

*Discurso de investidura como Doctor "Honoris Causa" del
Excmo. Sr. D. Paul H. Rabinowitz*

30 de enero de 2009

Rector Magnífico de la Universidad Complutense de Madrid,
Esteemed Colleagues,
Ladies and Gentlemen:

It is a great privilege and pleasure for me to receive an honorary degree from this ancient and distinguished university. It is especially gratifying since as Carlos Fernández Pérez mentioned, I have long had ties to members of the Mathematics Department. They began in the early 1970's when two young students, Carlos Fernández Pérez and Jesús Hernández, took the course I taught at the University of Paris on Topics in Nonlinear Functional Analysis. More recently, about two years ago, at the invitation of Julián López Gómez, I gave a short course here. So thanks to them all, as well as to the members of the Mathematics Department, who helped make this occasion possible.

Whatever I have achieved required lots of encouragement and support, so further thanks are due to many others: my teachers, especially my thesis advisor, the late Jürgen Moser; my collaborators, especially Mike Crandall and Antonio Arnbrosetti, whose names Carlos mentioned; my colleagues in Madison for making it such a congenial place; and of course to my very patient wife, Birgit.

Mathematics is what brought me here so I want to make a few observations about it and its practitioners. Mathematics is different from the other sciences. Mathematicians don't need expensive laboratories or elaborate equipment. This freedom from being in a fixed location allows them to work anywhere in the world, even while travelling on trains or planes. One famous mathematician said he did some of his best work on the beaches of Rio. Mathematics is a universal subject. Research on mathematics is done throughout most of the world.

Mathematicians like to communicate with each other, When they get together at conferences, in their enthusiasm to discuss their research, they will write on any surface available. At mealtimes this means even napkins or tablecloths! This does not endear them to restaurant owners.

Every four years there is a very large meeting called the International Congress of Mathematicians. Back in 1986, it was held in Berkeley, California. I've been told that since it was a major scientific event, the New York Times sent a reporter as an observer. He went to several talks and wrote an article about the meeting. It said the majority of talks were 45 minutes long and they consisted of 3 parts. First an introduction accessible to all. Next came a more specialized

presentation appropriate for people in the general area of the talk. Then there was a final part understandable only to the speaker and a handful of his closest professional colleagues. To save time, most speakers began directly with the 3rd part. I suspect this story is apocryphal, but there certainly is truth in it!

A rough classification of mathematics divides it into two parts: pure and applied. Applied mathematicians tend to make and explore mathematical models of real world phenomena and for them the computer is often a major tool. Just to give you the flavor of the areas this includes, in my own department alone, we have people who do research on topics as varied as medical imaging, chemical and biochemical reactions, mathematical physics, cryptography, geophysical fluid dynamics and mathematical biology. Of course there are also people in other departments who apply mathematics.

In contrast to applied mathematicians, pure mathematicians deal with abstractions. They have developed notions and associated terminologies which give great precision to their work. Unfortunately this precision creates a knowledge barrier that makes it very difficult to communicate about their subject with non-mathematicians, even highly educated ones. That's why I haven't tried to discuss my own research here.

Even the purest of mathematical areas can have unexpected and important applications. Here's a nice example. When we look at something as commonplace a printed word or even a letter, who would think that what we see is the result of pure mathematics. Indeed hidden in the heart of a software package that controls the printer, there is an important mathematical tool that determines the appearance of the printed letters and words before us. This too is called a *B-spline*. The word *spline* was first used in mathematics by my late colleague, Ivo Schoenberg. Back in the mid-1940's he introduced a family of tools into the field of mathematics called approximation theory. Although of considerable theoretical interest, B-splines had little practical value because of difficulties in performing computations with them. But years later came two important breakthroughs. The first was the appearance of high speed computers and second was the development of a highly useful algorithm to work with B-splines. Nowadays, B-splines play an essential role in a wide variety of fields ranging from computer graphics to computer aided design. For example, they are routinely employed in the automobile and aviation industries. The algorithm I mentioned was discovered by my colleague, Carl deBoor in the early 1970's and for his work, he was awarded a Presidential Medal of Science a few years ago.

I'm going to tell you my favorite piece of mathematical humor. Although it is best appreciated by mathematicians and their spouses, it is also enlightening to others. The following question is posed to a doctor, a lawyer, and a mathematician: Is it better to have a wife or a mistress? The doctor answer is "A wife. Marriage leads to a more stable life. It's better for your health. It's too stressful to have a mistress". On the other hand, the lawyer says:" it's better to have a mistress. If you are married, conflicts are inevitable and they can lead to

messy lawsuits. A mistress is better.” When the mathematician is asked, he responds “It’s better to have both. Then if you are not present, the wife thinks you are with the mistress, the mistress thinks you are with the wife, and you can go to your office and work on mathematics”.

On that note, it’s time for me to stop and go to the office and do some mathematics!

Thank you.