Back to the Future: Grasping Molecular Biology with Tangible Interfaces

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Spatial reasoning is becoming increasingly important for our understanding of the world around us. The molecular basis of life's processes is an area of growing importance for society. DNA, genomics and proteomics are having increasing impact on areas as diverse as healthcare, criminal justice, and social evolution. As molecular biologists uncovering the structures of complex molecules, we face the problem of educating and communicating the nature of a world that is invisible to human perception.

We have been developing new ways to represent, visualize and interact with the molecular structures that make up the machinery of life. We are adapting two emerging computer technologies, "solid printing" and augmented reality, to create a natural and intuitive way to manipulate and learn from molecular models. We create tangible models utilizing computer autofabrication. Each model can be custom made, with an ease similar to that of printing an image on a piece of paper. Specific model assembly kits can be made with this technology to create "molecular Legos" that go well beyond the chemical models of the nineteenth and twentieth centuries. Augmented reality is used to combine computer generated information with the physical models in the same perceptual space. By real-time video tracking of the models as they are manipulated we can superimpose text and graphics onto the models to enhance the information content and drive interactive computation.

These models and tangible interfaces have been used in both teaching and research settings. The talk will include a live demonstration of the models and interactive use in an augmented reality setting.

Student with Protein "Lego" model

Augmented reality display of two interacting protein molecules.