NEIGHBORHOOD NETWORKS

www.neighborhood-networks.net

NEIGHBORHOOD NETWORKS is a long-term research project that combines community arts, participatory design, informal learning, and engineering to discover and articulate how communities use, or might use, new and emerging technologies.

This project would not be possible without close collaboration with community groups and organizations. The Lawrenceville Corporation, Lawrenceville United, and Heritage Health Foundation have been instrumental in helping us develop our programs.

For more information contact Carl DiSalvo at carl.disalvo@gmail.com

THE PROJECT IS MADE POSSIBLE BY A GENEROUS GIFT FROM INTEL RESEARCH.

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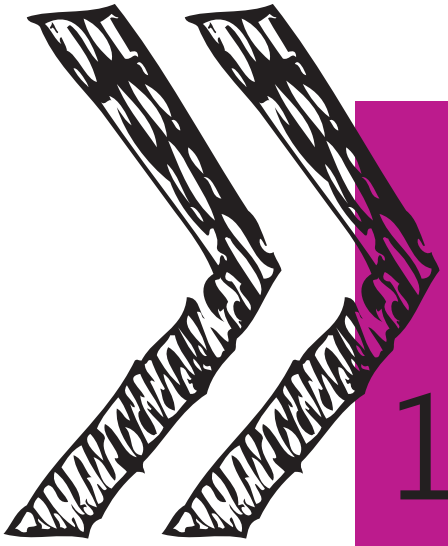

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RESEARCH OPPORTUNITIES

There is a lack of case studies, ethnographic data, methods, and exemplary prototypes to inform and guide the development of community-oriented technology products and services.

PROJECT OBJECTIVES

NEIGHBORHOOD NETWORKS was created to address the growing need to describe and support the process through which people appropriate and use technology at the community rather than the individual level. Neighborhood Networks is a long-term research project that combines community arts, participatory design, informal learning, and engineering to discover and articulate how communities use, or might use, emerging technologies. Although there are various types of communities and network technologies, we are interested in neighborhood groups that are organized for local collective representation and action. Examples of such groups include block-watches, community gardeners, and preservationists. Through Neighborhood Networks workshops, residents explore, design, and build prototypes of interactive devices that address their personal issues and causes. These issues and causes range from lessening noise pollution to monitoring air quality to celebrating local history and heritage.

We are particularly interested in understanding the learning and empowerment that occur through participatory design workshops that apply sensing and robotic technologies to topics of community safety and revitalization. We hope that the results from this project—in the form of published papers, video documentation, and prototypes—can be implemented by community groups, museums, and other advocacy and informal learning organizations.

Neighborhood Networks aims to instruct and empower communities to use emerging technologies to explore and express their physical and social environments in support of shared issues and causes. We use public and participatory art practices as strategies to assist communities in documenting their environments, issues, and causes and then relay that documentation to a larger public in a compelling manner. Our goal is to have the participating neighborhood groups develop long-term strategies and immediate tactics for using technologies to disseminate knowledge and propagate technological resources to other communities.

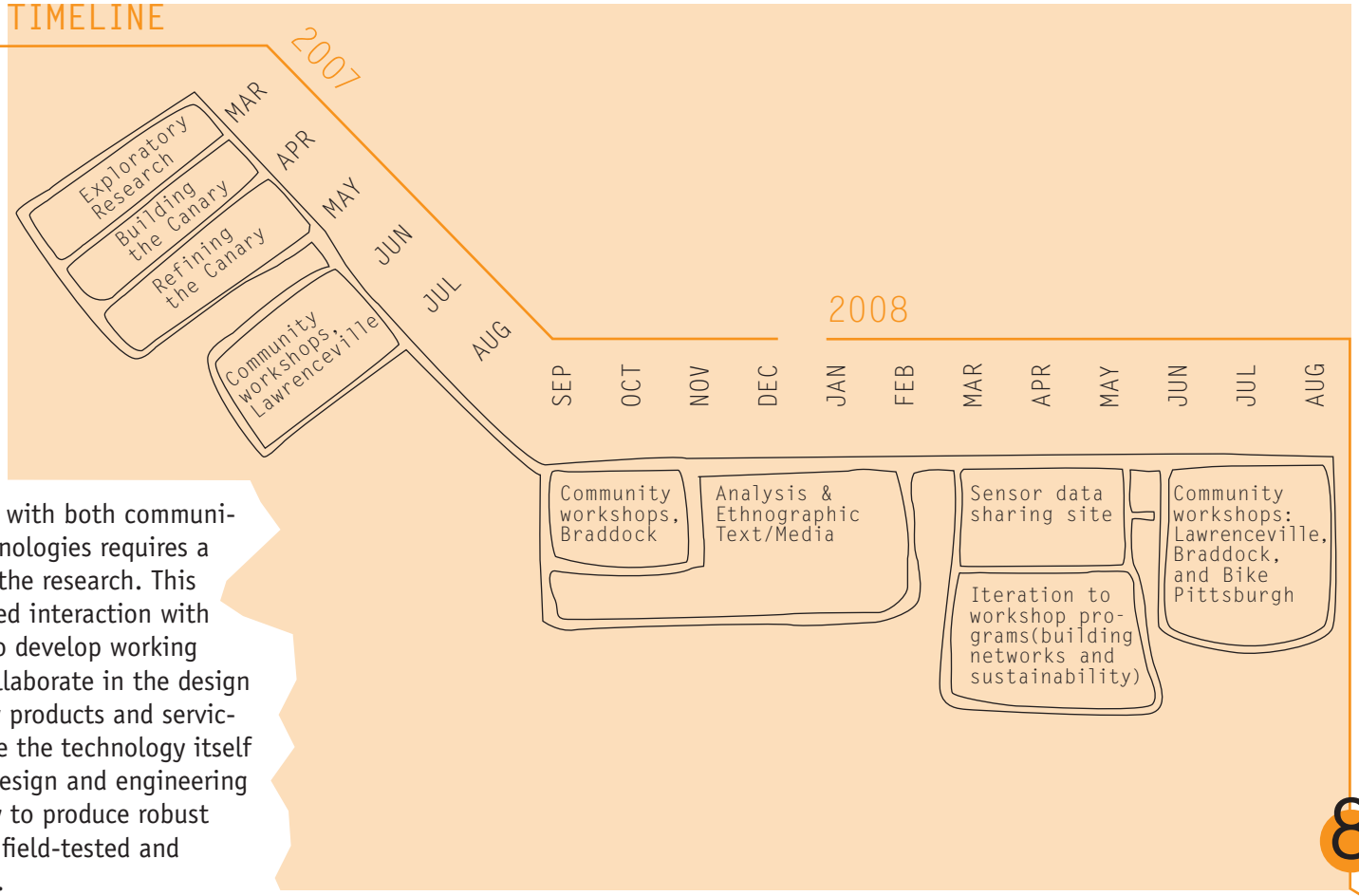
OUR RESEARCH APPROACH

ALTHOUGH THE Human-Computer Interaction community (HCI) has conducted some research that falls under the rubric of "Designing for Community Appropriation," the Neighborhood Networks project surpasses this work in both scope and subject matter. It attempts to bridge the participatory aspects of citizen science and public art with the application development focus of the HCI community. Central to this project is the notion that educational and cultural outreach initiatives and application research need not be mutually exclusive—that in fact they can productively intermingle and be mutually beneficial. Neighborhood Networks extends the recent research of using art practices in HCI in new directions.

Much of the similar HCI research has been influenced by art practices primarily for exploratory research—as methods for collecting information and capturing the qualities of contexts and experiences. While building on that research and momentum, this project includes the collaborative and collective creative activities of the community members themselves as important aspects and outcomes of the project.

Unlike prior related research, our work incorporates technology from robotics that permits actuation as well as sensing and communication, thus adding a physical dimension for possible expression with technology. Also, we are explicitly concerned with the dissemination of the research through multiple channels, including submission of papers to relevant conferences, reports to industry, public presentations, and the free release of the software developed during the project. We pursue this research with the intention of jointly influencing industry practices, contributing to academic knowledge in the arts and engineering, and fostering community development.

PROJECT TIMELINE



The nature of this work with both communities and the given technologies requires a long-term approach to the research. This project requires extended interaction with communities in order to develop working relationships and to collaborate in the design and engineering of new products and services. In addition, because the technology itself is emerging, iterative design and engineering cycles will be necessary to produce robust prototypes that can be field-tested and quantitatively assessed.

COMMUNITIES & NETWORK-BASED TECHNOLOGIES

NEW KINDS of applications, uses, and interactions are emerging from the convergence of ever-expanding network technologies and the increased use of these technologies by diverse publics. Consequently, new opportunities for application development are arising in the domain of community-oriented products and services. With these opportunities also comes the challenge of developing methods of working with communities in the research and development process and designing technologies that extend beyond the individual-user paradigm.

Whether it be cell phones, personal computers, or video game consoles, the technological design paradigm is still geared toward the single user who is cast as a consumer. The problem is that, currently, there is a lack of case studies, ethnographic data, methods, and exemplary prototypes to inform and guide the development of community-oriented technology products and services that function outside of a traditional consumer model and exist as a do-it-yourself approach to technology. This deficit is prominent in the domains of Human-Computer Interaction and interaction design—two domains that are central to the innovation and development of network technologies.

PUBLIC PERCEPTIONS OF MEDIA & TECHNOLOGY

TECHNOLOGY HAS become an indispensable component of our lives—something used everyday at work and at home. We check our email, fax and photocopy documents, watch DVDs, listen to portable MP3 players, call each other on cell phones, and snap digital images of friends and family. Regardless of whether or not we think about it, our society is immersed in and dependent on technology. When it comes to art, people now use technology as a tool for self expression. Graphic artists use computer monitors as canvas and design software as paint and brushes. Filmmakers use their cameras and editing software as instruments to channel their artistic visions.

Although few could deny that technology is integral to modern communication and art, most people do not associate technology itself as artistic expression. They may be able to appreciate the aesthetic beauty of a new MacBook or the visual appeal of a graphic user interface for new photo-editing software, but they usually don't think of them as works of art. And because they don't think of technology as art, they might not believe that technology can convey messages in a way comparable to media.

From our research, we learned that many community members were more comfortable with and had a greater interest in media than they did with technology. They viewed media as the means of mass communication—television, print journalism, radio, etc. They felt that media, not technology, was the best method for effecting social change. Residents found media to be more accessible and familiar than technology; they found technology somewhat abstract.

This public perception of technology challenged us to develop an educational/ research program that would allow us to observe and study how people use technology to express themselves. We wanted to cast technology as media—to express sensed data as information, to publish and stream that sensed data, and to use the outcomes of community tech programs as content for traditional media. We had to form connections between community members and social/ cultural issues by enabling creative uses of local space and technology.

In conjunction with the concept of using the local space, we had to create an accessible platform for teaching—both an educational curriculum and a device that would directly link technology to creative expression.

TECHNOL

OGIES

SENSING & AWARENESS

WHEN PEOPLE check the weather on the Internet, they get a temperature value for the whole city. But if they want to learn about local conditions in their neighborhood, it's a bit harder—especially if what they care about are things like sound or air pollution or the combination of multiple factors such as light, temperature, sound, and air pollution that are in their immediate vicinity. Although there are sensor systems that measure all these factors in close quarters, the are expensive and almost always used only by experts.

A dominant theme of Neighborhood Networks is to empower the public by facilitating their use of technology for self expression. For the Neighborhood Networks workshops, sensors play an important role in that empowerment. Sensors detect and record physical properties that are unquantifyable or undetectable to the human senses. Although people base their daily decisions on information that they acquire from sensors (e.g., weather reports), they typically do not have the opportunity to directly use sensors in specific, empowering ways. Sensors can be a bridge between the realms of technology and art. By amplifying and expanding upon human perception, sensors can furnish a sense of superhuman control. They allow people to acquire information that could not be gathered with the human senses.

Sensors unite technology and art into a vehicle for activism. By using sensors, people can convey their specially acquired information to others—in a way that fuses the roles of media and technology.

THE CANARY IS THE COMPONENT NEW LIFE INTO

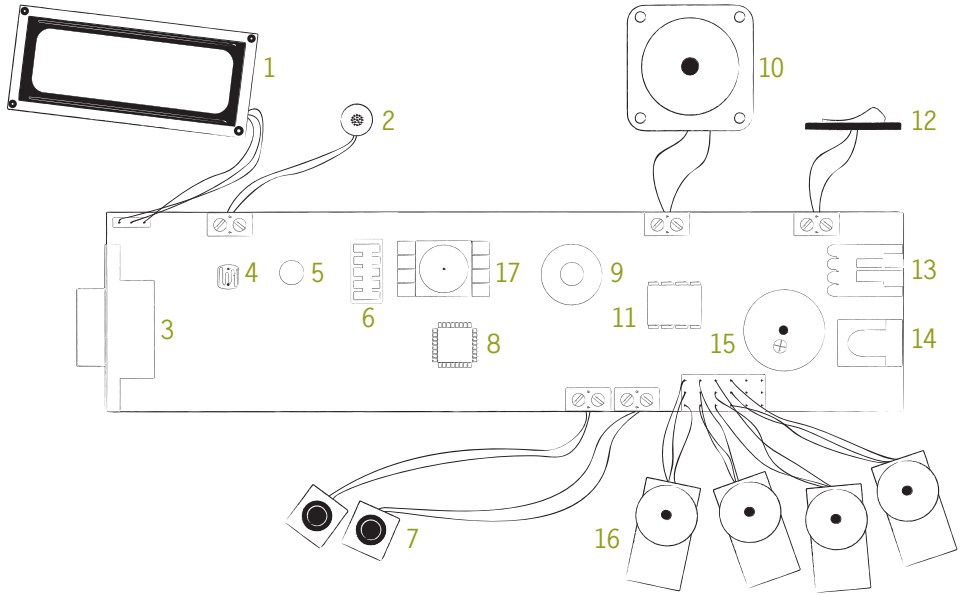
THE ANIMATOR, THAT BREATHES THE CREATION.

THE CANARY

The Canary enables people to design and build devices that react to environmental stimuli such as air quality, light and sound.

CANARY SENSOR BOARD

THE COMMUNITY Robotics, Education, and Technology Empowerment (CREATE) Lab wanted to create a device that would bring sensory methods to the general public. They conceptualized, designed, and constructed the Canary; a small, handheld device for monitoring a suite of environmental factors including general air quality, humidity, temperature, and sound and light levels. The CREATE Lab designed the Canary with the goal of bringing sensing technologies to a broader audience and, in the process, fostering technological fluency and new understanding of the environment.

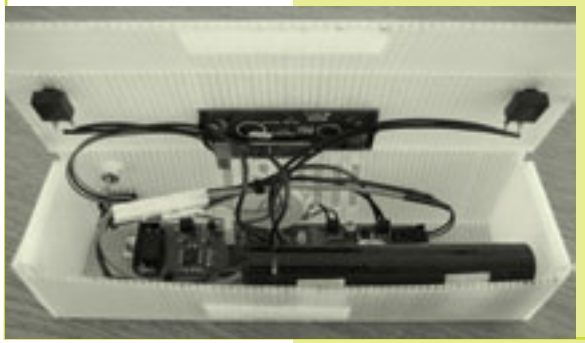


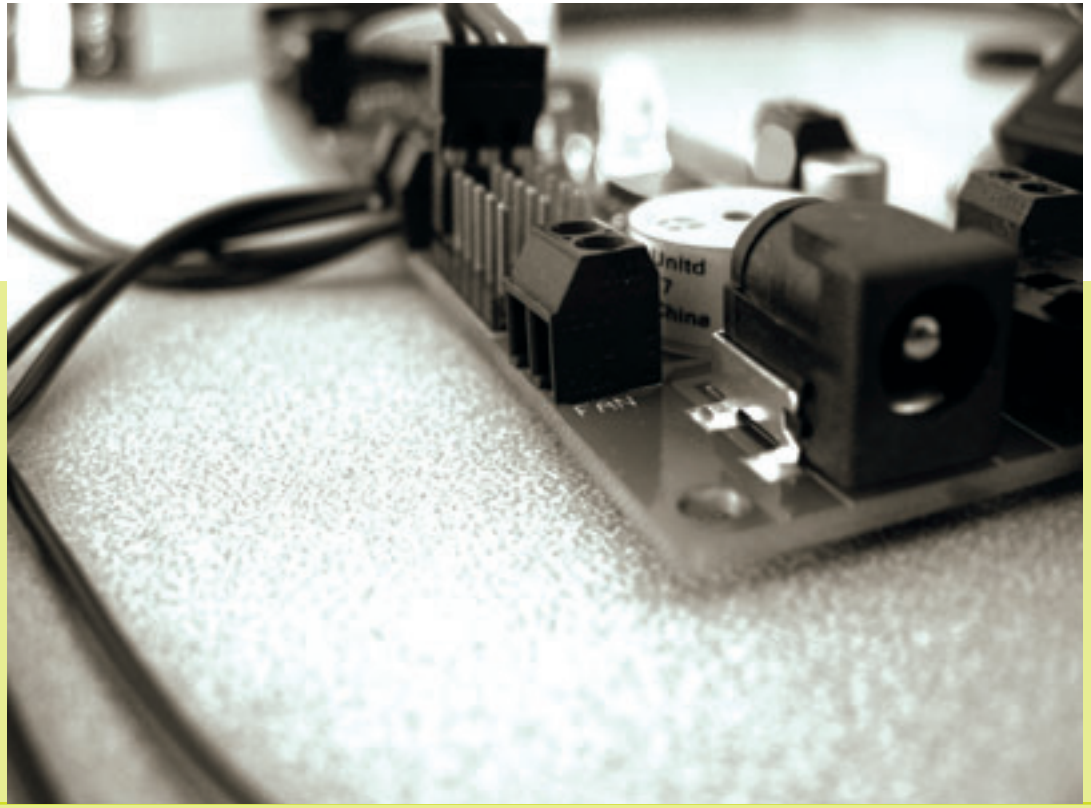
1 LCD Screen
2 Microphone
3 Serial Port
4 Light Sensor
5 Temperature Sensor
6 Humidity Sensor
7 Buttons
8 Microprocessor
9 LED
10 Air Quality Sensor
11 Op Amp
12 Switch
13 Battery Power
14 Wall Power
15 Buzzer
16 Servos
17 Barometric Pressure Sensor

The Canary is based on the versatile Atmel Atmega168 programmable microcontroller; a popular IC for low-cost embedded applications. The Atmega168 has eight analog inputs used for reading environmental sensors, a UART for serial communication with an external computer and for displaying text to an LCD, and about a dozen general purpose digital I/O pins that are programmed for controlling the servos, LED, buttons, and buzzer. The Canary uses a number of different circuits that sense light, temperature, ambient noise, air pollution, humidity, and atmospheric pressure. The light and temperature sensors are based on simple (and cheap) components that vary resistance based on an environmental stimulus. The Canary obtains values for humidity and pressure by using off-the-shelf integrated circuits that output a voltage value, which linearly maps to the stimulus. The ambient sound level is found by combining a microphone, a simple one-transistor amplifier, and a software filter running on the Canary's firmware. Finally, air pollution is determined using the Dart Sensors Air Quality Sensor; this sensor is based on fuel cell technology which outputs a small current based on the presence of certain air pollutants. A current-to-voltage amplifier converts the current into an output voltage that can be read by the Atmega168.

CANARY APPLICATIONS

ALTHOUGH THE Canary is not as accurate as some of the expensive sensor units, if people could walk around with these compact devices and see measurements as they go, they would be exposed to a whole new type of exploration. The Canary enables the general public to design and build physical devices that react to environmental stimuli; it gives people a better sense of their environment. Using the Canary people can rapidly produce tangible interfaces, kinetic sculptures, and interactive spaces that are coupled to the environment. Because the Canary has both sensors for measuring and plugs for attaching motors, someone can build a robot or kinetic sculpture, plug its motors into the Canary, and the motors will move based on sensor values. If desired, one could make a robot wave a red flag whenever the air pollution levels are high.





Top left An example of a servo motor that can be attached to one of four ports on the canary [photo courtesy of Alex Woolsey Puffer]
Middle left Insides of the Canary
Bottom Canary LCD screen
Right The Canary board [photo courtesy of Alex Woolsey Puffer]

CANARY HOUSING

IN CONJUNCTION with the electronic components, the design of the Canary's sensor board housing was critical to creating the end-product. We had to present the device in a form that would compel, not intimidate, the workshop participants. Because the device had to be compact, hand-held, and user-friendly for non-technical users, the presentation of the device was important. It also had to be low-cost, simple to reproduce, and easy to customize and modify (using a hobby knife or, at most, a Dremel tool). The participants should not feel uneasy about opening the Canary's housing to see what is inside—to look at the actual sensors and experiment and play with them. Our industrial designer produced many iterations of the Canary housing—versions that were made from items such as sea salt containers, drink mix canisters, low density polyethylene (LDPE) squeeze bottles, and fabric pencil cases. In the end, we chose a Canary that was cut from sheets of corrugated plastic. The final version made it easy for users to open the housing and access the sensor board.

THE NAME

The Canary calls to mind the role of the canary in the coal mine. Coal miners would bring caged canaries down into the coal mines to test the quality of the air. Because canaries have sensitive metabolisms, they would quickly die if the mines were filled with carbon monoxide or methane gas. If the canaries died, the miners knew that the mine was not safe. Canaries were one of the earliest embodied sensors; they dramatically made the conditions of space visible and known. The design goal of our Canary was to create a toolkit that people could use to create their own representations of the environment (without hurting animals in the process!).

Above Examples of iterations of the Canary housing

OTHER TECHNOLOGIES: GIGAPAN

GIGAPAN COMPRISES three technological developments: 1) a robotic camera mount for capturing very high resolution (gigapixel and up), panoramic images using a consumer-level, digital camera; 2) custom software for constructing gigapixel panoramas; and 3) a new type of website for exploring, sharing, and commenting on gigapixel panoramas and the detail users will discover within them.

Developed by Researchers at Carnegie Mellon and NASA Ames, Gigapan is the newest development of the Global Connections Project, which aims to help build communities and foster learning about our planet through images that have so much detail that they are, themselves, the objects of discovery and wonder. We believe that enabling people to explore, experience, and share each other's worlds through images can be a transforming experience. [http://www.cs.cmu.edu/~globalconn]

If you live in the Pittsburgh area and are interested in attending Gigapan workshops, please contact Ron Gaydos at the Heritage Health Foundation for more information at 412-351-0535.

Right Gigapan in action
Below Gigapan without a digital camera [photo courtesy of Alex Woolsey Puffer]

IMAGINE ART FROM JTION & RO

MAKING AIR POLL BOT PARTS

OUR PRO

JECTS

WORKING WITH COMMUNITIES

Our focus in 2007 and 2008 is working with Pittsburgh neighborhoods and advocacy groups, specifically in the Lawrenceville and Braddock areas.

Residents explore, design, and build prototypes of interactive devices that address their personal issues and causes.

THE LAWRENCEVILLE PROJECT

(June 2007 - July 2007)

BECAUSE NEIGHBORHOOD Networks is concerned with community growth, we chose to conduct the pilot project in Lawrenceville, Pittsburgh's most rapidly growing neighborhood. Although Lawrenceville is an old neighborhood with an industrial past and a blue-collar ethos, it is currently experiencing a Renaissance. Factors such as affordable housing, cultural history, and easy access to bus lines and downtown have attracted many young professionals, artists, musicians, and students. As more young people, art galleries, and new businesses move into the neighborhood, Lawrenceville evolves as an amalgam of old and young, hip and historical.

Experiencing more than just an influx of residents, Lawrenceville is also a hotspot for community advocacy and social awareness. Several initiatives and organizations have addressed the concerns and issues of the community—groups such as the Lawrenceville Corporation, a nonprofit, community development corporation that is dedicated to bringing investment to the neighborhood and Lawrenceville United, also a nonprofit group that focuses on voicing the concerns of residents to community leaders. Organizations such as these not only strive to solve problems but also seek to promote community growth.

Before launching the workshops, we conducted background research with various community leaders and advocates including a City of Pittsburgh city planner, the City of Pittsburgh Office of Public Art, Lawrenceville Corporation's Executive Director, the Lawrenceville United Executive Director and its members, Lawrenceville Stakeholders members, and Neighborhood activists (including an artist and an amateur historian).

the LAWRENCEVILLE PROJECT

Top left & bottom left Historical images of Lawrenceville
[Photos courtesy of the Historical Society of Western Pennsylvania]
Right Penn Avenue mural in Lawrenceville, 2007

“What I really workshop were moments when wanted to com art, what our and how we’re

» From an interview with participants of the Neighborhood

liked about this
the collaborative
we decided why we
bine technology and
creation would do,
going to build it.”

Networks program in Lawrenceville (Summer 2007)

THE LAWRENCEVILLE PROJECT

Through the program, approximately 10 residents met one evening a week for seven weeks during the summer of 2007 at the Stephen Foster Community Center to explore how sensing and robotic technologies might be applied to issues and conditions in their neighborhood.

The program began with a sensor scavenger hunt, progressed to brainstorming and storyboarding, and ended with public demo-night at which participants presented prototypes of a variety of devices, sculptures, and model installations that used sensing and robotic technologies to address issues such as noise pollution and traffic calming.

In the end, residents were able to familiarize themselves with the intangible aspects of their environment. Participants often took Canaries home with them to test the conditions in and around their homes, and to use the data that they acquired as inspiration for their final project. Each project idea varied in focus, presentation, and application– from a series of butterflies rising and falling depending on the conditions outside of a window of a children's hospital, to a sculpture named Barney (pictured far right) who covered his ears when the room became too noisy.

All projects reflected the passions and creativity of community members. Some participants plan on continuing their work on their prototypes and applying for local grants to build full scale models to physically place in the community.

Top left Results from the scavenger hunt. Participants used photo documentation to record readings from the Canary

Top Right Participants brainstorm and begin to build robots that responds to sensor data

Bottom left Participants mapped their photos to orient the environmental data

Bottom Right Participants present their robotic sculptures and storyboards to the community

FINAL PROJECTS IN LAWRENCEVILLE

One participant, who was concerned with the vehicles that sped through the neighborhood streets, used the Canary to create a device that would visually document these speeders. She connected a servo to the sound input of a Canary and then attached an arm to a servo so that when the Canary picked up loud noises, the servo arm would trigger the shutter-release button on a Polaroid camera. She took her creation home and set it on her front porch. If a speeding vehicle passed, its noisy engine would set off the Canary sensor, and the device would take a picture of the speeding vehicle.

Another participant used the Canary to interact with the board game Loopin' Louie. In the game, a motor in the center of the board turns a boom arm with a little plane attached to the end. The board has four radial levers, each one leading to its "home" for each player. The objective of the game is for each player to protect the plastic disks that are balanced on the roof of his or her home. Before the plane reaches a home, players must knock it off course by hitting their levers to raise the plane so that it misses the disks. The workshop participant attached a servo-controlled arm at each lever. He connected each servo to a different sensor port on the Canary. By replacing the human players with the Canary, the participant was able to create a device that played Loopin' Louie by responding to sensory input.

In the end, participants were able to familiarize themselves with the intangible aspects of their environment. They often took Canaries home with them to test the conditions in and around their houses and to use the data that they acquired as inspiration for their final project. Each project varied in focus,

Top Discussion about the "Loopin' Louie" project at the final workshop session

Bottom The Polaroid camera project is tested by visitors at the final workshop session

presentation, and application. Examples of final projects include a series of butterflies that rise and fall depending on the conditions outside the window of a children's hospital and a sculpture named Barney (pictured far right) who covered his ears when the room became too noisy.

All projects reflected the passion and creativity of community members. Some participants plan to continue working on their prototypes and then apply for local grants to build full-scale models to use in the community.

PROJECTS IN DEVELOPMENT

BRADDOCK

This Fall we will be conducting a series of workshops in Braddock with the Heritage Health Foundation.

Braddock is a borough of Allegheny County in the Pittsburgh Metropolitan area. It was the site of the historic Battle of the Monongahela (or Braddock's Defeat) and of Andrew Carnegie's first steel mill. Although the neighborhood has declined since the downfall of Pittsburgh's steel mills, there has been a new interest in revitalizing the community.

These workshops will focus on the power of visual information. Using Gigapan and digital networked imaging, workshop participants will develop a stronger community awareness for their neighborhood and be able to communicate concerns and issues through their artistic creations.

BIKE PITTSBURGH

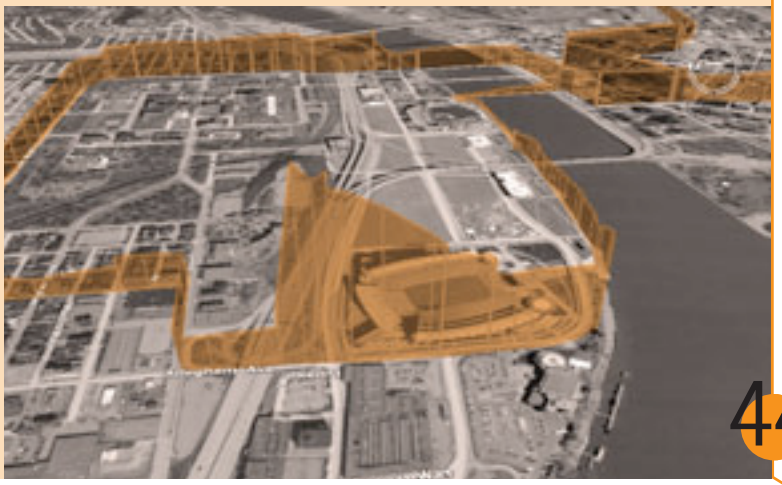
Bike Pittsburgh is a local nonprofit organization dedicated to promoting Pittsburgh as a bicycling city and community by educating bicyclists and motorists on road safety and by representing the interests of bicyclists.

Neighborhood Networks will partner with Bike Pittsburgh members, who will attach sensor units to their bicycles as they pedal around the city. By becoming mobile sensors themselves, the cyclists will be able to gather new data about environmental conditions. This method for collecting data will then be used as the basis for public online networking tools that provide visualizations of this unique environmental data and a new way of seeing the city will emerge.

Top Left/Top Right Braddock, a community focused on revitalization, is the site of our next set of Neighborhood Networks workshops

Bottom Left Member of Bike Pittsburgh equipped with environmental sensors [photo courtesy of Alex Woolsey Puffer]

Bottom Right A sample visualization of air quality data collected on a bike route



COLLABO

RATORS

The Neighborhood Networks project is directed by Carl DiSalvo and Illah Nourbakhsh. They are the project's principal investigators with research strengths in the areas of participatory design, interaction design, qualitative research, public art, engineering, and technology curriculum development.

ILLAH R. NOURBAKHSH is an Associate Professor of Robotics in The Robotics Institute at Carnegie Mellon and head of the Robotics M.S. Program. He was on leave in 2004 and served as Robotics Group lead at NASA Ames Research Center. He received his Ph.D. in computer science from Stanford University in 1996. He is co-founder of the Toy Robots Initiative at The Robotics Institute. His current research projects include educational and social robotics, electric wheelchair sensing devices, believable robot personality, visual navigation and robot locomotion. Illah recently co-authored the MIT Press textbook, Introduction to Autonomous Mobile Robots.

Carl DiSalvo is an Assistant Professor in the School of Literature, Communication and Culture at the Georgia Institute of Technology. He received his Ph.D. in Design from Carnegie Mellon University in 2006 and from 2006-2007 was a post-doctoral fellow at Carnegie Mellon with joint appointments in The Center for the Arts in Society and The Studio for Creative Inquiry. Carl's current research projects include collaborative mapping systems, sensing and imaging urban environments, the role of design and technology in community advocacy and development, and the development of interaction and participatory design methods for emerging technologies, particularly in the domains of geographic information systems and robotics.

The University of Pittsburgh Center for Learning In Out-of-School Environments (UPCLOSE) is our partner in the Neighborhood Networks program, providing guidance and support in community outreach, program development, and evaluation. The Neighborhood Networks - UPCLOSE team is lead by Senior Researcher and Designer Marti Louw.

MARTI LOUW, a researcher at the University of Pittsburgh Center for Learning in Out Of School Environments (UPCLOSE), has a background in science communication and the design of informal learning experiences. Her production and design experience spans a range of educational media and environments including broadcast television, websites, multimedia exhibits, and informal learning venues from museum to everyday public spaces. In 2003, Louw completed a M.A. in Interaction Design from Carnegie Mellon. Her particular research interest is in the way design and its related communication strategies can be used to create successful educational media, informal learning experiences and produce technology artifacts that positively impact learning.

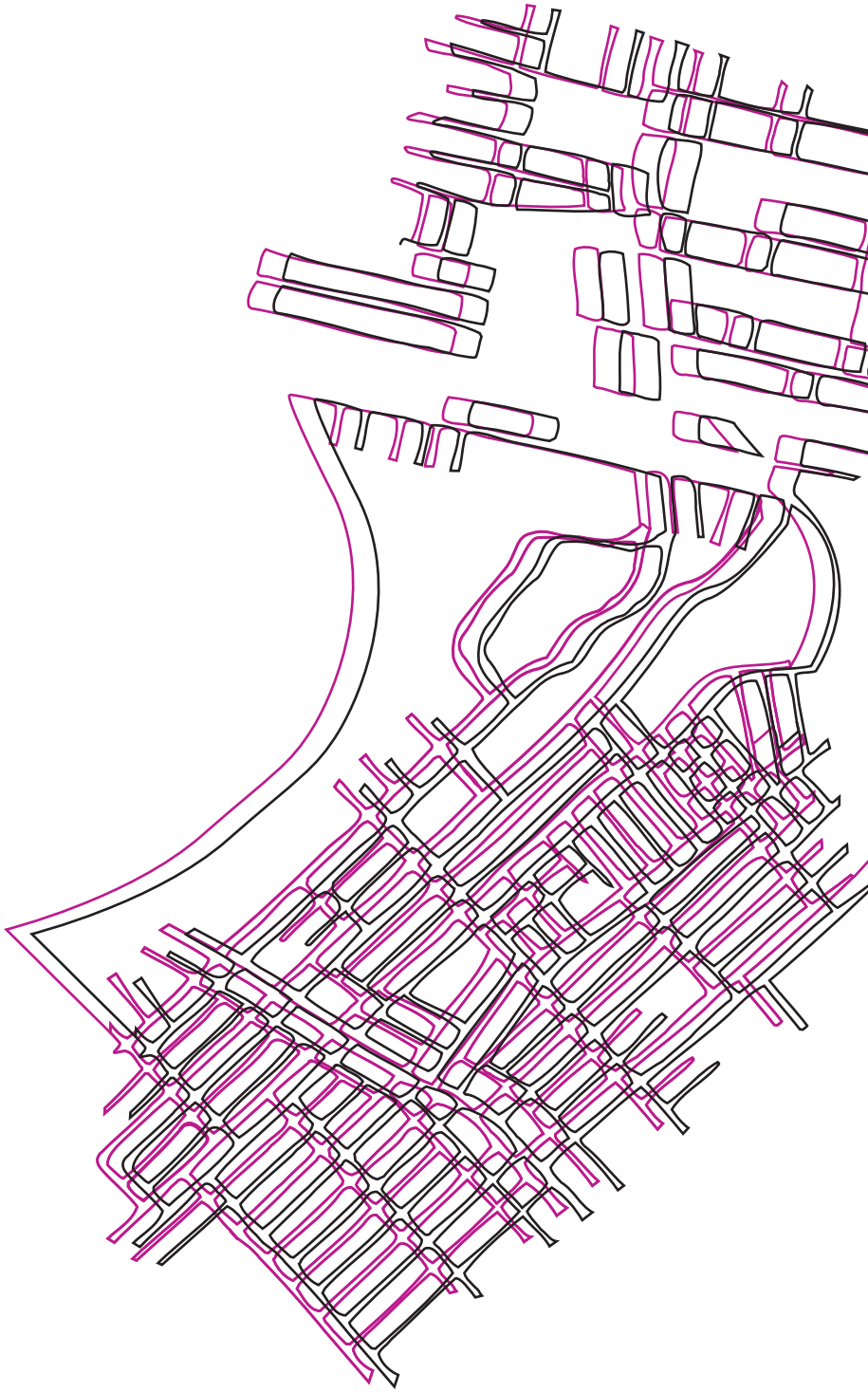
Other major collaborators include:

AYÇA AKIN is a graduate student in the School of Design at Carnegie Mellon. Her professional interests are in political science, environmental science, nonprofit development, and information and communication design. Ayça received her B.A. in political science from the University of Michigan and has worked with nonprofit organizations and as a free-lance designer. She is especially interested in how information visualization, in physical or digital form, can be used to affect social change. Her thesis work focuses on the history and future of visual data representations when used as rhetoric and open source programming tools for nonprofit groups and community activists.

DAVID HOLSTIUS is a Senior Research Programmer at Carnegie Mellon's Robotics Institute. In 2004, he received a Masters degree in Human-Computer Interaction from Carnegie Mellon. In 2005, David led technical development for the redesign of the U.S. Postal Service's Domestic Mail Manual. Before joining the CREATE Lab, he worked as a Software Engineer at MAYA Design, where he designed and built integrated systems in support of distributed indexing, geoinformatics, and location-awareness projects. David is a strong advocate for Universal Design and research methods that accurately represent the diversity of technology users' abilities and goals.

TOM LAUWERS is a fifth year Ph.D. student at Carnegie Mellon's Robotics Institute. He received a B.S. in Electrical Engineering and a B.S. in Public Policy from CMU in 2003, and a Masters in Robotics from Carnegie Mellon in 2006. He has a long-standing interest in educational robotics, as both a participant in programs like For Inspiration and Recognition of Science and Technology (FIRST) and later as a designer of educational technology and of a robotics course. He is currently studying curriculum development and evaluation and hopes that his study of the educational sciences will help him design better and more useful educational technologies.

DANIEL LETSON is a fourth-year undergraduate student in Carnegie Mellon's Industrial Design program. He is currently a member of Carnegie Mellon's Solar Decathlon team, which works to design and build an 800 square foot solar-powered home for a yearly international competition. He has completed collaborative product development projects with Calphalon and General Motors. He has also worked as an archival researcher for the museum exhibit "Nakashima Revealed: The Carnegie Mellon Collection", and as an apprentice to Pittsburgh furniture designer and craftsman Tadao Arimoto. Dan's recent work has been concerned with sustainable and recycled design products, user co-design, and critical design practices.



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