about designing experience-capturing tools for crisis workers

1. Mobility of work and sensing
2. Different crises, different relevant data
3. Different types of data
4. Sensor data and user-submitted data
5. Different use, different sharing
6. Intuitive, hands-free interaction
7. Automate and discrete capturing
Contribution III

Novel sensing-based interaction techniques to support crisis training
Contribution IV

Knowledge about implementing prototypes to be deployed into the wild
Conclusions and future work

The CSRL model can be instantiated into an ecology of sensing-based interfaces for the capture, re-creation and generation of crisis work experiences

*Future work will further map with technology the activities described in the model*

Unpredictably of relevance for the data and highly varying crisis scenarios make hard to design experience-capturing tools. A design space is provided in a set of design choices

*Future work will explore further implementation of the design space*

Theory in the field of tangible, embodied and embedded computer can drive the design of user interfaces for supporting reflection in crisis training

*Future work will generalise findings to other application domains*

Building sensing-based interfaces require a wide skill set. Further technology to be tested during (simulated) crisis work has to be build for high resilience

*Future work will develop tools to ease the development of sensing-based systems*
Thanks!

The work here presented is co-funded by EU-ICT 7FP MIRROR project (http://www.mirror-project.eu). Photos by ANPAS Piemonte and Simone Mora.