Designing for Mobile Co-located Collaborative Interaction

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Summary & Learning goals

The students are introduced to the concept of designing for co-located collaborative interaction mediated by technology. A framework for designing co-located mobile interactions is presented that can be a useful tool for work in this area.

Learning goals:
The students will be able to

- recognize the need and possibilities for co-located interactions.

- describe relevant factors for mediating co-located interactions

- analyse the design of technologies for co-located interactions

Recommended readings

- Lundgren, S., Fischer, J. E., Reeves, S., & Torgersson, O. (2015). Designing Mobile Experiences for Collocated Interaction. Paper presented at the Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing, Vancouver, BC, Canada. https://doi.org/10.1145/2675133.2675171
- Olsson, T., Jarusriboonchai, P., Woźniak, P., Paasovaara, S., Väänänen, K., & Lucero, A. (2020). Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches. Computer Supported Cooperative Work (CSCW), 29(1), 29-83. doi:10.1007/s10606-019-09345-0

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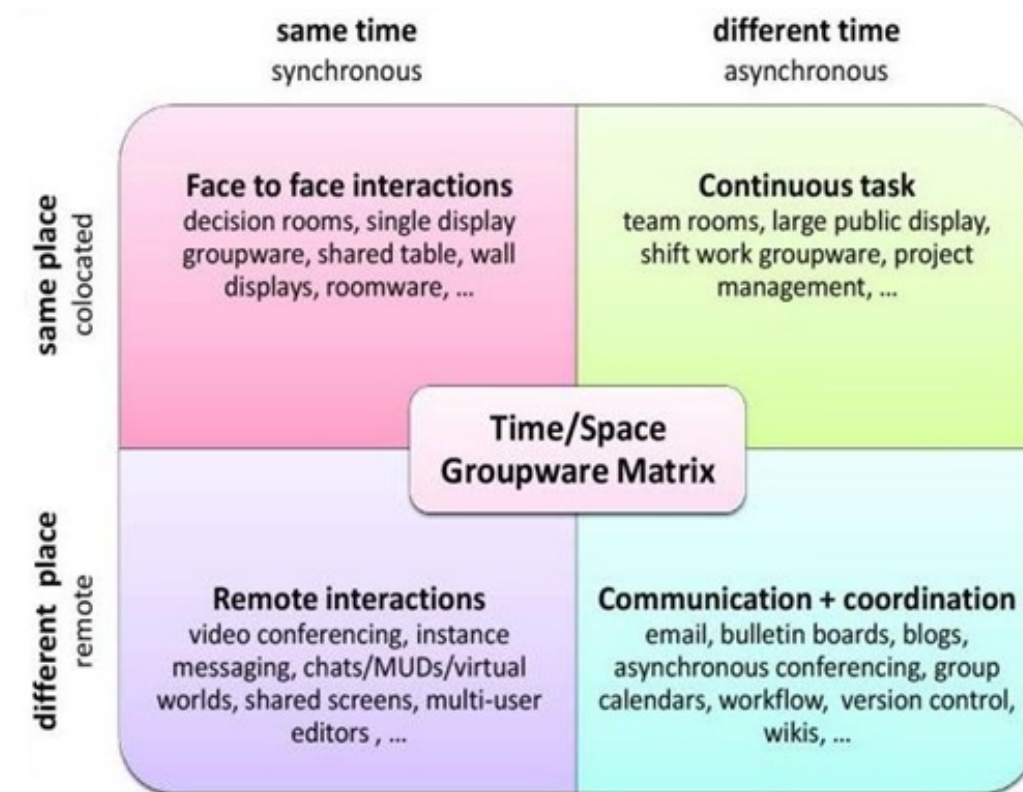- References

COLLABORATIVE INTERACTION

Photo credit: https://public-images.interaction-design.org/literature/articles/heros/566d806939506.jpg?tr=w-1024

COLLABORATIVE INTERACTION

- *Co-located interaction*

same time
synchronous

different time
asynchronous

same place
colocated

Face to face interactions
decision rooms, single display
groupware, shared table, wall
displays, roomware, ...

Continuous task
team rooms, large public display,
shift work groupware, project
management, ...

Time/Space
Groupware Matrix

different place
remote

Remote interactions
video conferencing, instance
messaging, chats/MUDs/virtual
worlds, shared screens, multi-user
editors , ...

Communication + coordination
email, bulletin boards, blogs,
asynchronous conferencing, group
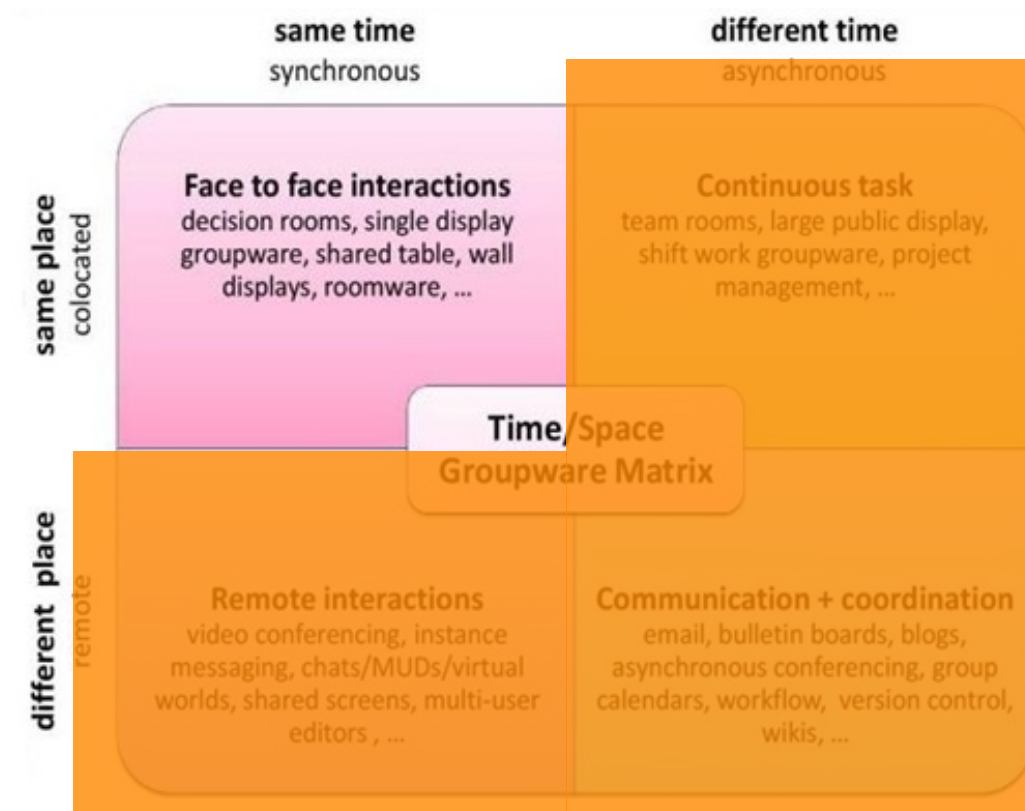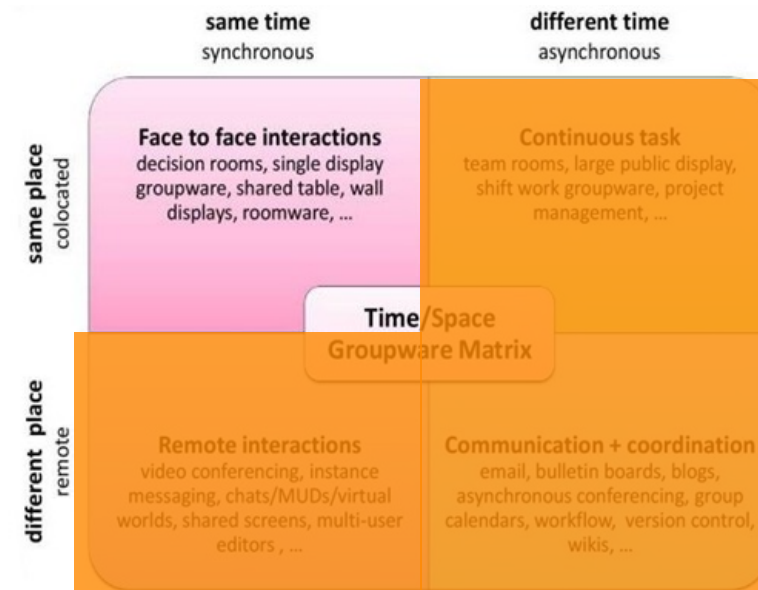calendars, workflow, version control,
wikis, ...

Photo credit: https://public-images.interaction-design.org/literature/articles/heros/566d806939506.jpg?tr=w-1024

Co-located Collaborative Interaction

- Relatively rather little studied in CSCW/HCI
- Main focus so far on the other quadrants

- Lots of opportunities

	same time synchronous	different time asynchronous
same place colocated	**Face to face interactions** decision rooms, single display groupware, shared table, wall displays, roomware, ...	**Continuous task** team rooms, large public display, shift work groupware, project management, ...
different place remote	**Remote interactions** video conferencing, instance messaging, chats/MUDs/virtual worlds, shared screens, multi-user editors , ...	**Communication + coordination** email, bulletin boards, blogs, asynchronous conferencing, group calendars, workflow, version control, wikis, ...

Time/Space Groupware Matrix

Why Co-located Collaborative Interaction?

- There's more to explore

- Studying co-located collaborative interaction can be helpful for developing succesful hybrid technologies where co-located interaction is one important part

- …

Areas for Improvement

Two broad (wicked) problems:

1. The use of current technology disrupting ongoing social interactions
   - Can this be avoided?
2. Lack of social interaction in co-located situations where it would be desirable.
   - Can technology be used to mediate social interaction?

Olsson, T., Jarusriboonchai, P., Woźniak, P., Paasovaara, S., Väänänen, K., & Lucero, A. (2020). Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches.

Current technologies disrupting

People's interactions are disturbed by the presence of e.g., mobile devices

- People who have conversations without mobile devices reported higher levels of connectedness and empathy than those who simultaneously use mobile devices
- The technnology locks us in to our mobile bubbles
- Could design to support social interaction instead

Olsson, T., Jarusriboonchai, P., Woźniak, P., Paasovaara, S., Väänänen, K., & Lucero, A. (2020). Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches.

Lack of social interaction

Investigate possibilities in co-located situations where social interaction would be desirable.

- Design to support e.g., communities of practice
- Meeting familiar strangers
- Enhancing communication and collaboration in schools
- …
- Many possibilties to support interaction

Olsson, T., Jarusriboonchai, P., Woźniak, P., Paasovaara, S., Väänänen, K., & Lucero, A. (2020). Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches.

Enhancement

- The goal could be to use technology to *enhance* co-located interaction
  - *technology not only enabling social interaction but taking an active role in deliberately attempting to improve its quality, value or extent.*
- Beyond simply supporting
- Focus areas
  - facilitating
  - inviting
  - encouraging.

Olsson, T., Jarusriboonchai, P., Woźniak, P., Paasovaara, S., Väänänen, K., & Lucero, A. (2020). Technologies for Enhancing Collocated Social Interaction: Review of Design Solutions and Approaches.

Co-located Mobile Interaction

- Or Bursting the Mobile Bubble
- What?
  - Current apps lock us in
  - Shield to environment
  - Users are in their mobile bubbles

Bursting the Mobile Bubble

- Music, single-player games, facebook, news,…
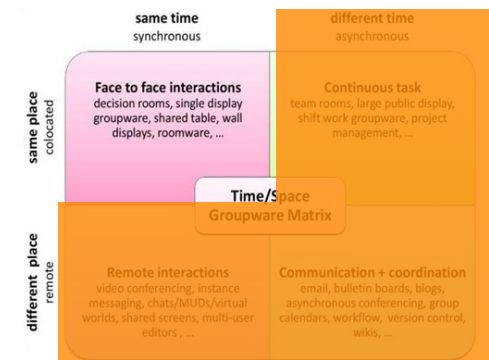- Also all sorts of social multi-player games & social tools
- Distance – in the bubble
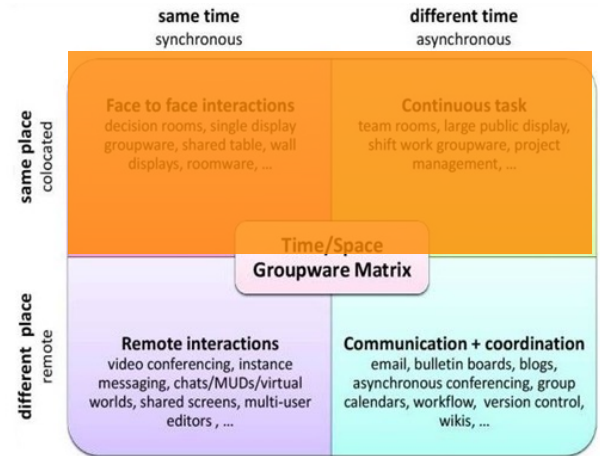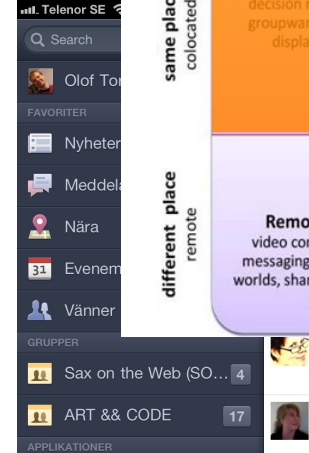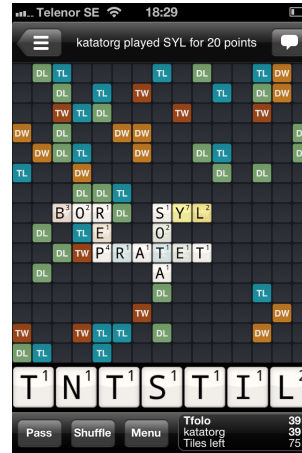
Bursting the Mobile Bubble

No! Yes!

"…how we might support *collocated*, face-to-face situations using mobile devices."
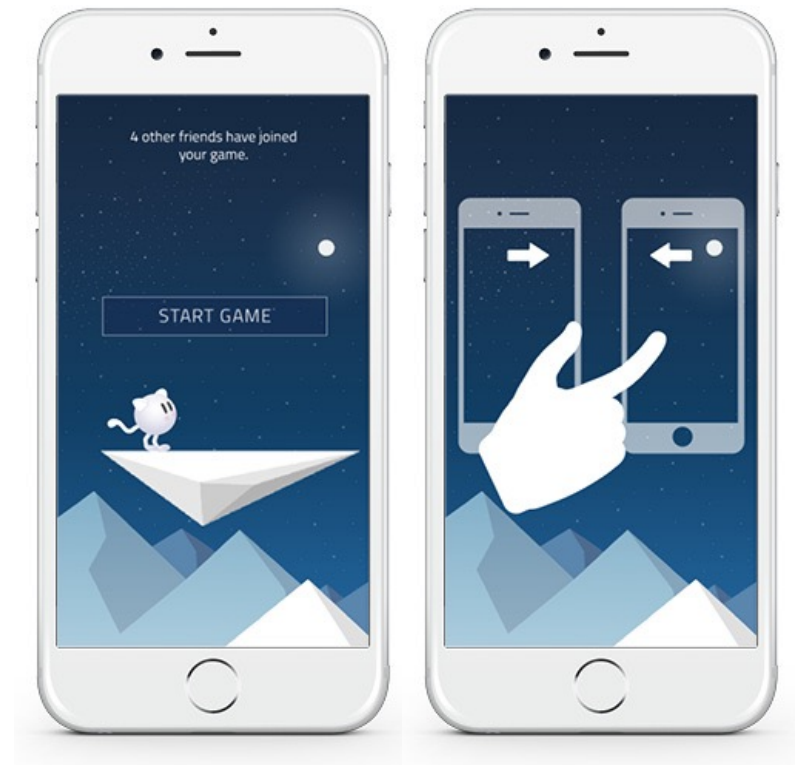
Bursting the Mobile Bubble

- Apps to do things together where you are
  - Games
  - Design
  - Music
  - Work
  - …

- Several units communicating?

Bursting the Mobile Bubble

- Take a Leap
  - Course project
  - Master's course

- Movie
  - https://vimeo.com/151787586

Designing for Co-located Interaction

- Framework targeting design of mobile co-located interaction

- Attempts to capture and describe important factors

- Contains 2 representations
  - Map
  - Properties and values

- Analytical & Generative

Designing Mobile Experiences for Collocated Interaction

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ABSTRACT
Many of our everyday social interactions involve mobile devices. Yet, these tend to only provide good support for *distributed* social interactions. Although much HCI and CSCW research has explored how we might support *collocated*, face-to-face situations using mobile devices, much of this work exists as isolated exemplars of technical systems or interaction designs. This paper draws on a range of such exemplars to develop a practical design framework intended for guiding the design of new mobile experiences for collocated interaction as well as analysing existing ones. Our framework provides four relational perspectives for designing the complex interplay between: the social situation in which it takes place; the technology used and the mechanics inscribed; the physical environment; and the temporal elements of design. Moreover, each perspective features some core properties, which are highly relevant when designing these systems. As part of presenting the framework we also explain the process of its construction along with practical advice on how to read and apply it.

Author Keywords
Collocated interaction; face-to-face; design framework; interaction design.

ACM Classification Keywords
H.5.2 [Information Interfaces and Presentation]: User Interfaces.

General Terms
Design

INTRODUCTION
Physical collocation and 'face-to-face' forms of interaction are now a pervasive and mundane feature of much technology use. We might navigate through streets with others [12], share photos [36], listen to music together or jointly edit a document using mobile devices. Yet, many portable technologies—particularly consumer electronics like smartphones and tablets—tend to be strongly oriented towards supporting *distributed* interactions, and have only limited built-in support for *collocated* use where face-to-

face interactions play a key role [39]. For example, taking and sharing group photos with your co-present friends and family can be an awkward endeavour. 'Support' for collocated action is provided by the possibility of 'showing' another person the screen of a phone or tablet or simply handing the device over. Sharing copies, however, often ends up being done by email, despite being collocated.

Technological support of collocated collaborative work is a central feature of CSCW. This research has often revolved around describing topics such as collocated awareness and coordination practices [8,23,25]. A classic exploration of this domain may also be found in single display groupware systems [27]. Recently, there has been significant research exploring more inherently *mobile* settings, examining novel collaborative ways of supporting physically collocated mobile device users beyond simple screen sharing practices described above [1,16,36]. While this strong line of work offers a large corpus of knowledge for CSCW, little coherent design synthesis of it has taken place.

In this paper we present a design framework to help analyse and design for collocated interaction. The framework is the outcome of a process *focussed on helping designers shape mobile experiences which support collocated interaction*. Our process of exploration has included a conference workshop with researchers, design activities with students, reflection on our own design experiences, and reviewing the literature on collocated mobile experiences, all of which aimed to cover and describe various perspectives and properties that are relevant for design within this domain.
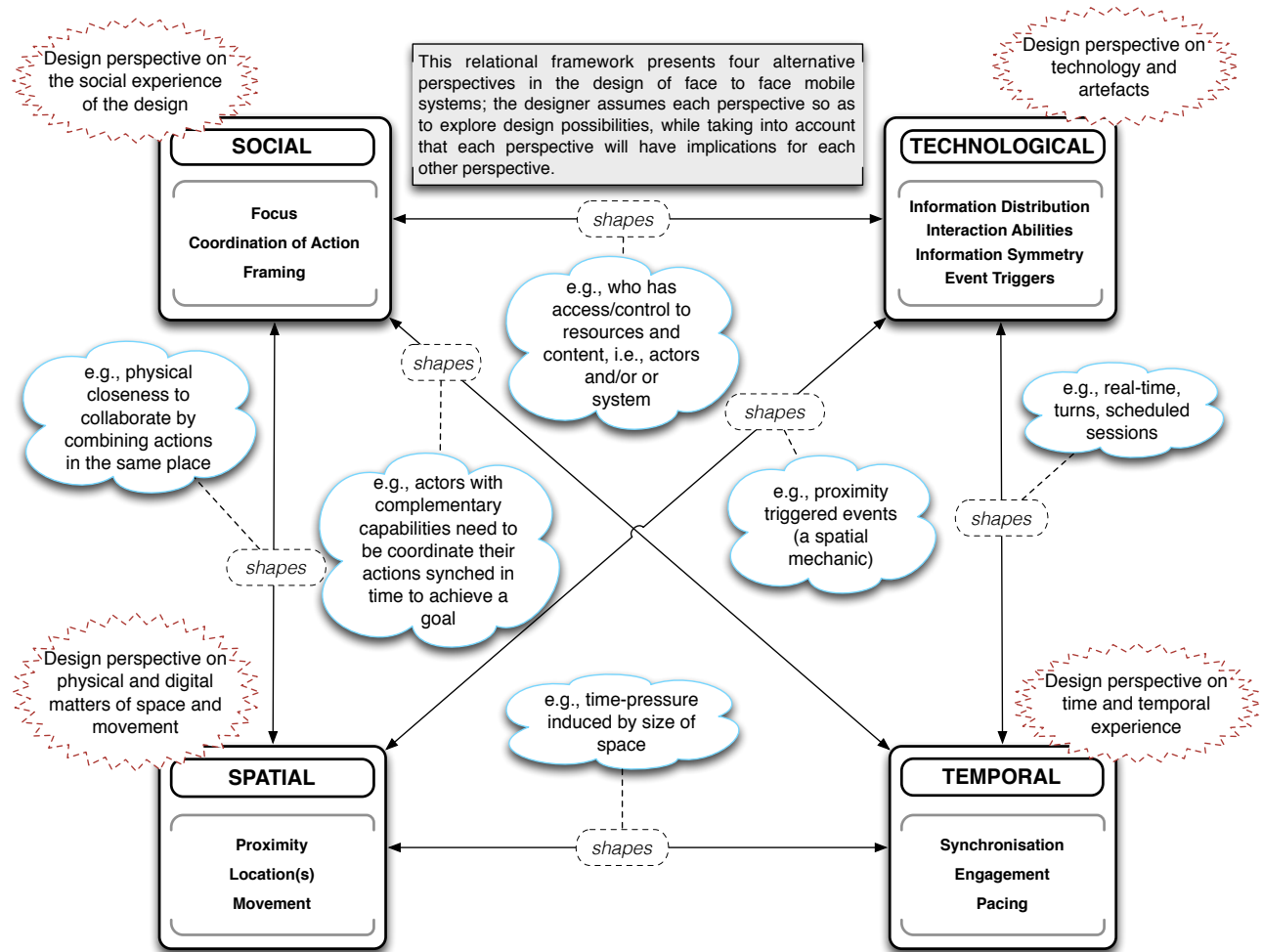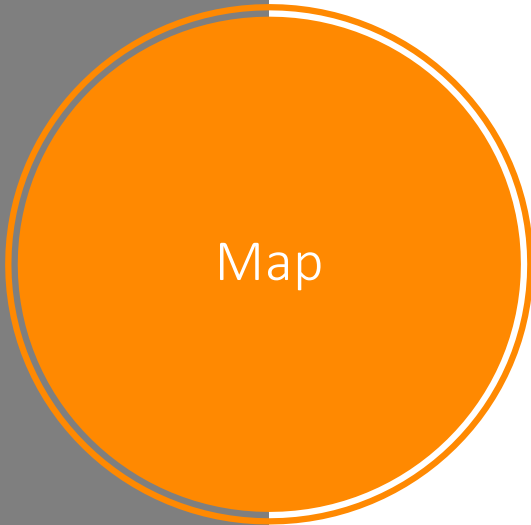
The resulting framework has two *representational forms*: a *diagrammatic form* and a *list form*. Respectively these provide both a relational map and a set of design properties. The framework is intended for two main forms of use:

- As a **design tool** for ideating and (re)-designing through selection and adaptation of the framework's properties;
- As an **analytic tool** for systematically describing interactive systems for collocated mobile experiences.

The core contribution of this work is to help understand how we can practically design interactive systems that support, enable, or augment face-to-face group interactions that occur in collocated settings.

We firstly review a range of literature that informed the framework's construction. The paper then offers a presentation of the framework itself. Finally we provide

Map

This relational framework presents four alternative perspectives in the design of face to face mobile systems; the designer assumes each perspective so as to explore design possibilities, while taking into account that each perspective will have implications for each other perspective.

Design perspective on the social experience of the design

SOCIAL

Focus

Coordination of Action

Framing

Design perspective on technology and artefacts

TECHNOLOGICAL

Information Distribution
Interaction Abilities
Information Symmetry
Event Triggers

shapes

e.g., who has access/control to resources and content, i.e., actors and/or system

shapes

e.g., physical closeness to collaborate by combining actions in the same place

e.g., real-time, turns, scheduled sessions

shapes

e.g., actors with complementary capabilities need to be coordinate their actions synched in time to achieve a goal

e.g., proximity triggered events (a spatial mechanic)

shapes

Design perspective on physical and digital matters of space and movement

e.g., time-pressure induced by size of space

Design perspective on time and temporal experience

SPATIAL

Proximity

Location(s)

Movement

shapes

TEMPORAL

Synchronisation

Engagement

Pacing

Properties

	PROPERTY	STATES	DESCRIPTION
SOCIAL	FOCUS	collaboration | communication | competition | combined	What it is that users do together, i.e., what the focus of their social actions are intended to be.
	COORDINATION OF ACTION	timing actions | combining actions | combined	Whether, and if so, how actors perform coordinate actions together.
	FRAMING	public | private | combined	The main social situation where the activities are carried out.
TECHNOLOGICAL	INFORMATION SYMMETRY	symmetrical | asymmetrical	Whether all users should have access to the same type of information or not.
	INTERACTION ABILITIES	symmetrical | asymmetrical	Whether different users have different abilities/possibilities to interact with or in the system.
	INFORMATION DISTRIBUTION	free | unfolding | limited | shared | combined	In which way information is being distributed to users and spectators
	EVENT TRIGGERS	information-based | time-based | proximity-based | combined	What users or the system need to do in order to trigger an event that may change or cause progress in the system
SPATIAL	PROXIMITY	people | devices | objects | locations | combined	To which things proximity matters, and what needs to be proximate to what.
	LOCATION(S)	One or more | none	One or more specific locations or places that matter for the experience
	MOVEMENT	on the go | sedentary | combined	Whether users move through the space as part of the experience.
TEMPORAL	SYNCHRONISATION	user-driven | system-driven | combined	This property describes the synchronisation of actions within a temporal frame, if any.
	ENGAGEMENT	continuous | intermittent | sporadic	Users' temporal patterns of action within the experience.
	PACING	high-paced | slow | user-paced | combined	How the intensity of action is distributed across the experience, e.g. number of actions per time-frame.

The Social Perspective

- Which kinds of activities are common in the social situation at hand?

- Private or public?

- Users' abilities and skills

- Relationship between users.

- Users' roles: Working? Playing? Performing? Visiting?

- Are there spectators?
If so, do they know/care that users are engaged in an experience?
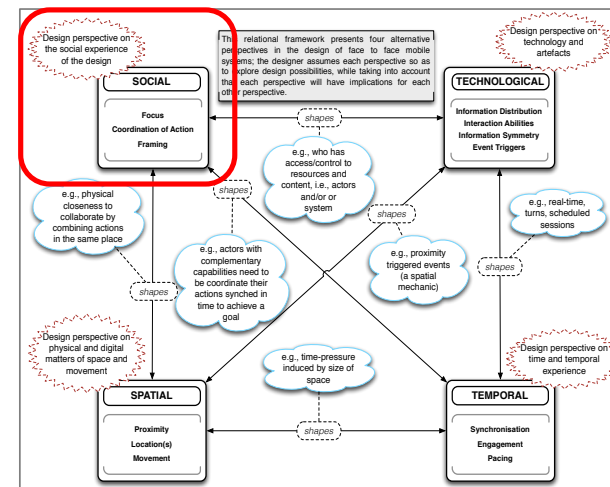
- Three properties: FOCUS, COORDINATION OF ACTIONS and FRAMING.

Social Properties

- Focus: What is the main activity it's designed for?
  - [*collaboration | communication | competition | combined*].

- Coordination of Action: What do users do in relation to or with each other? Shapes interplay.
  - [timing actions | combining actions | combined].

- Framing: The main social situation for the activity
  - [*public | private | combined]*

The Technological Perspective

- Hardware possibilities
- Hardware limitations
- Combination of devices
- How many users per device?
- Means to automatically collect information
- (Technical) means of communication
- Generation/provenance/ownership of content

- Four properties: INFORMATION SYMMETRY, INTERACTION ABILITIES, INFORMATION DISTRIBUTION, and EVENT TRIGGERS.
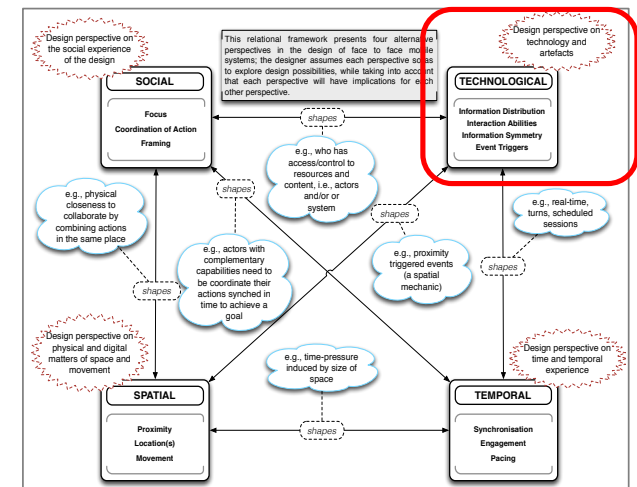
Technological Properties

- Information Symmetry
  - [symmetrical | asymmetrical]
- Interaction Abilities: How users can act/interact
  - [symmetrical | asymmetrical]
- Information Distribution: Who knows what when
  - [free | unfolding | limited | shared | combined].
- Event Triggers: What the users or the system need to do to trigger a change/cause progress
  - [*information-based | time-based | proximity-based | combined*].

The Spatial Perspective

- Size and boundaries
- How we move through it
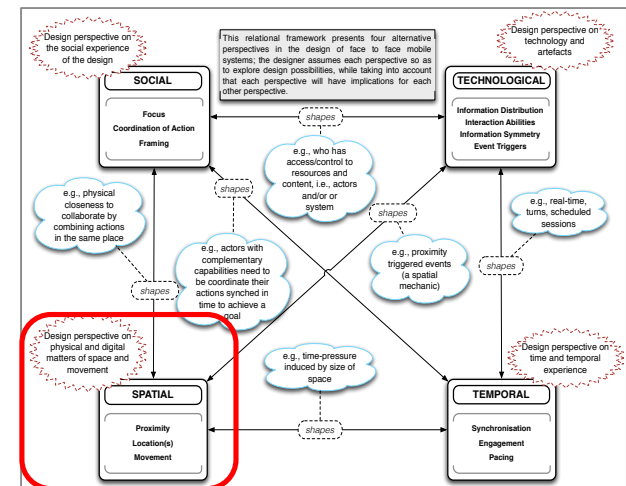
- It has three properties: PROXIMITY, LOCATION(S) and MOVEMENT.

Spatial properties

- Proximity: Which things need to be close in order for an activity, or event to play out.
  - [*people | devices | objects | locations | combined*]
- Location(s): Whether there are any specific locations or places within the spatial boundaries that matter for the experience
  - [*one or more | none*]
- Movement: If/how movement is part of the experience.
  - [*on the go | sedentary | combined*]*.*

The Temporal Perspective

- Temporal behavior of software
- Temporal character of experience
- Rhythm
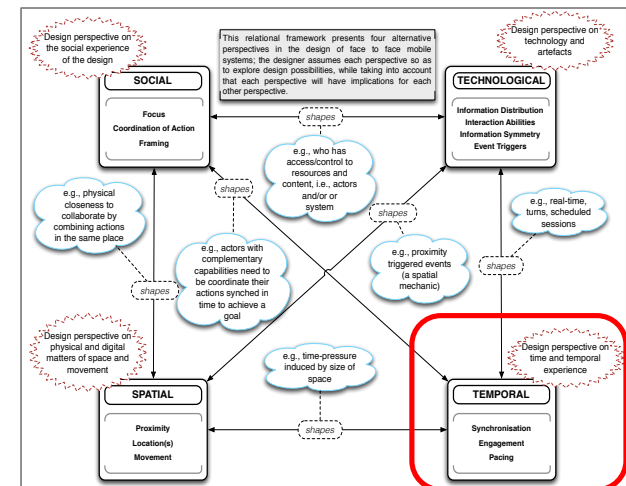
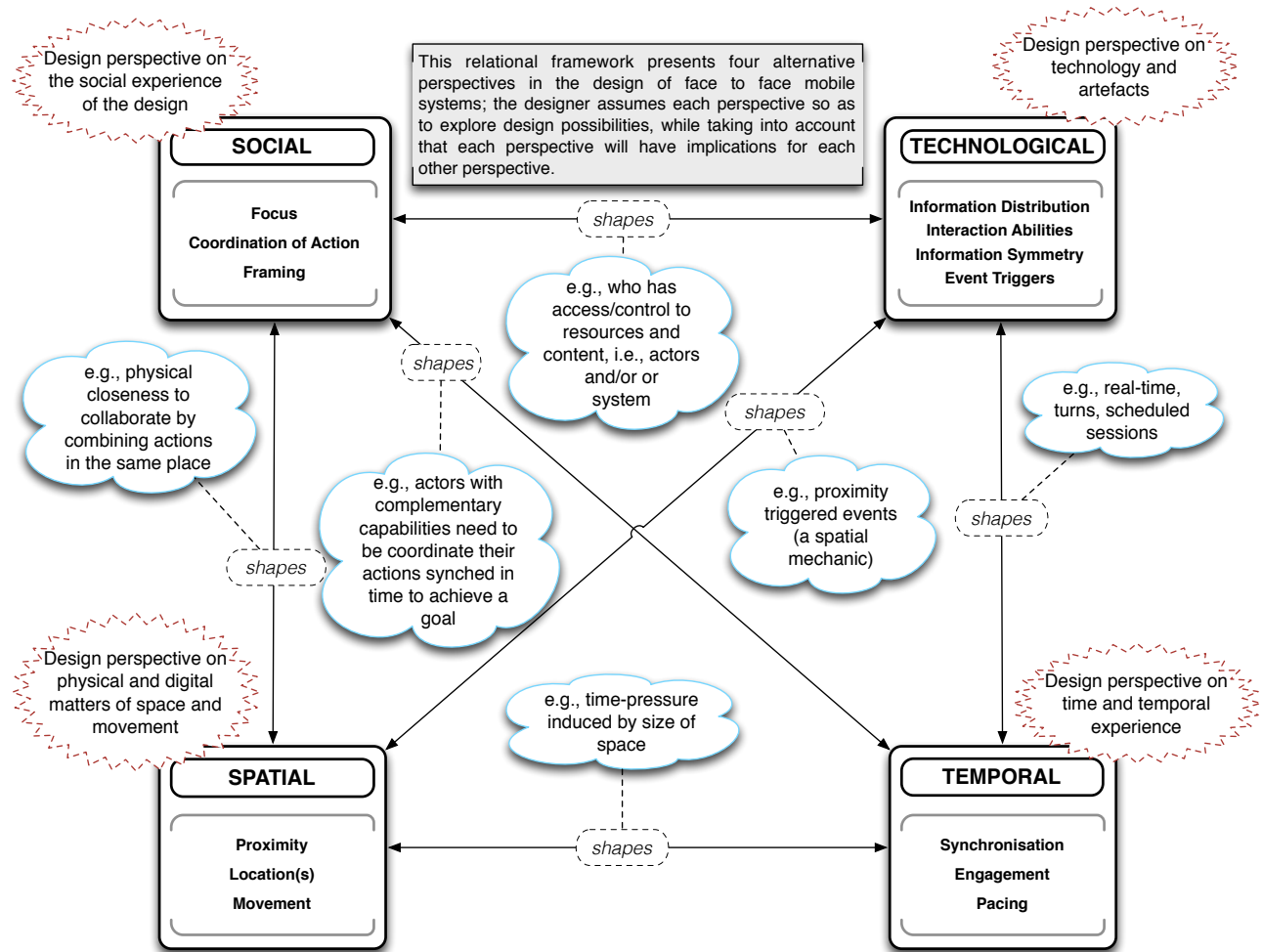- Three properties: SYNCHRONISATION, ENGAGEMENT and PACING.

Temporal Properties

- Synchronization: Whether and in which way synchronization is prompted
  - [*user-driven | system-driven | combined*]

- Engagement: Users' broad temporal patterns of action
  - [*continuous | intermittent | sporadic*]

- Pacing: The way in which actions are distributed over time
  - [*high-paced | slow | user-decided | combined*]

Relations

This relational framework presents four alternative perspectives in the design of face to face mobile systems; the designer assumes each perspective so as to explore design possibilities, while taking into account that each perspective will have implications for each other perspective.

SOCIAL
Focus
Coordination of Action
Framing

Design perspective on the social experience of the design

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e.g., who has access/control to resources and content, i.e., actors and/or system

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e.g., proximity triggered events (a spatial mechanic)

e.g., real-time, turns, scheduled sessions

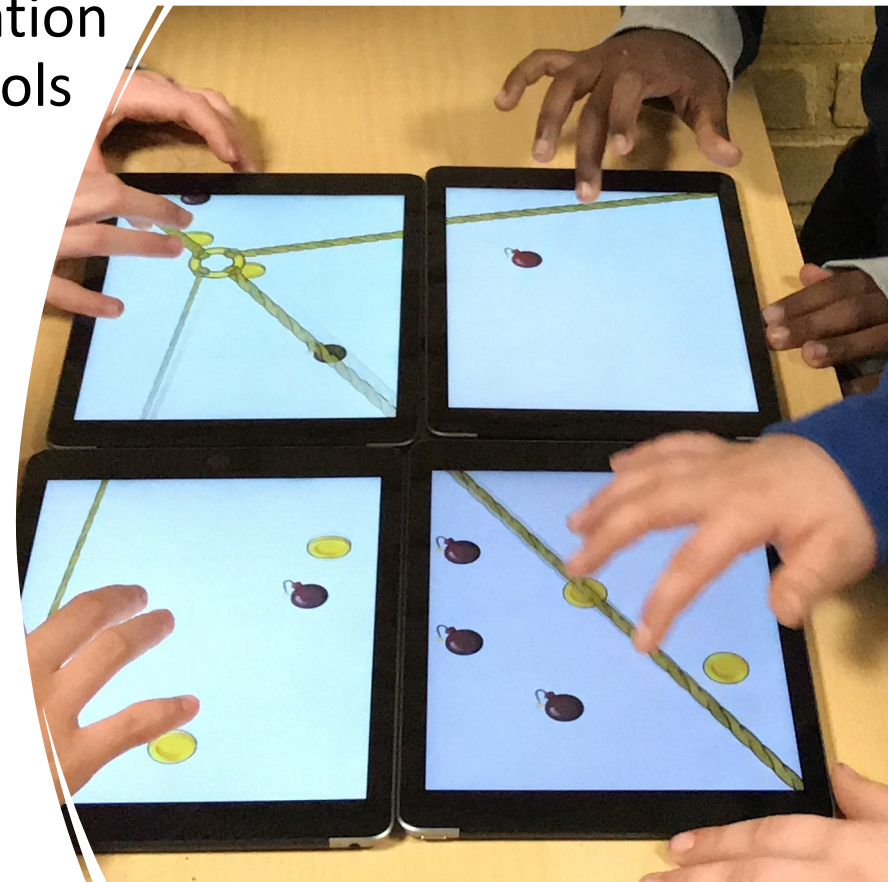e.g., time-pressure induced by size of space

Key Applications

- Analysis
  - Describe existing designs & applications
  - Categorization
  - Understanding
  - …
- Design
  - Generative tool
  - Pick properties & values
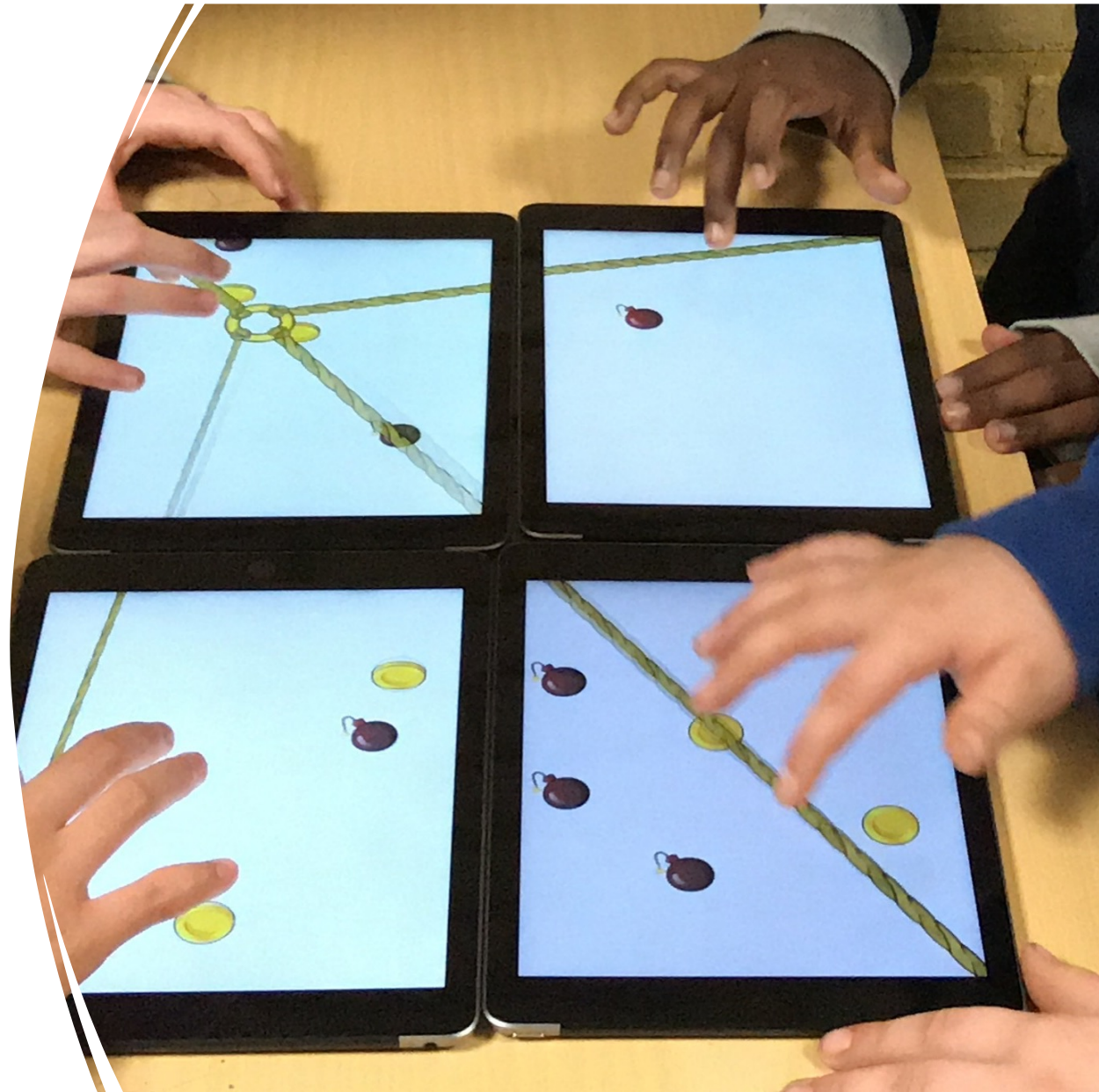 - Restricts and stimulates design

Example - StringForce

- Designed for children to practice collaboration using the tablets that are common in schools

StringForce

- Shared goal – catch coins & avoid bombs

- Collaborative action – move ring by pulling and releasing rope

- Coordination through verbal communication

- Symmetrical

- Fast-paced

StringForce Properties

Perspective	Property	State(s)
SOCIAL	FOCUS	*collaboration, communication*
	COORDINATION OF ACTION	*combined*
	FRAMING	*combined*
TECHNOLOGICAL	INFORMATION SYMMETRY	*symmetrical*
	INTERACTION ABILITIES	*symmetrical*
	INFORMATION DISTRIBUTION	*free*
	EVENT TRIGGERS	*combined*
SPATIAL	PROXIMITY	*people, devices*
	LOCATIONS(S)	*none*
	MOVEMENT	*sedentary*
TEMPORAL	SYNCHRONISATION	*system-driven*
	ENGAGEMENT	continuous
	PACING	*fast-paced*

Summary/take home

- Designing for synchronous co-located interaction is one specific form of collaborative interaction mediated by technologies worth investigating further

- One opportunity is to design mobile technologies that enhance co-located activities

- The framework for designing for co-located mobile interaction can be a support for both analysis and design

- The application StringForce was presented as one example of a co-located mobile collaborative technology supporting collaborative interaction

Recommended readings

- Lundgren, S., Fischer, J. E., Reeves, S., & Torgersson, O. (2015). Designing Mobile Experiences for Collocated Interaction. Paper presented at the Proceedings of the 18th ACM Conference on Computer Supported Cooperative Work & Social Computing, Vancouver, BC, Canada. https://doi.org/10.1145/2675133.2675171

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Thanks for listening