International Society of the Learning Sciences

Constructivist Dialogue Mapping: A Comparison of Museum Experience

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Abstract: We employ constructivist dialogue mapping to provide a comparison between the learning experience in a traditional museum exhibit, and the experience while using an agent-based modeling game built for learning in a museum. This paper serves as an example of the power of CDM to track the results of turning knowledge authoring over to the visitors.

Key Words: Museums, Evaluation, Agent-Based Models, Ants, Complexity, Constructivist Dialogue Mapping, Elaboration as Learning

Introduction

Since Leinhardt and Crowley (Leinhardt et al., 2003; Leinhardt & Crowley, 1998) presented their vision for studying elaboration as learning, museum studies has been looking for a way to operationalize studying elaboration. The framework makes it clear that it is essential to attend to the richness of visitor conversation around an exhibit. In this paper we offer a tenable means to track these elaborations using constructivist dialogue mapping (CDM) (Martin et al., 2020) and use it to compare between two museum experiences. Using CDM, we operationalize Leinhardt and Crowley's vision to present findings from exhibits that show divergent interaction types: deep behavior observation and wide recognition. Thomas Humphrey and colleagues argue that hands-on interaction with science museum exhibits is not the same as active, prolonged engagement (Humphrey & Gutwill, 2005). They argue that designers should look beyond attracting and initially engaging visitors to focus more on creating situations that invite prolonged exploration. *Learning Conversations in Museums* (Leinhardt et al., 2003) proposed a means to study how learning actually occurs in museums. The authors' work in museum learning addresses and attempts to solve a core issue: what constitutes learning in museum research, and specifically, what terms or actions do we track in order to measure it. From these problems, the authors propose three outcomes, the last of which is important for CDM. They argue that their approach provides a novel, stable, and distributable methodology to conceptualize, collect, and analyze conversations as a process and as an outcome of learning in the museum context. The qualitative method we use in this study, CDM, has the same aim and could solve core operations issues with the original framework, which we will demonstrate in this paper.

Methods

In this paper we compare the outcomes of the two exhibits using constructivist dialogue mapping (Martin, et al., 2020). Using conversational elaboration measured through CDM, we present the analytical result of the experience of a traditional exhibit and compare it to the result from a game-based exhibit. The game, Ant Adaptation, was designed to afford participants agency in authoring their experience. One hundred fifty participants played the game in the museum, and six participants walked through the traditional exhibit. We recorded all the interactions. We recruited participants as they approached the exhibits. we asked participants for permission to conduct a pre-interview. The three participants featured in this report were white women aged 30, 40, and 22. They were selected to make the samples more comparable. When patrons played the game, they walked up to it and interacted with it. We collected pre- and post-interviews, as well as recorded audio of their interaction. We then transcribed these recordings for a total of 150 interactions.

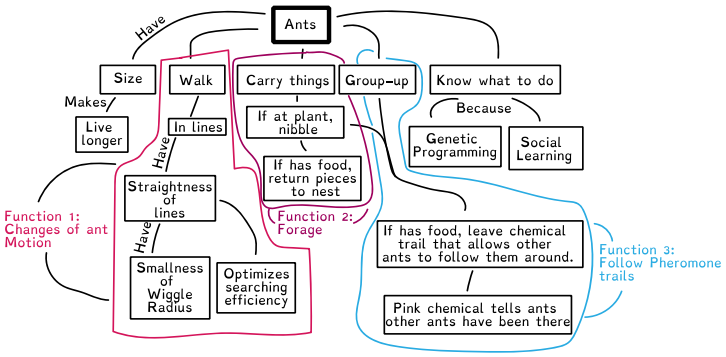

Figure 1. Change of ant motion, foraging, and pheromone trails explains how ants explore space.

Findings

We found participants name more total items in the traditional museum experience — wide recognition — but they elaborate more on items when using the dynamic agent-based model — deep behavior observation. Groups in the traditional exhibit referenced far more items during their visit. To demonstrate the differences in elaborations, we present an example of each exhibit below.

Marcia engages in deep behavior observation during a one-hour interaction with the game, Ant Adaptation. Marcia learned that size does not negatively affect an ant's chance to reproduce. But what led to her discovery was more complex: she first had to learn that an ant colony is a complex system where only the queen reproduces, and all the individual insects work towards that collective's betterment. At the beginning of the interview, she made basic observations about ants. When the interviewer asked if she'd ever noticed anything about ants she said "Yeah, they walk around and sometimes they appear in big groups walking around and sometimes they carry things from place to place. Like food stuff, and house building materials."

While playing, as shown in Figure 1, she ideates three functions: (1) 'Changes of Ant Motion', (2) 'Forage', and (3) 'Lay Pheromone Trails'. They are labelled in red, magenta, and blue, respectively. Extrapolating on these functions, she attains her big learning moment: that more, small ants collect more food faster and, therefore, "Smaller ants will reproduce at a faster rate." This implies a systems-understanding of how food flows into the colony.

We juxtapose this deep elaboration with the much wider, shallower elaboration afforded by the traditional exhibit. Two women—a mother and a daughter—attend an exhibit about biodiversity. During the pre-interview they named only one first order item, and two elaborations that expand its meaning: "Specimens (are) pieces of the natural world (that are) studied." While they walk through the exhibit, they elaborate on the items they notice but offer almost no behavioral elaboration. As shown in Figure 2, as they walk through, they mention a turtle they are looking at and take note of its aesthetic. They notice a bear brain that is "not very big", and gar, which the daughter hates. They note a pit viper would have made "Indian Jones unhappy", and that the tube worm is "gross and creepy". Notably, there is very little elaboration: of the 28 items they notice while walking through, they offer 18 elaborations, with an average elaboration of less than 1 per item. The elaborations they offer are surface level, such as "really pretty," "hates them," or "not very big." These are in contrast to the elaborations of functions noted while playing the game. After attending the traditional exhibit, during the post-interview, the two only mention six total items.

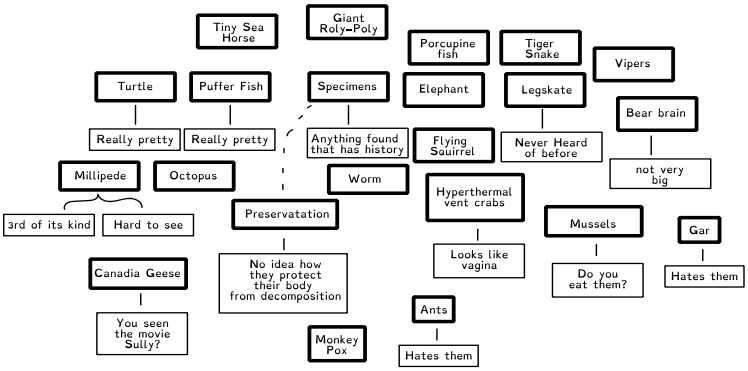

Figure 2. What was noticed during the biodiversity exhibit.

Conclusion

We seek to gain a better understanding of how constructivist dialogue mapping can help researchers understand how learners elaborate on their understanding, both in dynamics of systems and more traditional museum exhibits. In this paper, we saw two different types of learning unfold: (1) wide recognition and (2) deep behavior observation. In the biodiversity exhibit, we saw participants name a wide range of ontological items they noticed as they walked through. In contrast, while playing Ant Adaptation, participants deeply elaborated on the behavior of fewer ontological items. This paper has shown that CDM can demonstrate learning as elaboration, operationalizing Crowley and Leinhardt's earlier work. As seen through using CDM, we demonstrate that we can evaluate the design of museum exhibits and their impact on the type of learning the exhibit affords.

References

Humphrey, T., & Gutwill, J. (2005). *Fostering Active Prolonged Engagement. The Art of Creating APE Exhibits. Exploratorium*. Left Coast Press, Walnut Creek, CA.

Leinhardt, G., & Crowley, K. (1998). Museum learning as conversational elaboration: A proposal to capture, code, and analyze talk in museums. *Report Available at Http://Mlc. Lrdc. Pitt. Edu/Mlc*.

Leinhardt, G., Crowley, K., & Knutson, K. (2003). *Learning conversations in museums*. Taylor & Francis.

Martin, K., Horn, M., & Wilensky, U. (2020). Constructivist Dialogue Mapping Analysis of Ant Adaptation. *Informatics in Education*, *19*(1), 77–112. https://doi.org/10.15388/infedu.2020.05

