

Extending the Reach of Embodied Interaction in Informal Spaces

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Abstract: Exhibit designers in informal institutions are exploring the potential educational benefits of embodied interaction experiences. But are these exhibits—often relying on a single user for control—practical for settings with thousands of daily visitors? We present results from an observational study of an embodied interaction exhibit at a major zoo, focusing on how to make single-user embodied performances more inclusive and participatory for spectators.

Background

Zoos and museums have a long history of providing interactive learning experiences to visitors, and have been exploring more “naturalistic” embodied interaction approaches, from tangible user interfaces to whole-body interactives (Alisi et al., 2005). Embodied interaction is thought to confer usability benefits, but most designs only allow a small proportion of visitors to directly participate. However, thousands of visitors might encounter an exhibit in a day, so designers must extend the experience so that it is beneficial for non-participating spectators. This paper builds on existing work on extending spectator experiences, which has stressed increased display size (Diamond et al., 1995) and visibility of user/system interaction (Reeves et al., 2005). Spectators need to know what the participant is doing, and how it affects the system, to understand what is happening. Many embodied interactions unintentionally obscure this information, as the kinesthetic nuance is felt only by the person in control. In this work we explore how “visible” the lessons of existing single-user embodied designs are to spectators, and explore how to extend that “visibility”.

Our exhibit prototype, *A Mile in My Paws*, uses physical effort to illustrate the challenge polar bears face as they react to the changing climate. Zoo visitors control a polar bear avatar that must traverse the arctic environment in multiple sessions of past, present, and future time periods, as they search for food. Users control the bear by “swimming” with weighted motion-sensitive gloves (fashioned as plush polar bear paws) and walking in place on a pressure sensitive plate. As sea ice decreases over time, polar bears must work harder to travel the same distance, as they burn more calories swimming versus walking. This embodied experience is intended to prime learners for understanding the rate and magnitude of climate change (Lyons et al., 2012).

Methods

The *Paws* game was deployed in the underwater polar bear viewing area at Brookfield Zoo in Chicago, IL. The pilot data in this paper was gathered during two days of deployment, where the *Paws* interactive exhibit was available for use by the visitor population for a period of roughly one and a half hours each day. Ten zoo interpreters joined the research team across the two days, working as a team to run the exhibit. Zoo interpreters vary in age and experience, and are typically in charge of explaining phenomena at exhibits, answering questions, and facilitating specialty content like scheduled talks and specimen carts.

Interpreter and visitor behavior was captured through video and audio recordings. On the second day, interpreters passed out simple paper ballots for visitors to indicate whether they thought swimming or walking was more difficult for the polar bear—a key learning goal for the *Paws* exhibit, but one which is non-obvious to non-playing observers, who cannot feel the difference in effort while swimming versus walking.

Results & Discussion

Since the *Paws* game relies on the player’s perception of effort to convey the difficulty that polar bears are facing, our initial concern was that not all visitors would have access to this embodied experience. During the pilot, 26 visitors played as the virtual *Paws* bear, but this was only 2% of the 1049 total visitors who passed through the space (see Figure 1 for visitor participation with *Paws* over time). Using the paper ballots, we compared the responses of *Paws* players and non-players; while 82% of the players (9 of the 11 surveyed) answered correctly that swimming was more difficult than walking, only 70% of non-playing peripheral audience members (21 of the 30 surveyed) produced this response. This indicated to us that visitors who didn’t have the opportunity to embody the polar bear needed additional support to learn from the *Paws* exhibit, since they didn’t have direct experience of the relative difficulty of swimming versus walking.

Our first strategy for engaging non-playing spectators was “pantomiming”—having visitors mimic the swimming and walking actions of the person playing the game. This activity was created by the zoo interpreters during the design of *Paws*, as a means for supporting peripheral participation. While child visitors didn’t spontaneously engage in pantomiming, they participated enthusiastically when prompted to by interpreters.

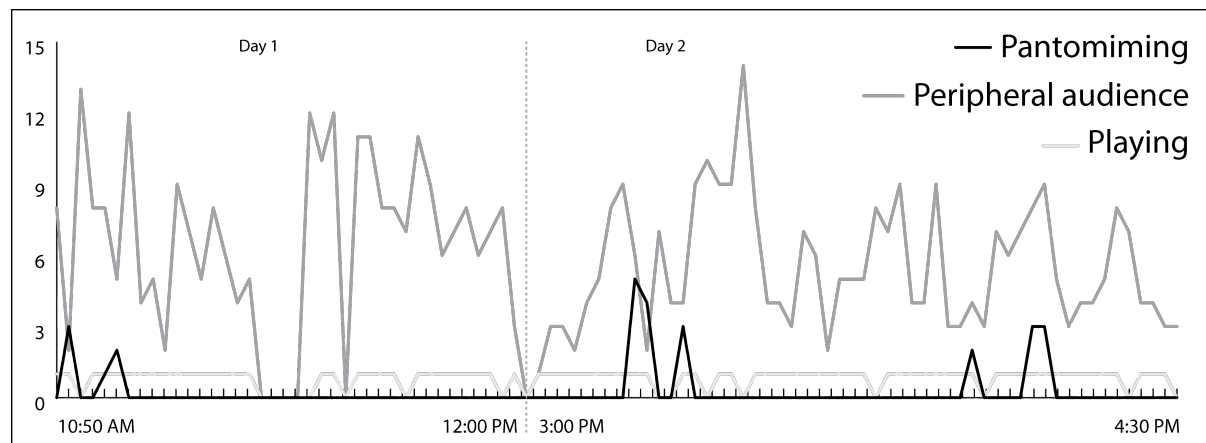


Figure 1: Number of playing, pantomiming, and peripheral visitors during the pilot.

When we gave the paper ballots to children who had pantomimed, 75% of them (9 of the 12 surveyed) marked that swimming was more difficult, an improvement over the more peripheral spectators. Using a Kruskal-Wallis analysis of non-parametric variance to compare the playing, pantomiming, and peripheral (non-playing/non-pantomiming) groups, we found that the difference between groups is significant with $p < 0.001$ ($K=34.6$, $df = 2$). The drop-off in correctness among these groups suggests that while spectators are generally able to figure out the core, embodied message of *Paws*, visitors that engage in pantomiming have additional but indirect access to the *Paws* player's experience. Pantomiming supports multiple simultaneous visitors, and could be further enhanced by giving pantomimers "dummy" weighted gloves disconnected from the system. Thus, pantomiming is a promising approach for helping an extended audience directly experience the kinesthetic differentiation between swimming and walking.

The downside to the pantomiming activity is that adults would not engage in pantomiming, even when it was encouraged by interpreters. Adult spectators would therefore require a different approach to engage them in the activity and make the player's kinesthetic experience "visible". We thus designed a mobile tablet app to facilitate discussion around *Paws* for non-pantomiming spectators. The interface included a live map of player progress and graph of the bear's simulated caloric expenditure. Our expectation was that by making visible multiple representations of the player's current state, this would allow an alternative access point for adults (and potentially some children) who might not want to participate in pantomiming. Interpreters were aided in scaffolding discussion around climate change through pop-up questions on the tablet as well as by being able to select information from the tablet to present on a large shared display. Although the tool was designed for spectators' needs, interpreters also used the tablet to interact with pantomimers and the visitor controlling the bear. Interpreters' decisions around what information to display or mention may reflect their dynamic judgments about what would be most engaging for visitors at different participation levels. Our team is in the process of analyzing the interaction between interpreters, visitors, and the mobile support tool, to see how learning with the alternate representations compares to the embodied learning that players and pantomimers engage in.

Our results indicate that for zoos to engage multiple audiences in exhibits with participatory, embodied content, they need to pursue multiple simultaneous strategies for different audiences. In our case, pantomiming affords child visitor interaction with *Paws*, but engaging adult spectators required a different strategy. We found success with a mobile support tool that displayed the player's progress and effort. These strategies enabled a wider audience of visitors to access and learn from a single-user interactive exhibit.

References

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