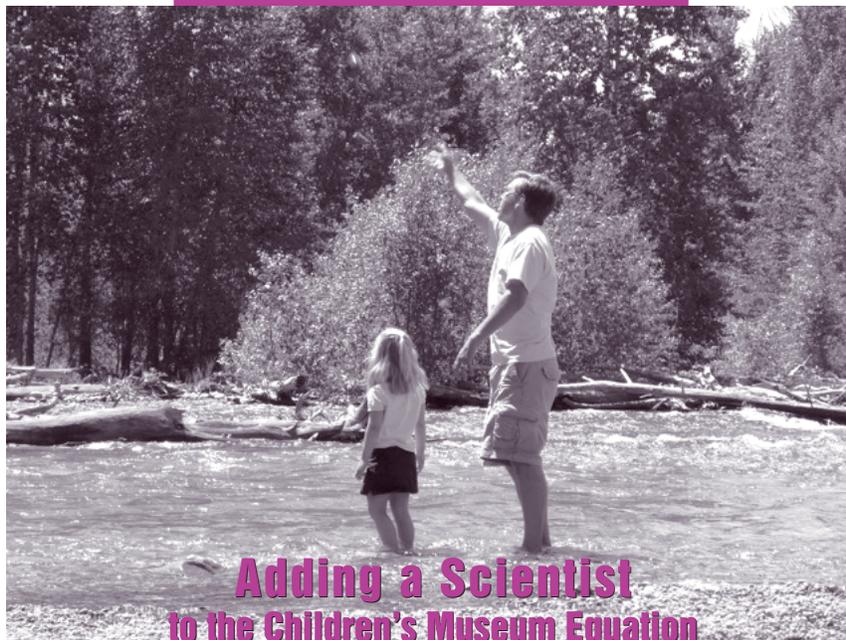


Dr. Mike Brown is the Richard and Barbara Rosenberg Professor of Planetary Astronomy at the California Institute of Technology. Famously, he is known for “killing” Pluto as a planet and reclassifying it as part of an entirely new group of astronomical objects. In 2006 he was named one of Time magazine’s 100 People Who Shape Our World. In 2007 he received the annual Feynman Prize, Caltech’s most prestigious teaching honor. His current book, *How I Killed Pluto and Why It Had It Coming*, was released in December 2010.

In 2008 Brown was asked to join the board of directors for Kidspace Children’s Museum in Pasadena, California. His role evolved to his current position as head of the exhibit development process for Kidspace’s newest project, the Enchanted Physics Forest, opening in the summer of 2012. While unusual for a board member at an established museum to take on such a major effort, Brown’s confluence of talents and interests was a natural fit for the role.

The Enchanted Physics Forest is a permanent outdoor exhibition that will provide engaging, highly interactive experiments through which visitors explore basic physics principles and come to intuitive understandings about how things work. The exhibits will serve as platforms for open-ended science learning through play that involves experimenting, questioning, socializing and experiencing the physical sciences. Designed to encourage self-guided exploration, the goal for the Enchanted Physics Forest is to create a fun, thought-provoking, exciting experience for the whole family that translates into lifelong learning.

Yvonne Chavez-Lombardi from Kidspace and Lyn Wood and Kathy Gustafson-Hilton from the exhibit’s designer and fabricator Hands On! Inc. recently interviewed Brown about science in his own childhood, his role as a scientist among children’s museum professionals, the impact of fatherhood on his views about science education and his thoughts about involving scientists in a children’s museum.



## Adding a Scientist to the Children’s Museum Equation

### An Interview with Astronomer Mike Brown

Interviewers: Yvonne Chavez-Lombardi, Kidspace Children’s Museum;  
Lyn S. Wood and Kathy Gustafson-Hilton, Hands On! Inc.

comments and corrections, which was great, because for years it was the most scientifically accurate account of those discoveries and the demotion of Pluto. The turnaround time for kids’ books is much faster than it is for scientific books, which take much longer to write and to produce. People would ask me where they could read about this change regarding Pluto, and it was the only source for a few years. It’s now a little bit out of date on the names of the newer discoveries; I need to get them to do a second edition.

**Q. Were you already a dad when you decided to sign on to the Kidspace board?**

Absolutely, and the reason I agreed to sit on the board was because my daughter, Lilah, loved going to Kidspace. She was probably only two at the time, but she loved the museum’s beautiful outdoor arroyo and the Early Learning space, so I was a big Kidspace fan.

**Q. Did they have a reason for wanting a scientist on the board?**

It’s a sciency type of children’s museum, and so having a scientist seemed like a good idea, but honestly, when boards talk about, “We need someone who does X,” they don’t always articulate why they think that or what the person will do beyond having somebody with a different skill set. I think that I’ve been a pretty good fit for Kidspace because of my particular range of interests and abilities, but not every scientist would have been. Having a daughter in the range of Kidspace’s audience has clearly been ideal for my board role. Because of Lilah, and because this was going to make Kidspace even better for her in the future as she gets older, I was willing to commit time to it.

**Q. What are some of your thoughts behind developing an outdoor Enchanted Physics Forest in a space that currently has no trees?**

Part of it comes from my love of California landscapes. I’ve spent a lot of time in the native oak forests around here, which are quite different from the arroyo environ-

**Q. How did you get interested in science? What did you mess around with as a kid?**

I grew up in Huntsville, Alabama, when they were building the Apollo rockets to go to the Moon. It was a place where everybody who lived there, it seemed to me, had someone in the family who worked in the rocket program. So, space and engineering and rockets and astronomy were everywhere and were incredibly natural things for everyone to want to do. My brother and I built model rockets all the time from LEGO. Then, when the model rockets weren’t explosive enough, we graduated to making our own gunpowder and blowing things up. I never actually got in trouble for that, even though I did give myself third degree burns on my arm one time. But my mom doesn’t know that, so don’t write that down!

**Q. Whose idea was it to write the children’s book *The Planet Hunter, The Story Behind What Happened to Pluto*?**

I got a phone call out of the blue one day from children’s book author Elizabeth Rusch. She said, “Hi, I’m writing an illustrated children’s book about you. Would you mind if I interviewed you?” to which you either say yes or no. If it’s no, I guess it becomes the unauthorized children’s biography, so I figured it was best if they actually interviewed me!

I had no part in the book’s conception, but they really did a great job. They gave me the text early on and let me make scientific

ment. I've always found the forests enchanting in their scale, with the big trees and lots of space between them. So, being able to plant mature trees and create this wooded backdrop as a place where these science experiments live is great. You will be able to settle into a native environment while you're also in the middle of a museum—and play—experience. I hate to call it a museum or a playground, because it's neither of those things.

**Q. And the trees help with some of the weather concerns we had about this outdoor exhibition. You could have told us to throw up some shade structures and call it a day.**

We talked a lot about the weather and the fact that Pasadena is so hot and sunny; we would definitely need shade. But, shade structures are expensive and require seismic engineering here. When the idea of planting a native oak forest struck, it seemed to everyone that it was such an obvious, “right” idea. And from there this idea of an *Enchanted Physics Forest* just grew. Of course, now we have to design with all the trees and maintenance in mind!

**Q. What are the advantages of having the exhibits outside?**

I like the openness of it. When we started, our original idea was to add a new building for exhibits. I think we had a fabulous layout, but things were more restricted by the architecture. Once we didn't have a building, we literally got to think outside the box and play more with height and scale. Also, exhibit components don't have to be packed as tightly together as they might be in a building in which you're trying to maximize square footage. That allows us to create a more open place where you can wander and explore and discover things. It's a much more natural setting for exploration.

I wonder, now, how much, if any, of this is an attempt to recreate some of my favorite childhood experiences. We lived at the edge of some woods behind our house, and most of my childhood was spent in the back yard running between trees and rocks and exploring all the nooks and crannies. It's the sort of thing that kids in Los Angeles don't get to do much of. Here they'll have a setting where parents will know it's okay to go and play outdoors. We have some of that already with the museum's current outdoor space, but soon visitors will discover these beautiful science exhibits that will make them want to learn more and find more and explore more.

**Q. What are some of the qualities that you're looking for as the teams develop these outdoor interactive elements?**

I've always pushed to include more experimentation. Even if there's an exhibit where you can only do one thing, I wanted it to include ways to change the variables. I think that's an important aspect of how kids learn; having two of the “same” things but they're different makes you have to think about how things really works. *Distribution of Mass*, in which you experiment with the relationship between mass and inertia, is one of the simplest exhibits that we have, and not the most visually spectacular, but I'm convinced that the right sort of experimentally-minded kid could sit there for hours and explore how things work. Experimentation rather than demonstration makes a big difference in science learning.



*Mike Brown (left), Kidspace board member Orrin Shively (center) and Hands On! exhibit fabricator Charlie Shaw (right) experiment with a prototype of Distribution of Mass in which visitors alter the mass of wheels using movable weights and then race them down an inclined track.*

**Q. Have the team's collective debates and discussions been helpful?**

Yes! The thing about being a scientist and a relatively well-known scientist is that you garner a lot of undeserved respect. There are people who are far too solicitous. I don't need people to do that. In the world of science, you're not used to people saying yes, yes, yes to everything. You're used to exchanging ideas and disagreeing and coming to common solutions. I don't expect my ideas to be correct to begin with, so I'm used to a world where people know different things and are willing to learn and work together to figure something out. I like that part of the scientific world, and it works really well when trying to develop exhibits.

**Q. Is that working well as we develop the Enchanted Physics Forest?**

Yeah, you guys are not particularly solicitous of me! I think it works out.

The trebuchet [a type of catapult] is a good example. I desperately wanted our exhibition to have a giant trebuchet that kids could aim and fire to experiment with altitude and trajectory and force. But, we also needed exhibits that didn't have to be staffed, so we talked about what we were trying to achieve with a trebuchet, debated its pros and cons, and took a long, hard look at safety and operations based on your experience. In the end we came up with a completely new exhibit that expresses the same science in a way that's safe, fun and doesn't require a staff person.

**Q. You're obviously a person who delights in the wonders of the world. Do you see that in your daughter, Lilah?**

If I take an interest in something and am delighted, Lilah is happy to be delighted along with me, but she's equally happy to be delighted by pink bows in her hair. That's just as good as Jupiter moving across the sky, but she's five! I'm sure I was delighted with such things when I was five. There's a fabulous picture of me in a pink shirt and pink shorts that my mother says I insisted on getting. What I don't know is, if I asked my mother what I was like when I was five years old, whether she would say I was clearly into science. Looking around at Lilah and all her five-year-old friends, there's no one I can point to and say, “Yes, this is a kid that's clearly interested in science and the world and the way the world works.” I don't know if I would recognize that in a kid that age.

I'm committed to Lilah having curiosity and a scientific mindset regardless of her doing science as an actual subject, however. I am going to forever make sure that we go around and ask questions and think about things and see how things work. Even if she decides she wants to draw pictures, which is her favorite thing in the world to do right now, I think that's an important thing for everyone to be able to do.

**Q. Are you learning about learning by watching Lilah learn?**

Oh, sure! I have my sample of one. Seeing what she reacts to and likes and learns—Lilah's definitely curious, and I think that curiosity is the same as a boy's, but the way that curiosity gets expressed is different. Boys her age tend to jump in and start pulling things apart, but they're not really pay-

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their “owl eyes” they looked closely at the bones and noticed the lines that make up this reptile. They lightly touched the skeleton. They documented what they noticed with observational drawings using a black pen. Observational drawing invites them to slow down and use their senses to explore the object more resulting in comments like: “It looks like mountains when he curves.” “He has a bump.” “He gets bigger, then he gets smaller.” “This side of the snake is different than this side. It’s smaller.”

Young children develop theories. They speculate based on what they notice and what they remember from previous experiences. Observations of the snake skeleton suggest several theories about the function of the bones: “Maybe those things help him move.” “I think those held on to his scales.” Theories about what ants eat proposed by children in the Old Blues Class, one of several preschool classes at The Family Museum’s Preschool Alternative, are very

much informed by the experiences of this class’s four-year-olds and what they like to eat. Ants would want to eat gold fish crackers, gummi fruits, cheese sticks and cookies. The group tests its theory, filling petri dishes with likely ant food favorites, and placing them where ants crawl around (in the dirt). They check the dishes daily, count the ants in each dish, and record the number of ants on a chart. After two weeks, the Old Blues conclude that ants like sweet foods; and, they observe, they do, too.

### An Early Start to Science Learning

Young children are eager for meaningful discoveries and are active and delighted in pursuing them. Time to engage in the complex process of learning guided by a teacher’s skilled facilitation encourages children to pay attention, build on old discoveries, find new connections, form new questions and follow their learning over days and weeks

and years. This process unfolds daily in preschools all over the world.

The potential of object-filled museums, with exhibits and collections to enrich daily activities and weekly preschool projects certainly distinguishes a museum preschool from other preschools. While use of these resources can and does vary, museum preschools also operate within an informal learning context and approach that guides the rest of the museum’s activities. The high value museums place on learning experientially with objects aligns firmly with the active, hands-on investigations of a young child’s science learning. 

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### Adding a Scientist to the Museum Equation *continued from page 5*

ing attention to what they’re pulling apart. She’s much more cautious and frequently more methodical in what she’s doing. Lilah has no problem digging and exploring, but she does it in a way that’s clearly different from her friends who are boys. It’s interesting for me as a man; she and I are learning this part together. We all see a limited set of kids from which we draw generalities, but that’s the one that seems to be true amongst her friends. With clear exceptions, however, so who knows! Kindergarten has been fascinating, just watching them and how they learn.

#### **Q. Do you think we’re addressing those gender differences in the Enchanted Physics Forest?**

Definitely. We’ve spent so much time trying to make sure that both boys and girls will find the exhibition enticing. Everything from the colors and materials we’re using to the scale of the experiences to the layout of the park to making sure there are exhibits you can do solo or socially with friends and parents—everything has an impact. It will be really interesting to see how it plays out when girls and boys are finally using the exhibits.

I know a good deal about educating college students, but I’m an amateur at younger kids. An interested amateur, but still an amateur. I rely on Kidspace to know the right thing to do and how both boys and girls that age learn best.

#### **Q. When the Enchanted Physics Forest opens and you take your daughter for the first time, who’ll be more excited, you or her?**

I’m going to be excited to take her there and I will have the biggest smile on my face that anyone has ever seen. I’m not going to point anything out or push her in any direction. I want to experience that wonder of the forest for the first time through her and see where she runs. I know the very first time she’ll spend ten seconds at each exhibit, but maybe there will be some things that she stays and works at. I just can’t wait, although I did promise her that we would go before it opens!

#### **Q. Do you have any advice for other children’s museums who want to get involved with scientists like you?**

My first advice is to find someone with a kid the right age or younger. Most of the board members at Kidspace have kids in the museum’s target age range or had them when they joined. It’s funny to go around for introductions and instead of, “Hi, I’m Joe Smith and I’m the CEO of whatever,” it’s “Hi, I’m Mike Brown and I have a five-year-old daughter.”

Second, not all scientists are good candidates for children’s museums boards or any board, for that matter. I take a strong interest in education at the college level, and I think I had just gotten a Teacher of the Year award at Caltech when Kidspace contacted me. It doesn’t mean you should only look for

people who win prizes, but it’s a good thing to look for—someone who is well-regarded by students as a teacher. It doesn’t mean that will translate down to young kids, but without it, the odds are probably not so good. I think those are the two things to look for.

It doesn’t require getting prominent research scientists, either. My research doesn’t really enter into my efforts at Kidspace; it’s much more my teaching. There are fabulous teachers everywhere, at Caltech and at community colleges. I know lots of scientists who would be equally good at what I’m doing with Kidspace, but people don’t think to ask them because their names aren’t in the news. They’re out there everywhere if people are willing to look for them. 

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