

observational studies. You have a bunch of birds on the ground, and then they suddenly all go up in the air and fly together at the same speed. It has to do with control theory, and robotics people want tiny robots to communicate with each other. They are the same phenomena. So they want to see how they can organize these kinds of common phenomena. A similar phenomenon occurs when a language emerges. The idea is how one can reach common understanding through the senses. In economics it would be the belief in a common price system, a necessary condition for prices to operate. So it goes back to my old question in economics: How do people arrive at a common belief in a price system?

**Szpiro:** *You have observed mathematics for half a century. Where do you think the field is going?*

**Smale:** My feeling is that there is a shift in mathematics away from traditional areas of physics. It used to be a big area for mathematics and for thousands of years inspired a lot of mathematics. But mathematicians seem focused too much on physics. I believe that things are changing much more in mathematics than in physics. Like the areas that I work in, like vision and the other questions coming in from biology, statistics, engineering, computer science, and especially computation. A lot of these things influence the way that mathematics is changing. So where is mathematics going? It is leaving physics to a great extent and moving into the areas I just mentioned.

**Szpiro:** *These are areas of applied mathematics. What about pure mathematics?*

**Smale:** I am not talking about applied mathematics. I don't believe in that dichotomy. I am talking about using mathematics to understand the world. When developing calculus and differential equations Newton was doing mathematics in order to understand the laws of gravitation. Did he do applied math? I don't think so. Did he do pure math? No. So that's the kind of mathematics I am thinking of. It's not what it was 150 years ago. Problems come down more from computer science, engineering, and biology. But it's mathematics proper, it's not applications.



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