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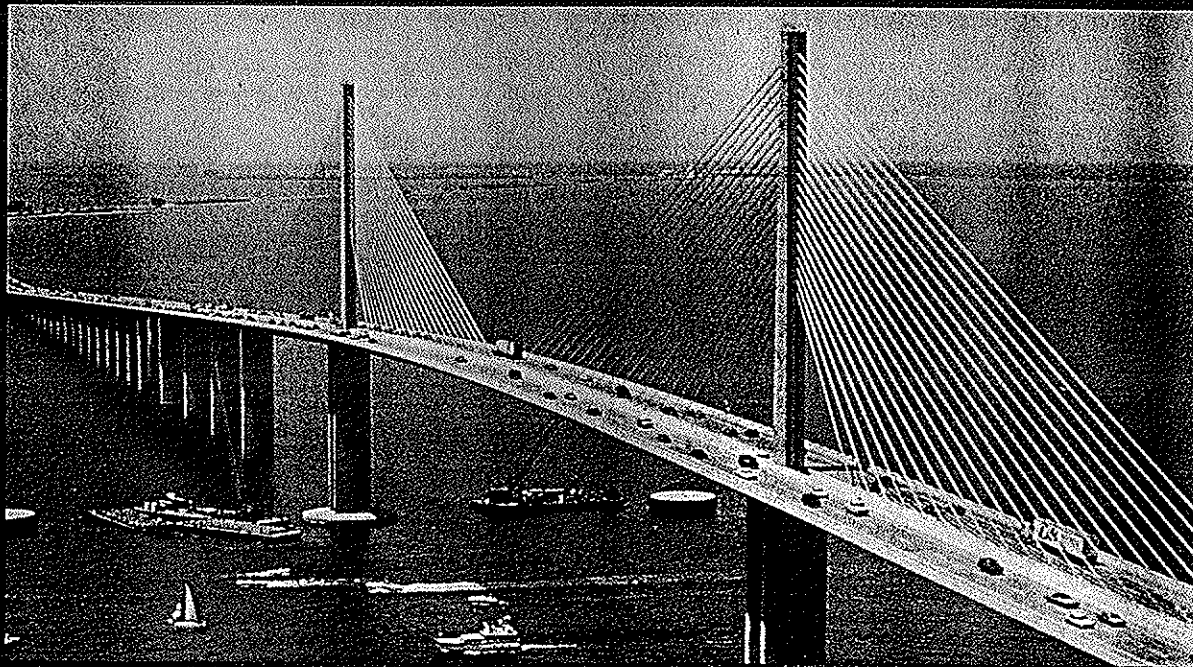
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Let Them Eat Chips

Ralph E. Gomory

The world is changing around us, but many of the most influential models we use today do not reflect or accommodate to that change



Ralph E. Gomory is president of the Alfred P. Sloan Foundation. This article is adapted from remarks delivered at the presentation of the 1993 NAE Arthur M. Bueche Award.

It is certainly a great honor for me to receive an award from this academy. I have always taken particular pride in being a member of the National Academy of Engineering, and although my early origins were in science, or worse yet, in mathematics, I have been fortunate in spending many years of my life in close contact with engineers and have come to deeply admire the difficulty, complexity, and importance of what engineers do.

I had the good fortune at an early point in my career to experience some of the complexity of real-world problems first hand. Together with my partner Paul Gilmore, we worked to install computers in paper mills, to solve the so-called paper trim problem. Each installation was a struggle as we learned to adapt our methods to the particular realities of each paper mill and to show that our mathematical and computer-based calculation could do better in actual practice than the cut-and-try methods that were being used.

Sometimes we won and sometimes we lost. Once we won, though our

results were not really better than what they were doing, because the person who did the cutting was going to retire, and there was no one else who could do it that well. Once, in a wood cutting application, we lost though our test system performed better. That is to say, it performed better in the few hours before its electric eye, which detected the knots in the wood we were cutting, became clogged with sawdust. That test system was thrown out and never got back in.

Then and on many occasions since then as part of the rapidly evolving computer industry, I have been struck by the complex and nonobvious factors that often divide success from failure. In contrast with this complexity, the economic models that are very influential in national policies toward industry are remarkably simple and often do not reflect the realities of modern industrial life.

It's not what you don't know that hurts you, it's what you don't know you don't know that hurts you.

Having the wrong model and not knowing you have the wrong model and therefore pursuing it with conviction can be quite damaging. It has been said that it's not what you don't know that hurts you, it's what you don't know but think you do know that hurts you. Or alternatively, "it's not what you don't know that hurts

NAE President White presents the 1993 Arthur M. Bueche Award certificate to Ralph E. Gomory "for exceptional contributions to the theory of discrete mathematical optimization, leadership in the management of research and development at industrial and professional institutions, and advising the government on research and technology policy."

you, it's what you don't know you don't know that hurts you." In this form, this thought has been ascribed variously to Yogi Berra, the Marx Brothers, Machiavelli, and Sophocles, among others.¹

The damaging effects of not knowing what you don't know can sometimes be quite extreme. More than 200 years ago, Marie Antoinette stood on a balcony watching the Paris crowds clamoring for bread. Reacting to what she saw as their unreasonableness in insisting on that particular article of food, she uttered the immortal words "Let them eat cake."

I like to think that standing next to Marie Antoinette was some grizzled councilor who, on hearing her views about bread and cake, muttered to himself "Her Majesty has the wrong model," and hopefully even went on to say "ce n'est pas ce que vous ne savez pas qui vous fait du tort, c'est ce que vous ne savez pas que vous ne savez pas, que vous fait du tort."

Whether Marie Antoinette actually said anything like this is doubtful. But it is true that the life of the court to which she belonged was remote from the realities of the life of common people, so it wasn't easy to get the model right. And, though it wasn't obvious, the whole monarchical outlook, or model, of which her remark was only a manifestation, wouldn't do any more. In France the functions of the nobility had disappeared while their privileges lived on, and the entire old regime had become vulnerable to the criticisms of Voltaire and the other philosophers. The world was starting to change around them.



While this was hard to see, what anyone at that time could see was a fiscal crisis. The government debt, and even the deficit, increased year after year, in spite of every attempt at retrenchment and despite the resort to every fiscal expedient. The taxes the government could raise simply could not cover the sum of domestic and military expenditure. Finally, and unwillingly, the king was obliged to summon the Estates General to obtain their consent for new taxes. But in that changing world, the Estates General did not obediently confine themselves to voting new taxes but instead launched the monarchy on the rapid downward path from which it never recovered, and which led with stunning speed to all the convulsions of the French Revolution.

More than 200 years have passed since that remarkable period of history. Marie Antoinette and all those who participated in those tragic days are gone, but bad models live on. In place of "let them eat cake" we have today a modern American government official staking his claim to immortality with the deathless words "computer chips, potato chips, what's the difference, they're all chips."

Once again it is not clear that these words were ever uttered, but once again they do convey an attitude that is there. There are simple and widely used models that tell us that all change, including the loss of major industries, is for the good because, in these models, such a loss always involves a gain somewhere else in the economy that more than compensates for what is being lost. And in these models a dollar of potato chips is as good as a dollar of computer chips. These are the models that have told us in the past, for example, that the exchange rate adjustment mechanism would automatically take care of the trade imbalance. And these and similar models cannot explain the most important feature of our present time, the general slowdown in U.S. productivity.

I believe that the world is changing around us, but many of the most influential models we use today do not reflect or accommodate to that change. These models do contain remarkable and useful insights, and in recent years especially, some models have begun to incorporate important new elements, but those that mainly affect thinking today are deeply rooted in a world in which there were almost no large organizations, technology moved slowly, and international trade consisted of England exporting textiles to Portugal,

and Portugal selling wine to England.

Although we may be outraged by "computer chips, potato chips, what's the difference, they're all chips," the sad fact is that we don't have anything coherent to offer in its place. You can't beat something with nothing, so these models and points of view will continue to have great influence until there is a more general realization that things are more complex than that.

Unfortunately, the true complexity of industry is almost invisible to almost everyone. Students in our colleges can choose to learn something about science, but they can learn almost nothing about real technology or the workings of industry. Both our university faculties outside of the engineering departments, and the various arms of government, legislative or executive, have too few people with experience of this process. Yet it is from the nonengineering parts of the universities and from government that come the models and the policies that affect our response to a changing world. Meanwhile, in industry itself, those who do know something are engaged in getting on with the work of the world. They are engaged in making things work, not in producing intelligible pictures of what is going on.

The true complexity of industry is almost invisible to almost everyone.

We need to make more visible what is really happening in our own individual industries. There is no problem more important for the country today than increasing the economic growth and national productivity on which real wages and the standard of living ultimately depend. We in industry can certainly not explain the changes in some national productivity index, whose ups and downs no one has ever succeeded in explaining. But we can explain in concrete terms what affects productivity and growth in our own industries. And it is, after all, these industries added up that make up national productivity.

We must make clear that the type of industry matters. There are some industries in which cutthroat

competition and little choice of technology or of manufacturing or marketing methods, will always force wages down to the level of the lowest wage participant. But there are others in which the rapid evolution of technology, or the ongoing evolution of special manufacturing skills, or even the ability to understand what is needed in a rapidly evolving market, are the decisive issues, not the price of labor. We need to show by concrete examples that the contribution of many of these industries to the nation is not measured by their profits alone but by the high wages they can afford to pay, by the unique skills they develop, and the other industries they affect and advantage.

In short, we need to show, by bringing forward a more detailed and more realistic view, that when it comes to the real world, computer chips are not potato chips.

We need to add these thoughts and our direct knowledge of the particularity and complexity of industries to

the more abstract discussions that generally take place. We are the only people who can do this. Others have at best a distant view of what we do. And if we look, we will find ways to do this.²

We cannot continue to leave the discussion of our own fate so entirely in the hands of others.

Notes

1 While these references are, to say the least, apocryphal, I am grateful to the member of the audience who gave me a real reference to chapter 71 of the (circa 500 B.C.) Taoist classic, the Lao-tzu.

2 One example is the Sloan Foundation's program of industry centers at major universities. The principal objective of this program, which requires a high level of industry cooperation in each of the seven industries involved, is to bring a realistic view of each industry to economists, engineers, and others in the university world.