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Virtual Gorilla Modeling Project: Middle School Students Constructing Virtual Models for Learning

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Abstract: The Virtual Gorilla Modeling Project (VGMP) was a research and development project that explored the integration of a prototype pedagogy and immersive virtual reality (VR) environment into Zoo Atlanta's Summer Safari program.

Keywords: virtual reality, modeling and science education

Background

Current technological advancements make possible new types of learning experiences, in which students can immerse themselves within interactive contexts that challenge and extend their understandings (Allen & Otto, 1996). Many such technologies have been discussed in the literature, including VR, which has great potential to ground learning in rich environments (McClellan, 1996; Dede, Salzman, Loftin, & Sprague, in press; Winn, 1995). The VR allows students to visualize abstract concepts, to observe events at atomic or planetary scales, and interact with events that would be otherwise impossible (Hay, Johnson, Barab, & Barnett, in press).

The Virtual Gorilla Modeling Project Technology

The objectives of the VGMP were the development of richer conceptual understandings of the biomechanical parameters of gorilla behavior (e.g., self-grooming or knuckle walking). Zoo Atlanta’s Virtual Gorilla Habitat consists of a head-mounted display (HMD)-based VR exhibit (Allison and Hodges, 1999). The environment embodies a pre-developed virtual model of the Zoo Atlanta gorilla habitat with behaviorally and anatomically correct gorilla models. The learner wears a HMD and becomes an adolescent gorilla within the virtual gorilla troop. The central focus of this study was the development of a tool which affords students the ability to create biomechanical models of gorilla movement. Additionally, students created a set of interactional rules on paper that were implemented by the project programmer. Once created, students then tested their models in the original virtual habitat.

Findings

Unfortunately, in this short amount of space, we cannot discuss all our findings, therefore we focus on characterizing the process through glimpses of a student pair as they created a virtual model of the seemingly simple behaviors of walking and eating. The process began with scientific observations of gorilla behavior at the exhibit, creating an authentic experience base upon which the students could build their understanding of gorilla behaviors. Students then constructed pipe-cleaner models of each frame of a gorilla behavior. The pipe-cleaner models helped them in three ways: 1) They began confronting their anthropomorphic bias (expecting gorillas to act and move like people), 2) they worked out the notion of key frames, and 3) most importantly, they negotiated the exact nature of the gorillas motion. Through the modeling process the students were challenged to re-think and re-examine their notions of gorilla behavior. Despite the valuable scaffolding that the pipe-cleaner modeling provided the students, the major shortcoming was that they were not anatomically correct. For example, gorillas have long arms that make it easy for them to knuckle walk, as opposed to humans who have relatively short arms that make knuckle walking difficult. Because the computer-modeling program was anatomically correct (gorilla possessing long arms and short legs), the students were better able to create and evaluate their models. The connection between the model and reality in this case was strong. Because the modeling program provided a more realistic environment to structure students modeling practices, it fostered rich dialogues among students and between students and instructors. In the following dialogue, Christi and Greg were attempting to model the behavior of a gorilla poised to knuckle walk.

Greg:	We want him to be in a standing position - on all fours
Instructor:	Gorillas don t stand erect, do they?
Greg:	Like this [gets up and bends over to demonstrate how he wants the gorilla to look]
Greg:	We need to find out whether he is moving around a lot
Christi:	Ok - go down-use lower case y [the gorilla is raised and lowered on the screen]

The virtual model provided a powerful communal artifact around which students discussed and evaluated their understanding of the biomechanics of gorilla behavior. The computer-modeling program allowed Greg to transform the physical understanding inherent in his demonstration to an anatomically correct model of the gorilla. The main feature of the modeling program which impacted this transformation was the placement of physical restraints on the positioning of the gorilla, forcing the students to use gorilla dimensions and movements rather than their own.

Conclusions

The Virtual Gorilla Modeling Project study points to new opportunities rather than states definitive conclusions. We have demonstrated that middle school students can enter into the world of computational science and build models to aid in their understanding. The findings suggest that model building may create a powerful goal structure that drives students to confront their anthropomorphic bias, in characterizing animal behavior. The practice of modeling in the VGMP was mediated by both physical (with pipe-cleaner models as well as using their own body) and VR modeling tools that emerged as a focus for students to engage in conversations. The discourse helped to compel the students to refine their concepts and challenged their existing understandings while manipulating the virtual gorilla model and comparing it with their field observations. This model-driven process allowed students to progress beyond the understanding derived from school-based factual learning or zoo-based observational learning. In addition, modeling of gorilla behavior fosters the development of a robust understanding of animal behavior while reducing the potential for anthropomorphic bias. The VGMP was the first step in a program that Zoo Atlanta hoped to establish allowing students to develop a deeper understanding of animals in their habitats and in turn, a stronger conservation ethic in the members of the next generation. Finally, this project adds strength to the growing number of VR based modeling environments (Virtual Solar System Project, [Hay et al., in press], the Digital Weather Station/Virtual Exploratorium [Hay, 1999]) that provide students with powerful tools for learning science through the process of computational modeling.

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