

A program for Universities and Science Museums

by

Leo P. Kadanoff*

University of Chicago

*e-mail: LeoP@UChicago.EDU

Abstract

I am going to describe a program for cooperation between universities and science museums which we put into place in the years 2002-2008 in the City of Chicago.



goal: informal science education

Roles of Science Museums, Science Centers

Story 1. Oliver Sacks

Story 2. Overheard in New York's American
Museum of Natural History

Chicago's Museums

Art Institute of Chicago

Adler Planetarium and Museum, The Field Museum,
The Shed Aquarium

Chicago's Museum of
Science and Industry



small museums in
neighboring cities:
e.g. SciTech Hands-on-
Museum, Aurora

Museum's have an important role to play in inspiring us to value the cultural treasures they house.

In the United States, we have valued science and technology too little. Science and technology enable us to make real things. Instead in recent years, we have looked to the transfer of money, information, and images to form the center of our economic life. This center has proven hollow.

Museums like the Museum of Science and Industry can help us to better understand the value of technology and science. The fact that they are tremendously undersupported only reflects the weaknesses that we see resulting in the crash in our economy.

Purposes of Chicago Museums:

Support Tourism

Educational Mission for

not only for Schoolchildren

but also for University of Chicago.

The University of Chicago Benefits from these
Museums in our Educational Mission.

We have an NSF Mandate to look broadly

NSF support science and also

broader social missions

Specifically, the large multi-investigator NSF labs each have a broad program of outreach activities. I'll talk about museum part of one of these here.

MSCOPE Program (2002-2008)

Museum of Science and Industry, SciTech, Chicago

Outreach Program in Science Education

of museum visitors, graduate students, museum staff, professors, ...

described by

Leo P. Kadanoff

Professor emeritus, University of Chicago

President, American Physical Society (2007)

Member and Past Director of UofC Materials Center (NSF)

sources of program support:



MRSEC

SciTech
HANDS ON MUSEUM



Our program was aimed at helping

- **grad students** learn about the public presentation of science.
- **museums** get university based knowledge.
- **universities** and **museums** get new resources.
- **students** and **teachers** get paid
- **students** develop new career paths
- **museums** find a new source of professional talent

I am here today to explain to you in a nuts and bolts way how to do this kind of job and accomplish some fraction of these goals

Program Content

We trained 12 grad students per year, half from the sciences and half from the social sciences. They each worked about 10 hours per week during an academic year, in museums and at the university.

This provided enough time so that we could teach them effectively. We taught them how to design materials and exhibits for science museums. But, the work was spread out over enough time so as not to detract substantially from their graduate training. We always kept their main graduate training as their first priority.

Our work started at SciTech

Ronen Mir, physicist and SciTech chief, explains physics to our interns



The students spend their first quarter in learning about museums, the second in discussing possible projects for exhibits and demonstrations which would be useful

for the cooperating museums, and the third in building and testing their designs. They are taught by museum staff and university-hired “coaches”.



graduate students being instructed by museum staff at SciTech hands on museum in Aurora Illinois

A different Kind of Enterprise

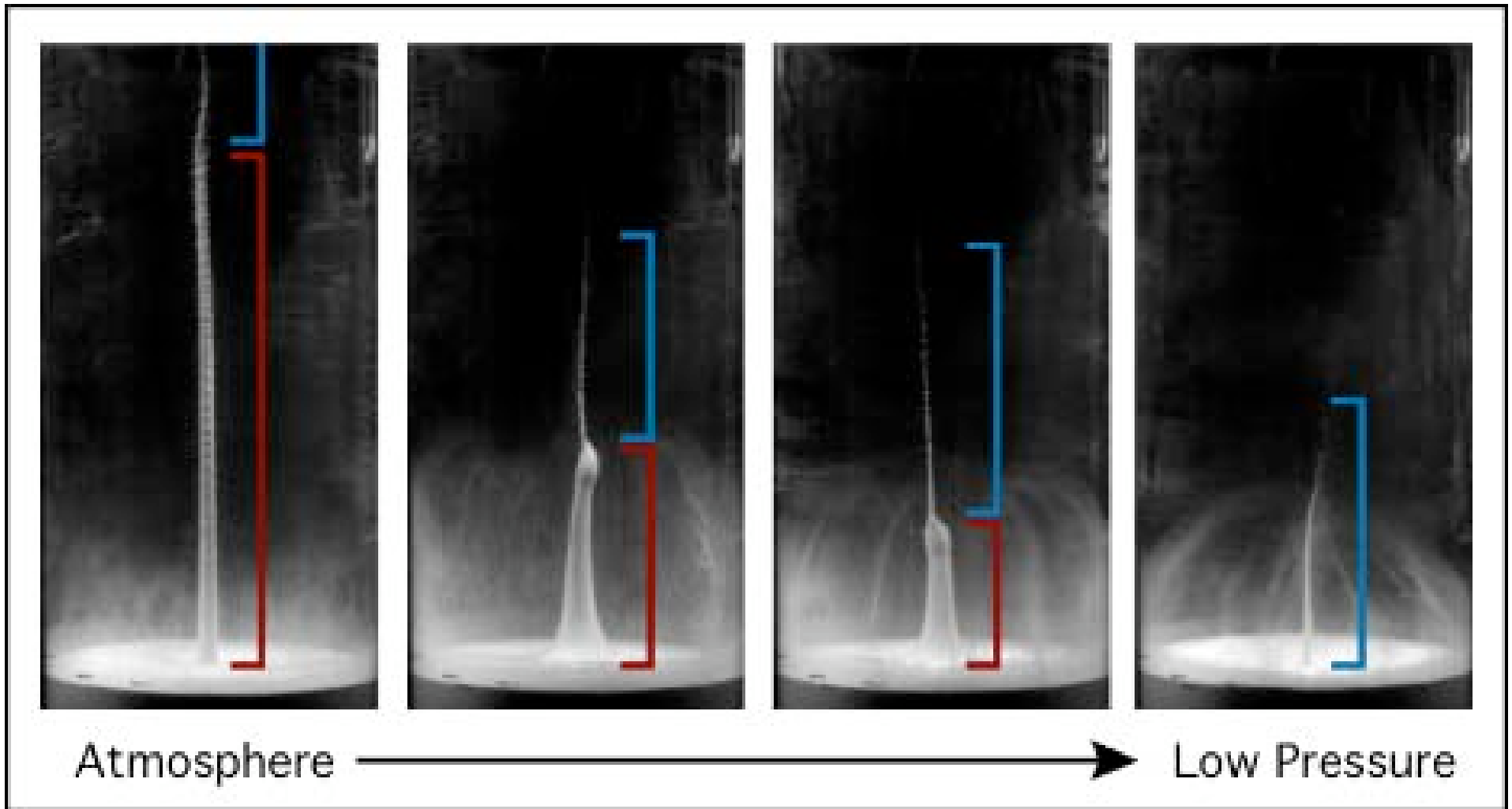
In some ways this work is entirely different from the other parts of their graduate and undergraduate work. A key piece of the work is the outcome: a workable design for a museum exhibit or activity.



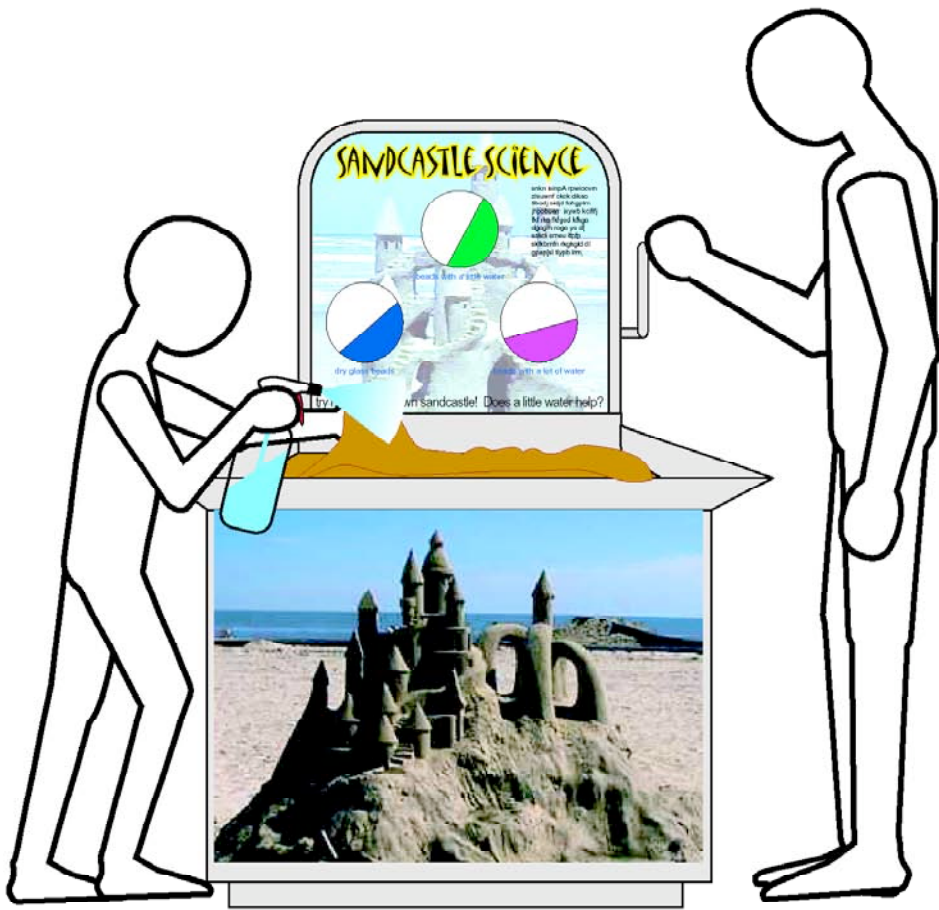
Sand at Chicago

For us, museum work starts from an understanding of some piece of science, in this case the behavior of granular material. Since I love science, I can hardly forego from talking about our science. Here is one spectacular experiment which we are trying to fit into a museum environment.

sand jets: A metal ball is dropped into uncompact sand
two jets emerge



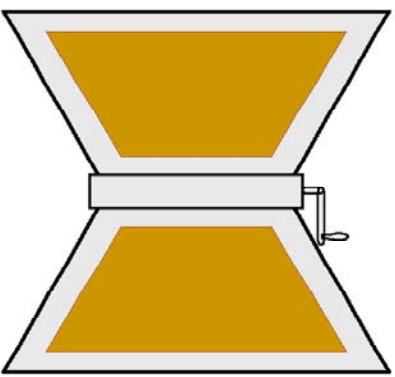
Our sand-study inspires museum exhibits



5'



2004



Circular containers are partially filled with a granular material, possibly colored glass beads. One container holds beads only, one holds beads with a small amount of liquid, and one holds beads with more than enough liquid to cover the beads.

The hand crank on the side turns all three containers at the same rate and in the same direction, making the beads tumble. Visitors can observe the beads tumbling, and that the beads within each of the containers achieve different angles before tumbling.

top view, double-sided unit



2006

wet sand slides differently from dry

Finished Exhibit on the Museum Floor 2007



Adler Planetarium and Museum wanted interactive computer material



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SciTech brought us to use equipment which produced 3d graphics, which Mark SubbaRao, from Adler, loaded with data about star positions

With our computer sciences students, Denoj and Daniela Rosner, Adler put together an interactive star voyage in 3D





Administrative Issues:

Program is broader than any department
Therefore hard to fit into university framework

teaching, leadership of grad students in University done by
“coaches”, who are part time faculty
Coaches are hard to fit into university framework

Program offers grad students \$1000/ quarter.
Additionally, in hard sciences, faculty owns students. We pay
student salary and tuition for one quarter to convince faculty to
release grad student time. That usually works.

It's hard to have museum staff and university people work together
There are significant differences in outlook and compensation
rates.

Chicago's Museum of Science and Industry

We worked with their education department on science shows for visitors. In fact, there were two separate groups doing this: the MSCOPE group and one under under Prof. Heinrich Jaeger. The latter started by putting on shows at MSI, and moved to school groups.

a science club school show by one of the Jaeger grad students



As this was happening MSI was planning the structure of its main science hall with Profs Jaeger and Nagel

MSI puts on Leonardo Exhibit and then features Nagel's & Jaeger's experiments as “modern Leonardo’s”



Using MSCOPE for public outreach

Bridge It!
MSCOPE 2006-07

Development Team
Milena Tsvetkova
Keith Vanderlinde
Panos Oikonomou

Design bridges and experience engineering at the Museum of Science and Industry

Description
Bridge It! is a hands-on exhibit that invites visitors to experience a design process and to explore the rules of structural engineering through the challenge of building a bridge. Visitors use a collapsible bridge deck, ropes and pieces of wood to build a bridge and test its strength with weights.

The exhibit demonstrates how the three main aspects of structural design – static mechanics laws, material properties and economic considerations can be creatively exploited.

The modular and open-ended nature of the exhibit develops creative thinking and artistic expression.

The challenge of solving an engineering problem helps visitors learn to apply the concepts, principles and processes of technological design – they identify a design problem, consider limitations in available materials, build a simulation, test it, assess the results and make improvements. Visitors gain an applied understanding of pure scientific concepts such as tension, compression and torque forces, and Newton's second law.

MSI's Leonardo exhibit had a bridge that public could build

Our students independently designed a better and more flexible bridge

MSI took our bridge downtown as part of a citywide show called Science in the City. It was a big success

We then took our Museum Team to Washington

Two divisions of APS threw a party to advertise their work to Congress

Chicago people including the MSCOPE group entertains in a APS, DCMP +DAMOP party in the Rayburn house office building. Our MRSEC director is in the foreground. Many congressional staffers, **Vern Ehlers**, **Rush Holt**, **Arden Bement** come to party.

Our message to Washington: basic research is vital to America's economy and our children's futures (and it's fun!).



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Our MSCOPE students learn that research is only half of a scientist's job- the other half is telling people about it.



Sarah Case (working for MSCOPE) , **Meg Warnement** (a congressional staffer), **Sid Nagel**, and a granular flow exhibit.

Sarah just got her Ph.D. and is going to work as a intern for NAS/NRC

Sid Nagel visits the Exploritorium

They brought him there for a month to consult about exhibits.
Three of them came to us for two weeks.
More contact to come.



Bottom Line:

With a substantial investment from science center, university, and outside funder one do many important things, e.g.

make the graduate students better communicators, especially by making them aware of their different audiences



allow the museum visitors to be more informed about science and scientists

help the museums better serve their visitors and bring them better knowledge of science.



Help some grad students and museum visitors see new career opportunities

The program worked

Things got designed for the museums. These things work on the museum floor and in other contexts.

The grad students enjoyed the process, partly because it put some variety into a too focused curriculum. They worked long hours and reported themselves to be happy doing so.

The program did not disrupt the usual process of disciplinary training.

Some students went on to jobs in the world of museums and informal education. Each major Chicago science museum has hired at least one of our graduates.

With many thanks to

Policy Committee:

Ronen Mir, Leonid Irakliotis, Morrie Fred, Leo Kadanoff

University instructors, “coaches”: Panos Oikonomou, Debby Mir, Brenda Lopez, Jim Sweitzer, Randy Landsberg, Eileen Sheu, Anshu Dubey, all of whom taught me about museums and teaching

Museum people: Ronen Mir, Bryan Wunar, Shawn Carlson, Mark SubbaRao, and many more people from their museums, all very inspirational

