Outline

Day 1: Technology

Day 2: Ubiquity

Day 3: Society
Ubiquitous computing
Millions of volunteers, in 226 countries, have downloaded the SETI@home screensaver. The SETI@home volunteers have formed one of our planet’s most powerful supercomputers and have enabled the world’s most sensitive SETI search.
Volunteer Computing
Volunteer Computing
SETI@HOME
Volunteer Computing
LHC@HOME

Test4Theory

Calibrate the search!

Test4Theory aims to bring the world's largest particle accelerator into your home. Simulate high-energy particle collisions which scientists can compare to real-life collisions, such as those occurring in the Large Hadron Collider.

Tell me more

Welcome

What is the Universe made of? How did it start? Physicists at CERN are seeking answers, using some of the world's most powerful particle accelerators.

LHC@Home is a volunteer computing platform where you donate idle time on your computer to help physicists compare theory with experiment, in the search for new fundamental particles and answers to questions about the Universe.

News from the forums

- Issue with data transfers, no more WTs available
  24 Oct 2015 / ATLAS news
- Dealing with unpredictable job sizes
  20 Oct 2015 / ATLAS news
Perceptions of the future
Computer generated realities
Perceptions of the future
In popculture
Perceptions of the future
In reality

Police Program Aims to Pinpoint Those Most Likely to Commit Crimes

By JOHN ELIGON and TIMOTHY WILLIAMS SEPT. 24, 2015

KANSAS CITY, Mo. — At the request of his probation officer, Tyrone C. Brown came to a community auditorium here in June and sat alongside about 30 other mostly young black men with criminal records — men who were being watched closely by the police, just as he was.

He expected to hear an admonition from law enforcement officials to help end violence in the community. But Mr. Brown, 29, got more than he had bargained for. A police captain presented a slide show featuring mug shots of people they were cracking down on. Up popped a picture of Mr. Brown linking him to a criminal group that had been implicated in a homicide.

"I was disturbed," said Mr. Brown, who acknowledges having been involved in crime but denied that he had ever been involved in a killing.

That discomfort was just the reaction the authorities were after.

Mr. Brown, whose criminal record includes drug and assault charges, is at the center of an experiment taking place in dozens of police departments
E-textiles

Figure 4. Yarn-based transistor.

a. Metal-wrapped Yarn  b. Metal-filled Yarn  c. Metal Yarn

a. Soldering  b. Stapling  c. Bonding

Images: Textile World
E-textiles
Power generators

(a) Ag coated textile
ZnO/PDMS
Ag coated textile

(b) Ag coated weave textile
Hydrothermal growth
ZnO nanorods
Dip-coating
PDMS nanostructure

(c) Image of E-textile fabric

(d) Image of E-textile application
## E-textiles

### Practical problems

#### Comparison Of Washability

<table>
<thead>
<tr>
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<th>Cho</th>
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<th>Slade</th>
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<tbody>
<tr>
<td>Material</td>
<td>Cu/Ni plated polyester</td>
<td>Cu/Ni plated polyester</td>
<td>Ni/Cu/Ag plated yarn</td>
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<td>Structure</td>
<td>Ripstop</td>
<td>Mesh</td>
<td>Woven Ribbons</td>
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<td>Washing Type</td>
<td>Machine wash</td>
<td>Machine wash</td>
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<td>Dry cleaning</td>
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<td>Initial Resistance ($\Omega/cm^2$)</td>
<td>0.035</td>
<td>0.097</td>
<td>~ 0.0040</td>
<td>~ 0.0032</td>
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<td>Resistance after 10 cycles ($\Omega/cm^2$)</td>
<td>0.062</td>
<td>5.063</td>
<td>~ 0.0037</td>
<td>~ 0.0042</td>
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<td>Resistance after 50 cycles ($\Omega/cm^2$)</td>
<td>N/A</td>
<td>N/A</td>
<td>~ 0.0090</td>
<td>~ 0.0057</td>
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**References**

E-textiles: already a choice
Musical Jacket

- MIDI SYNTHESIZER
- EMBROIDERED KEYPAD
- FABRIC RIBBON CABLE
- BATTERIES
- SPEAKERS

Image: berzowska.com/MIT
ILLUM Jacket concept
ILLUM Jacket concept
E-textiles + Brain power
Wearable computing

Steve Mann: Evolution of Wearable Computing + Augmented Reality in everyday life

Human-Computer Interaction
Perceptions of the future
In popculture
Human to human... via computer

Schematic Diagram of the Experiment

Brain 1 ("Sender")
(see target, decides to fire cannon)

Brain 2 ("Receiver")
(stimulation moves the hand to press the key)

EEG Recording of Brain Activity

Hand motor imagery detected

Brain Stimulation using TMS

Internet
Human to human... via computer
Perceptions of the future
In popculture
Perceptions of the future
In reality

http://www.motorolasolutions.com/promo/publicsafety/connected-law-enforcement-officer.html#product_tour_tab

Image: Motorola
Perceptions of the future
In popculture
Perceptions of the future
In reality

BIOMETRIC STRAP AND HEALTH MONITORING

Remotely monitor your police officers vitals during an incident or training exercise to ensure their health.

Learn more
Perceptions of the future
In popculture
Perceptions of the future
In reality

The Instrument Itself

As envisioned for this competition, the device will be a tool capable of capturing key health metrics and diagnosing a set of 15 diseases. Metrics for health could include such elements as blood pressure, respiratory rate, and temperature. Ultimately, this tool will collect large volumes of data from ongoing measurement of health states through a combination of wireless sensors, imaging technologies, and portable, non-invasive laboratory replacements.

The devices are expected to accurately diagnose 16 health conditions – 13 required core conditions and a choice of three elective conditions – in addition to capturing five real-time health vital signs, independent of a health care worker or facility, and in a way that provides a compelling consumer experience.

Required Core Health Conditions (13): Anemia, Atrial Fibrillation (AFib), Chronic Obstructive Pulmonary Disease (COPD), Diabetes, Hepatitis A, Leukocytosis, Pneumonia, Otitis Media, Sleep Apnea, Stroke, Tuberculosis, Urinary Tract Infection, Absence of condition.


Required Health Vital Signs (5): Blood Pressure, Heart Rate, Oxygen Saturation, Respiratory Rate, Temperature.

Given that each team will take its own approach to design and functionality, the device's physical
Future computing in medicine
"How are you?" now has a really accurate answer.

Heart rate, calories burned, blood sugar, cholesterol — your health and fitness apps are great at collecting all that data. The Health app puts that data in one place, accessible with a tap, giving you a clear and current overview of your health. You can also create an emergency card with important health information — for example, your blood type or allergies — that's available right from your Lock screen.
Implants
A cyberpunk staple
Implants

In reality

How Retinal Implants Work

1. Eyeglass-mounted miniature wireless camera system
2. Wireless external processing unit
3. Eye with implanted retinal prosthesis circuitry

Transceiver unit
Inductive RF loop antenna
Micro interconnect
Retinal implant
Retina
Optic nerve

Image: Caltech and U of Ar.
Implants
In reality
World’s first cyborg?
World’s first cyborg?
Our Research

DARPA’s investment strategy begins with a portfolio approach. Reaching for outsized impact means taking on risk, and high risk in pursuit of high payoff is a hallmark of DARPA’s programs. We pursue our objectives through hundreds of programs. By design, programs are finite in duration while creating lasting revolutionary change. They address a wide range of technology opportunities and national security challenges. This assures that while individual efforts might fail—a natural consequence of taking on risk—the total portfolio delivers. More

DARPA and the Brain Initiative

President Obama announced the BRAIN initiative in April 2013. Today, the initiative is supported by key contributors to the field of neuroscience. DARPA supports it through a number of programs.

DARPA Open Catalog

The DARPA Open Catalog is a public Web portal that shares the publicly releasable results of DARPA research in the form of software, peer-reviewed publications, data and experimental details.
The DARPA innovation model

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<th>QUEST FOR FUNDAMENTAL UNDERSTANDING?</th>
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<td>YES</td>
<td>PURE APPLIED RESEARCH EDISON</td>
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The Sandtable

UPSD
D-Wave processor
Scientists confirm a cornerstone of quantum computing
Quantum computing

\[|1\rangle \iff \text{qubit}
\]

\[|0\rangle \iff \text{qubit}
\]

\[|0101\rangle \iff |5\rangle
\]

\[|4\rangle + |5\rangle
\]

qubits can be in a superposition of all the classically allowed states
Quantum computing
“One can accomplish something only so long as one cannot accomplish everything.”

-- Stanisław Lem, Polish Sci-Fi author and philosopher