

Design implications from Cognitive Event Analysis: A case study of digitally mediated interaction in autistic children

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Background and Aims

- ‘Social overtures’ are deliberate initiations and maintenance of social interactions, and reduced or atypical overtures are associated with autism [1]

We ask

- **How and when do autistic children make social overtures whilst using digital technologies?**
- **Can we extract design recommendations to promote opportunities for such child-led interactions?**

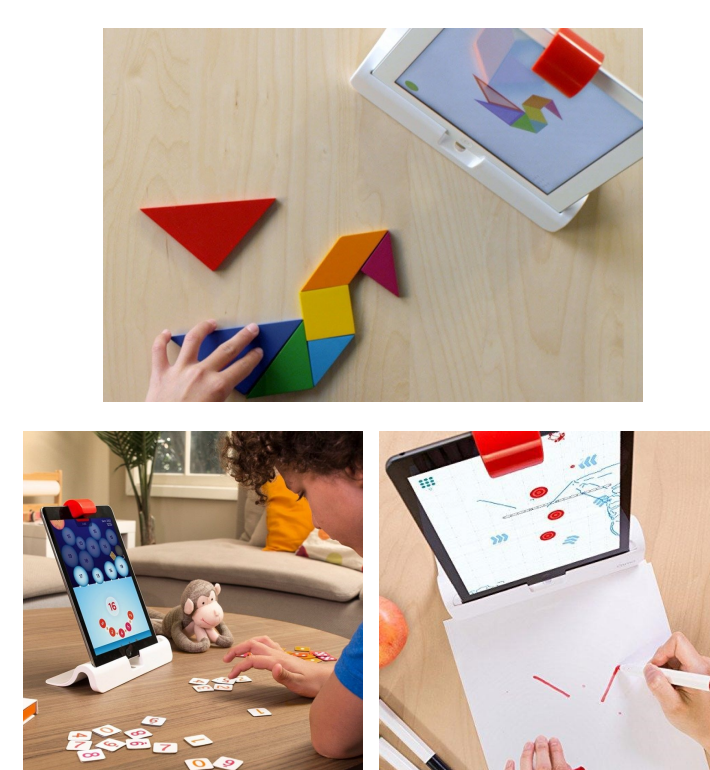
Procedure

- Four autistic children with learning disabilities (8-11 years) were observed in class with a range of different technologies (free-play setting)
- Three interfaces were available: **screen-based** (iPads), **physical to digital** (Osmo), and **augmented physical** (Code-A-Pillar).
- Nine observations were recorded over the course of 5 weeks. Footage analysed so far = 2.5 hours (20%).

iPads



Osmo



Code-A-Pillar



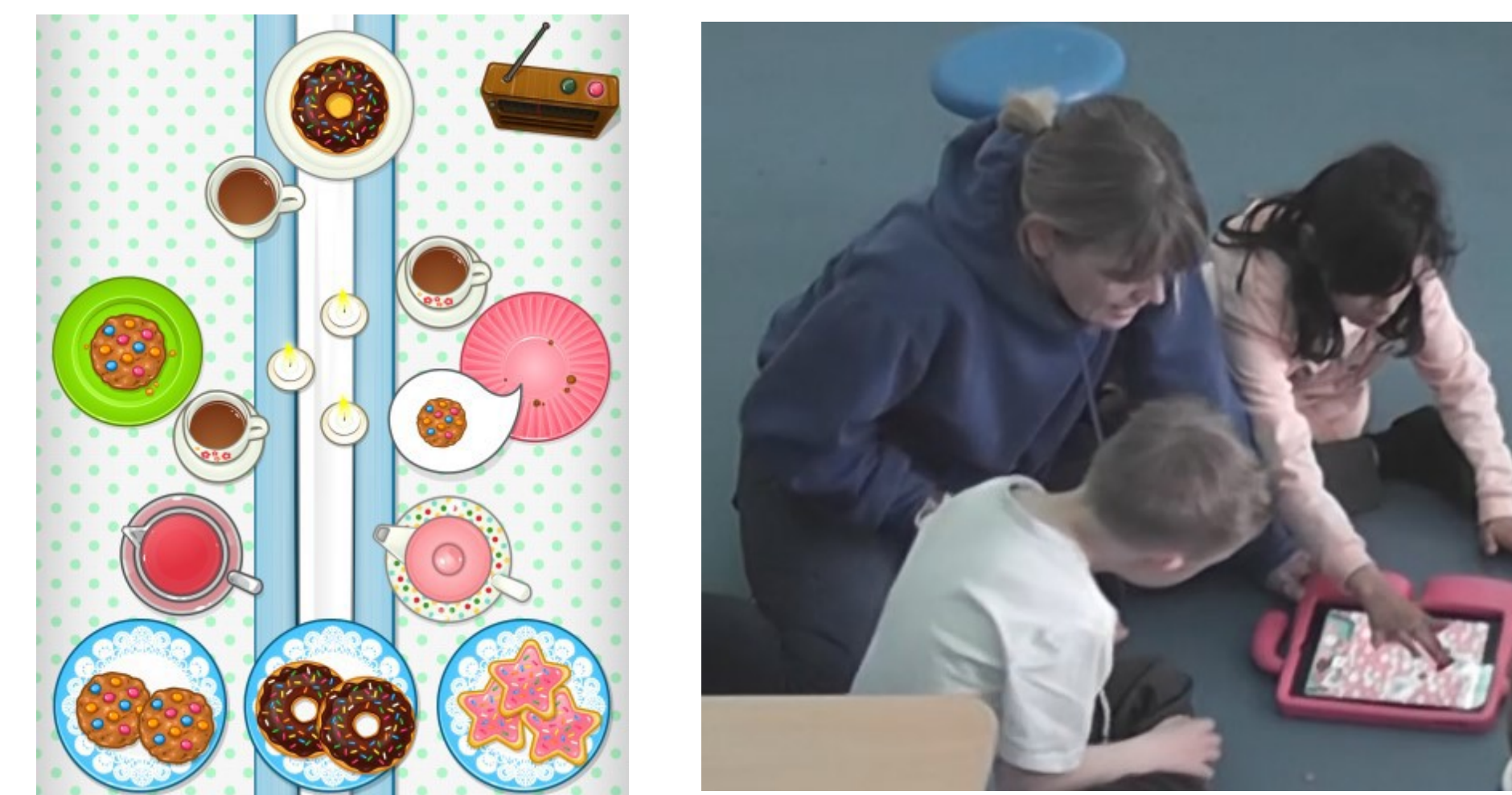
Digital features which facilitate social interaction

Example 1: Visual Cues

One child is playing Toca Tea Party with their teacher, with another child (A) looking over from a distance. **A pop-up bubble appeared on the plate** on the same side as A (see figure).

When the bubble appeared, the child moved closer to the other child and said **“I’ll do it!”** The children then continued to engage in turn-taking, responding to the **in-game events** in Toca Tea Party.

Even **when collaboration is suggested**, rather than enforced, children can still respond and engage in collaborative play. Having the **choice** to do so may be important for autistic children. **Pop-up events** can provide something to comment on and share with others.



Example 2: Multimodal feedback

Osmo Numbers provides in-game **auditory and visual feedback** on each level. After spending a while learning how to play with Osmo, child B was elated to discover these **new sounds** when he earned extra bonus points. When the sounds played, he turned to his teacher and says **“Yay, I did it!”**

Progression markers and engaging feedback can create opportunities for children to **share their achievements**. Having a **clearly presented goal** gives something that children can comment on, or seek help with. Multimodal feedback can also **increase accessibility**, allowing more interaction opportunities to a wider range of children.

Example 3: Tangible environments

Child C was playing with Code-A-Pillar at one side of the room, and programmed the toy to move to the other side of the room. The Code-A-Pillar started headed towards another group of children (see figure). When the Code-A-Pillar bumped into the group of people, the teacher yelled **“Look out!”** and all started laughing.

Augmented toys can offer more pathways to interaction, through the combination of digital and physical interaction.

Some children may benefit from designs which enforce proximity, but for others, having **flexibility** and personal boundaries is needed. Here, the **expansion of interactive space** through a mobile augmented toy seemed to offer more social opportunities.



Cognitive Event Analysis

- Cognitive Event Analysis is a technique which aims to infer cognitive changes from observed behaviour, and provides a valuable link between *behaviour (event)*, *time* and *context*, [2]
- ‘Events’ in this study were **social overtures** made by children whilst they played with the technologies. These were identified using standardised criteria from autism assessments [1]. Events were annotated for features of digital technologies or digital environments which preceded social overtures.

For more details see www.dart.ed.ac.uk/research/autism-tech-play

ML is supported by a Chancellor’s Studentship from Centre for Clinical Brain Sciences University of Edinburgh, and received travel support from ACM SIGCHI.

Photographs shared with permission from individual/parents.

Conclusions and Future Directions

- Digital artefacts, such as visual cues, multi-modal feedback, and tangible designs, can facilitate social interaction in autistic children. We extend previous research to examine *intrinsic, child-led* interactions.
- Cognitive Event Analysis (CEA) offers a valuable link between behaviour, time, and context, and this information can be useful for evaluating child-computer interaction, particularly with small idiosyncratic samples.
- Our future work will analyse the rest of the dataset and highlight more ways that off-the-shelf technologies can create social opportunities for autistic children, as well as the contexts in which autistic children initiate interaction in digital environments.

References

1. Autism Diagnostic Observation Schedule (2012; 2nd edition). Western Psychological Services.
2. Steffensen, S. V., Vallee-Tourangeau, F., Vallee-Tourangeau, G. (2016). Cognitive events in a problem-solving task: A qualitative method for investigating interactivity in the 17 animals problem. *Journal of Cognitive Psychology*, 28(1), 79-105.

Thank you!

To all of the children, teachers, and the school that contributed to this research

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