Theatrical Modeling as a Design for Perspectival Learning

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Abstract: We envision a set of activities, termed Theatrical Modeling, for engaging students in collectively modeling solar systems and celestial phenomena from multiple perspectives. Theatrical modeling hybridizes participatory theater with agent-based modeling to support representational practices at the intersection of science and the arts. Drawing on experiences from a six-iteration design study with 5th grade students, we discuss theoretical underpinnings of theatrical modeling and how we believe it promotes perspective-taking in both scientific and social modes.

Research problem: Perspective-taking as a learning objective

Solar systems present a unique opportunity to study students' perspective-taking activities, a topic of importance in both school and non-school learning sites. On one hand, solar systems are complex systems that give rise to phenomena that fundamentally depend on perspective. On the other hand, they can be captured using a relatively small number of interacting bodies, enabling small groups of learners to use theatrical approaches to enact and study the behavior they are working to understand. Traditional educational approaches to solar systems too often engage students in attempting to comprehend pre-made diagrams that embody a fixed (often external and 'overhead') perspective on *our* particular solar system. This is problematic in several senses: (1) students are positioned as passive recipients of canonical knowledge embodied in such pre-made representations; (2) developing rich understandings of celestial phenomena in solar systems requires negotiation and representation from *multiple* perspectives, not just one; and (3) modeling activities that position our own solar system as normative run the risk of prematurely shutting down expansive forms of inquiry about solar systems in general that might stem from imagining and studying alternative (possibly fantastical) solar systems.

In response to these problems, we envision a set of learning activities that empower students (1) to collaboratively construct their own representations of solar systems phenomena; (2) to stabilize multiple perspectives on these phenomena by assuming the relevant perspectives in performance; and (3) to imagine, and model, a range of alternative possibilities for celestial phenomena. Activities that support these goals would support learners in both collectively and individually developing perspectival understandings (Greeno & van de Sande, 2007). We believe that two modes of activity already exist for engaging participants' perspectives in a collaborative, socially distributed way: participatory theater, especially Theatre of the Oppressed (Boal, 1985), and agent-based modeling (Wilensky & Stroup, 1999; Wilensky & Rand, 2015). We have embarked on a six-iteration project of design-based research (Cobb et al., 2003) to explore activity at the intersection of these two practices under the heading of Theatrical Modeling. This poster intends to foster conversation about structural parallels between these two forms of activity that are revealed through students' participation in Theatrical Modeling, and to unearth potentially broader epistemic parallels between liberatory artistic practices and scientific representation and modeling that may inform efforts to transform traditional science education.

Study context

In our design work, we have partnered with a teacher and several groups of 5th grade students at a public middle school (grades 5-8) in the southeastern US. Our partner teacher, Ms. S, teaches a course called "STEM Related Arts," which takes a project-based approach to engaging students in multidisciplinary STEM learning. All students at the school are required to take the course, with the 5th graders participating for a reduced half-hour period each day. The course repeats on a quarterly basis, so every 9 weeks a new group of 25 5th graders cycles through the STEM Related Arts curriculum. In this context, we designed and have been iterating a three-week sequence of activities that engages students in exploring solar systems through theatrical modeling. Drawing on methods of Interaction Analysis (Jordan & Henderson, 1995), our data offer insights into the hybridizing work of students as they work to model solar systems phenomena from a range of embodied physical and social perspectives.

Theoretical background

Our notions of participatory theater are drawn primarily from Boal's Theatre of the Oppressed, or TO (Boal, 1985), in which groups use theatrical forms to analyze conditions of oppression, and propose, explore, "rehearse," and stabilize proposals for actions to produce social and political change (Boal, 1995; 1998). TO is a

socially distributed way of engaging participants' perspectives as social and political actors. It draws upon Freirean perspectives and approaches, as suggested by the homage in the name (to *Pedagogy of the Oppressed* (Freire, 1970)). In the context of formal science education, we intend for the liberatory power of TO to be directed at engaging groups of learners in collectively appropriating the *means of production* of scientific representations. Our designs toward a theatrical modeling practice have involved groups of learners in constructing theatrical models that genuinely illuminate questions brought to the investigation by the students themselves, opening new practices to the community. We argue that this adaptation of the practice of TO is consistent both with its spirit and with the diversity of institutional applications that TO practitioners have explored (cf., Boal, 1992, 1995).

In investigating perspectival phenomena, learners benefit from projecting themselves into the representational infrastructure (in our case, theatrically; in others, through imaginatively assuming the role of modeled entities (Wilensky & Reisman, 2006)). Ackermann (2003) has described this as a dance of 'diving in' and 'stepping out' as learners alternately immerse themselves in systems by taking on intrinsic perspectives, then remove themselves to assume an extrinsic perspective. These points of view correlate to what Greeno and van de Sande (2007) have called "enactive/projective" and "depictive/descriptive" points of view, respectively. In our view, the movements in Ackermann's dance have the potential to play out richly when studying solar systems, as many celestial phenomena hinge fundamentally on not only the intrinsic or extrinsic nature of the viewer's perspective, but also on finer details of the position and orientation of that perspective. Consider this in conjunction with TO, a practice dedicated to exploring and refining designs for collective engagement with multiple perspectives on oppressive social systems. Theatrical modeling may enable learners to explore perspectives in scientific representations along not just a physical dimension, but also social and political ones, as they investigate questions of authorship, intent, purpose, and implications in canonical models..

We notice both resonances and tensions between TO and agent-based modeling. Both activities involve participants in immersive and collective perspective-taking practices, distributing epistemic authority among social groups and recruiting their embodied experiences as important resources for furthering this collective enterprise. They largely differ, however, in their sociopolitical objectives; while modeling is concerned with building new knowledge for society's use, TO seeks to transform society by raising consciousness about realities of oppression and activating strategies of resistance. We aim to support learners' engagement in the representational and perspective-taking practices we see as common to both activities, while acknowledging and leveraging the tension between them as potentially generative sources of change both in students' lives and in formal science education. This is relatively new design work, and we invite others to consider how generative parallels between participatory theater and agent-based modeling could re-shape learning practices in both formal and informal STEM contexts.

References

Ackermann, E. (2003). Perspective-Taking and Object Construction: Two Keys to Learning. *Constructionism in Practice: Designing, Thinking and Learning in a Digital World*, 25–35.

Boal, A. (1985). *Theatre of the Oppressed. Theatre Communications Group*.

Boal, A. (1992). *Games for actors and non-actors.* New York, NY: Routledge

Boal, A. (1995). *The rainbow of desire: The Boal method of theatre and therapy*. New York, NY: Routledge.

Boal, A. (1998). *Legislative theatre: Using performance to make politics.* New York, NY: Routledge.

Cobb, P., Confrey, J., DiSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational researcher*, *32*(1), 9-13.

Freire, P. (1970). *Pedagogy of the oppressed* (MB Ramos, Trans.). New York: Continuum.

Greeno, J. G., & Van De Sande, C. (2007). Perspectival understanding of conceptions and conceptual growth in interaction. *Educational Psychologist*, *42*(1), 9–23.

Wilensky, U., & Rand, W. (2015). *An introduction to agent-based modeling: modeling natural, social, and engineered complex systems with NetLogo*. MIT Press.

Wilensky, U., & Reisman, K. (2006). Thinking like a wolf, a sheep, or a firefly: Learning biology through constructing and testing computational theories—an embodied modeling approach. *Cognition and instruction*, *24*(2), 171-209.

Wilensky, U., & Stroup, W. (1999). Learning through participatory simulations: network-based design for systems learning in classrooms. *Proc. CSCL*, (1), 80.

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