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Exploring New Interaction Mechanisms
to Support Information Sharing and Collaboration
Using Large Multi-touch Displays in the Context of Digital Storytelling

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What is this all about?

- I. Introduction
- II. Interactive Tabletop Application
- III. User Interaction Study
- IV. Evaluation
- V. Conclusion

I. Introduction

- multi-touch displays offer new possibilities for collaborative interaction
- interactive tabletops are promising in regards to overcome physical space limitation
- experiences using interactive tabletops are rare

- Digital Storytelling (DS) in general:
 - relatively new technique in Technology-Enhanced Learning
 - offers opportunities to creatively craft powerful and personal stories, reports and messages
 - suitable for personal use as well as for various learning activities

- Motivation:
 - combine mobile digital stories with interactive tabletops
- Research questions:
 - *Are large multi-touch enabled displays suitable for collaborative learning in the context of mobile Digital Storytelling?*
 - *Does the co-located collaboration encourage and enhance the exchange of information while working with the tabletop hardware?*

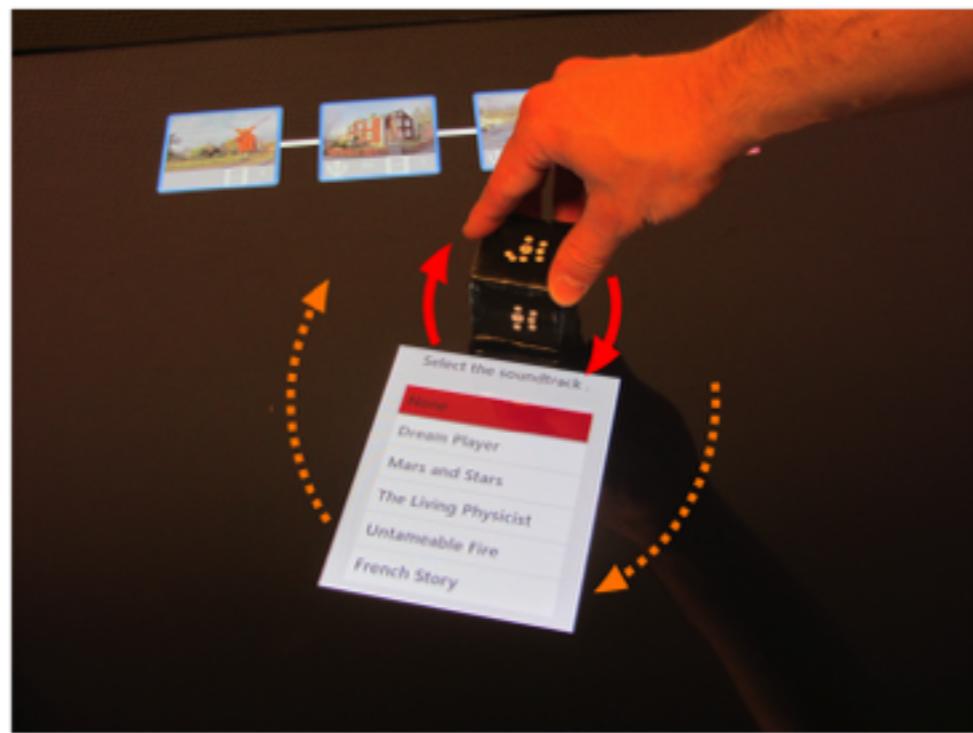
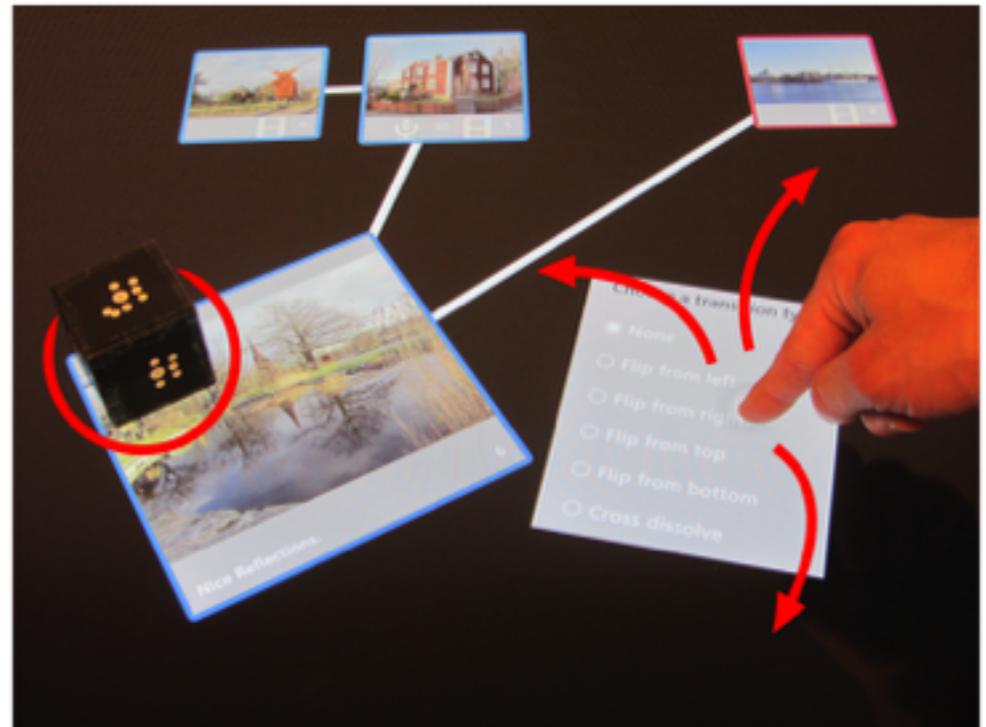
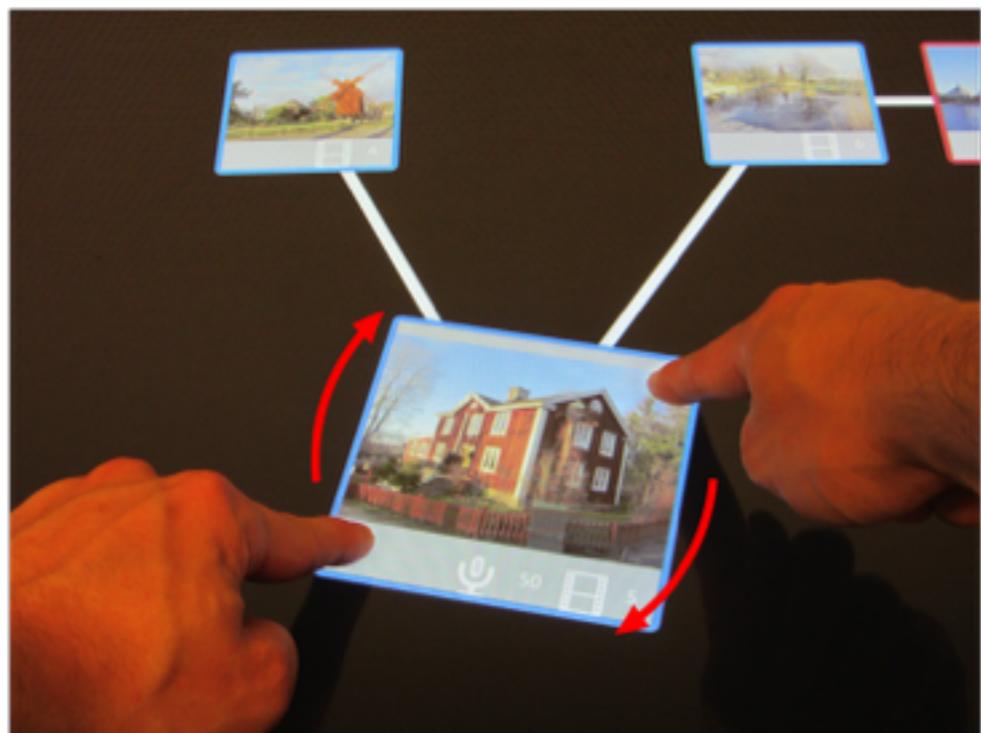
II. Interactive Tabletop Application

S. Nordmark, M. Milrad. Tell your story about history – a mobile seamless learning approach to support mobile digital storytelling (mDS). Book chapter in Seamless Learning in the Age of Mobile Connectivity, Eds. L-H Wong, M. Milrad & M. Specht, Singapore: Springer Verlag, 2014



- support *Reflect, Remix & Reuse*
- allow co-located collaboration
- mixture of
 - Natural User Interface (NUI): interaction with displayed content
 - Tangible User Interface (TUI): trigger functionalities
- Tangible Objects: physical cubes
- minimalistic, color-coded storyboard interface





III. User Interaction Study

- identify potential strengths and weaknesses in the concept, as well as the technical implementation of the tabletop application
- 5 workshop-like sessions with 2 participants each
- 10 participants (8 male, 2 female), aged between 20 and 44 years
- Data collection via
 - questionnaire (Likert scale, open questions)
 - think-aloud protocol
 - video recordings

- participant pairs were introduced to the application
- participant pairs had to complete a sequence of different tasks
 - “Create a new story by choosing elements of both existing stories.”
 - “Change the subtitle of at least 3 story elements.”
 - “Set a new soundtrack for your story.”

IV. Evaluation

Multi-Touch

- examined the overall ability to **interact (move, rotate, scale, place)** with the content on-screen as well as the **precision of the recognition**
- interactions easily resulted in desired outcome
- often: started interacting by using just one hand with later switching to two-handed interaction
- general good results for using different gestures
- bad results for precise movement of UI elements and recognition
- hardware issues: very sensitive input recognition
- simplicity of the UI design was rated positive, but need for more visual feedback

Tangible User Interface

- examined the overall ability to **interact (easy, intuitive, natural, confusing)** using Tangible Objects with the content on-screen as well as the **precision of the recognition**
- users need time to learn how the Tangible Objects work
- provide added value (allowed the simplicity of UI)
- hardware issues: recognition of the tag(s)
- cubes as Tangible Object were rated negative: rotation of the cube to find desired function took too much time
- overall issue: Tangible Objects cover displayed content

Collaboration and Simultaneous Interaction on-screen

- examined the overall perception of the participants towards their **simultaneous interaction** with the content on-screen as well as their **collaboration**
- overall good results support hypothesis that collaboration and large multi-touch displays support each other
- sharing objects on-screen helped in the argumentation
- being able to follow the happenings on-screen resulted in an easier understanding
- much more natural collaboration than looking at separated displays

Comment of a participant:

“This is a step forward compared to work on a network with your own screen, where things are less dynamic and context is lost. Now I can see why a figure is moving, as I can see my colleague interacting with it.”

Verbal Collaboration and Information Sharing

- examined the overall perception of the participants towards their **verbal collaboration** and their **exchange of thoughts and information** while working with the application
- exchange of information contribute important added value
- active co-located discussion helped understanding as well as focussing on the current task/context
- more familiar to the other person after collaboration: needs further examination
- being able to perform immediate interaction after discussion was rated positive
- rated negative: standing next to each other (personal space)

V. Conclusion

Are large multi-touch enabled displays suitable for collaborative learning in the context of mobile DS?

- concurrent interaction and collaboration go hand in hand
- ability to see what their partner was doing through observation is important
- most of the time participants were in state of close collaboration
- introducing Tangible Objects was novel and resulted in excitement...
- ...but issues in object recognition slowed the overall workflow

Does the co-located collaboration encourage and enhance the exchange of information while working with the tabletop hardware?

- participants took advantage of co-located collaboration
- arguments were supported by gestures towards content on-screen
- interactions could be performed or demonstrated immediately
- standing next to each other and being able to verbally discuss, exchange information and make points assisted the collaboration
- mixture of argumentation and interaction on-screen could easily be followed

General conclusions

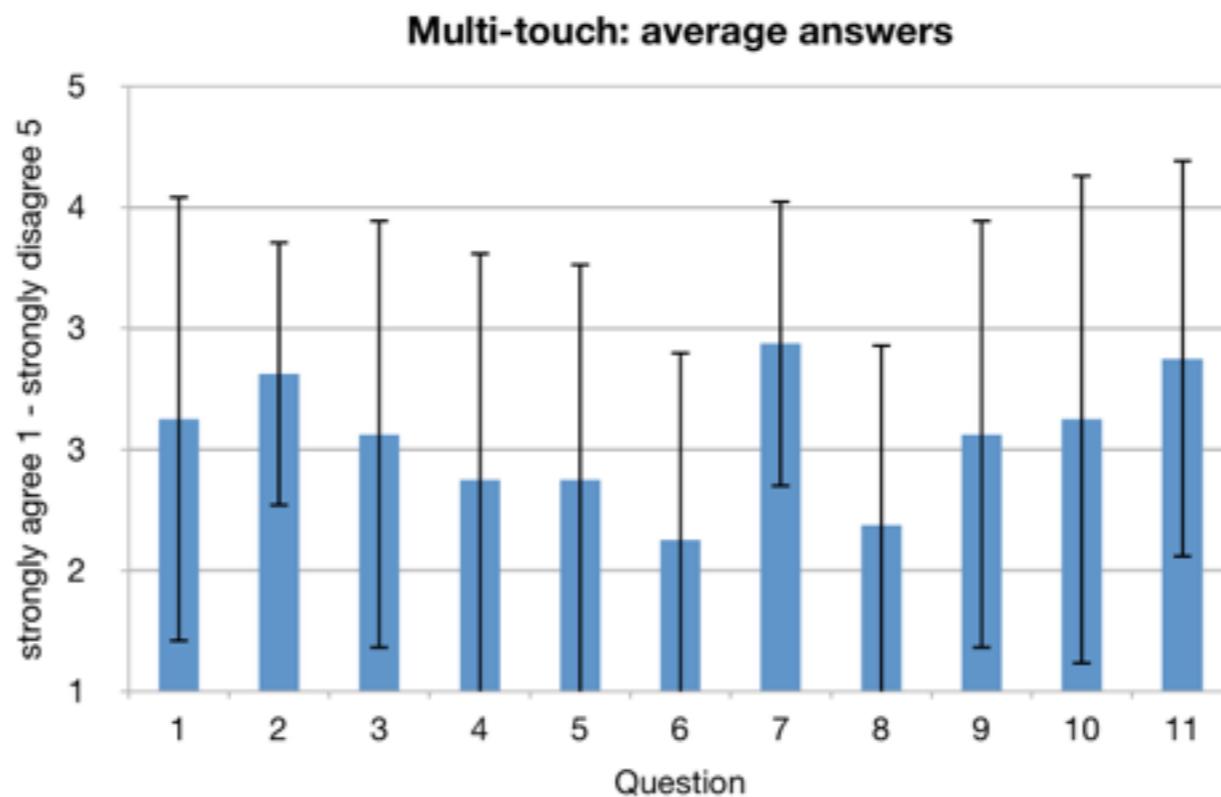
- users adapted to working collaboratively very quickly
- space for improvements regarding Tangible Objects and overall recognition through the hardware
- multi-touch hardware, large screen and simplistic UI worked well in Digital Storytelling scenario
- mixture of simultaneous argumentation and interaction rendered assistance with understanding and following the partner's ideas and thoughts

Questions?

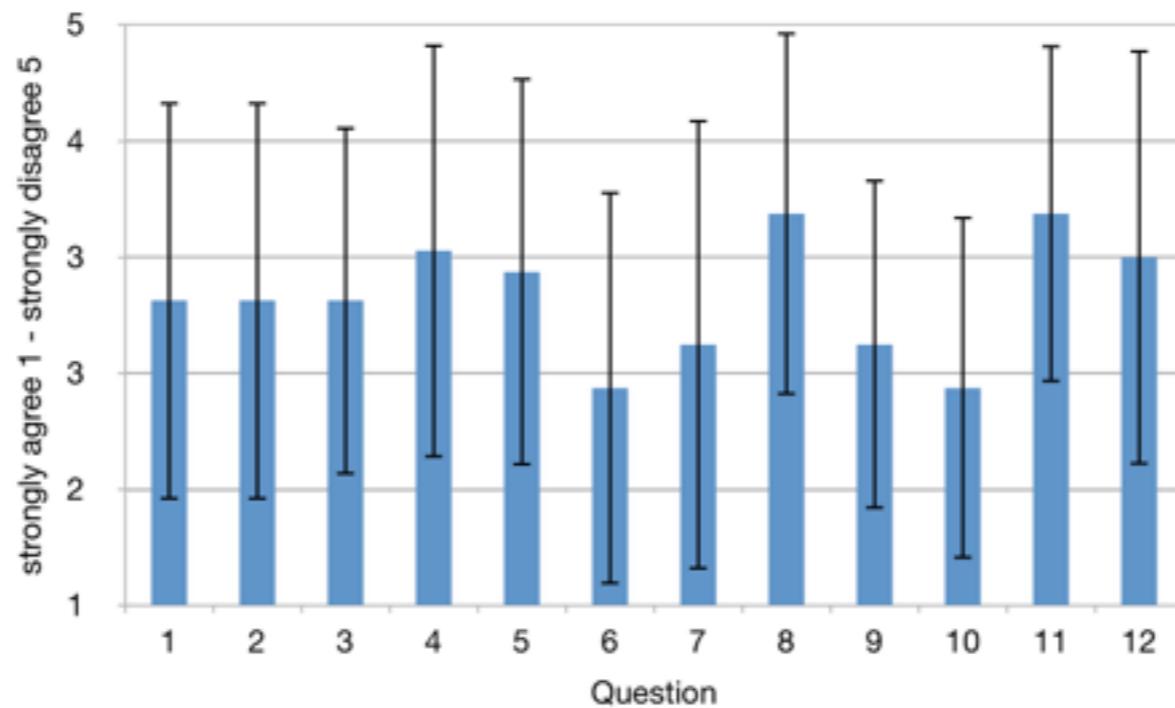
Thank you very much for your attention!

Appendix: Quantitative data

No.	Statement
1.	It was easy to interact with the application.
2.	It was intuitive to interact with the application.
3.	It was fun to interact with the application.
4.	It was easy to move objects on the screen.
5.	It was easy to rotate objects on the screen.
6.	It was easy to scale objects on the screen.
7.	It was easy to place objects very precisely at desired locations.
8.	It was easy to select items in menus.
9.	It felt comfortable to use the virtual keyboard for text input.
10.	The text input using the virtual keyboard got always recognised correctly.
11.	Touch interactions got always recognised correctly.

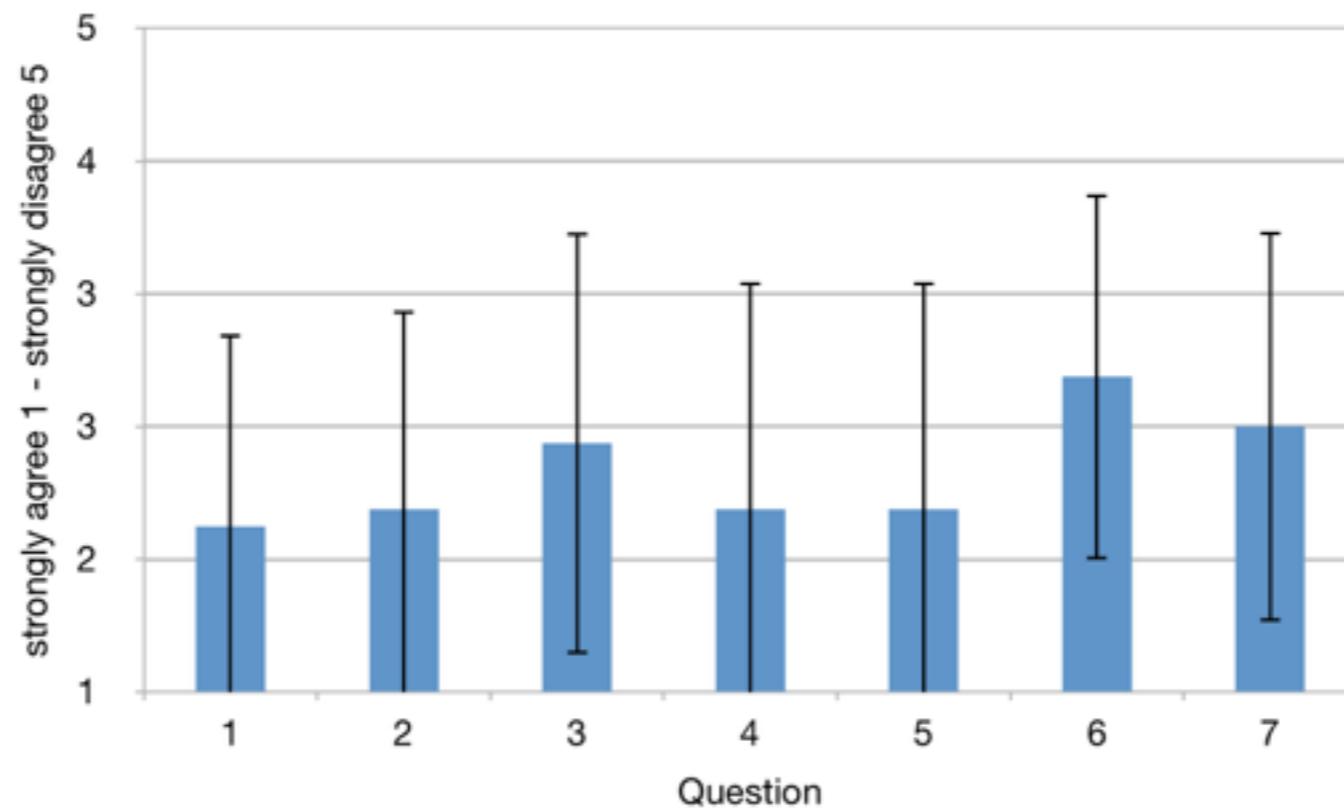


No.	Statement
1.	It was easy to use tangible elements.
2.	It was intuitive to use tangible elements.
3.	It was fun to use tangible elements.
4.	It felt natural to use tangible elements.
5.	It was confusing using tangible elements.
6.	I got used to using tangible elements quickly.
7.	Using tangible elements brought a benefit to the user interface.
8.	Using tangible elements enriched the workflow.
9.	I liked objects on-screen which moved along with the tangible element.
10.	I liked objects on-screen which were freely moveable independent of the position of the tangible element.
11.	Tangible elements got always recognised correctly.
12.	Tangible elements got always recognised immediately.

Tangible User Interface: average answers

No.	Statement
1.	It was easy to interact with another person on-screen at the same time.
2.	Simultaneous multi-touch interactions from me and another person were always recognised correctly.
3.	It felt convenient to interact with another person on-screen at the same time.
4.	Sharing objects with another person helped me in my argumentation.
5.	I could always follow what was going on on-screen.
6.	Working on the same objects with another person enhanced my workflow.
7.	Working on the same objects with another person helped focusing on the current task.

**Collaboration and simultaneous interaction on-screen:
average answers**



No.	Statement
1.	It was nice to exchange thoughts verbally with another person.
2.	Discussing helped me understanding the other persons thoughts.
3.	Discussing helped me focusing on the current task.
4.	Interacting with the application is possible without any discussion at all.
5.	After collaborating with another person I felt more familiar to the person.

Verbal collaboration during using the application: average answers

