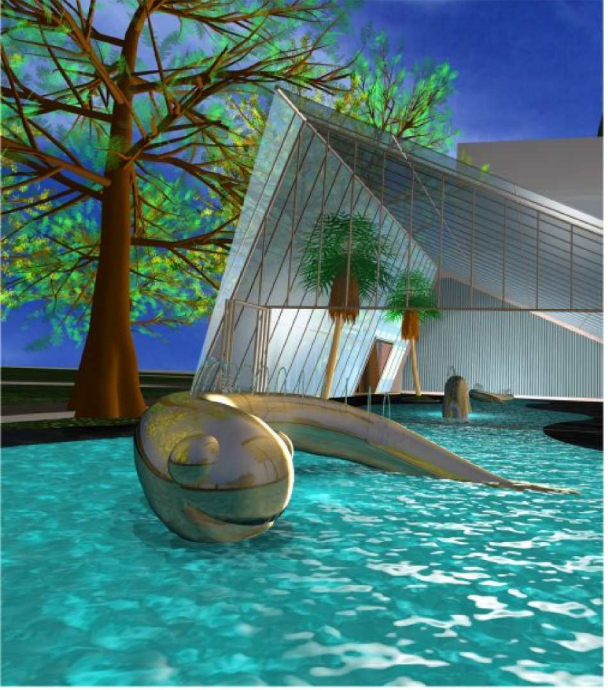
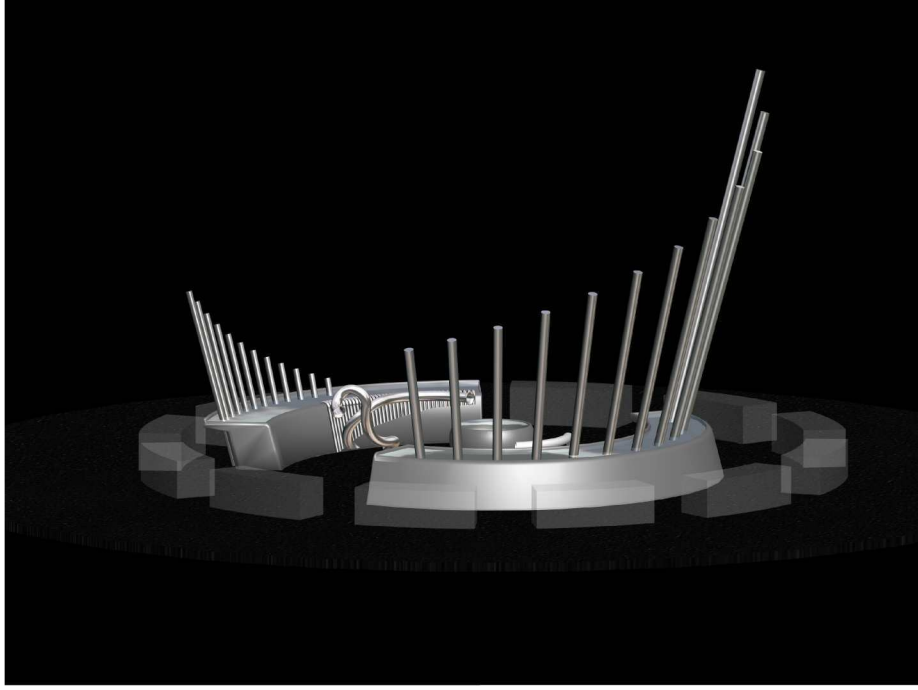
Selected Artistic works

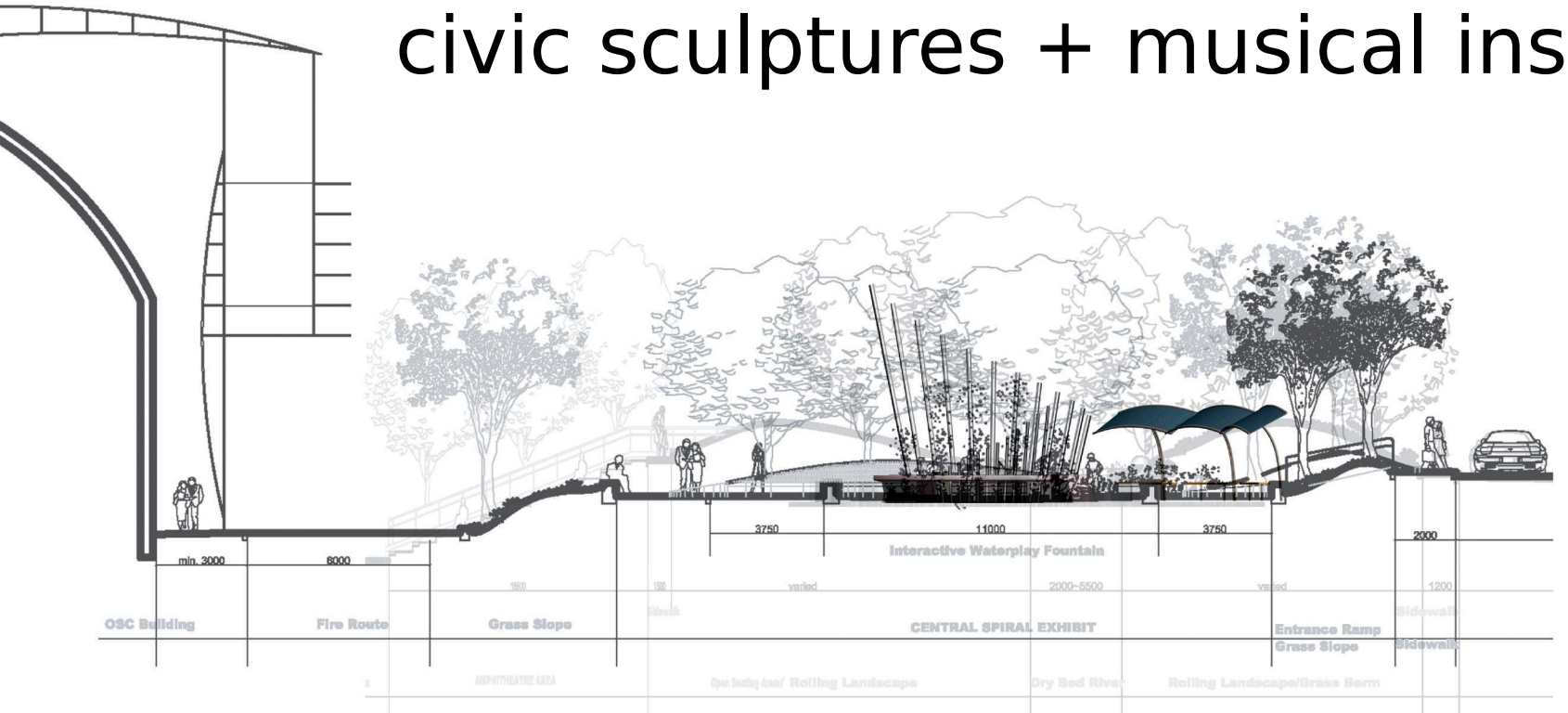
Steve Mann





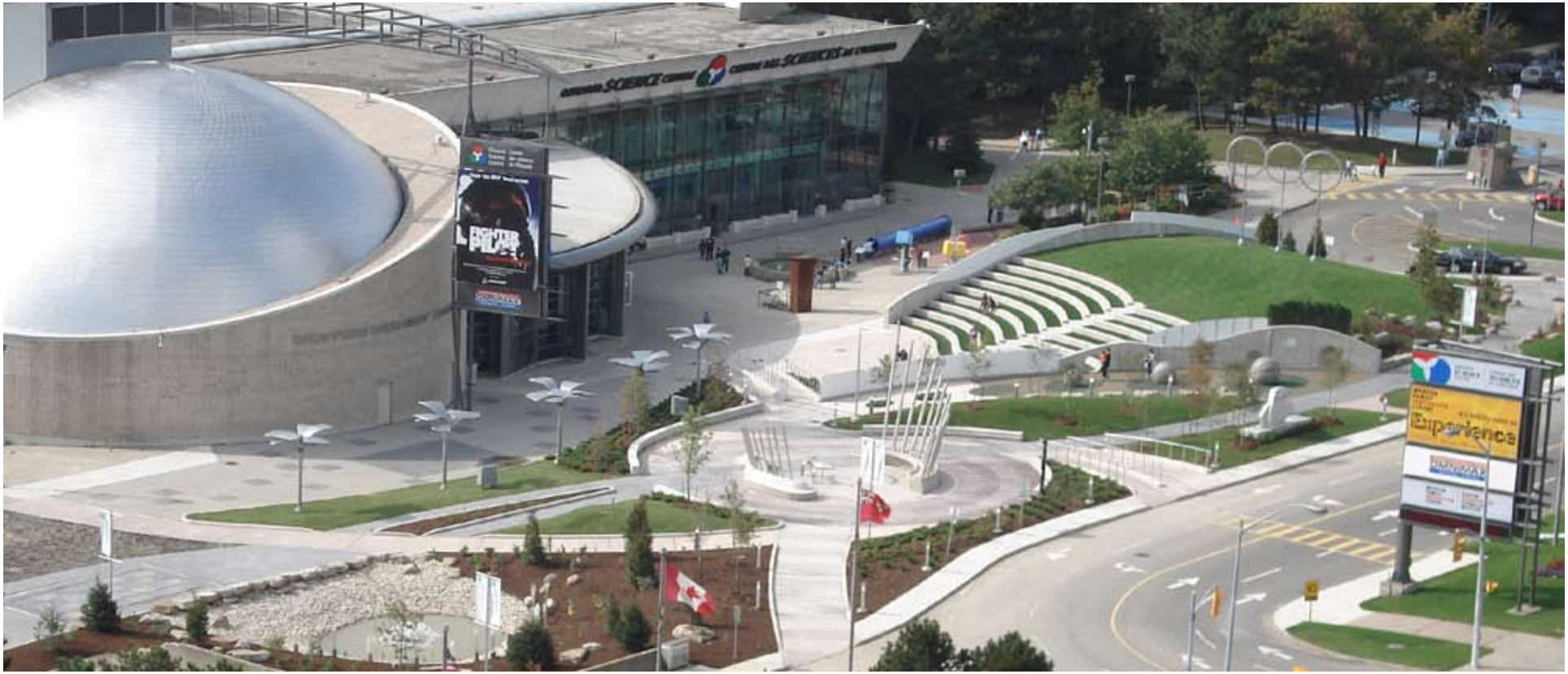
hydraulophone

civic sculptures + musical instruments



Hydraulophone installation at Ontario Science Centre:
(Steve Mann and Chris Aimone, 2006)

The hydraulophone is like a woodwind instrument but it runs on water rather than air. You play the hydraulophone by stopping the jets of water with your fingers or hands. By blocking multiple jets you can even play chords.



This hydraulophone installation, as the main architectural centerpiece out in front of the Ontario Science Centre, is a musical instrument that is open to the public 24 hours a day.

Top: Aerial view of hydraulophone installation in Teluscape park.
Bottom: Nighttime panorama of the piece.

Hydraulophone installation at Early Learning Centre:
(Steve Mann and Chris Aimone, 2005)
Starting from the left side of the hydraulophone, each jet corresponds to a note on the musical scale starting at "A", and moving through the musical alphabet, where each jet can be labeled as "A, B, C, D, E, F, G, a, b, c, d, e."

CATHY MCFEE:
CNIB OPENS INNOVATIVE OUTDOOR CLASSROOM FOR CHILDREN

BY **SARAH FABBRI**

A young boy in a playground giggles when he discovers that a special water fountain he is playing with makes different sounds when he moves his fingers – like a keyboard. The boy is blind and he's playing on something called a hydraulophone which is helping him learn more about the world around him. He's in the CNIB's (Canadian National Institute for the Blind) recently opened Outdoor Classroom in Calgary. It's the first facility of its kind in Canada.

"We have created something that has tremendous meaning for these children and their families," says Cathy McFee, Director of Services and Operations, CNIB - Alberta NWT Division. McFee received her Leadership Development Certificate of Excellence last spring and says her Banff Centre experiences played an important role in the development of the Outdoor Classroom.

The idea for the classroom started more than two years ago when employees with Urban Systems, a Calgary consulting firm, participated in the United Way's Day of Caring by painting fences in the CNIB's Family and Children's area, says McFee.

"We invited the Urban Systems team in for a tour, to share information about CNIB, and this led to some discussion about developing a sensory playground to better meet the needs of children with vision loss," she says. Currently CNIB Calgary has about 80 preschool children registered with its services.

"We started to ask ourselves questions such as: Who uses this space? How is it used? How does it compliment the services of the CNIB program?" says Leighton Ginther of Urban Systems.

There was a lot of enthusiasm and creativity, recalls McFee. "We pulled together an exciting plan. We designed an educational facility where children with vision loss could explore, develop skills, and build confidence in a safe, interactive and accessible environment."

Plans featured a tactile map at the entrance to help children mentally map the outdoor space, a looped pathway system to give children the opportunity to develop their orienteering skills, a xylophone, and a sound bench.

"We were faced with a number of challenges," says McFee. These included securing approval from the CNIB's national office and securing the resources to fund the project.

At the time, McFee was just about to start her fourth Leadership Development program, *Leading Teams for High Performance.*

During Leading Teams, McFee says she had a chance to present the Outdoor Classroom plans to her learning group. "I gained more confidence about how to communicate a plan to our national office, highlighting the benefits and outcomes to the organization. I (also) learned about staying focused, connecting with my own sense of values, and leading others with both purpose and passion."

The national office gave McFee the nod of approval to go ahead with the project.

McFee and her project team then secured additional partners in addition to Urban Systems, including WestJet. The tasks expanded, from creating a fundraising strategy to organizing volunteers.

"I learned about facilitating a new team that involved both internal and external stakeholders," explains McFee. She now had to build consensus and foster collaboration around a common goal.

In November 2007, McFee took *Art of the Executive Leader,* her fifth program. "One of the things I have learned is that for nonprofit organizations to be competitive and successful you need to be innovative and mobilize every sector of society."

On October 3, 2008 McFee's shared vision became a reality and the CNIB Outdoor Classroom officially opened. The most memorable moment for McFee was watching several of the young children with vision loss engaged in play with the many components of the Outdoor Classroom.

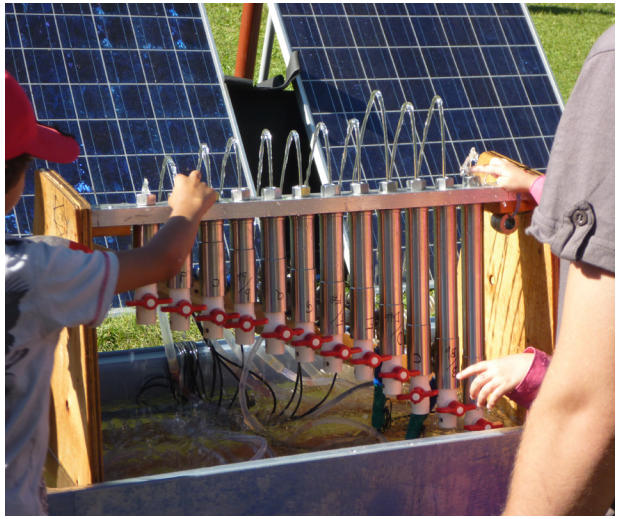
"One very small child stood quietly – head bowed, eyes closed, tiny hands grasping onto the smooth xylophone bars – enjoying the calming vibrations of sound as his father delicately struck the instrument," McFee says.

McFee says she is grateful for the support she has received along her 10-year learning journey, one made possible thanks to the generosity of others. "It happened because of the Centre's scholarships for non-profit leaders and I want to express my gratitude and appreciation."

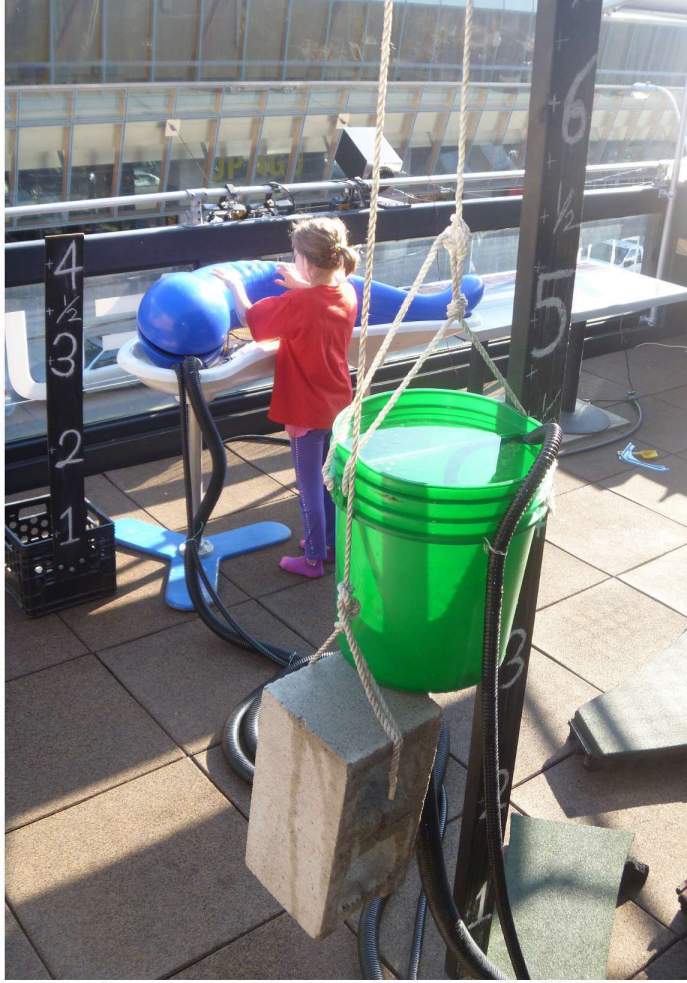
Sarah Fabbri is marketing officer for Leadership Development.

Natural Technologies

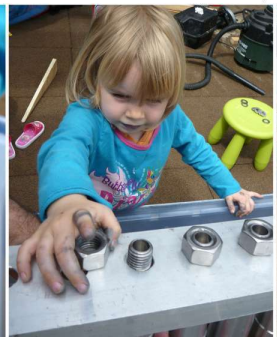
Our technology has been designed to run on low-voltage (12 volts DC), making it easy to run from **green technologies** such as solar panels.

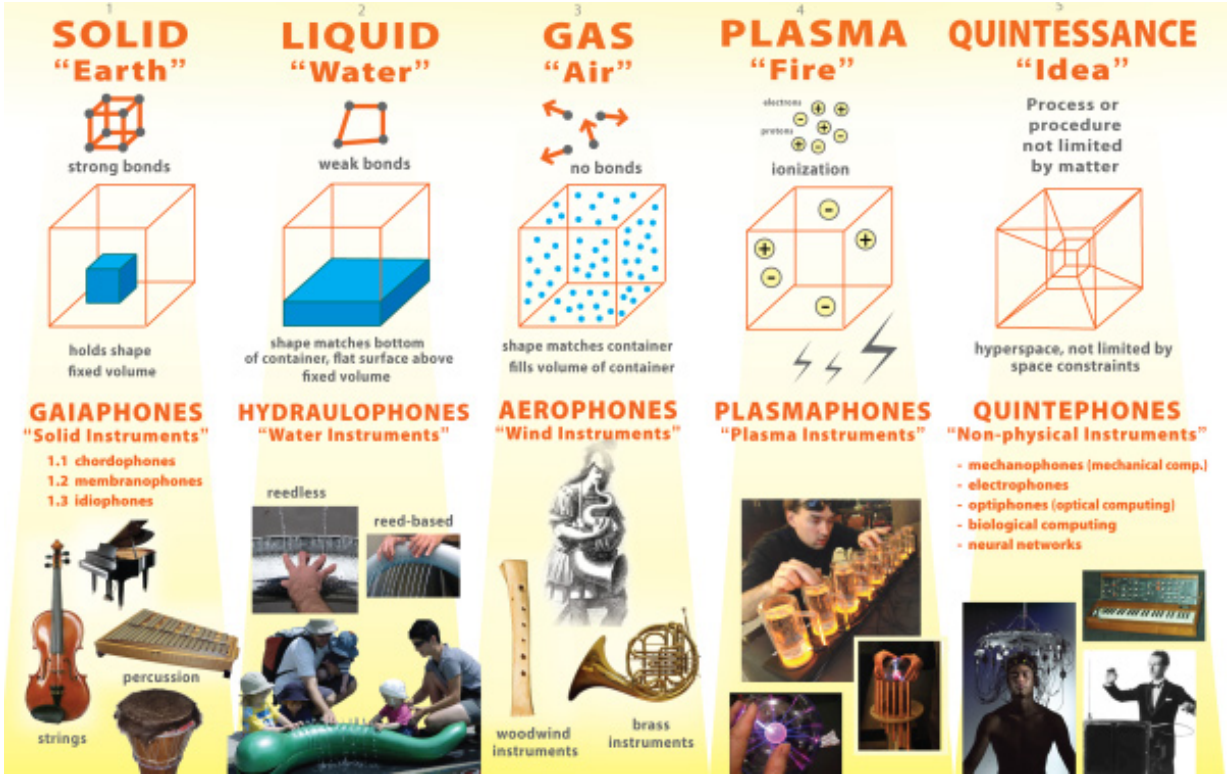


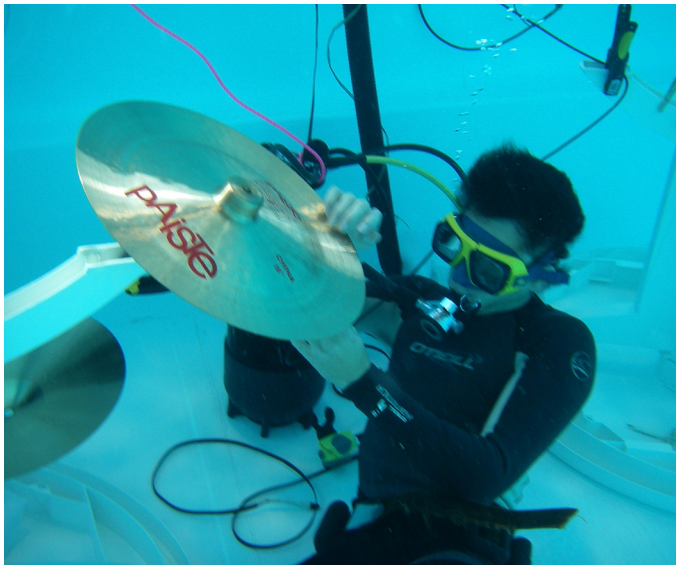
The pictures to the right show a solar panel powered **WaterTouch**tm prototype placed in a water table. Both Children and parents alike find the gentle soothing vibrations wonderful to the touch,providing hours of musical fun and entertainment.

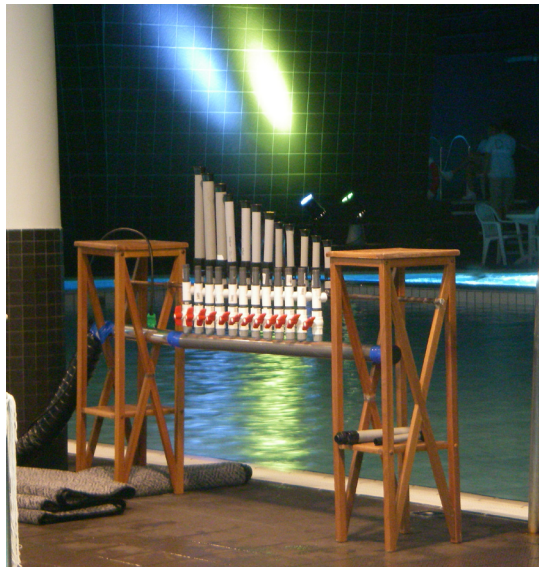


Hydraulikos activities: Science, exploration, experimentation, and understanding









States of Matter Ensemble:
(Steve Mann, Chris Aimone, Ryan Janzen, Ariel Garten, 2007)

Here we see the logical extension of the theme of musical embodiments of the ancient states of matter. There are already displays of how water and ideas can be manipulated to create music, here are examples of art that embodies air, earth, and fire.

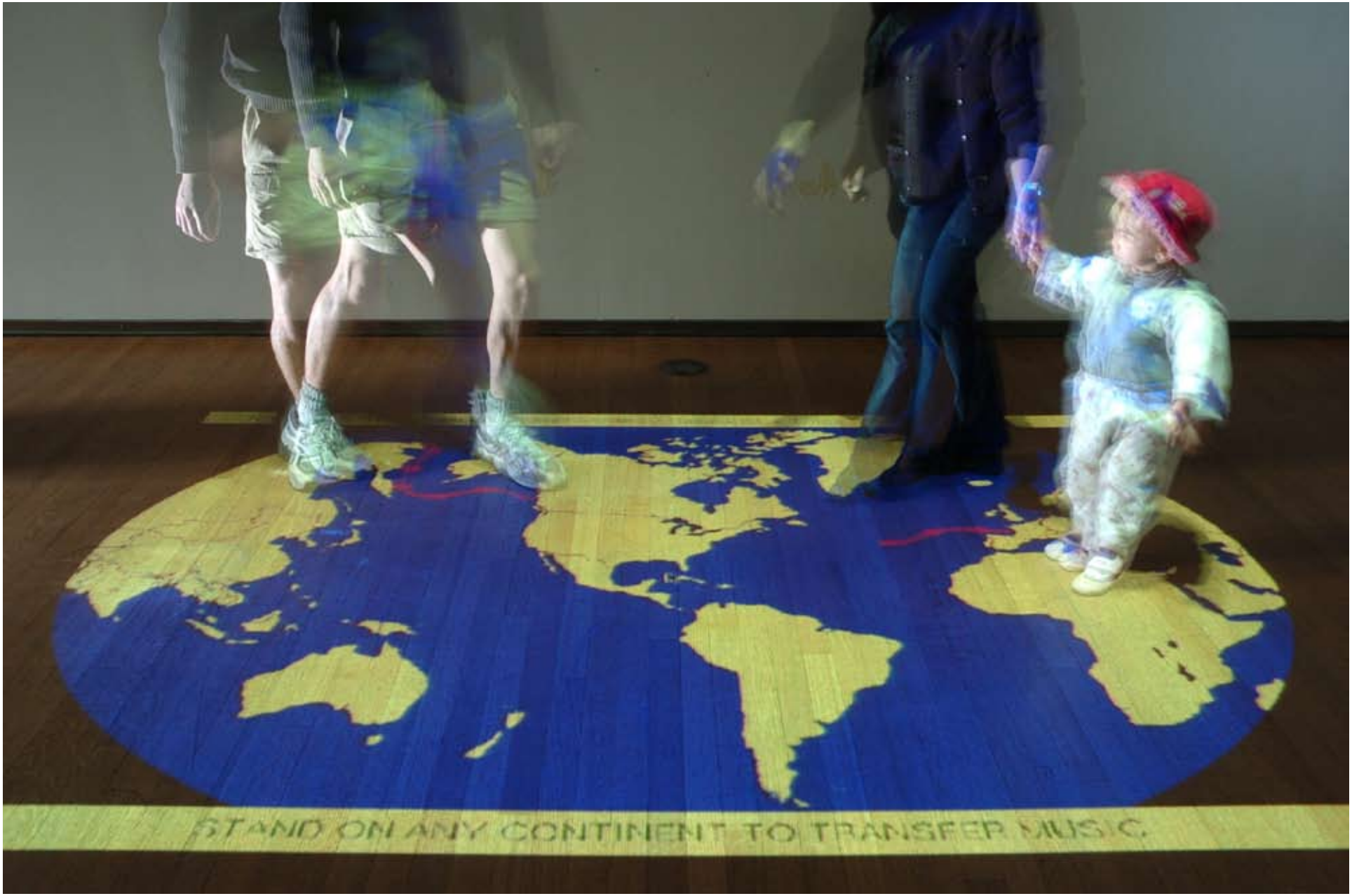
See video: Pneumatophone.

see also: http://wearcam.org/icmc2007/

The Andantephone:
(Steve Mann 2005)

The Andantephone is an interactive musical instrument that is played by stepping on different pads. Each pad corresponds to a note of a song that is programmed into the instrument. As the user walks across the Andantephone a note is played and the user can change the tempo the song is played at by speeding up or slowing down.

See video: Andantophone
see: wearcam.org/andantephone/



"Mapster" at Digifest 2004: (Chris Aimone and Steve Mann, 2004, opening conincident with Mann's keynote address at Digifest)
By walking on the map, mp3 files are transferred from remote file servers to North America. Music is transferred over the internet and across boarders thus challenging copyright laws, while agency is transferred to the unwitting individual who is clearly not accountable for his or her actions.

The Blue-roofs project:
(Steve Mann with Chris Aimone and A. Sehgal, 2004)

The Blue-roofs "Urbeach" design combines sustainable energy (wind, solar, etc.) with ecologically conscious waterplay spaces.
A blue-roof is an urban oasis that recontextualizes the boundary between public and private space.
The project included the world's first roof membrane to encapsulated photovoltaics. Additionally a wind turbine harvests electrical energy. Solar heated water provides warm showers and fun waterplay. The water is reclaimed and used to irrigate a "green roof" (rooftop garden).

This eco-shower concept won first place (a 10,000 euro prize) in the 2004 Coram International Design Competition.

Interactive brainwave music and art:
(S. Mann, C. Aimone, J. Fung, and A.Garten. 2003)
A communal bathing experience via a network of Internet-connected baths. EEG brainwave monitoring allows biofeedback between bathers in other places. The collective brain activity produces sound and light, yielding a soothing musical aquatic environment.

Art installation at Vancouver Olymics, 2010...

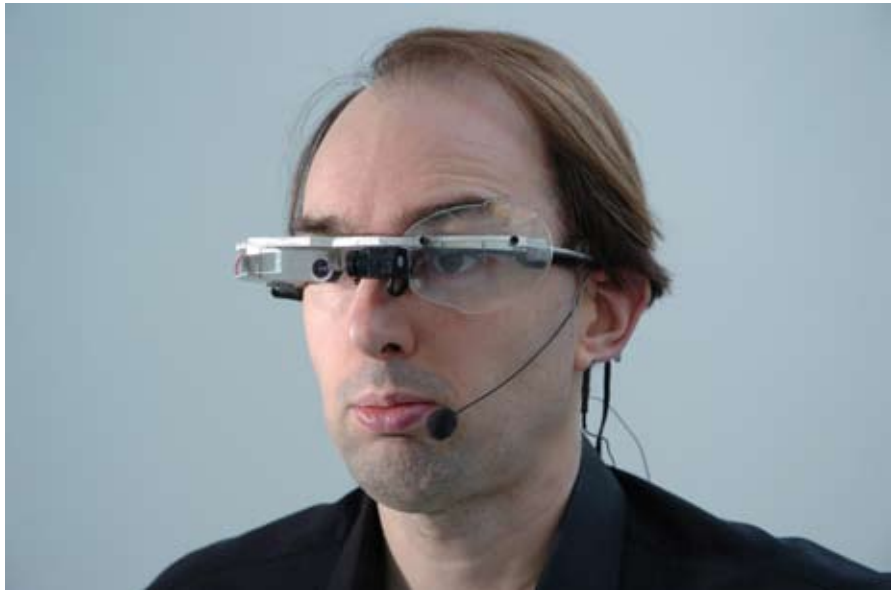
Leftmost: Testing early prototype at 330 Dundas Street West, Toronto, Ontario, where InteraXon is co-located.

Steve Mann, Mark Post (pictured), James Fung, Ariel Garten, Chris Aimone, and Trevor Coleman.

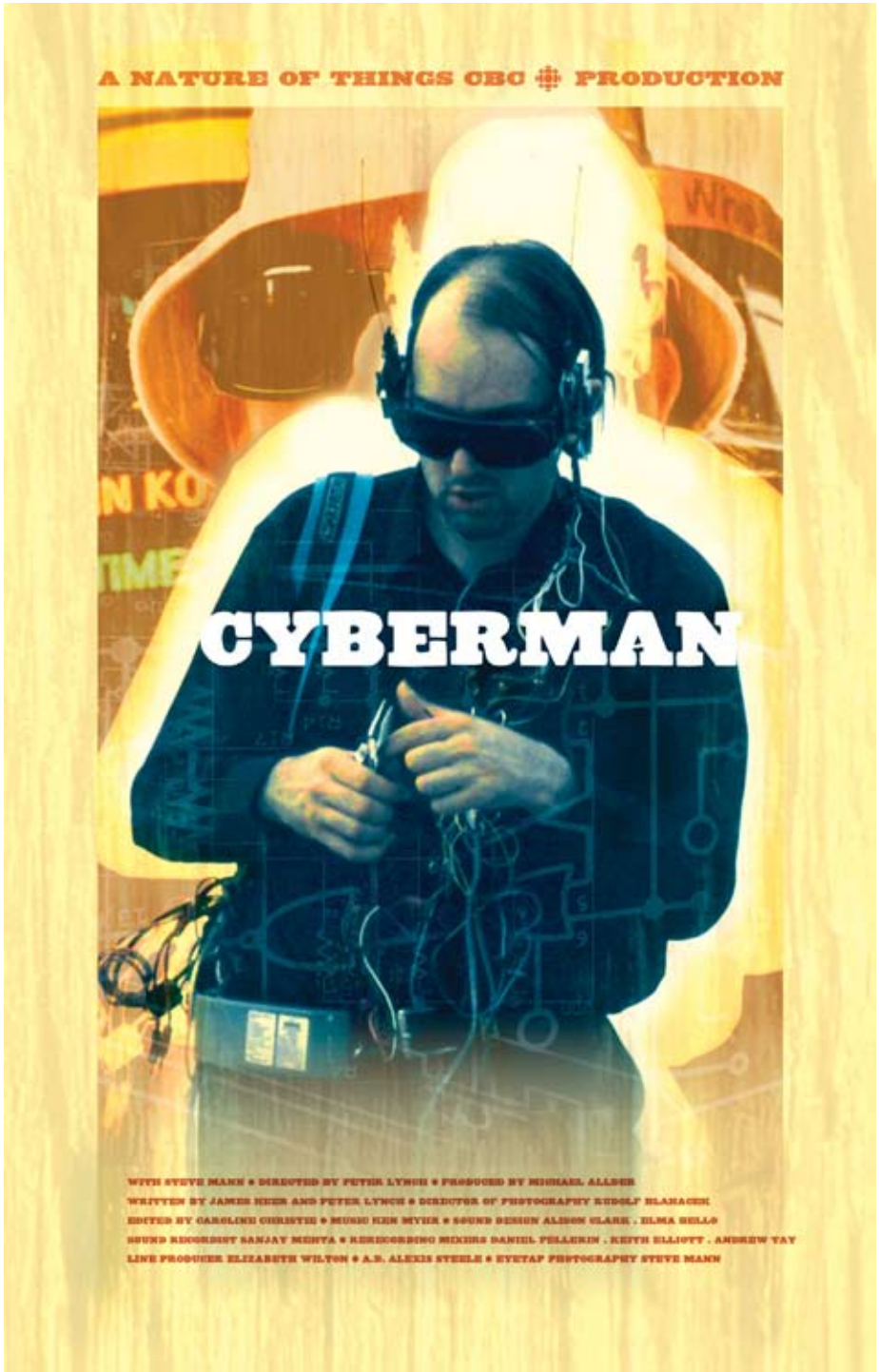
This installation art bridges the gap between cyberspace (cyborgspace) and physical space, using brainwave-controlled architectural lighting.

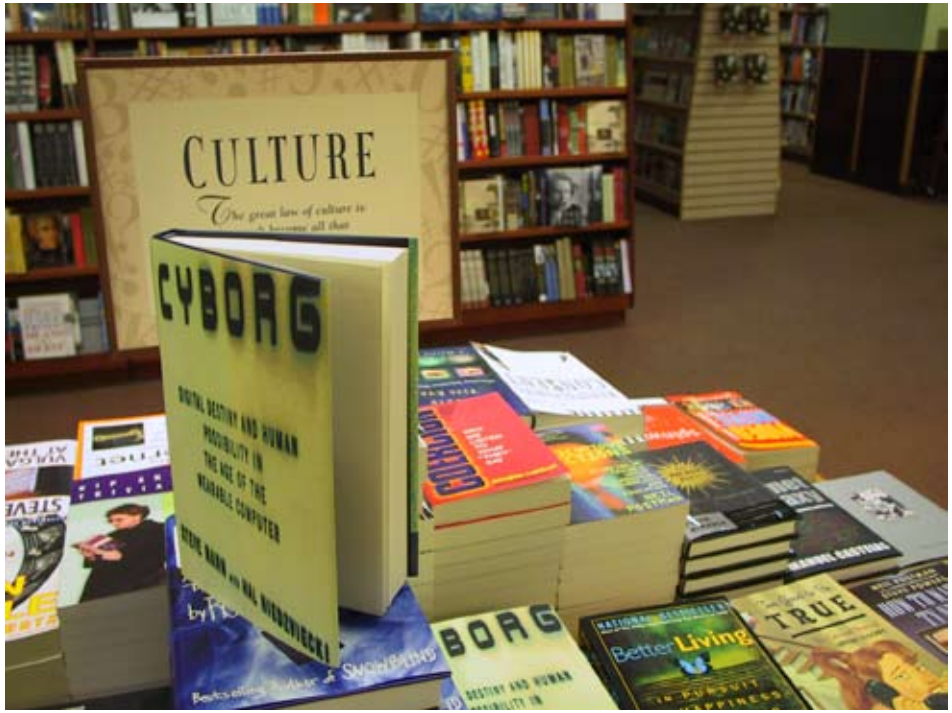
Participants are invited to control the lights on major architectural landmarks, such as the CN Tower in Toronto, the Parliament Buildings in Ottawa, and the lights on Niagara Falls, all from the Ontario Pavillion at the 2010 Olympics in Vancouver.

This public art installation extends out across the country and will be open to the public to experience as part of the Ontario Pavillion during the entire time of the Olympics, February 12-28, 2010.



Public cyborg art:
Left: Worlds first wearable computer with
24hr continuous audio / video streaming. (S.Mann, 1984).
Above: Contemporary designs. (C.Aimone, S.Mann. 2002)





Left: "Cyberman": (Directed by Peter Lynch. 2001)
"Steve Mann is the world's first real cyborg, a man who exists in harmony with technology. With the help of a computer that he developed to serve as an extension of his own senses, he is able to absorb reality electronically, ... able to confront issues of privacy and the manipulation. ... Cyberman is a brilliant exploration of obsession, the nature of genius, and mass media."
-- Canadian Film Institute, 2001.
"Cyberman, is about a genius computer geek at the U of T who created the world's first wearable computer."
-- Globe and Mail.
Rated, by P.O.V.'s Peter Wyntonic as "Canada's most important film of the year", and was rated by Toronto Life as the best film at the International Film Festival, 2001.

Top: "Cyborg": (S. Mann with Hal Niedzviecki, 2001)
Book on cybernetic art and technology
"Cyborg is packed with extraordinary insights into the relation between power, culture and technology, and the complex perceptual and cognitive reality that is quickly emerging on the threshold of the transhuman epoch." -- Christopher Dewdney, --The Globe and Mail

General-Purpose Wearable Computing in everyday life:

World's first wristwatch videophone

Steve Mann, 1998, June 1999, July 2000

Canadian Intellectual Property Office — An Agency of Industry Canada
Office de la propriété intellectuelle du Canada — Un organisme d'Industrie Canada
Canada

Canadian Patents Database

Patent Summary

(12) Patent:	(11) CA 2275784
(54) English Title:	WRISTWATCH-BASED VIDEOCONFERENCING SYSTEM
(54) French Title:	SYSTEME DE VIDEOCONFERENCE SUR MONTRE-BRACELET

Patent Details

(72) Inventors (Country):	MANN, STEVE (Canada)
(45) Issued:	2000-10-24
(22) Filed Date:	1999-06-29
(41) Open to Public Inspection:	1999-12-29
Examination requested:	1999-06-29
(30) Availability of licence:	Yes

(30) Application Priority Data:

Application No.	Country	Date
2,237,939	Canada	1998-06-29
2,247,649	Canada	1998-10-13
2,248,473	Canada	1998-10-29

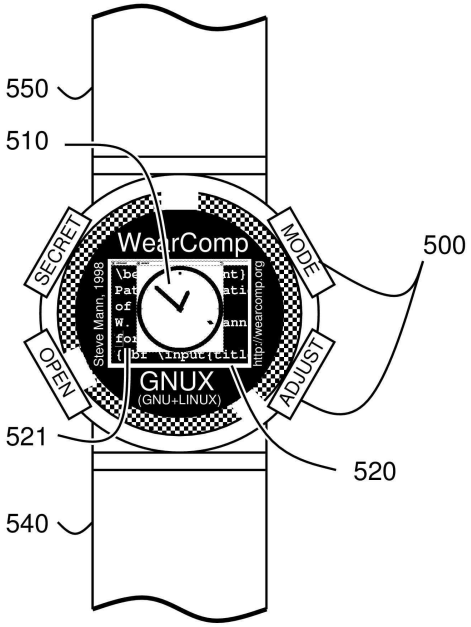


FIG. 5a: WRISTWATCH VIDEOPHONE CLOCKFACE

ISSCC: 'Dick Tracy' watch watchers disagree

By Peter Clarke
EE Times
(02/08/00, 9:12 p.m. EST)

SAN FRANCISCO -- Panelists at a Monday evening (Feb. 7) panel session at the International Solid State Circuits Conference (ISSCC) here failed to agree on when the public will be able to buy a "Dick Tracy" style watch for Christmas, with estimates ranging from almost immediately to not within the next decade.

Steve Mann, a professor at the University of Toronto, was hailed as the father of the wearable computer and the ISSCC's first virtual panelist, by moderator Woodward Yang of Harvard University (Cambridge Mass.).
...

A GNU/Linux Wristwatch Videophone

Jul 01, 2000 By Steve Mann
in Audio/Video

This fully fuctioning prototype, designed and built by Steve Mann in 1998, was demonstrated in 1999, and later used to deliver a videoconference at ISSCC 2000. ...
...

http://www.linuxjournal.com/issue/75

Cite/Reference the above patent and LJ 2000 article:
Title "A GNU/Linux Wristwatch Videophone", by Steve Mann, Linux Journal, Issue 75, July, 2000, Pp 86-91+Cover.

Canadian Intellectual Property Office
An Agency of Industry Canada
Office de la propriété intellectuelle du Canada
Un organisme d'Industrie Canada
Canada

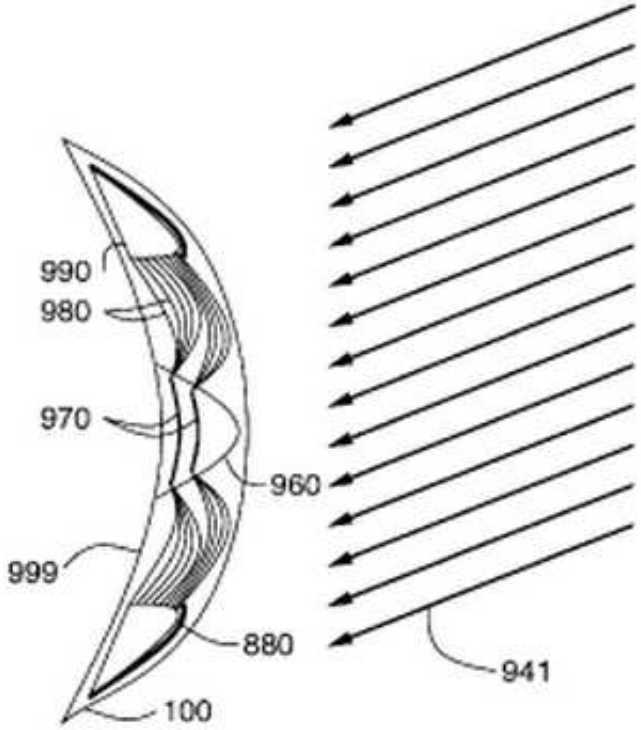
(12) Patent Application: (11) CA 2280022

(54) English Title: CONTACT LENS FOR THE DISPLAY OF INFORMATION SUCH AS TEXT, GRAPHICS, OR PICTURES

(72) Inventors (Country): MANN, STEVE (Canada)

(22) Filed Date: 1999-07-28

Representative Drawing



“SeatSale”: License to Sit:
(Steve Mann, 2001)

San Francisco Art Institute (SFAI, 800 Chestnut St.), organized by Independent Curators International (ICI) of New York, and curated by Steve Dietz of walkerart.org (Walker Art Center) of Minneapolis. SeatSale was also exhibited at various other museums and galleries, such as Austin Museum of Art, Oklahoma City Museum of Art, etc..

“Real-Life Cyborg Challenges Reality With Technology”, September 25, 2001, -- New York Times.

"Griefcase", Leonardo 2004 Award for Excellence

Service to the Community:

IEEE International Symposium on Technology and Society, 2013, Steve Mann, General Chair

IEEE
Advancing Technology for Humanity

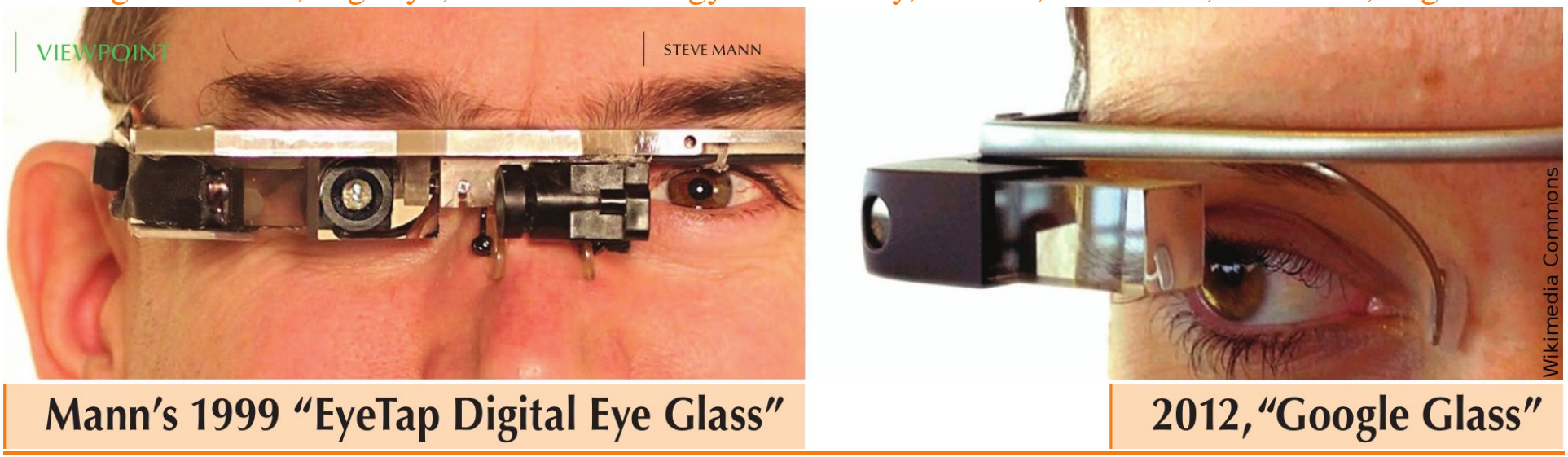
World's largest technical society

Insert credit card to retract seat spikes!
S. Mann, San Francisco Art Institute, 2001

Fingerprint-scanning briefcase designed to be opened by anyone except the owner. Therefore, a security guard wishing to search the owner's case must submit to being fingerprinted! Leonardo Award for Excellence, S. Mann, 2004

As a designer, artist, scientist, technologist, engineer, and mathematician, and Renaissance humanist, Mann is interested in ALL aspects of Advancing Technology for Humanity!

"Through the Glass, Lightly", IEEE Technology and Society, Vol. 31, Number 3, Fall 2012, Pages 10-14



Mann was recognized as "Father of AR" and the "Father of Wearable Computing" (IEEE ISSCC 2000)

... and Wearable Computing is now a $241 billion industry!!!

Vision system for the blind

Canadian Intellectual Property Office | Office de la propriété intellectuelle du Canada | Canada

Patent Summary

(12) Patent Application:	(11) CA 2313693
(54) English Title:	IMPLANTABLE CAMERA SYSTEM
(54) French Title:	SYSTEME DE CAMERA IMPLANTABLE

Patent Details

(72) Inventors (Country):	MANN, STEVE (Canada)
(22) Filed Date:	2000-07-19

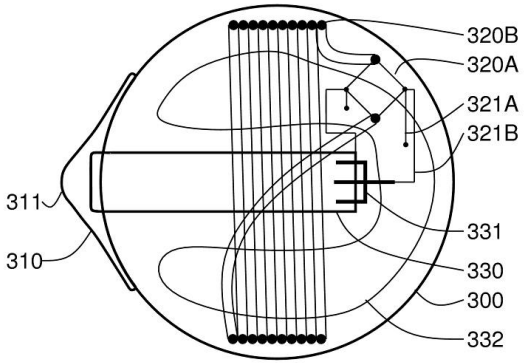


FIG. 3A = EYE IMPLANT

Dmitri Vitaliev visits three Toronto men who have created a functioning camera eye – an invention with far-reaching applications

the eyeborg man

THE HISTORY of technological breakthroughs is littered with simple questions producing

'sousveillance' device. This term was coined by Mann to describe the recording of an activity from

taught engineer from Westwood, California, who had designed and developed this proof of

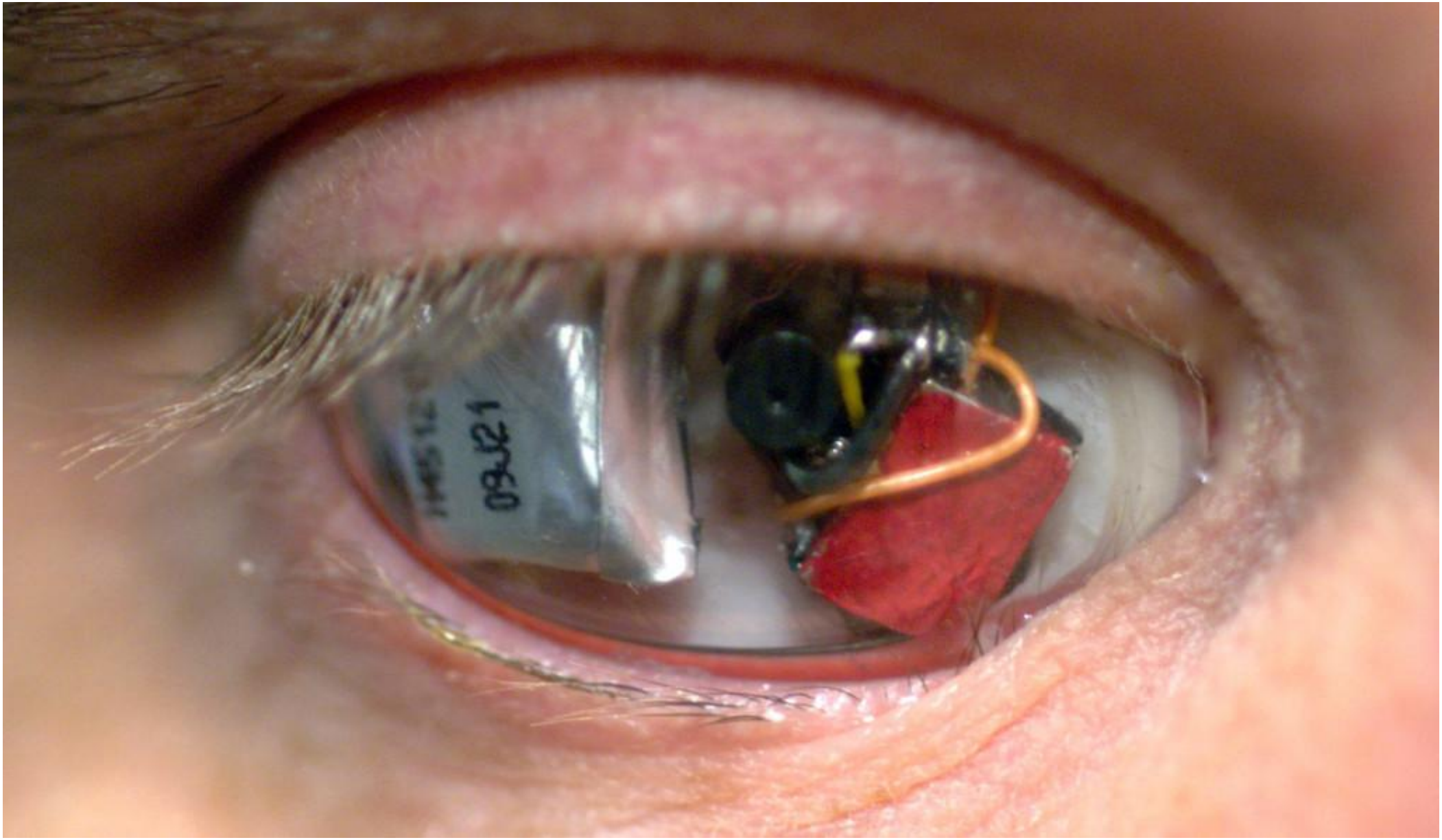
air balloon with a remote defla-tion system to conduct high-altitude air quality and pesticide

TECH SPECS OF THE VISION SYSTEM

"It's really quite simple"

Fox News and the Canadian Broadcasting Channel. Yet popularity has not brought

The 50 Best Inventions of 2009 -- TIME Magazine



Fully functional **Implantable Camera System**.
Inventor:
• Steve Mann (Patent CA2313693A1);
Film makers:
• Denys Desjardins ("My Eye for a Camera", National Film Board of Canada);
• Rob Spence (Toronto, Ontario, Canada).

For more information, see:
http://wearcam.org/eyeborg/

Mann's HDR (High Dynamic Range) imaging invention is used in nearly every commercially manufactured camera, including the Apple iPhone:

"The first report of digitally combining multiple pictures of the same scene to improve dynamic range appears to be Mann.[3] " -- *M. A. Robertson et al.*

Journal of Electronic Imaging / April 2003 / Vol. 12(2) / 219–228

References

1. **S. Mann** and R. W. Picard, "Video orbits of the projective group: A simple approach to featureless estimation of parameters," *IEEE Trans. Image Process.* **6**(9), 1281–1295 (Sep. 1997).
2. C. W. Wyckoff, "An experimental extended exposure response film," in *SPIE Newsletter*, pp. 16–20 (June/July 1962).
3. **S. Mann**, "Compositing multiple pictures of the same scene," *Proc. 46th Annual IS&T Conf.*, Boston, MA, pp. 50–52, May 9–14, 1993.
4. **S. Mann** and R. W. Picard, "On being 'undigital' with digital cameras: Extending dynamic range by combining differently exposed pictures," *IS&T's 48th Annual Conf.* Washington, D.C., pp. 422–428, May 7–11, 1995.

United States Patent 5,828,793

Mann

[54] **METHOD AND APPARATUS FOR PRODUCING DIGITAL IMAGES HAVING EXTENDED DYNAMIC RANGES**

[75] Inventor: **Steve Mann,** Cambridge, Mass.

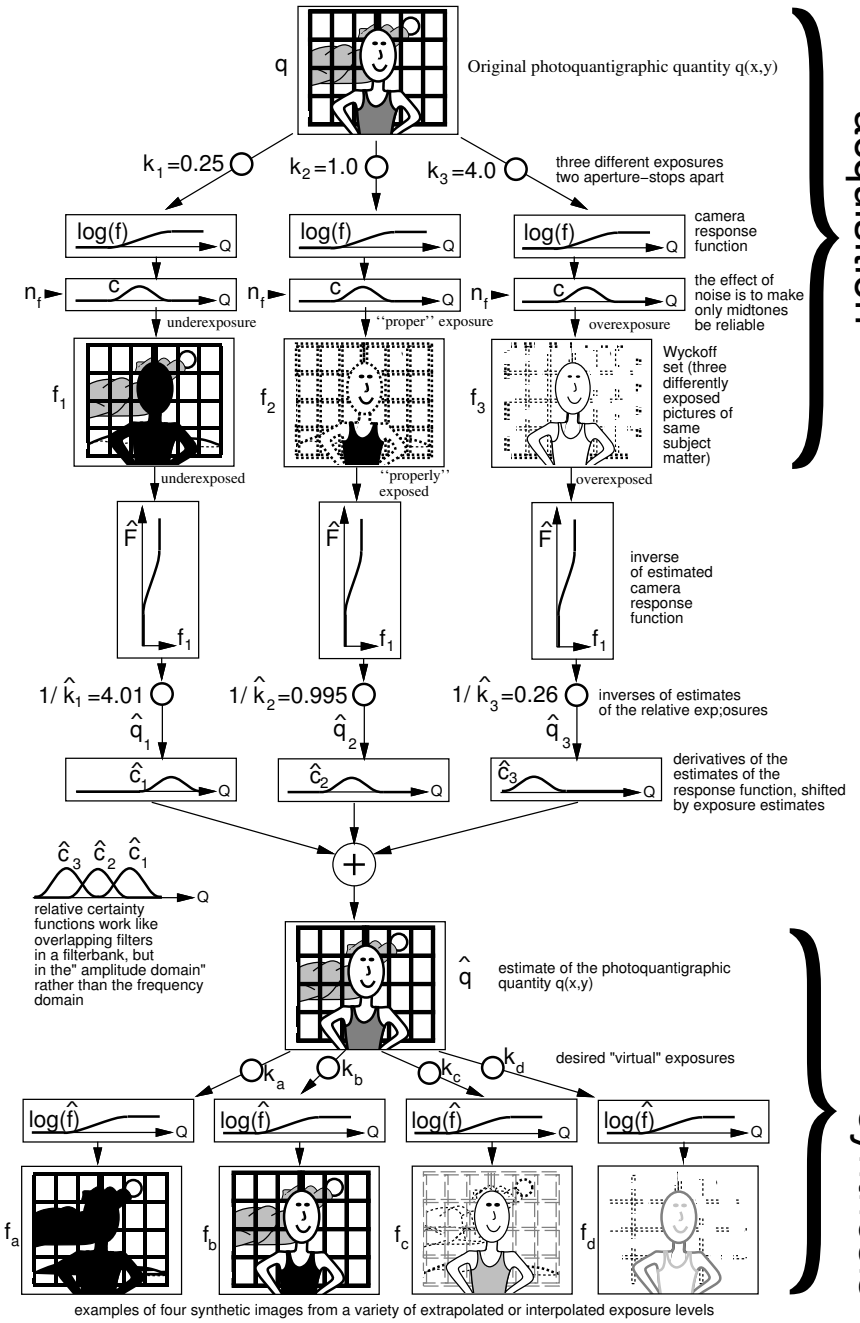
[73] Assignee: **Massachusetts Institute of Technology,** Cambridge, Mass.

[22] Filed: **May 6, 1996**

OTHER PUBLICATIONS

Mann, Steve; "Compositing Pictures of the Same Scene," Massachusetts Institute of Technology, Cambridge, MA 02139.

Mann, Steve; "Lightspace," *MIT Media Laboratory, Information and Entertainment Systems Group,* Dec. **1992.**



examples of four synthetic images from a variety of extrapolated or interpolated exposure levels

HDR (High Dynamic Range) Imaging, and Computational Photography, Steve Mann, 1992

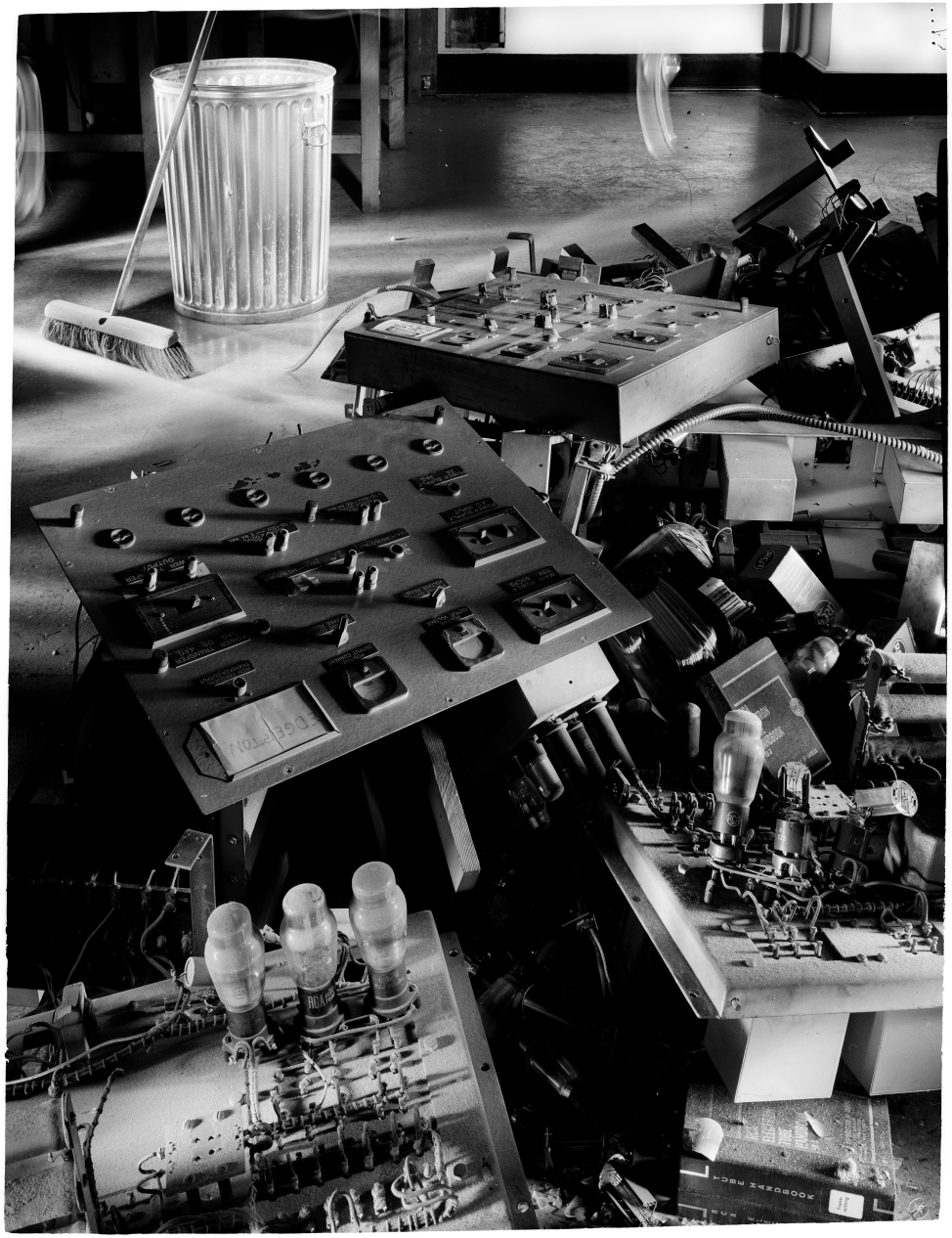
Quantigraphic camera promises HDR eyesight from Father of AR

Chris Davies, Sep 12th 2012

...

Traditional welding helmets use a sheet of smoked glass for the eyepiece, cutting down on the dangerous glare from the welding process itself, but also reducing overall visibility. The HDRrchitecture system, instead, processes images coming from one or more cameras, rendering a Full HD, 30fps stream with the brighter elements stripped out but the core details retained, all in real-time.

Steve Mann photography: "Spimelapse" (space-time-lapse), Microseconds and Millennia,
dealing with the spacetime continuum and the passage of time in the MIT Strobe Lab (the lab where the inventor of electronic flash, Harold Edgerton, took his famous pictures of bullets going through apples, etc.).
Exhibited at Olga Korper Gallery, Toronto Ontario, July 6 to August 16, 2000; see **http://wearcam.org/microsec/**



Mann's Sensor-camera (Lifegloging/Lifelogging) invention is now in widespread use:

Wearable Wireless Webcam

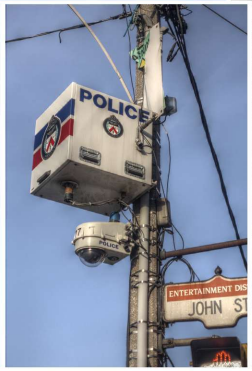
1998, Mann

SenseCam

2004, Microsoft

Lifelogging Camera

2012, Memoto



Photos (C) Steve Mann, 2010, 2012

Surveillance

... cameras on property (land, buildings, ...)

"Surveillance" is a French word that means "to watch" ("veiller") "from above" ("sur").

Mann coined the word "sousveillance" to denote the reciprocal, i.e. to watch "from below" ("sous").

Surveillance is putting cameras on buildings and lamp posts to watch people.

Sousveillance is putting cameras on those people!

Sousveillance situationist sculptures, S. Mann, 1998.
Photos (C) S. Mann, 1998.

Sousveillance

... cameras on people ...

Photos (C) S. Mann, 2005

500 sousveillance situationist sculptures made for ACM's Computers, Freedom, and Privacy 2005 conference.

Each attendee received a conference bag, some with working wireless webcams! Nobody knew which ones had cameras!





"Sousveillance" (inverse of the French word "surveillance") as a existemological inquiry...
"Sous" means "from below", whereas "sur" means "from above" ("veiller" means "to watch")

AZURE

Design Architecture & Art

MAY JUN 2001

DISPLAY UNTIL JULY 15

$5.95

INTERVIEW: SHIGERU BAN
WILDERNESS RETREAT
MONTREAL'S FULL METAL LOFT
THE BEST OF COLOGNE

THIS MAN'S WIFE IS BUYING TOMATOES

WEARABLE COMPUTING PIONEER STEVE MANN'S GLASSES TRANSMIT IMAGES OF WHAT HE SEES

06
CANADA POST REGISTRATION # 6577
0 55113 70029 3

A mid-1980s version of Steve Mann's photographic "dusting" apparatus, used to create paintings of his surroundings with light vectors

Taking liberties

When Steve Mann throws a party, *everyone* gets naked. The University of Toronto professor, best known for his wearable-computer inventions, recently hosted Deconference, on a sweltering late-summer night at a downtown gallery across from the Art Gallery of Ontario. Part party, part experiment, Deconference simulated a decontamination operation of the sort that might be imposed on the public following an anthrax or other bioterror scare.

The exercise was performed in a space designed by Mann that incorporated his patented decon technology. The four-storey gallery had been configured into a series of stations: a mass corral area, a strip-down room, a group shower, an outdoor post-decon holding pen, a rooftop soapbox and lastly a room filled with tables of wine and food. Participants were told in advance that absolutely no contraband, explosives, weapons, biological or mental contaminants would be welcome at the event, and complimentary attire would be provided.

Below: A diagram of U of T professor Steve Mann's design for a mass decontamination facility. Bottom left: At a recent simulated decon exercise in Toronto, a decontaminee is scanned following a quick group shower. Centre: A computer image tells the decon officers the size of Tyvek jumpsuit required. Top right: Inside the central control room. Bottom right: The six-person column shower and mirror/window.

Upon entry, decontaminees were handed – along with their mandatory neck-worn triage tags – plastic bags for clothes and personal effects. People were separated by gender and, in groups of 12, entered a starkly furnished "decontrabanding" area where everyone removed their clothes at the direction of "decon officers." The groups then moved into a room containing only a mirror/window and a six-person column shower.

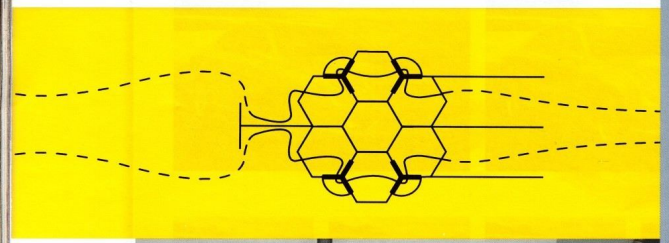
Mann, a professor in U of T's Department of Electrical and Computer Engineering and an inventor of long-standing, had designed the shower to be sensor operated and temperature controlled. Behind the mirror sat an operator to monitor behaviour and manually override the system, if necessary. Returning to the decontrabanding room, participants passed in front of a body scanner to be sized for Tyvek suits. (In real life, the facility would use turnstiles to manage and contain the unidirectional flow of traffic.)

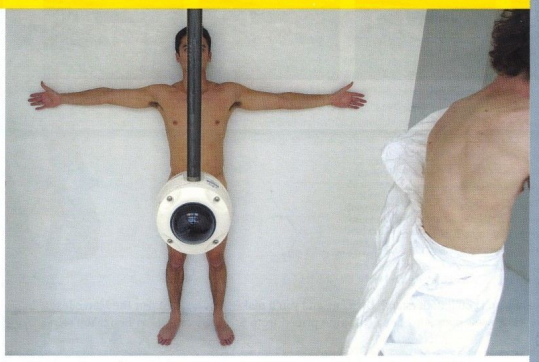
Steve Mann provides a refreshing voice in the debate surrounding the erosion of personal liberties in our security-obsessed world. He has a long history of challenging the ubiquitous surveillance to which we daily, often unknowingly, submit ourselves. In his documentary video *Shooting Back* (1994-96), Mann carried cameras into department stores and casinos, to turn the tables on commercial entities that routinely violate personal privacy. Today his work seems prescient: Mann applied for a patent for his anthrax-ready mailroom in April, 2000 and installed his first mock decon chamber at a Toronto gallery in July, 2001.

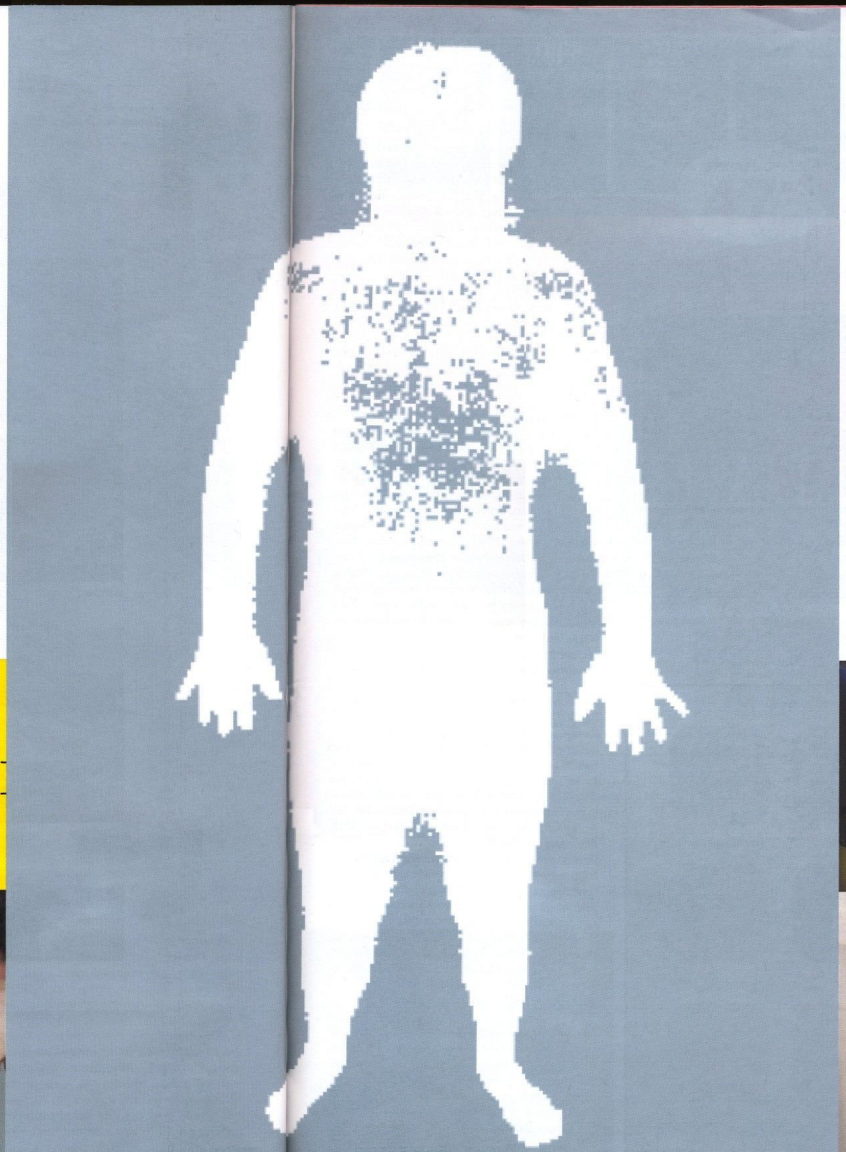
Elegantly designed, scientifically sound and laced with humour, Deconference achieved its objectives. It gave people a taste of the humiliation, fear, confusion and discomfort that would be part of a real decontamination exercise. Although Mann's decon facility is a real working prototype that one could easily imagine installed at the entrance to an airport or government office of the future, it was primarily intended to provoke thought. "It follows the tradition of asking questions, rather than necessarily providing a solution," he says. At the party that followed, strangers mingled in their white jumpsuits and drank wine with relief – and also with a heightened sense of the fleeting nature of freedom.

www.deconference.com

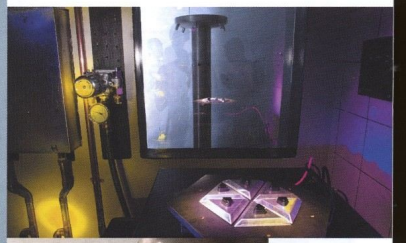
HEATHER MACKAY

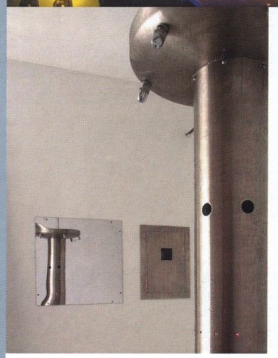


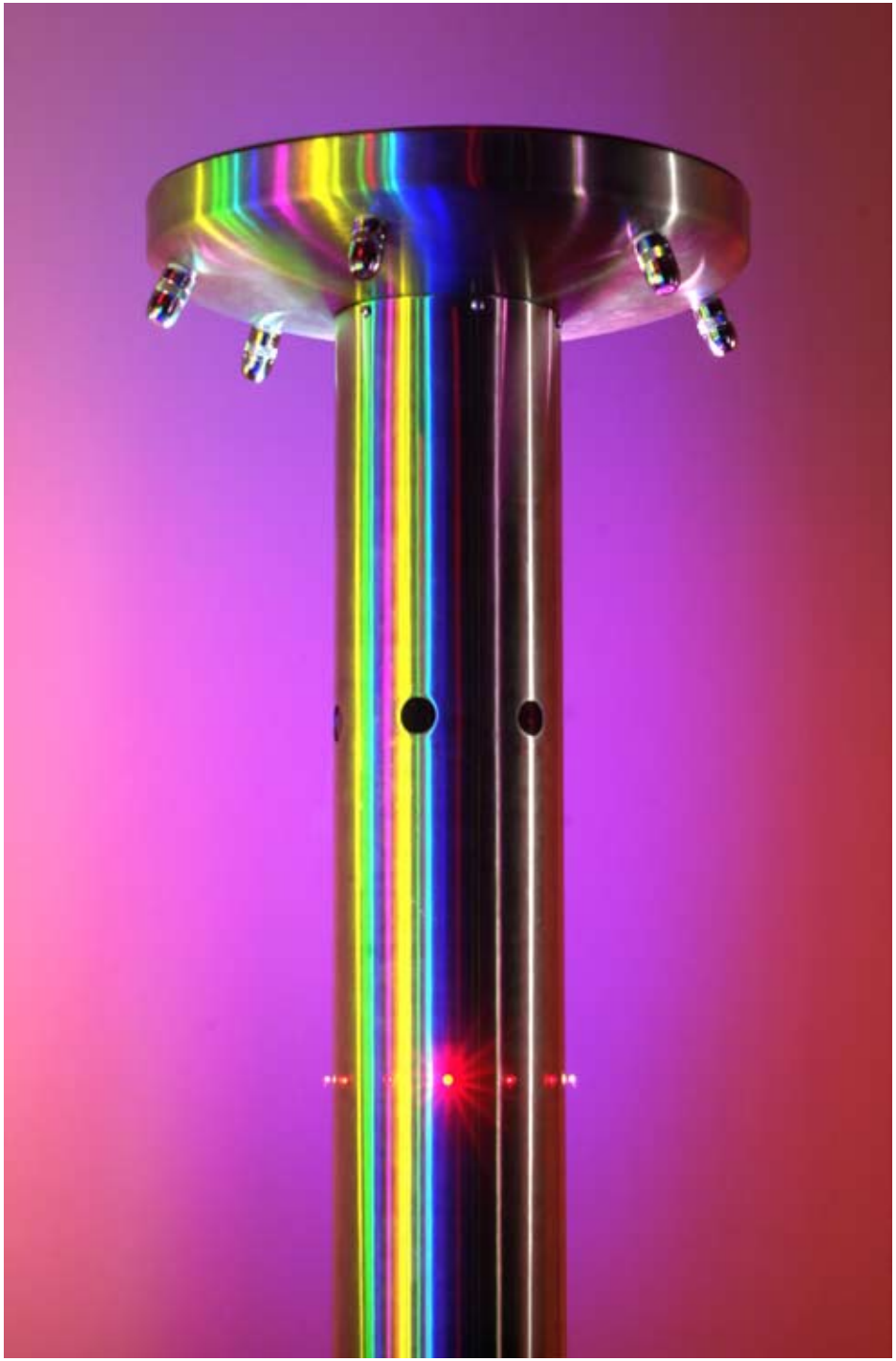


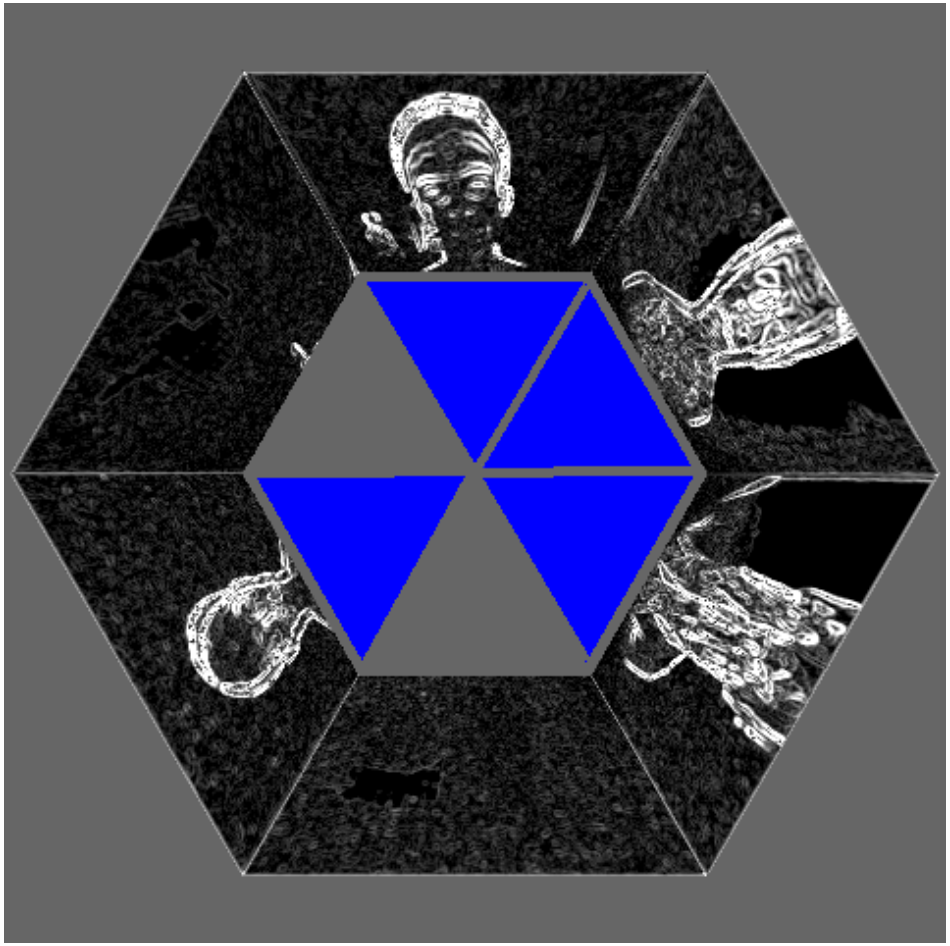


Tyvek size LARGE









Deconference 2002:
Social commentary in the Anthrax Age.
(Steve Mann, Chris Aimone, Dylan Crichton, 2002)
On the left: Interactive intelligent column shower developed as part of the exhibition and performance.
Above: Intelligent shower system uses advanced computer vision processing to track bathers and ensure that every drop of water lands on flesh.

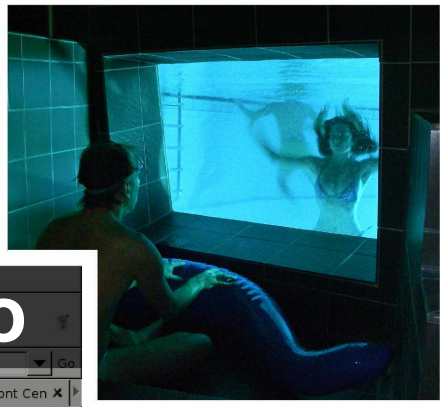
"Elegantly designed, scientifically sound and laced with humour, Deconference achieved its objectives..."
--Azure Magazine

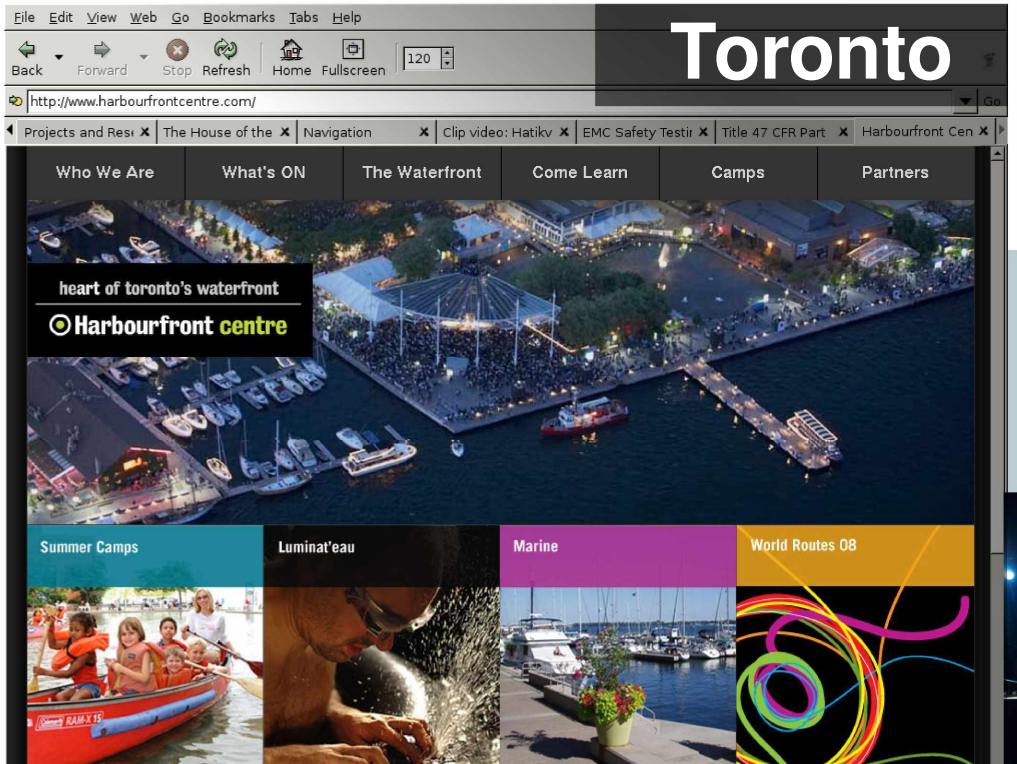
H_2Orchestra

HYDRAULOPHONE WORLD TOUR

San Francisco

Las Vegas

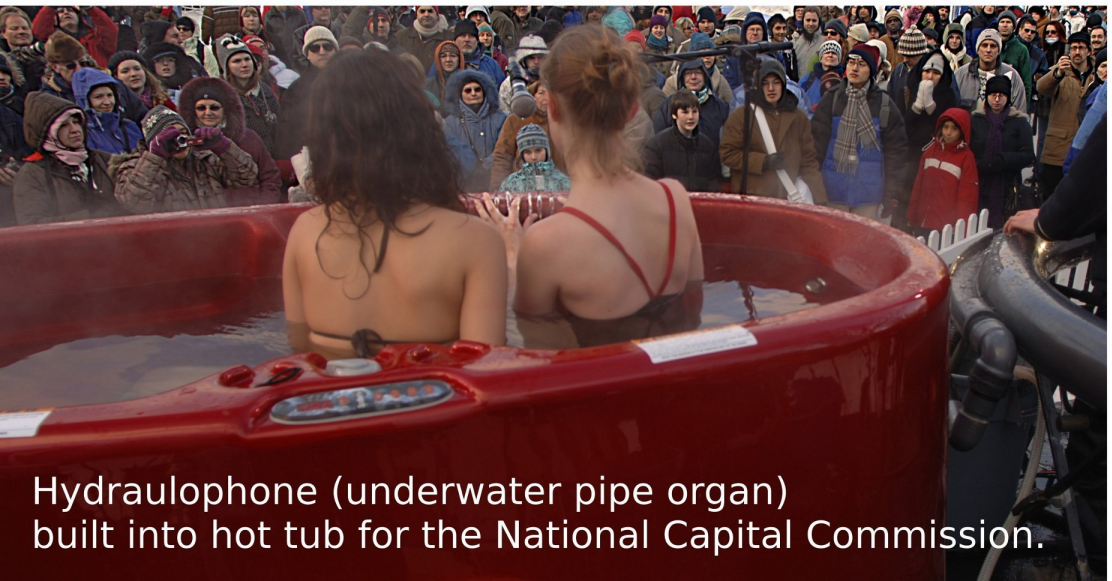




Toronto

Orlando

H2Orchestra was the main act for SPLASH Festival 2011.
Lake Simcoe was turned into the world's largest musical instrument.
Turning the lake itself into a giant musical instrument raised awareness of the importance of clean lakes and rivers.



Hydraulophone (underwater pipe organ)
built into hot tub for the National Capital Commission.

Main act for Winterlude, North America's
largest winter festival, played to
audience of more than 10,000 people.

The hydraulophone is a musical instrument used around the world in concerts and dramatic performances to raise awareness of the importance of clean lakes, rivers, and water as a natural resource.

Each water jet is a key on this water keyboard. Sound from vibrating water makes intricate microtonal harmonizations

Pagophone
Solid H_2O (Ice)

Hydraulophone
Liquid H_2O (Water)

Idratmosphone
Gas H_2O (Steam)

Plasmaphone
Plasma "H_2O" ("Lightning")

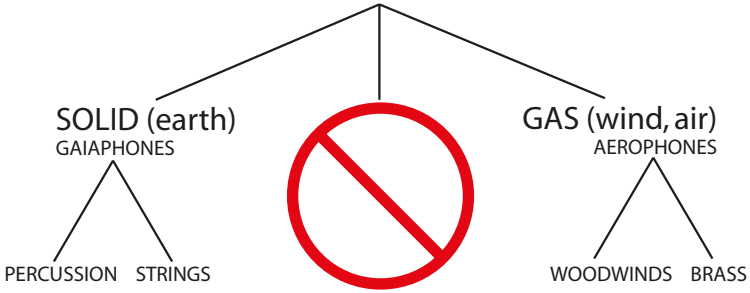
Hydraulophones and the "States of H_2Orchestra"

Dihydrogen monoxide H_20 exists in the familiar states-of-matter or phases, known as ice (solid), water (liquid) and steam (vapor, gas).

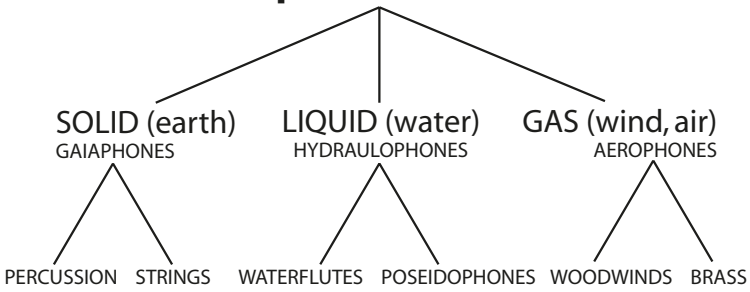
FUNtain's "H_2Orchestra" demonstrates a wide range of artistic and design creativity and an ability to invent a wide range of new sculptural forms such as musical instruments that exist in all four "Elements" of H_2O: "Earth" (solid H_2O, ice); "Water" (liquid H_2O); "Air" (gaseous H_2O); and "Fire" (H_2O-initiated plasma).

The States-of-H_2Orchestra was born in Canada in the early 1980s, with the invention of the hydraulophone. It was inspired by the sounds of liquid flowing through valves, by inventor Steve Mann whose work has been shown in numerous museums around the world, including the Smithsonian Institute, National Museum of American History, The Science Museum (Wellcome Wing, opening with Her Majesty The Queen June 2000), Museum of Modern Art (MoMA in New York), Stedelijk Museum (Amsterdam), Triennale di Milano, Austin Museum of Art, and San Francisco Art Institute. Mann also won the Coram International Sustainable Design Award (first place) for this interactive musical aquatic play invention/sculpture. These inventions are covered by an extensive patent portfolio, by patents filed in various countries.

Typical Orchestra (incomplete)



Complete Orchestra

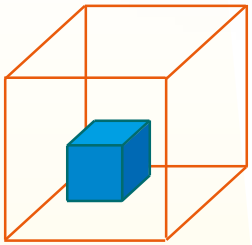


Physics-based Musical Instrument Classification

THE FIVE ELEMENTS OF MUSICAL INSTRUMENTATION

1 SOLID "Earth"

strong bonds



holds shape
fixed volume

GAIAPHONES "Solid Instruments"

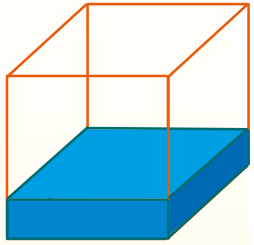
1.1 chordophones
1.2 membranophones
1.3 idiophones

strings

percussion

2 LIQUID "Water"

weak bonds



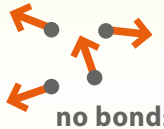
shape matches bottom
of container, flat surface above
fixed volume

HYDRAULOPHONES "Water Instruments"

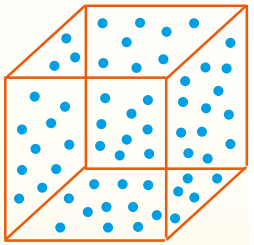
reedless

reed-based

3 GAS "Air"



no bonds



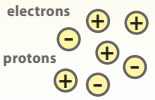
shape matches container
fills volume of container

AEROPHONES "Wind Instruments"

woodwind
instruments

brass
instruments

4 PLASMA "Fire"



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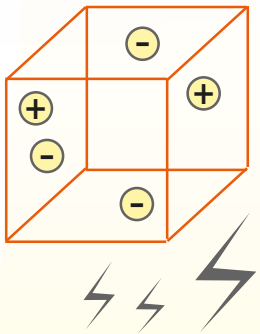
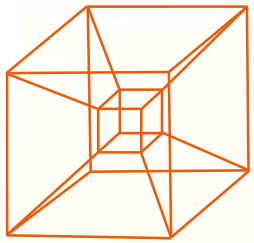


PLASMAPHONES "Plasma Instruments"

5 QUINTESSANCE "Idea"

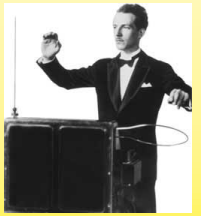
Process or
procedure
not limited
by matter



hyperspace, not limited by
space constraints

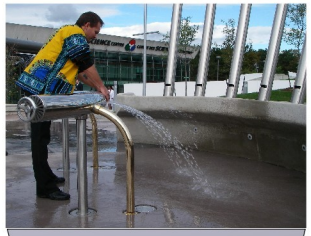
QUINTEPHONES "Non-physical Instruments"

- mechanophones (mechanical comp.)
- electrophones
- optiphones (optical computing)
- biological computing
- neural networks

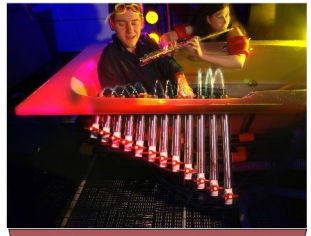


Kinematics and Musical Instruments

Two-stage Hydraulophone



Hydraulophone is *Absement*-sensitive



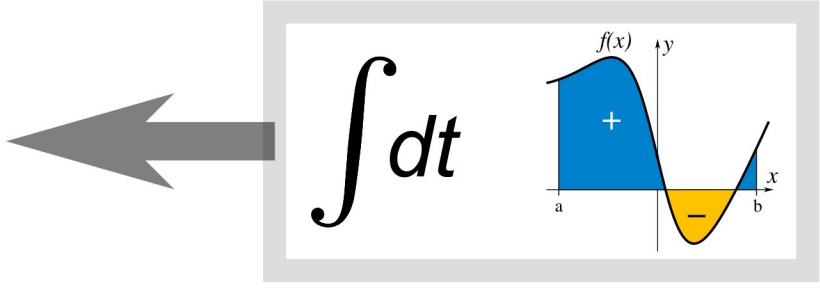
Organ is *Displacement*-sensitive

Piano is *Velocity*-sensitive

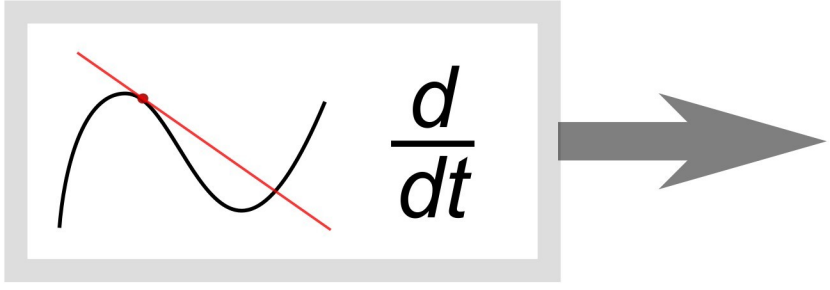
$\frac{d}{dt}$ $\frac{d}{dt}$ $\frac{d}{dt}$ $\frac{d}{dt}$ $\frac{d}{dt}$

... Abseleration | Absity | Absement | **Displacement** (Distance) | **Velocity** (Speed) | **Acceleration** ...

$\int dt$ $\int dt$ $\int dt$ $\int dt$ $\int dt$



Integration



Differentiation

A GUIDE TO THE CE INNERVERSE

IEEE Consumer Electronics MAGAZINE

VOL. 4, NO. 4, October 2015

Enhancing Reality for the Future

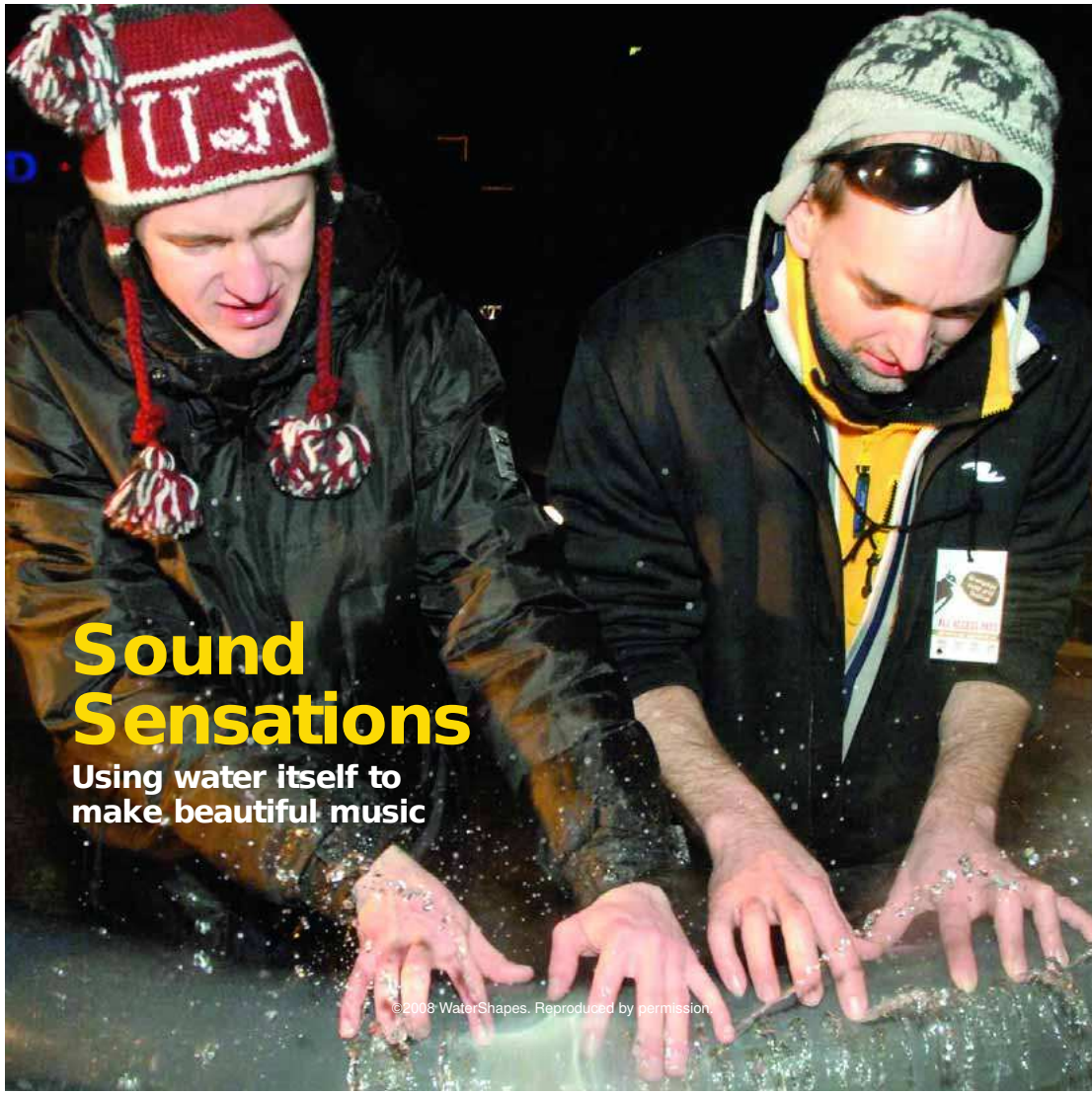
Steve Mann: 40 Years of Inventing Wearable HDR and Augmented Reality

IEEE

http://wearcam.org/PAR/

WaterShapes

Design • Engineering • Construction



Sound Sensations

Using water itself to make beautiful music

http://wearcam.org/watershapes/