Wave Interaction in Pools: a NetLogo Simulation
(Project 103 of the New Mexico Supercomputing Challenge)

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Abstract:
Swimming is fun and healthy, but a lot of people don't participate in swimming because they feel it is harder to do a sport in water than on land. This is because water, which is 800 times denser than air, acts as a wall. Also, making waves takes up a lot of energy. Both of us are competitive swimmers and we wanted to know how lane-lines and the waves bouncing off of them might affect our speed. Waves slow even the fastest swimmers down and drafting behind the wakes of other swimmers can be beneficial too. We created an agent based computer program that simulates the creation, reflection (from Snell's law) and transmission and damping of waves (based on our empirical observations) that occur in competitive swimming. Our ultimate goal was to simulate various ways in which waves interact with swimmers and see how it affects the swimmer's speed. We used NetLogo to simulate a pool with three swimmers, complete with lane lines and gutters. The wakes shed by the swimmers were simulated by creating wake agents that obeyed our programmed laws of reflection, transmission and damping. Transmission and damping were variables, as was the swimmer's initial wave speed. The results created realistic wakes and wave patterns when compared with several videos and photos we took of ourselves during practice. We are now hoping to expand our simulation by exploring different rules for how the wake agents should interact with a swimmer and would welcome suggestions. Perhaps someday our model might help a swim coach decide on the best race strategy for whether to draft a neighboring swimmer for several laps or not and may help pool directors decide what kind of lane-lines to buy to make their patrons have the most enjoyable experience.

Bios:
Lauren TenCate and Justine Yang are both 7th graders at Los Alamos Middle School and recently participated and presented their project in the 2009 NM Supercomputing Challenge held at Los Alamos National Labs. Neither had programmed before and they decided to spend Sunday afternoons working on this team project for the Challenge. Mentors were Emily TenCate (Lauren's older sister) and Jim TenCate (mostly logistics) with help from LAMS teachers Robert Dryja and T.J. Bonzon.