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## Art, Math, and Physics; All About FOR

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## **Abstract**

Anish Kapoor's public sculpture "Cloud Gate" and Frame of Reference.

## **Author/Artist Bio**

Chris Brownell is an Assistant Professor of Mathematics Education, Director of the STEM and Mathematics Education Programs at Fresno Pacific University, and a Senior Researcher at The AIMS Center for Math and Science Education. He is a former high school mathematics teacher, turned university math professor, turned mathematics education researcher. Chris is presently working on his doctoral dissertation at the Claremont Graduate University. His work at FPU included briefly directing the Title V PASEO grant. While at Claremont he also worked as the Teachers Employing Applied Mathematics to Engage Students (TEAMES) grant Coordinator. His research interests lie in math education practice and policy, how children come to understand the concept of Function, the Standard of Mathematical Practice known as Modeling with Mathematics, and has recently been focusing on teacher concerns related to the inclusion of Transformation Geometry in the Common Core State Standards in Mathematics. Steve Pauls holds a joint position between the Math & STEM Education Program and the traditional undergraduate science program at Fresno Pacific University. Over the years he has taught a variety of courses including chemistry, physics, elementary science methods, mathematics, earth, and even life science. Steve loves to find new hands-on ways of integrating new science topics involving real world applications. He is interested in woodworking, ceramics, cartooning, and integrating 3D printing and Arduino microcircuit technology across the educational STEM curriculum. Dr. Pauls received his Bachelor's of Science degrees in Chemistry and Physics from Bethel College in Kansas and a PhD in Physical Chemistry from Kansas University.

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**Art, Math, and Physics; All About FOR**

*Chris Brownell & Steve Pauls*

## **Art, Math, and Physics; All About FOR**

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Recently two colleagues from Fresno Pacific University attended conferences in Chicago, albeit different conferences and different times. Both of us have been engaged in discussion and research on the role of “Frame of Reference” (FOR) in Mathematics and Science Education. The conferences were focused on education but took place one week apart from each other in time. While in town though, we both made time to visit Anish Kapoor’s public sculpture “Cloud Gate.” This massive stainless steel sculpture has become an iconic image for both of us as we discuss FOR. Both of these images are of the same object, minor alterations in the frame of reference of the photographer make significant alterations in what information the image contains. We are constantly reminded that the goal of all studies remains similar, the search for truth, but the frames of reference: Art, Mathematics, Science all bring their own lens to this quest. One image, the one that takes in a large portion of the sculpture, reveals the reason Cloud Gate earns its nickname “The Bean.” This image reflects the world around the sculpture, bending light and reality. The second image, of the “omphalos” of the sculpture, conjures up the works of M.C. Escher, many a mathematician claim his works as favorites. We could discuss reflection, curvature, gravity, the mathematics of change, the art of altering perceptions, engineering, materials science and on and on. Each topic spinning out of our reflection upon what we perceive. We find this blend of interests both stimulating and productive.