Understanding Children’s Collaboration around Tabletop Computers

Rowanne Fleck
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- Background
- OurSpace
- Two studies of children’s collaboration around tabletops
  - Comparison of collaboration around multi-touch vs. single-touch tabletops
  - Analysis of how collaboration happens around multi-touch tables
- Conclusions
Background

- Collaborative activity is beneficial to children’s learning and development (Webb & Palincsar, 1996)
  - Mutual and joint activity
  - Reciprocal, coordinated interaction in which ideas and perspectives are explored and exchanged (Goos, Galbraith, & Renshaw, 2002).

- BUT requires participation
  - Inequitable interaction
  - One child dominating
Background

- Tabletops offer great potential to support collaborative learning
  - Natural, touch interface
  - Enable face-to-face communication
  - Large display to spread out and share, and increased awareness of each other’s actions
Previous work

- Children’s simultaneous access to technology (Stanton, et al., 2002)
  - Mixed findings
  - More equitable participation, higher focus on task
  - But more parallel working/less awareness
- Enforced turn taking at tabletops
  - SIDES (Piper, O'Brien, Morris, & Winograd, 2006)
  - Storytable (Cappelletti, Gelmini, Pianesi, Rossi, & Zancanaro, 2004)
OurSpace
an investigation of children’s collaboration around tabletop computers
Paper Prototype

- TASK – to plan a seating plan for your classroom
- Children in class used, and plan of children’s actual classroom
OurSpace – tabletop version
Study 1

Around the Table: Are Multiple-Touch Surfaces Better Than Single-Touch for Children’s Collaborative Interactions

Proceedings of the 9th international conference on Computer supported collaborative learning, 8-13 June 2009, Rhodes, Greece

Amanda Harris, Jochen Rick, Victoria Bonnett, Nicola Yuill, Rowanne Fleck, Paul Marshall, Yvonne Rogers
Multi-touch vs. Single-touch

- Two competing hypotheses:

1. multiple-touch mode supports better collaboration by allowing more equitable participation at the tabletop, thus allowing everyone to interact whenever they want (Rogers et al., 2009)
2. single-touch mode supports better collaboration as it forces more turn taking, thus increasing awareness of what each group member is doing (Hornecker, et al., 2008).
Method

- 45 Children
  - Year 3 (7-8 yrs old) and Year 4 (8-9 yrs old)
  - Same gender, same year groups of 3, chosen by teacher.
    - 7 boy groups
    - 8 girl groups
- Within-subjects design
Measures of Collaboration

1. Levels of Participation
   - Verbal participation
     - how much each person said
   - Physical participation
     - system logs of touches
   - Calculated equity of participation
     (using the Gini Coefficient: Weisband, Schneider, & Connolly, 1995).
Measures of Collaboration

2. Nature of Discussion
   – Task focused
   – Turn taking
   – Brief Response
   – Evaluation
   – Other
## Results

- Levels of Participation

<table>
<thead>
<tr>
<th></th>
<th>Multiple M (SD)</th>
<th>Single M (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Time on task</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(minutes)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Session 1</td>
<td>16.19 (4.4)</td>
<td>15.56 (5.2)</td>
</tr>
<tr>
<td>Session 2</td>
<td>10.41 (3.4)</td>
<td>14.21 (3.4)</td>
</tr>
<tr>
<td><strong>Level of participation</strong></td>
<td></td>
<td></td>
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<tr>
<td>(mean utterance/touch per minute)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal</td>
<td>15.46 (6.5)</td>
<td>16.08 (5.1)</td>
</tr>
<tr>
<td>Physical</td>
<td>92.96 (47.25)</td>
<td>63.18 (34.19)</td>
</tr>
<tr>
<td><strong>Equity of participation</strong></td>
<td></td>
<td></td>
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<tr>
<td>(Gini coefficient)</td>
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</tr>
<tr>
<td>Verbal</td>
<td>.17 (.10)</td>
<td>.21 (.17)</td>
</tr>
<tr>
<td>Physical</td>
<td>.18 (.09)</td>
<td>.20 (.12)</td>
</tr>
</tbody>
</table>
Results

- Equity of Participation

Physical equity by gender (lower values, more equitable participation)
Results

Nature of discussion

Figure 5. Task focused and turn taking talk by gender
Discussion

- Children equitable in both conditions
- Turn-taking talk replaced design discussions in single-touch
  - Big differences in how able groups were to manage this
- Discussions suggested more joint-awareness of other’s actions in single-touch
- Importance of considering age and gender
  - Differences less obvious in multi-touch
Study 2

Actions Speak Loudly with Words: Unpacking Collaboration Around the Table

ITS '09, November 23-25 2009, Banff, Alberta, Canada

Rowanne Fleck, Yvonne Rogers, Nicola Yuill, Paul Marshall, Amanda Carr, Jochen Rick, Victoria Bonnett
Understanding Collaboration around the Tabletop

- Previous tabletops research has reported general patterns of talk that occurred across different conditions or over time.
- Not related directly to other aspects of interaction around the tabletop.

“one major role of the computer in supporting collaborative learning is in providing a context for the production of action and gesture”

(Teasely and Roschelle 1993, p238)
Introduction

- Collaborative Learning Mechanisms (CLM) framework used to look at children’s verbal and physical interactions around the tabletop during a group design task
- This detailed analysis reveals subtle mechanisms at play
  - Implications for supporting collaborative learning with multi-touch tabletop
  - Value of our approach
The Collaborative Learning Mechanisms Framework

1. Mechanisms of Collaborative Discussion
   • making and accepting suggestions
   • negotiating

2. Mechanisms for Coordinating Collaboration
   • joint attention and awareness
   • narrations
Method

- 27 children
- Year 3 (7-8yrs) and Year 4 (8-9yrs)
- Groups of 3
  - 5 groups of girls
  - 4 groups of boys
- Children were observed conducting the OurSpace planning task around a multi-touch table
Making and Accepting Suggestions

- Made suggestions about classroom arrangements
  “let’s put chatty one’s near the front”

- Asked each other’s opinions
  “I think we should make it easier for people to get through the classroom as well. Do you think that’s a good idea?”

- Clarified/repeated each other
  B: “Talkatives...I’m gonna put talkatives on here.”
  A: “Talkatives!”
  C: “What everybody that talks on that table?”
  B: “Yeah!”
Making and Accepting Suggestions – Verbal and Physical

Making suggestions: presentations
  – Gesture
  – Manipulation of interface

Acceptances
Negotiating: Undoing, Blocking and Grabbing

- Undoing
- Fighting for control: blocking
- Explanation
Negotiating: Undoing, Blocking, Grabbing

- Blocking by grabbing
Negotiating: Undoing, Blocking and Grabbing – physical and verbal
Coordinating collaboration: Joint attention and awareness

- Mechanisms employed by children to maintain joint attention and awareness
  - Watching and listening to each other
  - Narrations
    - “I’ll put everyone with glasses in one place, and everyone who’s smiley in another place.”
Coordinating collaboration: Joint attention and awareness

- Aspects of tabletop and task encouraged awareness
  - Intrusions
The CLM Framework revisited: CLMs around a multi-touch table

1. Mechanisms of Collaborative Discussion making and accepting suggestions
   talking and listening
gesturing, moving and watching
negotiating
suggesting alternatives, disagreeing, explaining,
verbal blocking
demonstrating alternatives, undoing, blocking
The CLM Framework revisited: CLMs around a multi-touch table

2. Mechanisms for Coordinating Collaboration
   joint attention and awareness
   (both verbal and physical mechanisms above)
   narrations
   intrusions
Discussion

- Physical and verbal parallels in children’s interaction around a multi-touch tabletop
- Possible benefits of seemingly negative interactions
  - Undoing
  - Fighting for control
  - Intrusions
Implications for collaborative learning around multi-touch tabletops

- Other research has suggested using enforced turn-taking and joint actions to promote joint awareness.
- This analysis suggests ways we might encourage:
  - allowing undoing
  - encourage intrusions