Using 3D Game Engines to Overcome Naive Concepts of Motion

Problem:

During childhood and youth, students build up a number of naive concepts of motion that help them to cope with the behavior of real-world objects around them. As Driver, diSessa, Zollmann and others pointed out, this naive concept of motion may work as a serious obstacle towards deeper understanding of scientific concepts of motion.
In this poster, we deal with misconceptions regarding the trajectories of thrown objects. We propose a computer-supported laboratory experiment to overcome misconceptions and allow teacher education students to discuss how misconnects built up in learners.

Fig. 1

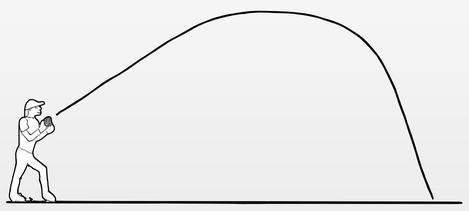
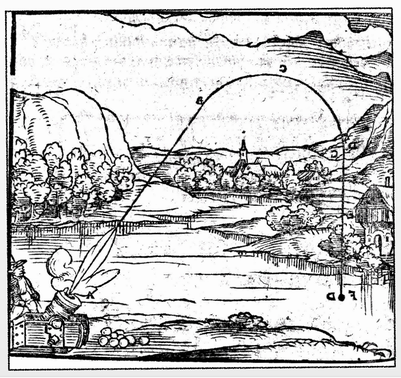
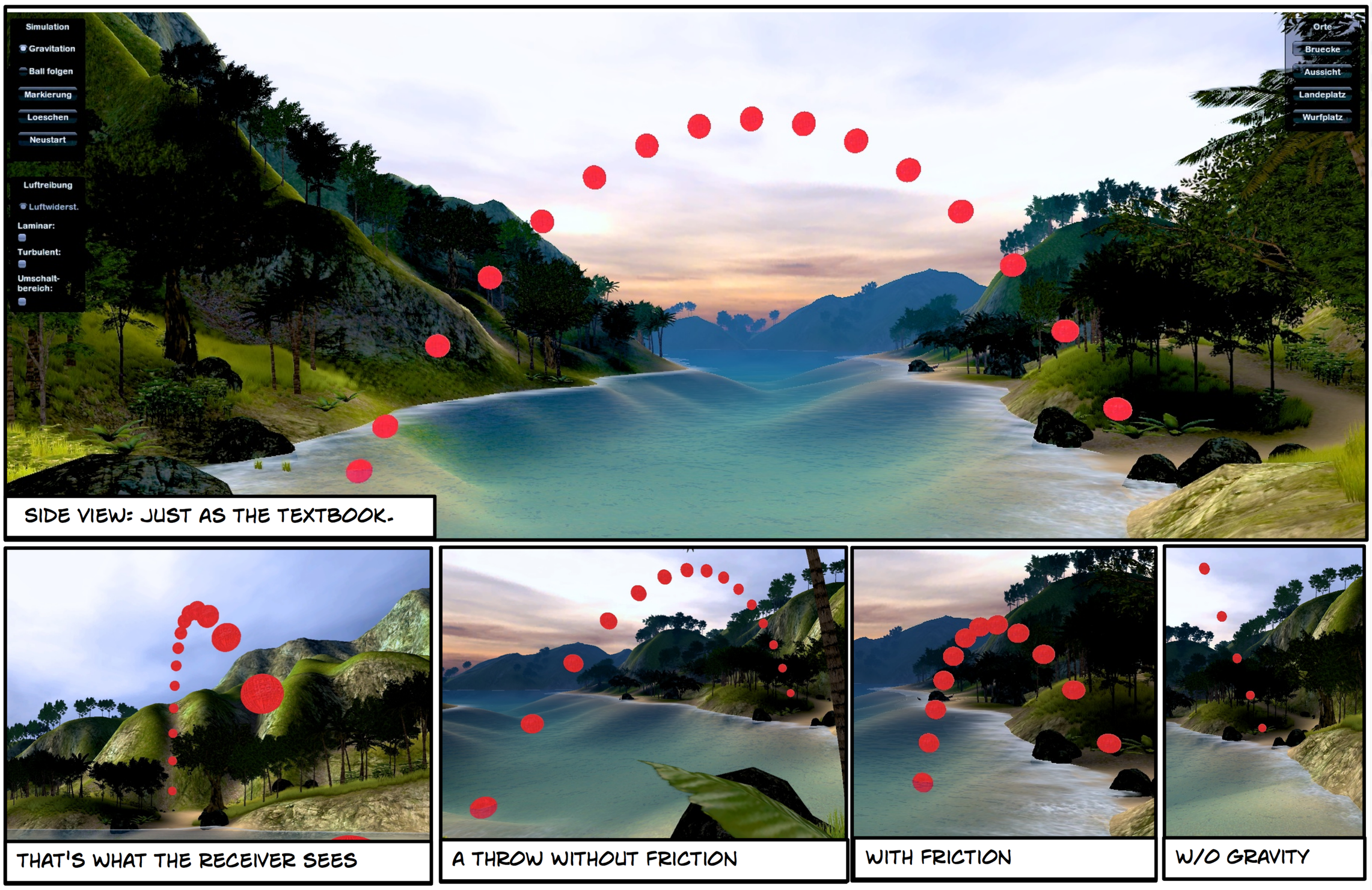


Fig. 2



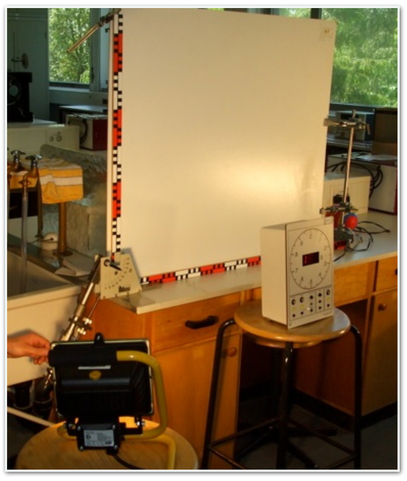
Reason:

When playing an active role in throwing or receiving a ball, a perfect parabolic flight path as depicted in textbooks is rarely seen. Taking the effects of distance and perspective into account, the trajectory as seen by thrower or receiver resembles closely to „misconceptions“ that are drawn by school kids, undergraduate students (Fig. 1) or seen in paintings of pre-Newtonian artists (Fig. 2). We argue, that the use of concepts that are „successful, but wrong“ when catching or throwing balls builds misconceptions that are resistant against lesser-active classroom or textbook work.



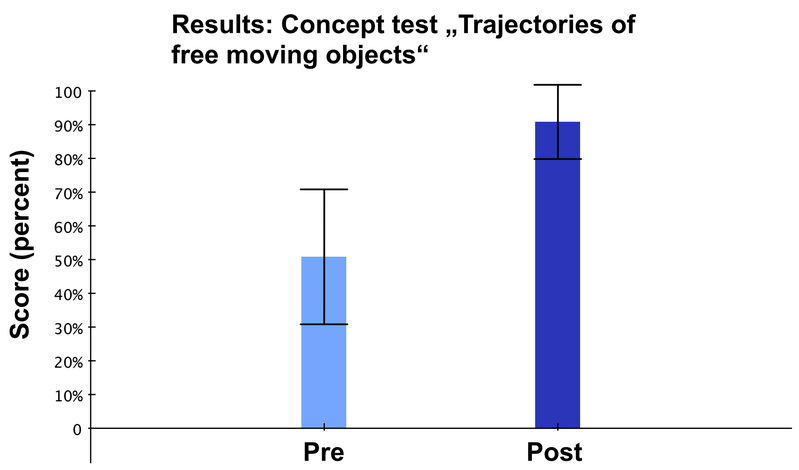
Solution:

We used the 3D Game Engine "Unity 3d" to design a rich surrounding which provides spatial orientation and a sense of depth and distance. While analyzing the marked trajectory from different perspectives, as frozen image or with moving projectiles, students are asked to discuss and explain how learners build up their naive concepts of motion. Studying the rendering of the 3D engine is embedded in a lab assignment, consisting of several conventional hands-on activities and motion capturing tasks.



Results:

5 weeks prior and 7 weeks post treatment, 22 teacher education students (8 male, 14 female) conducted a force concept test based on Watts and Zylbersztaijn (Phys. Edu 15, 360-15, 1981). Paired sample t-Test reveleals a significant improvement of students performance (t = 10.38, Cohens d = 2,21) even as the experiment was conducted 7 weeks before.



Contact:
Prof. Dr. André Bresges: Andre.Bresges@uni-koeln.de
Dr. Marga Kreiten: marga.kreiten@me.com

University of Cologne
Institute of physics education