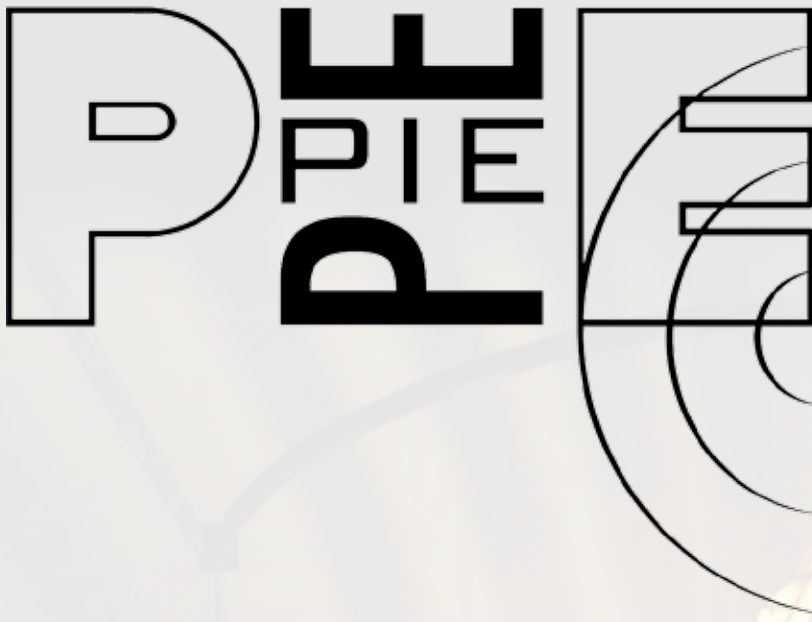


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ATELIER DOCUMENTATION

KINETIC CONTRAPTIONS AT THE EXPLORATORIUM JANUARY 22 - JANUARY 25, 2006





ATELIER DOCUMENTATION

The PIE Institute is a museum collaboration offering professional development opportunities for informal educators to explore new approaches to teaching science, art, and technology.

<http://www.exploratorium.edu/pie>

KINETIC CONTRAPTIONS

January 22 - January 25, 2007

At the Exploratorium
San Francisco, CA

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Cover image: Math and the Night Sea: The Round Wave, by Reuben Heyday Margolin October 2006 Exploratorium Seeing Gallery.
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a~te*lier
/n. [F] a workshop;
a studio for an artist
or designer.

PIE Institute Ateliers
explore new educational
activities utilizing digital
technologies, and provide
opportunities to share the
PIE philosophy of
teaching and learning.

The Kinetic Contraptions Atelier was for museum and out-of-school educators who wanted to combine art, science, and technology in exhibits, workshop activities, and museum public programs.

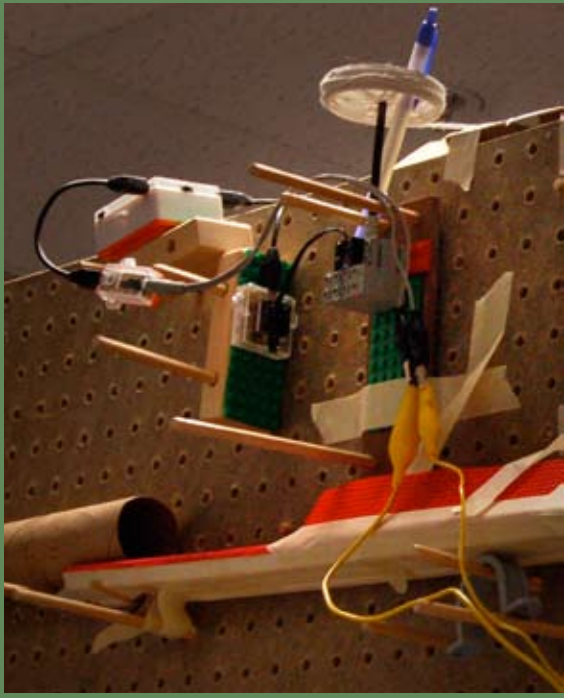
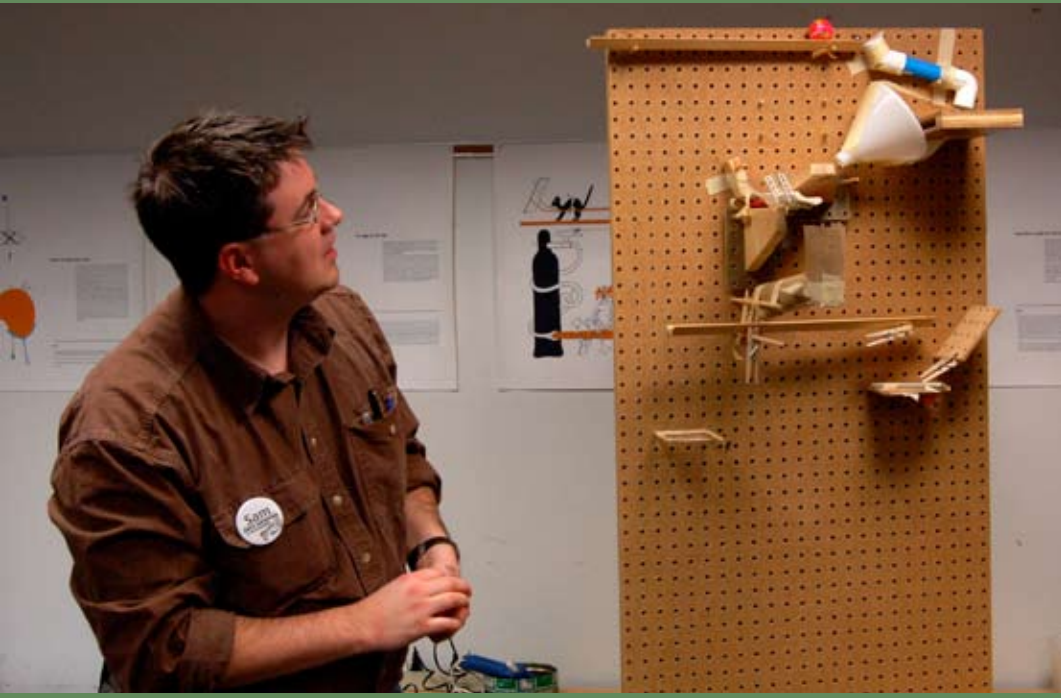
Participants explored Kinetic Contraption projects as learners, then deconstructed the activities in order to better understand how they are developed and tailored for diverse educational and audience needs. Projects included constructing marble runs, building computer-controlled kinetic devices, playing with light and shadow, contributing to a chain reaction contraption, and other activities.





Clockwise from top: Lani and Anita collaborate on their marble machine; Detail of an integrated PicoCricket; Sam waits for the ball to drop.

We constructed marble runs out of common materials, then introduced technology as an optional way to add new kinetic elements to the activity.



"I like the process of messing around. I like how you make something, and then you make something else, and then you have to go back and adjust the whole thing." Vayu

WHAT HAPPENED TUESDAY

Tuesday began with participants exploring a variety of shadow and light stations, as a way of becoming familiar with the phenomena.



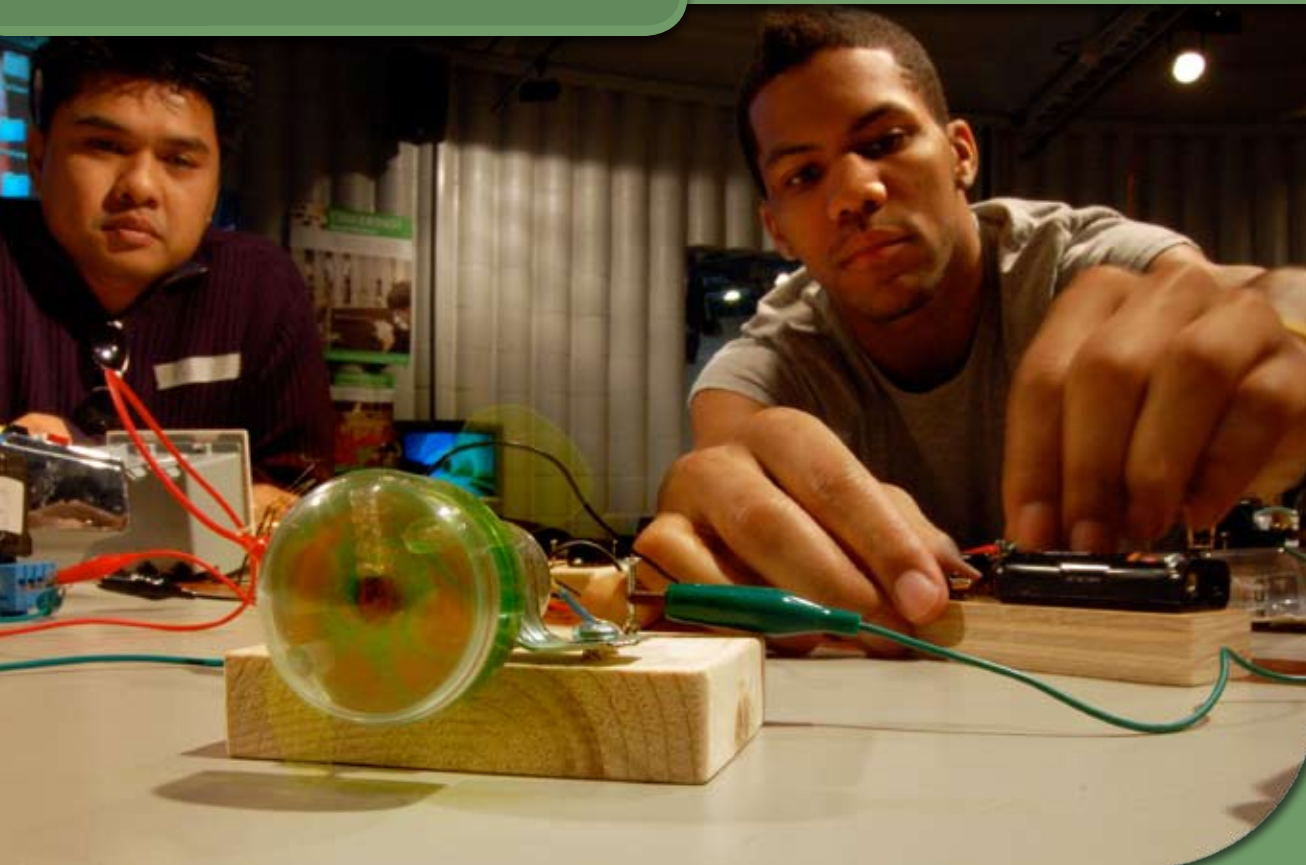
Vayu explores shadows and moire patterns.

We spent the afternoon constructing interactive shadow and light contraptions, in order to dramatically transform a space.



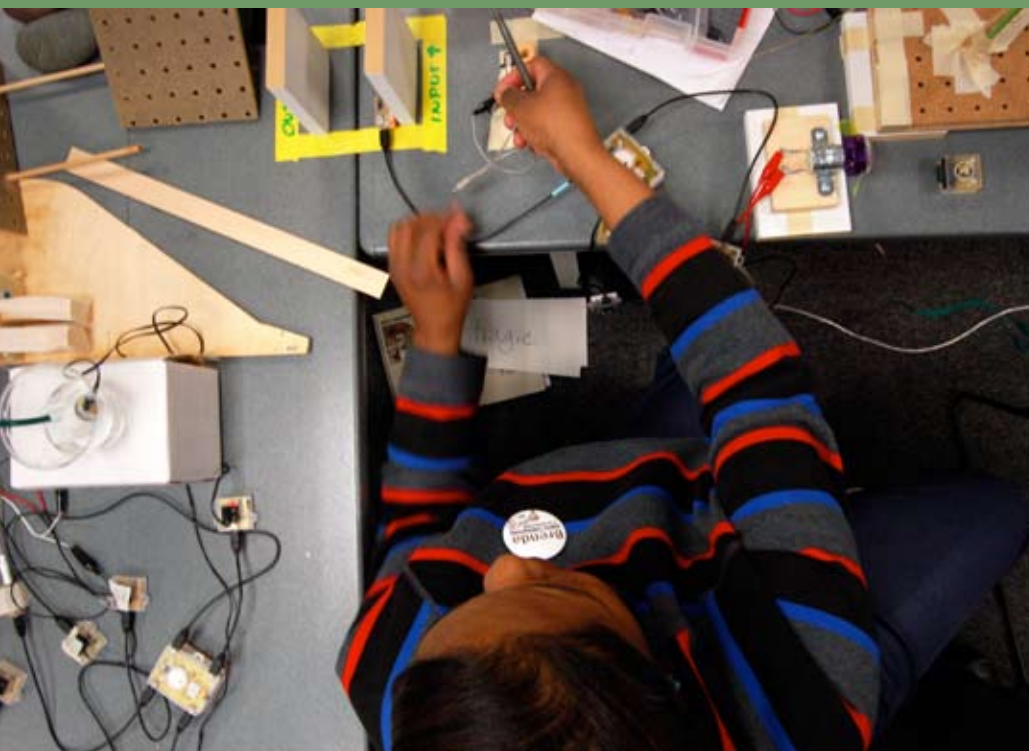
Anne starts her interactive light room with a roll of paper and a strawberry basket.

"I was inspired by the exhibits where the effects were created accidentally. I like incomplete things that have a lot of potential to become something." Brenda



The day started with a discussion about the pedagogy of PIE activities. Participants then explored a variety of home-made inputs and outputs.

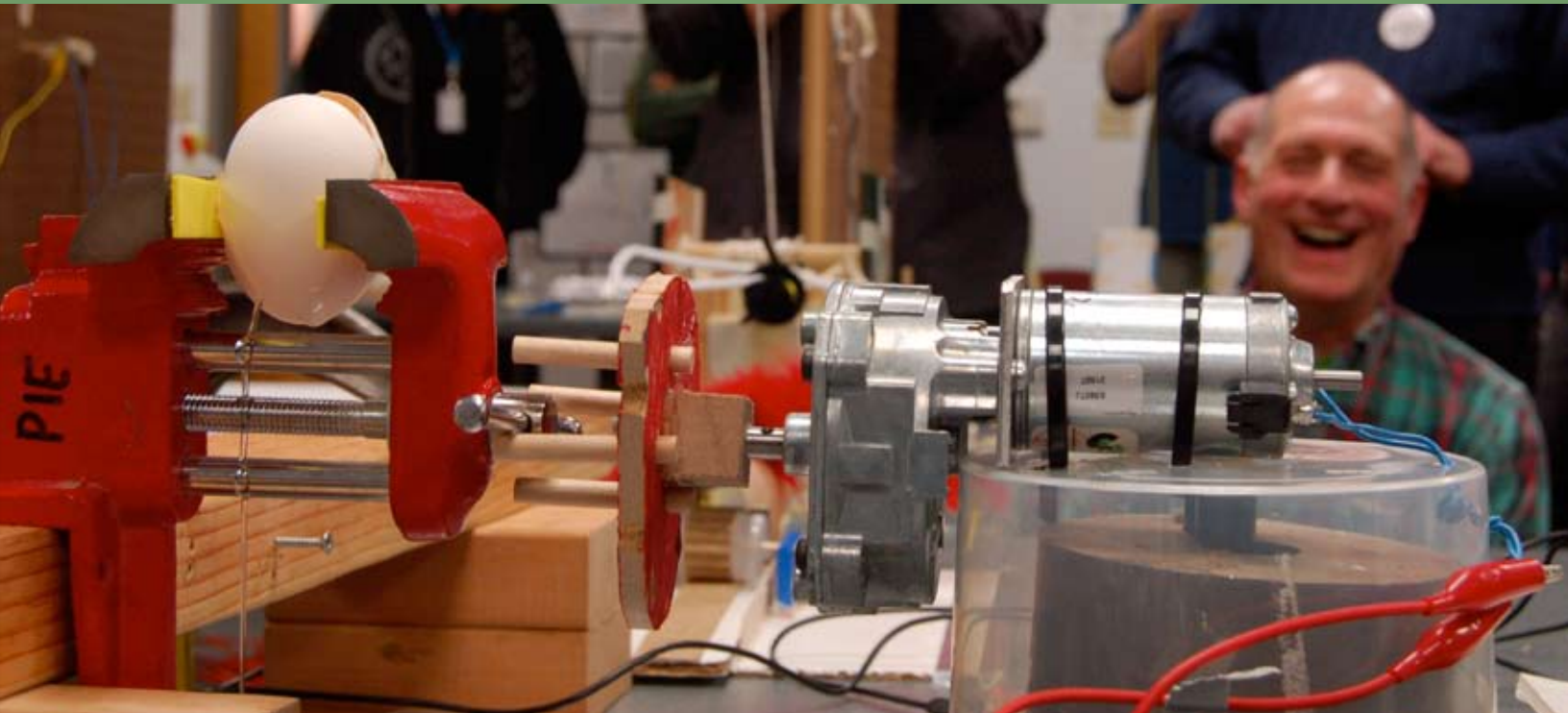
The chain reaction activity was introduced in the afternoon, and participants started by building on the theme: Machines that demonstrate LOVE.



"The demonstrations of the various home-made switches and relays opened it all up. It made so many new things seem possible." Lani



We completed our individual chain reaction elements, then connected them together and started the Love Machine chain reaction.



Our final discussion was an opportunity for everyone to share the big ideas from the week that they plan to bring back to their home institutions.

“The use of the love metaphor with the Chain Reaction activity gave the whole process a richness of language, an embedded aesthetic.” Sam

Atelier Goals

- To share a set of new and established PIE activities
- Demonstrate the integration of artists in the development of PIE activities.
- Model ways of integrating technologies into phenomena-based, PIE activities.

Atelier Context

Technology has an important role in PIE philosophy and practice, but technology is not the main focus or even the main tool of PIE's work. PIE Ateliers offer opportunities to gain greater understanding and facility with digital technologies such as the Cricket, computers, cameras, and cell phones, as well as with power tools such as drills and skill saws.

Technological skills and literacy are important to the pedagogical goals of PIE, but they are just two aspects among many. The emphasis in PIE is on working with simple materials and real natural phenomena. Technologies, whether mechanical or digital, are introduced to advance ideas that begin with more basic explorations.

MONDAY OVERVIEW

Monday's Theme

Marble Machines: no tech, low tech, and high tech.

Monday's Goals

Participants became familiar with the first PIE activity. Facilitators model the integration of PicoCricket contraptions into the “no-tech” Marble Machines activity. We introduced Bernie Lubell, artist in residence at the Exploratorium and workshop facilitator.



Marble Machines

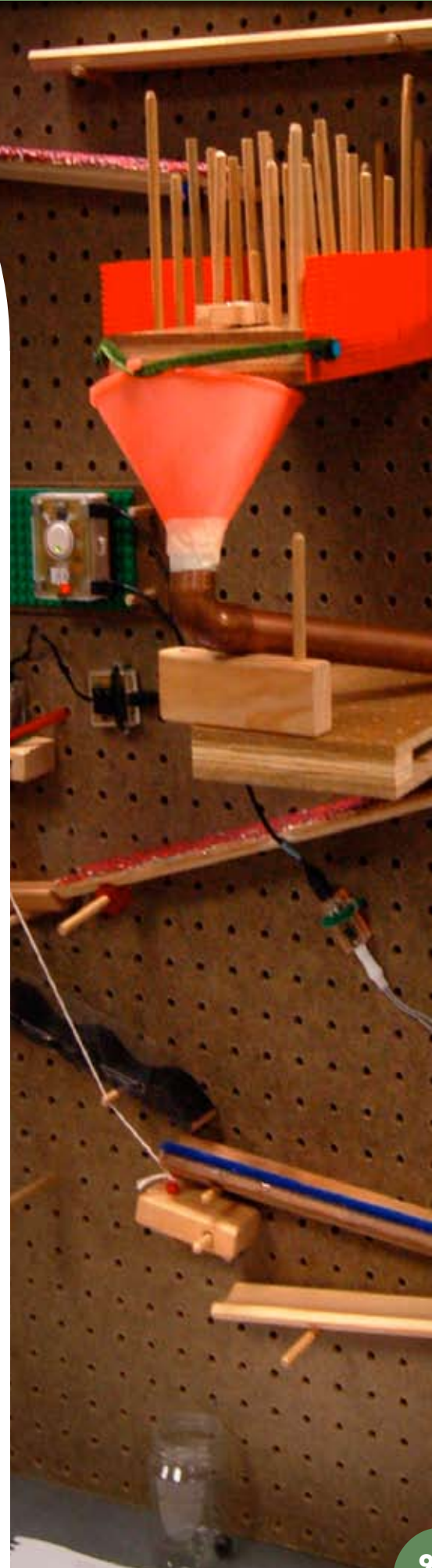
Participants used common materials from a local hardware store to build marble runs. The familiar materials were used in unusual and creative ways by teams of participants building contraptions that allowed the marble to travel as slowly as possible from the top to the bottom of their run.



PicoCricket Introduction

Some participants in the group utilized Pico Crickets, motors, and salvaged switches to create interactive kinetic elements such as elevators, ball starters, moving ramps, and creative inventions like dowel mazes, funnel basins, and feather flingers.

www.picocricket.com



From Facilitators

“We want you to learn something about mechanisms, about how to set up a workshop space, how and why we use different materials. Later in the workshop we’ll be asking you to help us unpack the activities, to think about how they relate to process skills in science, to relate what you notice about facilitation, and to think about how you would adapt them to your own institution and audiences.” (Mike)

“We set up a situation that minimizes the focus on outcome. We create the conditions for kids and adults to really love what they’re making.” (Kristen)



From Participants

“There’s something about the marble on the track. You just naturally want to fix it. It’s inherently interesting.” (Elib)

“I think the teamwork was really important. You learn from your partner. You share ideas.” (Lynne)

“It’s like learning a new language. Every time you learn something, you have a new tool.” (Andrea)



Tuesday's Theme

Light Play: Aesthetics and the transformation of space.

Goals

Participants explored light and shadow as pure phenomena. Then, inspired by László Moholy-Nagy and other artists, they transformed the workshop environment with interactive light and shadow projections. We discussed PIE activities in relation to David Hawkin's "Messing About in Science" article.

TUESDAY ACTIVITIES

Light Play Starting points

Participants rotated through four "starting point" stations for the light play activity. Each station focused on different aspects of light and shadow.

Station 1 Shadow moiré patterns were explored using handheld pinpoint sources of light, window screening, plastic grids, and other patterns printed on transparencies.

Station 2 Barry led a "Shadow-Making Devices" exhibit floor walk through the Exploratorium. ([Download Barry's Floor Walk Map](#))

Station 3 Shadows were projected on a variety of surfaces including white balloons, rolled corrugated cardboard, bed sheets swaying in the wind from a small fan, framed shower curtains, and several translucent materials.

Station 4 Shadow-making objects and a variety of light sources were placed on slow-moving turntables, creating slowly changing light and shadow displays.

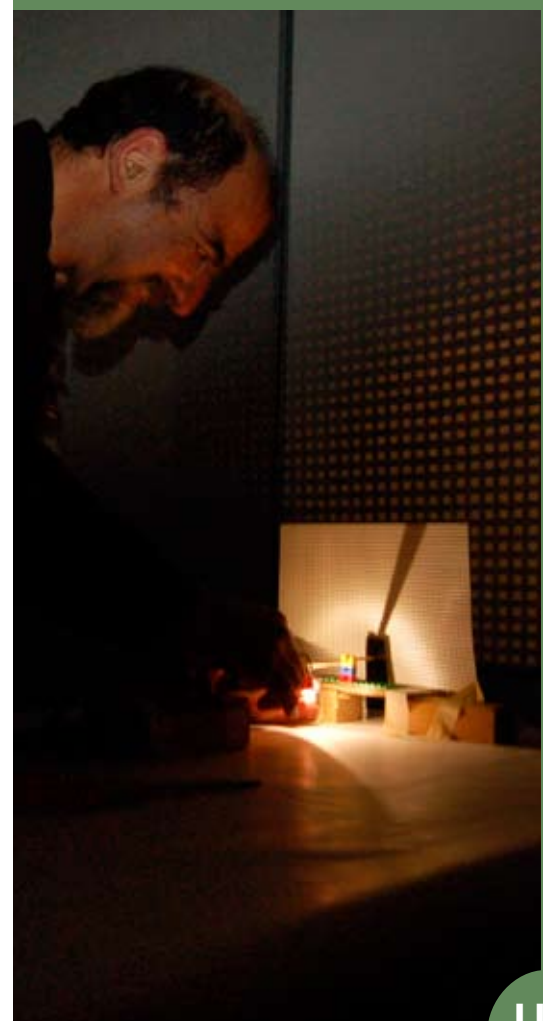


Light Play Setting the context

Jeannette presented a selection of light and shadow explorations by artists, then Liz Keim screened *Lightplay*, an abstract film by László Moholy-Nagy. ([Download Jeannette's presentation](#))

Light Play Transforming the environment

Participants utilized experiments from the starting point stations, and Pico Crickets to create interactive light and shadow installations, ultimately transforming the environment of the classroom.



Messing About in Science Discussion

Barry led a discussion about the connections between PIE activities and David Hawkin's article, "Messing About in Science." (Download the [David Hawkins article](#))

Barry led the discussion with the following prompts:

Prompt 1

Discuss your reaction to the "Messing About in Science" article. What stood out for you? What did it make you think about?

Prompt 2

You have now had the opportunity to experience several PIE activities. Discuss the commonalities and differences between Hawkins's messing about phase and PIE activities.

Prompt 3

In what ways do you think that PIE activities contribute to learning?



WEDNESDAY THOUGHTS

From Facilitators

"This is the ultimate in continuous experimentation." (Mike)

"It was about aesthetic experiences, not about making a functioning object." (Karen)

"Even in unstructured activities there are in fact structures. It's the underlying structure that creates the freedom. And it's incumbent on those who set up the workshop to really think through that underlying structure." (Barry)

"They were trying to create a relic of their own creativity. Something that would give them pleasure. A lot of people tried to replicate some aspect of an experience that they saw earlier in the day." (Walter)

From Participants

"The starters really make a difference. I did my light project without having done the starters. I didn't have a ready sense of what to do, or which of the boards, materials, and screens I wanted to use." (Barry)

"Some of the kids are really intimidated by science. Setting up the activity as a playful experiment takes away some of the intimidation factor. No one's going to be saying, you failed." (Andrea)

"Sometimes we present activities that have rules. But what happens before you introduce the rules?" (Elib)

Wednesday's Theme

Inputs and Outputs: Sensing the world around you.

Goals

Participants discussed the pedagogy of PIE activities. We extended the Pico Cricket kit by sharing examples of homemade sensors and actuators. In the afternoon we introduced the chain reaction activity based on the theme of LOVE.

WEDNESDAY DISCUSSION

PIE Pedagogy Discussion

Participants shared ideas about the pedagogical implications of PIE activities. (Download the [Pie Pedagogy Discussion and Responses Powerpoint](#))

WEDNESDAY ACTIVITIES

Inputs and Outputs

Participants rotated through three stations, each exploring a type of homemade input or output that can be utilized with the PicoCricket. Stations included:

Station 1

INPUTS - Switches. Salvaged and home-made switches, including tinfoil and metal switches, bucket switches, and unusual switches such as telephone dials and magnet switches were explored.

Station 2

INPUTS/VARIABLE RESISTORS - Common found objects became variable resistors when connected to the PicoCricket. Variable resistors included soap bubbles, conductive foam padding, graphite, dimmer switches, bend sensors, and pickles.

Station 3

OUTPUTS - Lights, motors, relays, buzzers, fans, water pumps, and other devices that can be powered by 4 volts, were connected to the PicoCricket.

Inputs were connected and tested using the Pico resistance sensor (see [image](#)). Outputs were connected and tested using the Pico motor board ([image](#)) and our homemade motor connector cable (see [image](#) or make your own [motor connector cable](#)).

Chain Reaction Setting the context

Bernie Lubell and Karen led the introduction discussion by sharing Rube Goldberg and Bruno Munari sketches of metaphorical chain reaction contraptions. Participants then brainstormed and chose their own phrases and words associated with the theme of LOVE.

Chain Reaction Building the elements

Favorite words were chosen by each participant pair, then design and construction began on machines that demonstrated LOVE.



From Facilitators

“The morning demos were relaxed. There were fewer materials and a more focused purpose.” (Barry)

“Using language as a starting point opened up the conversations.” (Bernie)

“The fact that Bernie’s opening example didn’t work perfectly actually ended up being a positive thing for the workshop. It made people more at ease.” (Karen)

From Participants

“Each part of the inputs and outputs explorations this morning was presented in a way that made it easy for us to understand and to feel comfortable playing with the different components. If it had been all combined and just thrown at use at once, it would have been overwhelming.” (Vayu)

“What you did today, with the explorations of inputs and outputs and relays and motors blew away a lot of barriers that I had about using the Cricket. Now I can see lots of ways to use it.” (Andrea)

“You know that everyone is going through the same thing while building their machines. You know that it’s going to be OK if it doesn’t work perfectly.” (Skoshi)

“We feed off each other’s ideas.” (Toni)

“This is an activity that can accommodate a wide range of skills.” (John)



Thursday's Theme

Chain Reaction: Mixing metaphor and motion.

Thursday's Goals

Participants completed construction of chain reaction elements. We set off the chain reaction as a group activity. Later we processed PIE activities and atelier elements, and discussed next steps for participants.

THURSDAY ACTIVITIES

Chain Reaction Finishing the elements, setting it off

Participant teams finished their elements, then connected them to one another so the group could share the complete chain reaction performance.

Chain Reaction Debrief discussion

We had an informal conversation about the chain reaction PIE activity. Discussion prompt: "Talk about the design and construction of your chain reaction element, and highlight skills, attitudes, and content used to complete your love machine."

PIE Reflections and Planning Discussion

This discussion shared participants' plans to continue PIE investigations at their home institutions.

Discussion Prompt

"Think about how you plan to continue PIE activity at your institution. What do you plan to do Monday? What do you hope to do someday?"



THURSDAY THOUGHTS

From Facilitators

"The initial process of brainstorming was a good way to get things focused. The theme was rich, with lots of variety." (Mike)

From Participants

"The love theme really worked. It was great to have to explain emotions through mechanics." (Vayu)

"In working on the chain reaction today, I noticed that I was working on something on my own, but I was also excited to know that it was going to be a part of a bigger activity later on." (Elib)

"A big part of what I took away from the workshop was a stronger awareness of my own process of working. I became aware of the progression of working with materials, getting stuck, and working through it. The discussions gave me a chance to reflect and think about that." (Sylvia)



ARTIST RESIDENCIES

PIE works with artists to explore new ways of using materials, new approaches to design problems, and new techniques for presenting phenomena. We worked closely with Bernie Lubell to design and facilitate the chain reaction activity. Bernie also installed *A Little Breathing Room* for atelier participants and museum visitors to experiment with during the week.

Bernie Lubell makes interactive installations that provoke the silly and playful kinesthetic comprehensions of childhood in service of philosophical explorations of the nature of consciousness and the origins of life. Working in an adamantly low-tech mode, he constructs sculptures from wood, latex, wire, and rope. The works use neither computers nor motors, but are rather entirely powered by visitors. As people work together to animate the mechanisms, their rocking, pressing, pedaling, cranking, pulling, and breathing engages bodies as well as minds in constructing understandings.

<http://blubell.home.att.net>



A Little Breathing Room - Bernie Lubell (2007)

Supplemental Materials

Browse the list below to download documents from the Kinetic Contraptions workshop. You can also review all of the websites referenced in the text of this document along with other connections we find inspiring.

WEBSITES

URLs

Pie Website	www.exploratorium.edu/pie
More about Marble Machines	Click for the online version
PicoCricket	www.picocricket.com
Bernie Lubell	http://blubell.home.att.net
Der Lauf der Dinge (The Way Things Go) 1986-87, 30 min by Peter Fischli and David Weiss	Available at www.amazon.com
Rube Goldberg	www.rube-goldberg.com
Arthur Ganson	www.arthurganson.com
George Rhoads	www.georgerhoads.com

IMAGE GALLERY

VIEW AND DOWNLOAD IMAGES FROM THE

KINETIC CONTRAPTIONS

GALLERY

<http://www.exploratorium.edu/pie/gallery/kinetic>



DOWNLOADS

Resources

- Participant List (560 kb)
- Short Schedule (2.1 mb)
- Pie Pedagogy Presentation (492 kb)
- David Hawkins Article (84 kb)
- Jeannette's Artists and Light Presentation (100kb)
- Barry's Floor Walk Map (876 kb)
- Kinetic Contraptions Journal (44.9 mb)
- Mitchel Resnick Article (108 kb)
- Marble Machines PDF (1 mb)

