Research Statement

I am interested in the value of data analysis collected from different platforms, both physical and virtual in the form of narrative. My previous research projects including Stories + Data to determine if it was functionally possible to computationally generate stories from topics found in text collections. The software was developed however, a more important question is; what form must the data take to be useful in different contexts such as education, decision making, or public policy? Technology can help early childhood development particularly learning information for example, through repetition and immediate feedback aiding children to learn more easily (Lampe and Hinske, 2007). The characteristics of the data feedback are more difficult to generate, assess, and provide as a set of guidelines for future development of data stories.

My PhD work considers full loop processes that generate and analyze data to inform the next iteration of a design in an effort to identify stories that reference the data. I believe the iterative design approach would benefit educational tools in the form of toys, games or activities specifically to help children with learning disabilities. Much research documents the commercial and educational success of games for able children or, for the severely disabled. However, little work has been done on assistive technologies as Anna-Liisa Salminen concedes in her review in *Technology and Disability*, "the whole research area becomes more marginalized than it deserves," particularly when it comes to mild intellectual disabilities. My PhD research topic centers on using data taken from toys that aids children who have difficulty making decisions by using stories created from resulting play. Examples of research that touch on the subject are Demir and Sahin's (2014) study of scientific toys particularly attuned to scientific creativity and, Kara et al. (2012, 2013) developed a smart toy examining storytelling skills, creativity and narrative activities. Both of these studies showed positive effects of toys on their dependant variables. However, there are few studies concerning how children play with these toys, (Johnson & Christie, 2009) which provides an opportunity to create toys not just for data collection but also to capture contexts in which they play. To complete the loop the data would be used to build a narrative around the context the kids interacted with the toy to improve the experience. This would require some dynamic input from sensors or users but should enable greater retention of the information provided to the children from the toy and at the same time enrich their experience.

Coincidentally, my brother is a computer engineer who has been involved in the development of software for a pressure matte system that measures pressure points through fabric used in hospital beds. The 'e-fabric' they use has conductive thread woven throughout the material, which measures electronic impulses and visually represents them on a video screen. If this fabric could be used to create soft toys that respond to children pushing or pulling, feedback that indicates a narrative structure to help them make choices would enable just such an environment. In preliminary research I found that the development of motor skill is linked to scholastic achievement exercising children's focused attention, inhibitory control, and working memory, "… higher levels of both executive function and fine motor skills, …predicted higher achievement on multiple subtests at kindergarten entry" (Cameron et al, 2012) Fine motor skills commonly used in predicting cognitive levels in kindergarten children, "are the strongest predictor of special education referral and the second strongest predictor of kindergarten retention controlling for vocabulary, auditory and visual skills…"(Cameron et al, 2012) These indicators determine a pathway through the education system. Many parents and caregivers would prefer to work with their child to get them ready for kindergarten than let the education system hold them back based on motor skill tests.

If children are assessed for cognitive ability by their fine motor skills can we encourage fine motor skills to develop cognitive ability? I would explore the question, what specific motor skills need to be practiced for better cognitive development and does their engagement improve cognitive skill. From a study published by the British Educational Research Journal the potential for motor skill training to positively effect academic achievement is encouraging. (Ericsson, 2008) Determining what physical qualities toys should have to optimally generate a positive effect is done through examining their attributes, feedback, and format for feedback the toy should posses. More importantly, observing the actions or sequence of actions identified by toys would help a child's development. Collecting the interaction and sequence of play can be compared relative to developmentally typical children mapping one child's play over others.

Data visualization tools have also held a prominent position in my work in both research and teaching a class I entitled, "Visual Design of Complex Systems". As I explain to my students, data without context is useless to the viewer. Building visualization tools must provide flexibility to changing contexts, and at the same time understand the constraints of the data to afford clear interpretation. Collecting the data from toys can be used to determine how children play but also provide a context to improve motor skill, cognitive support, and play through stories in a learning environment. I create tools that allow context framing so that researchers can determine optimal uses for the toy as well as generate narratives to disseminate the data analyzed by the tool. Design research often includes the development of tools to explore data. It is my belief that if we frame the data in narrative it becomes a more potent argument to help change the way kids learn.

References:

Claire E. Cameron, Laura L. Brock, William M. Murrah, Lindsay H. Bell, Samantha L. Worzalla, David Grissmer, Frederick J. Morrison
Fine Motor Skills and Executive Function Both Contribute to Kindergarten Achievement
Child Development, Society for Research in Child Development, Inc. Published: 2012

Ericsson, Ingegerd
Motor skills, attention and academic achievements.
An intervention study in school years 1-3
British Educational Research Journal, Vol. 34 (3), Pg. 301-313. Published: 2008

Demir, S., & Sahin, F.
Assessment of prospective science teachers' meta-cognition and creativity perceptions and scientific toys in terms of scientific creativity.
Procedia e Social and Behavioral Sciences, Pg. 152, Published: 2014

Kara, N., Aydin, C. C., & Cagiltay, K.
User study of a new smart toy for children's storytelling.
Interactive Learning Environments, Vol. 22(5). Published: 2012
http://dx.doi.org/10.1080/10494820.2012.682587.

Kara, N., Aydin, C. C., & Cagiltay, K.
Investigating the activities of children toward a smart storytelling toy.
Educational Technology & Society, Vol. 16(1). Published: 2013

Lampe, M., & Hinske, S.
Integrating interactive learning experiences into augmented toy environments.

In Proceedings of the workshop on pervasive learning 2007, Toronto Pg. 1**e**9. Published: 2007

Soska, Kasey C.; Adolph, Karen E.; Johnson, Scott P,
Systems in development: Motor skill acquisition facilitates three-dimensional object completion.
Developmental Psychology, Vol. 46(1), Pg. 129-138. Published: 2010

Yilmaz, Rabia M.
Educational magic toys developed with augmented reality technology for early childhood education
Computers in Human Behavior, Vol. 54, Pg. 240**-**248, Elsevier Press, Published: 2016