Gestures on a tangible tabletop during collaborative problem solving tasks

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Outline

• Taxonomy of Gestures
• Gestures, TUIs, and Cognition
• Pilot study in LIST
• Current research
• Research goals
Taxonomy of gestures (Semiotics)

Gesticulation → Emblems → Pantomimes → Sign language

- Iconic
- Metaphoric
- Rythmic (beats)
- Cohesive
- Deictic

[Kendon, 1982; McNeill, 2000/2005]
Gestures, TUIs, Cognition

- **Pointing** is a part of events provided by other meaning-making resources, such as speech, spatial properties, body posture, and **collaborative** action. [Goodwin, 1994]

- Systems that **constrain gestural abilities** are likely to **hinder the user’s thinking and communication**. [Klemmer et al., 2006]

- By providing users with multiple access points to the system and **maintaining their physical mobility**, TUIs enable users to take advantage of **thinking** and **communicating** through unconstrained **gestures**. [Shaer & Hornecker, 2000]
Pilot Study with Tabletop Display

Task of the participants: explore the relation of external parameters on the production of electricity of a windmill presented on a tangible tabletop.
Gesture taxonomy from the study

- **Deictic/pointing gestures**
  - point something/somewhere;
- **Iconic gestures**
  - resemble concrete objects or actions;
- **Emblems**
  - can be used instead of speech/are known by almost everybody in a social group
  - shoulder shrugging, headshake, head nod
- **Adaptors**
  - are not used intentionally during an interaction;
  - are linked with negative feelings (head scratching)
- **TUI-related/manipulative gestures**
  - occur specifically in interaction with TUIs.
Sample video
Distribution of gestures

- Pointing: 181
- Iconic: 28
- Emblems: 35
- Adaptors: 23
- TUI-related: 334
Findings

• Gesturing accelerates *collaborative* work;
• Reaction of participant(s) after gestural performance by another participant:
  ▫ 85% nothing
  ▫ 58% other person reacts
  ▫ 38% same person reacts
• 78.5% spoke during gesturing;
• *Problem solving* task on the TUI encourages the use of rapid *epistemic actions*. 
Current research

- Marie Curie H2020-MSCA-IF-2014 Project **GETUI: GEstures in Tangible User Interfaces**
- **Goal**: explore the gestural performance of users while interacting on a TUI in a collaborative problem solving task.
- **Methodology**: user studies similar to the international large-scale educational Programme for International Student Assessment (PISA) programme.
Research goals

- Video annotations with speech-gesture alignment of the user studies;
- A taxonomy of gestures used in interaction with TUIs for collaborative problem solving;
- Locale-specific differences in the above gesture taxonomy;
- Statistics and scores about task performance;
- Design guidelines for TUIs and applicability of the TUI for further PISA studies.
References

• Anastasiou, D., Maquil, V., Ras, E. (2014), Gesture Analysis in a Case Study with a Tangible User Interface for Collaborative Problem Solving, in: Journal on Multimodal User Interfaces, Springer.
• Greiff...
Thank you for your attention!

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