SPARKed
SPARK in Education

EDUCATOR GUIDE

Story Theme: Technophiles
Subject: Ken Goldberg
Discipline: New Media

Ken Goldberg monitors the number of players logging on to play Tele-Twister, his on-line, interactive game. Still image from SPARK story, February 2004.

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SECTION I - OVERVIEW

EPISODE THEME
Technophiles

SUBJECT
Ken Goldberg

GRADE RANGES
K-12 & Post-secondary

CURRICULUM CONNECTIONS
Visual Arts, Science, and Social Science

OBJECTIVE
To introduce students to the operations, issues, and ideas behind Internet and tele-robotic art through the work of artist-engineer Ken Goldberg

STORY SYNOPSIS
Ken Goldberg, net artist
Conceptual artist Ken Goldberg is considered a pioneer in the growing genre of "net art." A professor of Industrial Engineering at UC Berkeley, Ken combines his skills in robotics and his fascination with the social behavior of internet communities in a series of whimsical artistic "experiments" where strangers use the internet to jointly control and monitor real life events and activities together. SPARK joins Ken and his students at UC Berkeley as they host a weekly web event where players from all over the world log in to play "Tele-Twister."

INSTRUCTIONAL STRATEGIES
- Individual and group research
- Individual and group exercises
- Written research materials
- Group discussions

INSTRUCTIONAL OBJECTIVES
- To introduce the concept of robotics and Internet-facilitated art as forms of creative expression
- To provide context for the understanding of artists using technology
- To inspire students to consider larger audiences available for art through the Internet

EQUIPMENT NEEDED
- TV & VCR with SPARK story "Logging On" about Ken Goldberg
- Computer with Internet access, navigation software, speakers and a sounds card, printer
- Cassette player, CD player, or computer audio program

MATERIALS NEEDED
- Access to libraries with up-to-date collections of periodicals, books, and research papers
- Pencils, pens, and paper

INTELLIGENCES ADDRESSED
Linguistic - syntax, phonology, semantics, pragmatics
Bodily-Kinesthetic - control of one's own body, control in handling objects
Interpersonal - awareness of others' feelings, emotions, goals, motivations
Intrapersonal - awareness of one's own feelings, emotions, goals, motivations
Spatial - ability to manipulate and create mental images in order to solve problems
Logical-Mathematical - ability to detect patterns, reason deductively, think logically

See more information on Multiple Intelligences at www.kqed.org/spark/education.

SECTION II – CONTENT/CONTEXT

CONTENT OVERVIEW

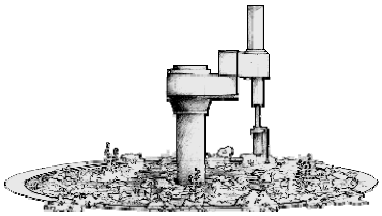
On selected Fridays at noon, artist and robotics engineer Ken Goldberg organizes a game of "Tele-Twister" at the Alpha Lab at the University of California, Berkeley. As in the original Twister game, Tele-Twister participants contort their bodies in order to place their hands and feet on colored dots; only in this version, remote players log in via the Internet and decide collectively how the participants move. In the SPARK story "Logging On" Goldberg takes viewers through several of his pioneering works in the emerging field of Internet and tele-robotic art.

Two UC Berkeley students play Ken Goldberg's Tele-Twister. Photo reprinted courtesy of the artist.

Goldberg began experimenting with using machines to make art while completing a PhD in robotics at Carnegie Mellon University in the late 1980s, but it was in 1992 that Goldberg received his first major recognition as an artist when he exhibited a work at the Fisher Gallery in Los Angeles. For the installation Power and Water, Goldberg and his students at the University of Southern California built a "painting machine," a robot programmed to paint on large paper during the exhibition. Because the piece combined robotics with painting – a medium usually associated with unique style produced only through an artist's hand – Power and Water raised many questions about the uniqueness, authenticity, and even authorship of art.

Though the exhibition had been well attended, Goldberg was frustrated with the limited audience reached through a gallery show. So, in 1994, with the emergence and widespread popularization of the Internet, Goldberg assembled the first tele-robot in a work called the Mercury Project. With this piece anyone with access to the Internet could remotely control a robot arm suspended above a sandbox, in which a number of artifacts had been buried. The piece was like an interactive on-line scavenger hunt, as users could see small areas of the sandbox through a Web-cam fixed to the robot's arm, and they could trigger a one second burst of compressed air to remove sand from atop buried objects. The work reached an audience unimaginable in a gallery context, receiving over 2.5 million hits in the 7 months it remained online.

While the Mercury Project introduced Goldberg's work to larger and more varied groups of people, it also changed the role of the audience. For the first time, Goldberg's robots were becoming tools to be manipulated by sizeable numbers of participants, introducing social interaction with art that took place both online and in the real world. Goldberg's next project, the Telegarden, explored these issues further.



Ken Goldberg, The Telegarden, 1994-5.
Image reprinted courtesy of the artist.

While the Mercury Project offered visitors a desert-like environment where they could forage for objects, The Telegarden (still online) offers participants use of a robot to dig holes, plant seeds, water plants and monitor their growth in a remote garden. There are no behavioral restrictions on the project; participants can do as they please. They can dig up other people's plants, over water, and otherwise jeopardize the efforts of other. That being said, Telegarden does

require its users to register and alerts participants that their names and email addresses are available to all other users. Participants are never entirely sure whether others are watching them or not. In this way, The Telegarden is concerned with the behavior of users who are aware that they may become subjects of scrutiny.

Since 1995, Ken Goldberg has been teaching Computer Science at the University of California, Berkeley, where he also co-founded the Art, Technology & Culture Colloquium.
His artwork has been shown internationally at Ars Electronica (Linz Austria), ZKM (Karlsruhe, Germany), Pompidou Center (Paris), Tokyo ICC Biennale, Kwangju Biennale (Seoul), Artists Space, The Kitchen, the Walker Art Center, and the Whitney Biennial (2000).

THE BIG PICTURE

Internet and tele-robotic art is only one of the more recent developments in a long history of artists introducing new technologies into the production of art. When Louis-Jacques-Mandé Daguerre, in 1837, produced the first stable photographic image on treated copper plates, photography was far from being considered an art form. In fact, the announcement of Daguerre's discovery positioned photography in opposition to older methods of image production, noting that it "requires no knowledge of drawing" and that "anyone may succeed and perform as well as the author of the invention." From its inception then, the artistic community treated photography with ambivalence, regarding it as a scientific advance that simultaneously extended the possibilities of image making while threatening to render an artist's skills obsolete.

Similarly, when motion pictures were introduced in 1895, it took a few years before the new medium was used for purposes other than technical demonstrations and began to be manipulated for creative expression. The landmark early 20th century works of French magician and filmmaker George Méliès represent some of the first experiments with film as a creative medium. Méliès pioneered techniques such as multiple exposures and he is even credited with the invention of film editing, splicing several shots together to create dramatic visual effects.

Artists have always used technology. From the discovery and development of new pigments and painting media, such as fresco, oils, and acrylics, to new printing techniques like lithography and serigraphy, to the most advanced digital technology that is now regularly used in the production of photographs, sound, and motion pictures. What have changed over the last century are the attitudes of artists towards technology: while some artists have chosen to revive traditional or archaic means of making art, others have embraced new technologies.

In the early 20th century, (especially between WWI and II) groups of artists emerged in Russia, Italy, and Germany who believed new technologies were changing artistic practice and what it meant to be an artist. In the early years of the Soviet Union, a group of artists calling themselves Constructivists theorized that under the new Socialist political system there was no longer a distinction between an artisan and the industrial class, and, as a result, a new creative figure had come to be – the artist-as-engineer. Artists such as Aleksandr Rodchenko, Vladimir Tatlin, and Varvara Stepanova advocated a rational, materialist, utilitarian approach to socially committed art, attempting to link art with industry, technology, and the ideals of a classless society through the production of socially useful objects.

Umberto Boccioni, Unique Form of Continuity in Space, bronze, 1913. Reprinted from http://www.futurism.

In Italy, the poet Filippo Tommaso Marinetti in 1909 formed another group dedicated to technology – the Futurists, dedicated to the glorification of technology, speed, and violence. The ideas and art of Futurism were some of the first efforts in the 20th century to reinvent life as it was being transformed by new technologies, and to conceive a new race in the form of machine-extended human beings. In opposition to the qualities of beauty and unity characteristic of Western traditional art forms and aesthetics, Futurists sought to develop an art of discontinuity and rupture, reflective of the newly technology-centered modern experience, as illustrated by Umberto Boccioni's Unique Form of Continuity in Space from 1913 (shown).

Similarly, in Germany, a number of artists, architects, and designers, led by architect Walter Gropius and inspired by the efforts of the Soviet Constructivists, formed Der Bauhaus, a design school committed to artistic and social regeneration through new forms of rationalist architecture – well-planned housing developments, street patterns, and city quarters. As with the Constructivists, Bauhaus artists sought to break down distinctions between the arts as well as those between the arts and industrial technologies.

The artistic fascination with technology has only strengthened in the last few decades, as artists have continually sought to discover modes of expression newly enabled by recent technological developments. In the 1960s and 1970s artists began experimenting with video as a medium, essentially appropriating the technology of television, which was in the midst of transforming the global cultural landscape. Artists like Nam June Paik, Joan Jonas, Gary Hill, Peter Campus, Bill Viola and others helped to create the genre of Video Art, experimenting with the possibilities of the new medium to produce challenging modes of expression characteristic of the emerging information society.

RESOURCES – TEXTS

Goldberg, Ken, ed. The Robot in the Garden. Cambridge, MA: MIT Press, 2001.

Howard, Philip N. and Steve Jones, eds. Society Online: The Internet in Context. Thousand Oaks, CA: Sage Press, 2004.

Kac, Eduardo and Marcelli Antunez Roca. Robotic Art. MIT Press Web Archive. http://mitpress2.mit.edu/e-journals/LEA/ARTICLES/kac4.html

Scholder, Amy and Jordan Crandall, eds. Interaction: Artistic Practice in the Network. New York: Distributed Art Publishers, 2001.

Stallabrass, Julian. Internet Art: The Online Clash of Culture and Commerce. London: Tate Publishing, 2003.

RESOURCES – WEB SITES

Ohio State University's Art & Technology Program Web site – Information on Ken Goldberg and an audio stream of his lecture there in 1994 - http://artandtech.osu.edu/colloquium/html/goldberg.html

Bauhaus Archive Museum of Design - Web site for the Bauhaus archive - http://www.bauhaus.de/english/bauhausarchiv/geschichte_bauhausarchiv.htm

Carnegie Mellon University's Robotics Art Studio - http://www-2.cs.cmu.edu/~RAS

Guggenheim Collection - Web pages dedicated to Futurism - http://www.guggenheimcollection.org/site/movement_works_Futurism_0.html

Information on filmmaker George Méliès - http://www.nwlink.com/~erick/silentera/Melies/melies.html

Ken Goldberg's Art, Technology, and Culture Colloquium Web site - http://www.ieor.berkeley.edu/~goldberg/lecs

Ken Goldberg's personal Web site - http://www.ken.goldberg.net

Paik Nam June (also called Nam June Paik) - Web site for Korean-born Video artist Nam June Paik - http://www.paiknamjune.org

PhotoNet - A timeline of the history of photography - http://www.photo.net/history/timeline

Robotics Society of America - http://www.robotics-society.org/html/

SF Gate - An article on Ken Goldberg from 1998 - http://www.sfgate.com/eguide/profile/arc98/goldberg0115.shtml

Telegarden - Ken Goldberg's Telegarden Project - http://telegarden.aec.at

UC Berkeley-published article about Ken Goldberg's artwork -

http://www.ieor.berkeley.edu/~goldberg/IIE-Solutions.pdf

US Library of Congress - Daguerreotype Portraits - Archive of images made using the process invented by Louis-Jacques-Mandé Daguerre - http://lcweb2.loc.gov/ammem/daghtml/daghome.html

Wired - An article about art and robotics - http://www.wired.com/news/gizmos/0,1452,48253,00.html

BAY AREA FIELD TRIPS

Exploratorium
3601 Lyon Street, San Francisco, CA 94123,
415.EXPLORE
http://www.exploratorium.edu

The Tech Museum of Innovation
201 South Market Street, San Jose, CA 95113
408.294.TECH
http://www.thetech.org

Zeum
4th & Howard Streets, San Francisco, CA 94107
415.777.2800 - http://www.zeum.org

Computer History Museum
1401 N Shoreline Blvd., Mountain View, CA 94043,
650.810.1010
http://www.computerhistory.org

San Francisco Robotics Society of America
Science Department, San Francisco State University,
1600 Holloway Ave., San Francisco, CA 94132
http://www.robots.org

Lawrence Hall of Science
University of California, Berkeley
Centennial Drive, Berkeley, California 94720
510.642.5132
http://www.lhs.berkeley.edu

SECTION III – VOCABULARY

Agriculture
The science, art, and business of cultivating soil, producing crops, and raising livestock; farming.

Collectively
Of, relating to, characteristic of, or made by a number of people acting as a group.

Communal
Of, belonging to, or shared by the people of a community.

Conceptual art
Art intended to convey an idea or concept to the perceiver and need not involve the creation or appreciation of a traditional art object such as a painting or sculpture.

Diverse
Comprised of different populations or communities; varied.

Dynamic
Forceful, energetic.

Evolutionary
A gradual process over time, in which one thing changes into another, usually becoming a more complex or better-adapted form. Derived from the theory of evolution - all existing species of animals, plants, etc. develop from a few simple forms of life by modification of characteristics over successive generations, through mutation, selection, etc.

Expressive
Serving to vividly express, utter, or represent; indicative; communicative.

Genesis
Origin; coming into existence. Derived from the story of creation in the Bible.

Interaction
A mutual or reciprocal action.

Interface
A point, process, or portal through which individuals, independent systems, or diverse groups interact.

Malicious
Destructive or causing harm, injury or distress to others.

Manipulate
To move, arrange, operate, or control by the hands or by mechanical means, especially in a skillful manner.

Monitor
To keep track of systematically with a view to collecting information.

Novelty
The quality of being new.

Patent
Statement of official rights granted to an individual or company for an invention, product, or idea.

Pioneer
Originator of an enterprise. The term often refers to an explorer or early settler.

Privilege
To give particular status to - can refer to an idea or concept that is given particular emphasis and seen to be most important.

Prohibition
An order to halt or refrain an action(s); an interdict. A National state of Prohibition existed in the United States between 1920 and 1933 when it was illegal to make or sell alcohol.

Robotics
The science or study of the technology associated with the design, fabrication, theory, and application of robots - machines or mechanical devices that operate automatically or by remote controls.

Scenario
An account or synopsis of a sequence of events.

Sequel
Something that follows; a continuation.

Social interaction
The way people act together and relate to each other in a group or social situation.

Straddle
To be on both sides of something; to extend over or across.

Venue
The setting in which an event or presentation occurs, a locale.

SECTION III – ENGAGING WITH SPARK

STANDARDS-BASED ACTIVITITES AND DISCUSSION POINTS

1 - Show the Ken Goldberg SPARK story and ask students to make notes while watching of the ways in which Goldberg defines art. What are the defining features or ideas he identifies when he talks about his art? Ask students to then spend a few minutes thinking about Goldberg's ideas and identifying 3 key concepts.
Then divide students into small groups and invite them to discuss the concepts.

- Would they define "art" the same way?
- What do they think about Goldberg's ideas? Do they agree or disagree, and why?
- Can they cite other examples of works of art that reflect similar ideas?
- Can they name works that are not "art" but reflect similar ideas?

2 - Build on the exercise above by initiating a group discussion on Internet art as a new technology, asking: **How does the technology of the Internet affect the perception of it as art?**

Have students write a 500-word response to this question, drawing on other technologies as examples if necessary.

Show the SPARK story again, pausing after each description of a Ken Goldberg project - Tele-twister, Power and Water, The Mercury Project, and The Telegarden. Initiate a discussion of each project by asking students to:

- Describe the project, how it works, and what is it trying to achieve?
- Is the Internet critical to the success and effect of the piece, and in what way(s)?
- What makes it an example of a work of art?
- What is aesthetic about this work? Is that intrinsic to a work of art?

Finally invite students to share their responses to the work but only after they have been through the questions above.

RELATED STANDARDS - VISUAL ARTS
Grades 9-12 Advanced

5.0 CONNECTIONS, RELATIONSHIPS & APPLICATIONS
5.1 Speculate on how advances in technology might change the definition and function of the visual arts.
5.4 Investigate and report on the essential features of modern or emerging technologies that affect or will affect visual artists and the definition of the visual arts.

RELATED STANDARDS - SOCIAL SCIENCES
Grades 9-12

Historical and Social Sciences Analytical Skills
Chronological and Spatial Thinking
1. Students compare the present with the past, evaluating the consequences of past events and decisions and determining the lessons that were learned.
2. Students analyze how change happens at different rates at different times; understand that some aspects can change while others remain the same; and understand that change is complicated and affects not only technology and politics but also values and beliefs.

3 - Ken Goldberg describes how new technologies have always been greeted with suspicion as valid art forms. He refers to video, cinema, and photography, and now robotics. Divide the class into small groups and direct students to the Internet, libraries, or other appropriate sources to research the early years of each of these technologies and how they were received as art forms. To assist students in this research it may be helpful to brainstorm possible sources of information, such as the Pacific Film Archive or the Bay Area Video Coalition, and list these on the board.

Taking the project as a 3-4 week endeavor, allocate video, cinema, photography, and robotics to each group to research. Have each group construct a timeline that identifies key landmarks in the history of the technology. Refer to other timelines, such as the following:

http://teachers.teach-nology.com/web_tools/materials/timeline

Invite students to prepare group presentations, illustrating their timelines with photos, video clips etc. Importantly each member of the group should cover an aspect of the research so that all students participate in the presentations.

Finally, allocate sufficient time for groups to present their work, allowing for feedback and discussion. As the facilitator, try to tease out common themes that illustrate the way new technology has been received and the importance of the technology to the art

What can you express with the technology that couldn't be expressed before?

form. Try to elicit a response to Goldberg's question:

RELATED STANDARD - VISUAL ARTS
Grades 9-12 Advanced
3.0 HISTORICAL AND CULTURAL CONTEXT
3.2 Identify and describe the role and influence of new technologies on contemporary works of art.

4 - With younger students, discuss the concepts of Goldberg's Telegarden project, focusing on the notion of unsupervised participation in a group project. Ask students to articulate the benefits and challenges of such a social space. Discuss how they might undertake such a project at the school?

As a group, prepare a plot of soil for a garden somewhere on school grounds. Invite each student to work (or not work) in the garden by him/herself. To facilitate this, assign each student an identifying number. This number will be used to schedule their time in the garden and it will keep students from knowing who is in the garden and at what time. When composing the schedule, keep 10-15 minutes of more between students to minimize chances of students seeing each other in the garden.

Assure them that they will not be observed and that each should feel free to do what they please. Students can bring seeds, plants, ornaments, or other embellishments for their time in the garden.

Over a period of months, take daily or weekly photographs of the garden to monitor and document progress and changes.

At the end of the timeframe, discuss the garden project with the group looking through the photos together and visiting the garden to reflect on the experience and to view changes to the garden. Encourage students to discuss what they enjoyed or found challenging about the project?

- What did they feel and think about working in the garden alone, knowing they were part of a group enterprise?
- What did they feel and think about the fact they were not observed or required to behave in any particular way(s)?
- How did this impact on what they did?
- How would they describe the purpose and result of this project?
- What qualities, experiences, or results make this experience "art"?

5 – As a class, play Tele-Twister with Ken Goldberg and his students. To find out the next game date time, visit http://www.tele-actor.net/tele-twister. This information is continually updated to reflect the next upcoming game. (In this description, the students on the Twister board are the "participants"; those people logged onto Twister via the Internet are the "players.")

In Tele-Twister, participants in UC Berkeley's Alpha Lab move their bodies according to the majority decisions made by all of the players logged into the game via the Internet. Each player can see their username as well as the usernames of all other players as they watch the participants move on the screen according to the player's decisions, transmitted in real time via the Internet.

In order to play, each student will need to log into the game in advance and develop a username that they will use to play. This can be a real name or a pseudonym. Creating usernames can be done anytime before the game, although it is best to do it a number of days before you intend to play. When you develop a username, a password will be mailed to you within the hour. Each student will need to use this username and password to log in on the day of play.

In order for students to participate you will need computers with DSL, T-1, or high-speed dial up access to the Internet. You will also need Microsoft Internet Explorer 5.0 or higher, or Safari 1.0 or higher. If only a few computers are available, the class can be divided into teams

6 – Ken Goldberg and students at UC Berkeley offer a complete biotechnology project using Goldberg's Tele-Actor project that can be incorporated into science curricula for grades 9-12. The "Robot, Clone, Human" project may be reviewed and printed from the Tele-Actor Web site at http://www.tele-actor.net/RCH, including activities, resources, and an assessment too

For more information about SPARK and its educational content, including the Visual & Performing Arts Standards, visit the Web site at http://www.kqed.org/spark/education.

For more information about the California Visual & Performing Arts Standards, visit the CA Dept. of Education at http://www.cde.ca.gov/be/st/ss/.