Here Comes Wearable Technology!

QCon London, March 2013
Rain Ashford - http://rainycatz.wordpress.com

According to the media hype, Wearable Technology looks like..

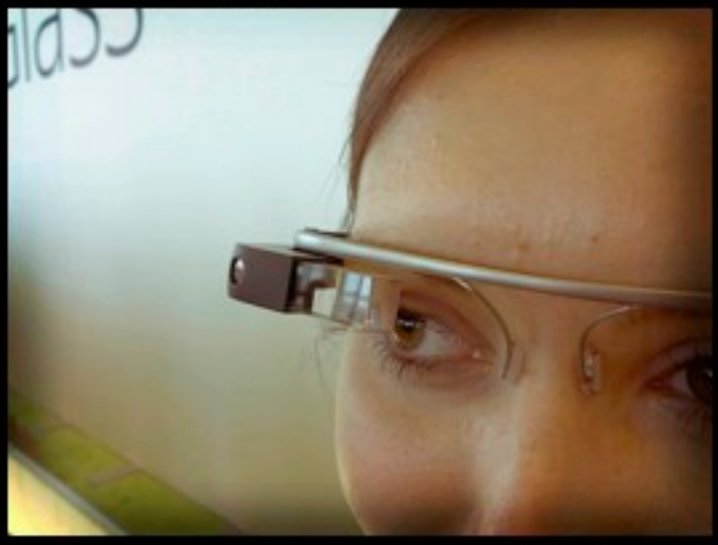


Image: Antonio Zulgaldia

..and they're all trying to guess what this one looks like!

Image: GarRobMil

But extensions of the body, including wearable tech, have been around for much longer depending on your viewpoint..

Image: Titus Carisius, 46 BC coin. Vulcan over anvil, tongs and hammer flanking, all within laurel wreath by Carlo Morino

Image: Casio CFX-400C Scientific Calculator Watch, 1985, by Magnus Manske

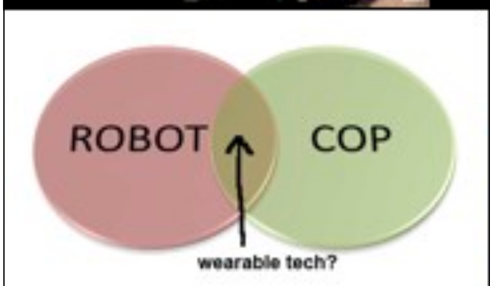
Fairly recent wearable technology was still heavy, angular & clunky...

Person with a head-mounted display (HMD), wired glove and joystick. Image:

MannGlass Welding Helmet

Wearable Wireless Webcam, Steve Mann, 1994

Though there's no escaping that wearable tech was indeed influenced by many flavours of cyborgs.



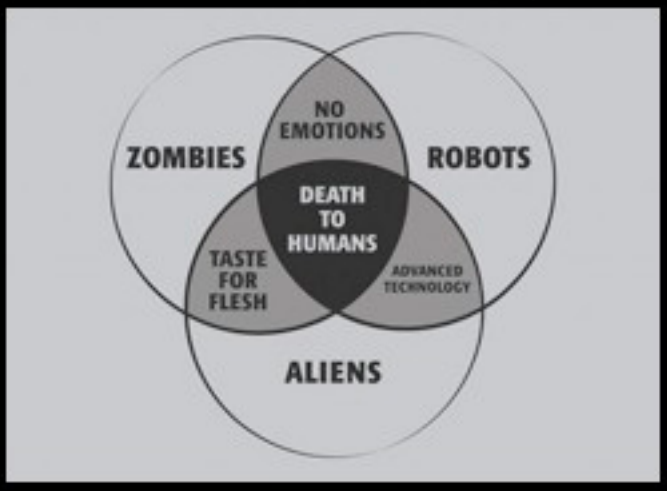
Images: Robocop DVD cover, pic by Pfamdi, BSG motivational poster by thegreatgeekmanual
RobotWearableCop Venn diagram, derivative repurposed by Kain Ashford, original by GraphJam. Robocop Minis pic by inferis

Beam me up Scotty...
..and sci-fi has a lot to answer for!

Images: Jean-Luc Picard as Borg Locutus by El Carlos / Trivisio HMD 2012 by Rain Ashford

Images: Star Trek Tricorder & Peter Jansen's Tricorder Project Mk2

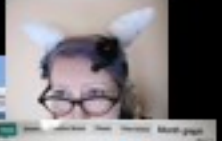
There is also a fear of technology, machines, cyborgs, robots, etc.



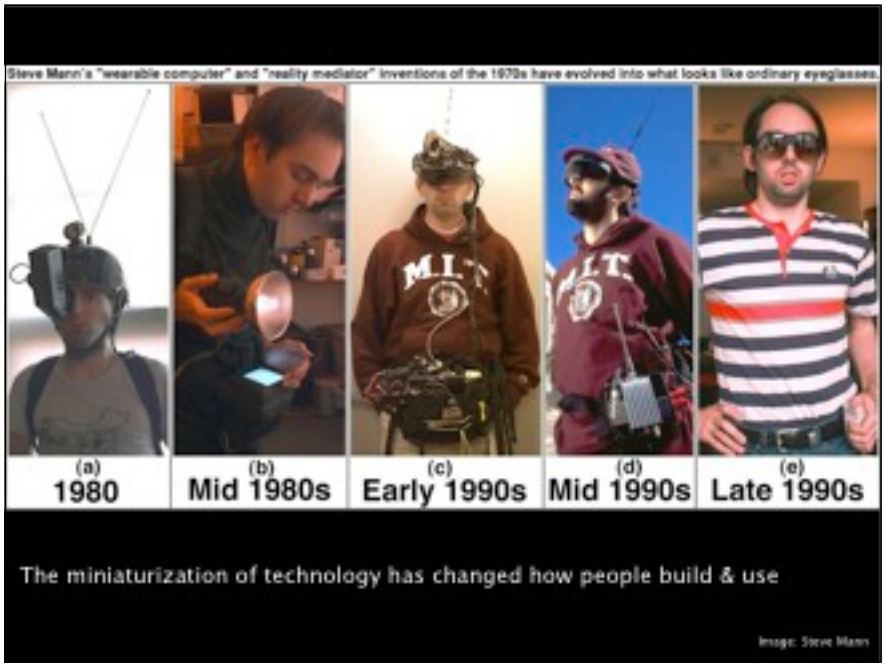
"Let's just hope that they all don't show up at once." Anon

Image: unknown author / popular cyber

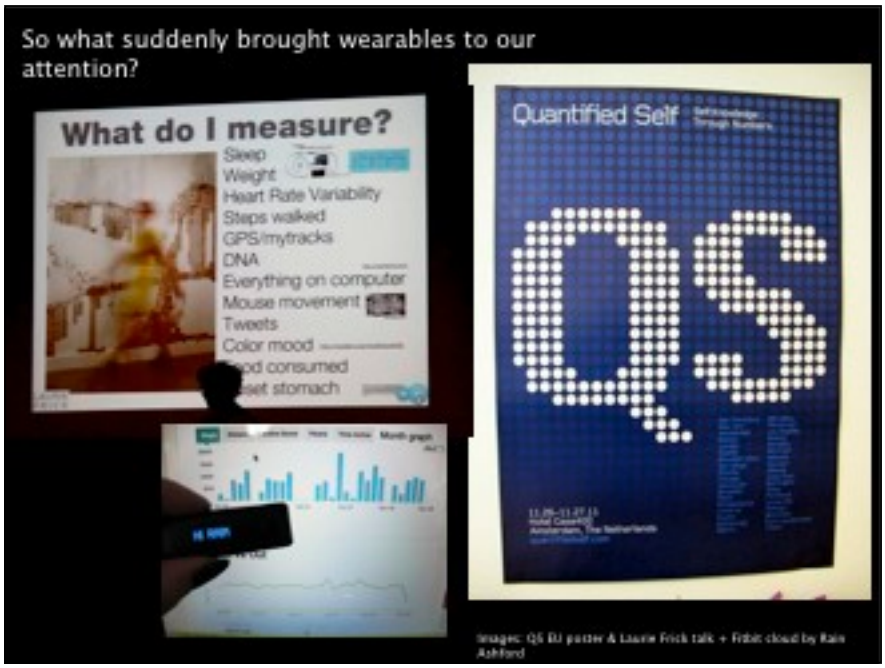
Wearable technology is hugely diverse! areas include, medical, art, fashion, whimsical, sensing, fun, practical, protective, interactive, military, energy, decorative, performance, energy harvesting, communicating, space, music and lots more...



Images: LED Eyelash made by Seoni Park. Electronic Tattoo by John A Rogers/Uni of Illinois. Thunderstorm Dress made by Rainbow Winters. Microsoft Printing Dress.
Embedded electronics fibre by Nottingham Trent University. SILVER cells by Australian National University. Remote Control T-Shirt by Rebecca Allwood. Fitbit &


Steve Mann's "wearable computer" and "reality mediator" inventions of the 1970s have evolved into what looks like ordinary eyeglasses.
(a)
1980
(b)
Mid 1980s
(c)
Early 1990s
(d)
Mid 1990s
(e)
Late 1990s
The miniaturization of technology has changed how people build & use
Image: Steve Mann


..the convergence of miniturisation and communications tech means we'll all be wearing our phones soon
Possibly a little more discreetly!
Image: Pinterest


So what suddenly brought wearables to our attention?
What do I measure?
Sleep
Weight
Heart Rate Variability
Steps walked
GPS/mytracks
DNA
Everything on computer
Mouse movement
Tweets
Color mood
Quantified Self
Images: QS EU poster & Laurie Frick talk + Fitbit cloud by Rain Ashford

..it wasn't long before the big players in industry caught on to how well gadgets go with smartphones!

Image: personal tracking devices for iPhone in Apple Store, Dec 2011, by Rain Ashford

..whilst behind the scenes much has been invested in areas such as military, space, industrial and medical uses and developments for wearable tech

Nottingham Trent University: Micro-device Encapsulation Technology - Electronically Active Intelligent Yarn for Self Monitoring, Medical, Fashion & Industrial

Military / Extreme Environment
The Australian National University: SLIVER cells
Lightweight and tough bifacial solar panels

In-shoe device: University of Wisconsin-Ma
An in-shoe device designed to harvest the energy that is created by walking, and store it for use in mobile electronic devices

Medical: Epidermal Electronics, Electronic Tattoo by University of Illinois, artificial pancreas & insulin pumps in development as shown by Gil de Paula of Pancreum at WT Conference 2012

Energy harnessing space suits, NASA Motivating Undergraduates in Science and Technology initiative

But, there's been a lot of work going on in other areas too.

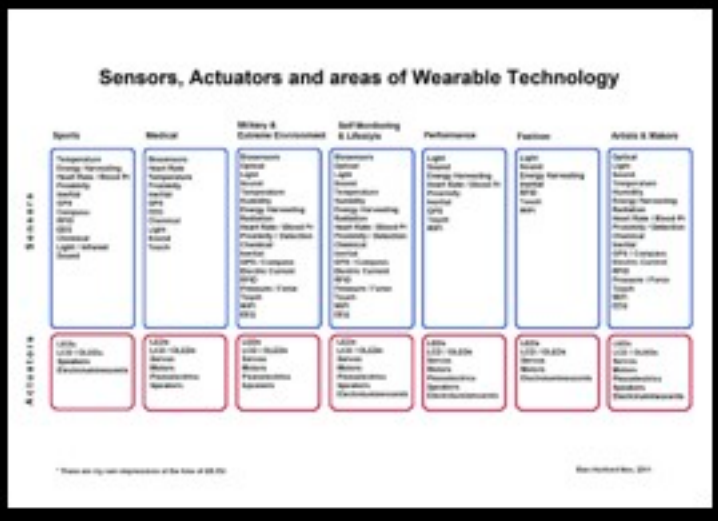
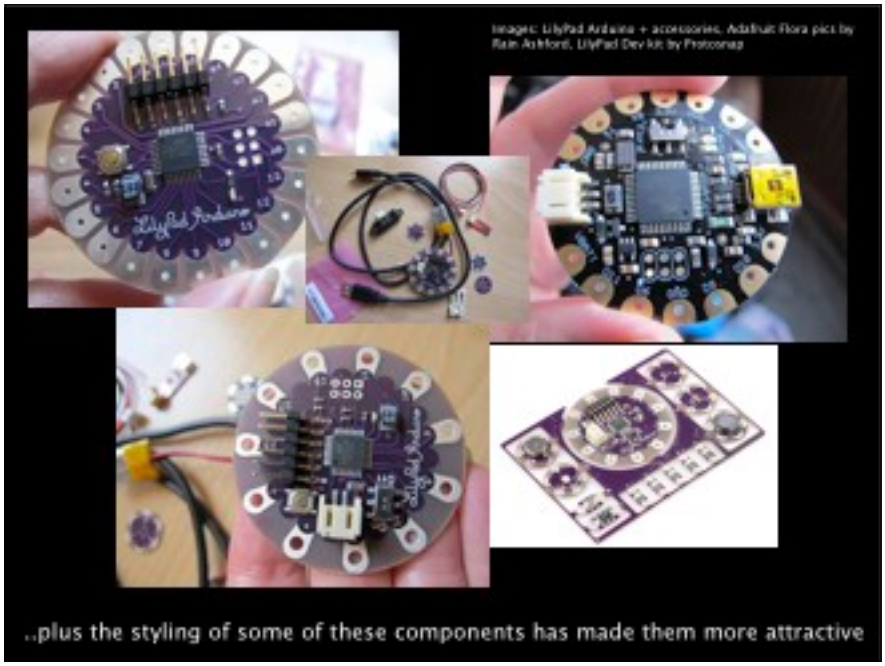
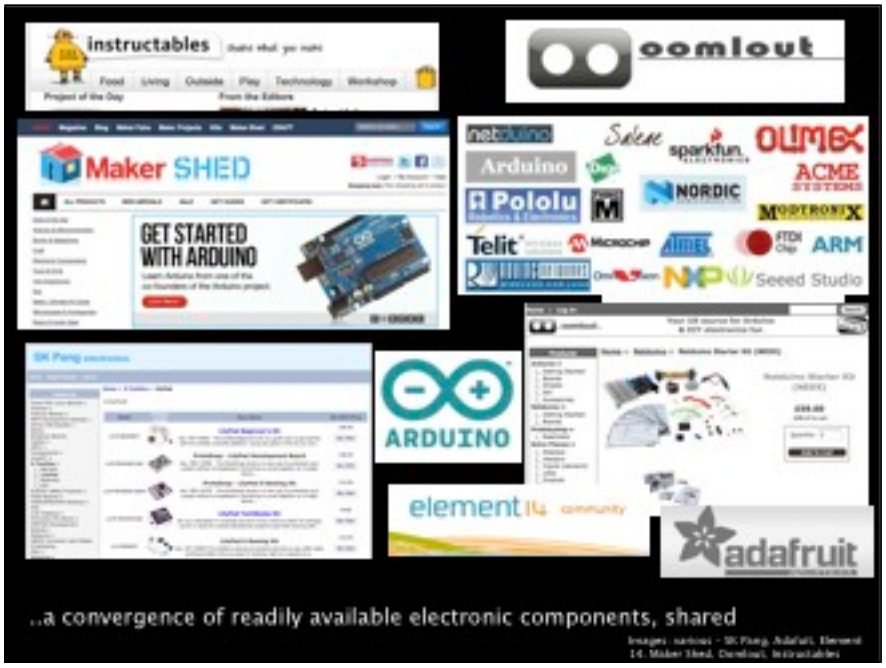


Image: Rain Ashford

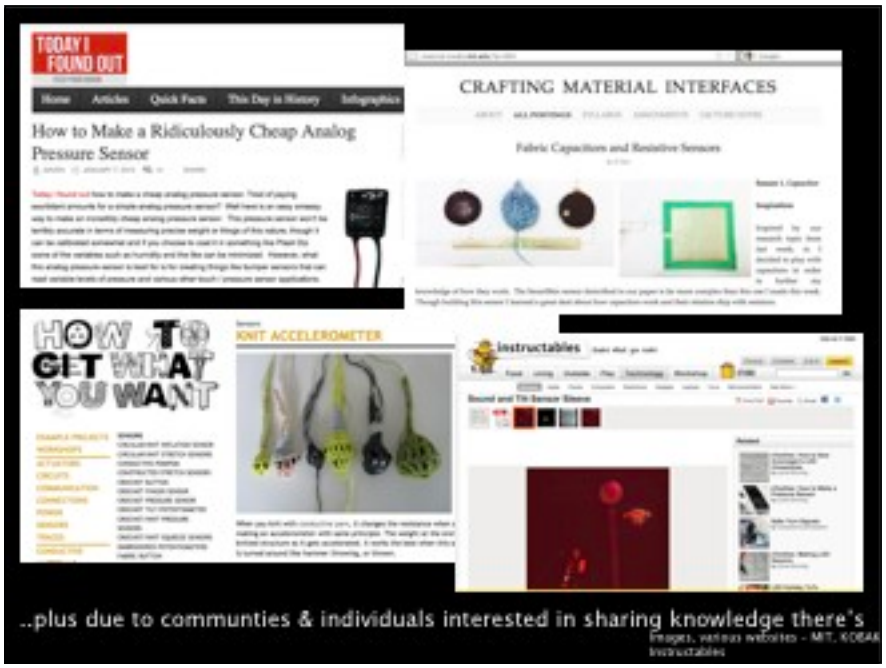

For me, the availability of sewable electronic & e-textiles has revolutionised


Images: LilyPad Arduino + accessories, Adafruit Flora pics by Rain Ashford, LilyPad Dev kit by Protosnap
..plus the styling of some of these components has made them more attractive


Brighton Mini Maker Faire
MORE THIS WAY
What is a Hacker?
The growth of maker & hacker culture, and resulting communities has inspired
Images: Rain Ashford


instructables
oomlout
Maker SHED
GET STARTED WITH ARDUINO
Arduino
Sparkfun
OLIMEX
ACME SYSTEMS
Pololu
NORDIC
MODTRONIX
Telit
ARM
Seeed Studio
ARDUINO
element14 community
adafruit
..a convergence of readily available electronic components, shared
Images: various - SK Pang, Adafuit, Element 14, Maker Shed, Oomlout, Instructables


SK Pang
Choose a sub category
The availability of sensors in particular that allowed me to bring my ideas to
Images: SK Pang, Oomlout, Seeed Studio, SparkFun


TODAY I FOUND OUT
How to Make a Ridiculously Cheap Analog Pressure Sensor
CRAFTING MATERIAL INTERFACES
Fabric Capacitors and Resistive Sensors
HOW TO GET WHAT YOU WANT
KNIT ACCELEROMETER
instructables
..plus due to communties & individuals interested in sharing knowledge there's
Images, various websites - MIT, KOBAN, Instructables


Month graph
RESULTS
Good
training
week
So what's all this got to do with me? Well ..I'm an avid self-tracker and fan of sensors!


..I create interactive wearables and art, working with many flavours of microcontrollers & various components.

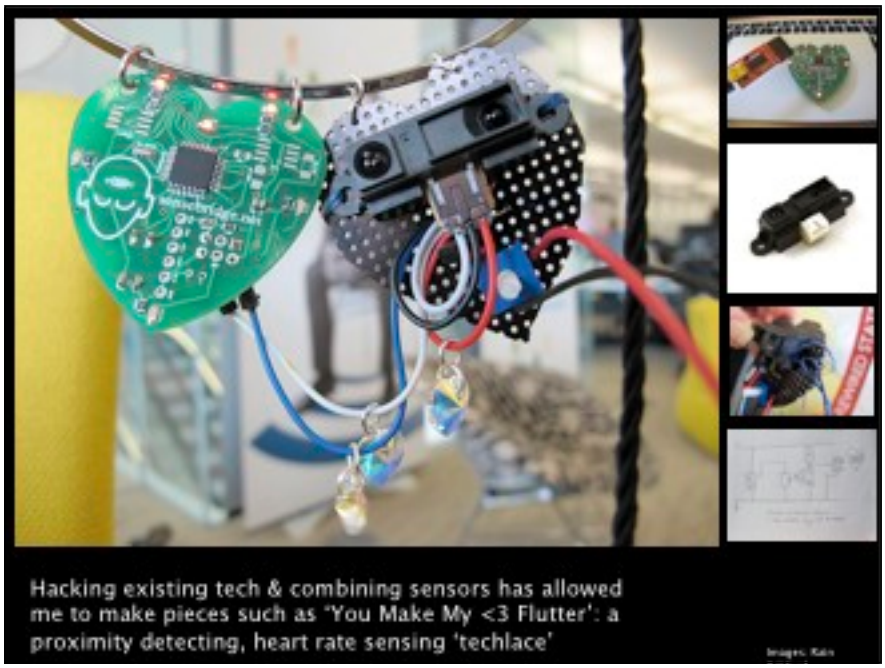

I'm interested in...
Social interaction - formal and informal events where one is put on the spot/ excruciating circumstances: networking, bars, clubs, meet ups, introductions, conferences, etc.
Building multi-sensor wearables which output data on the wearer's physiological signs comprised of various components such as:
a logging device
sensors - tracking physiological signs: EEG, GSR, heart rate, accelerometer, temperature, etc.
Actuators
C code / algorithms
To be...
Visually reactive
Sonically reactive
Might record sound / display feedback from user
camera

LilyPad Arduino Microcontroller

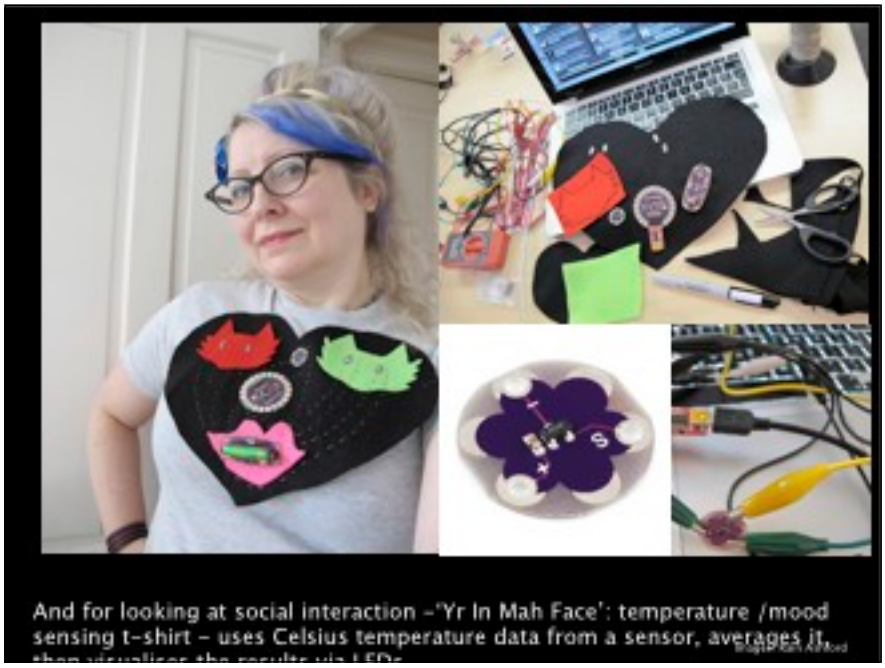
- Conductive Thread
- E-Textiles
- C (ish) Programming
- Sensors
- Actuators
- Hacked Electronics
- Conductive items

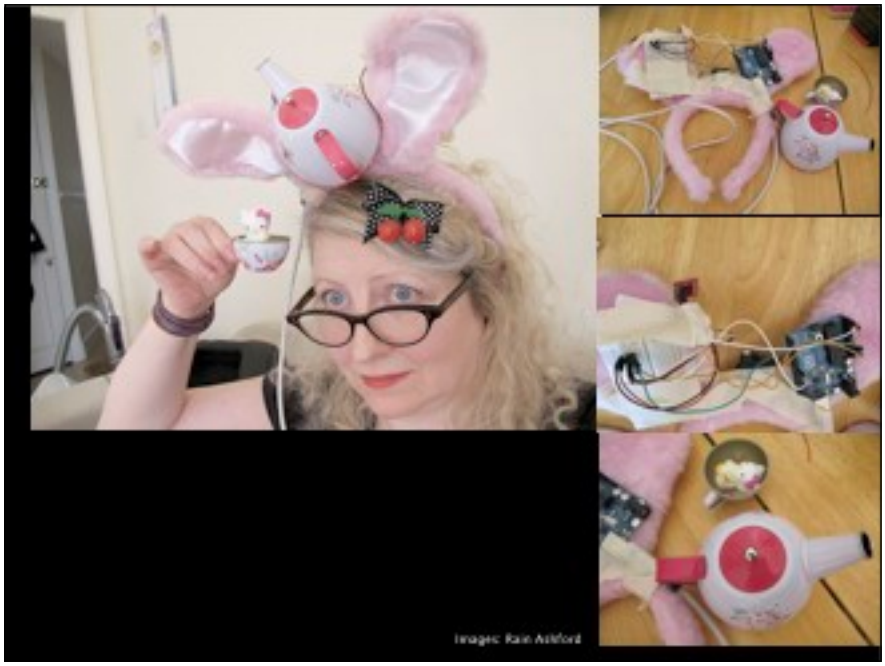
- Wearables
- Sound Artworks
- Games
- All Interactive

...incorporating the technology into the design



Hacking existing tech & combining sensors has allowed me to make pieces such as 'You Make My <3 Flutter': a proximity detecting, heart rate sensing 'techlace'


And for looking at social interaction -'Yr In Mah Face': temperature /mood sensing t-shirt - uses Celsius temperature data from a sensor, averages it,


Images: Rain Ashford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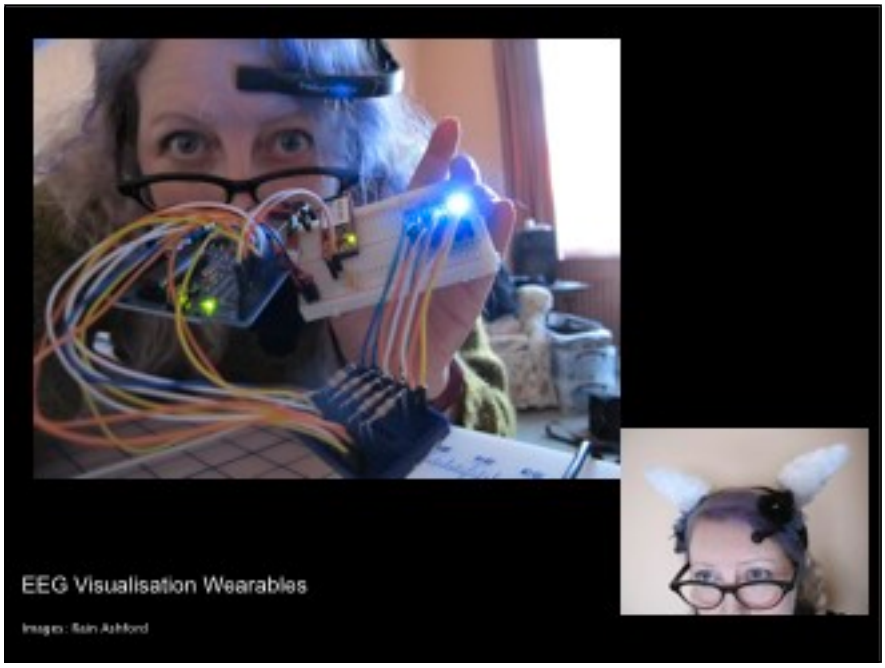
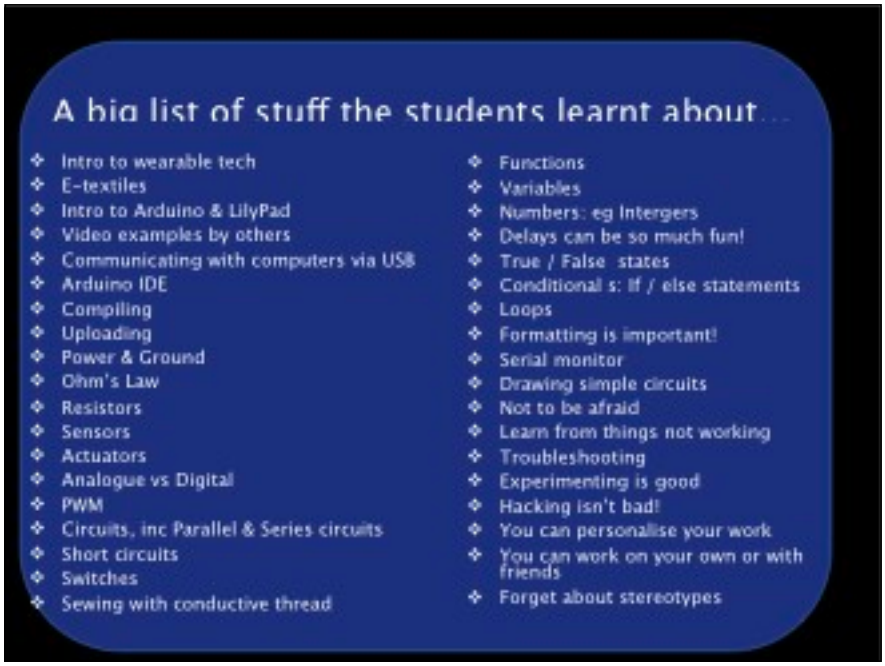


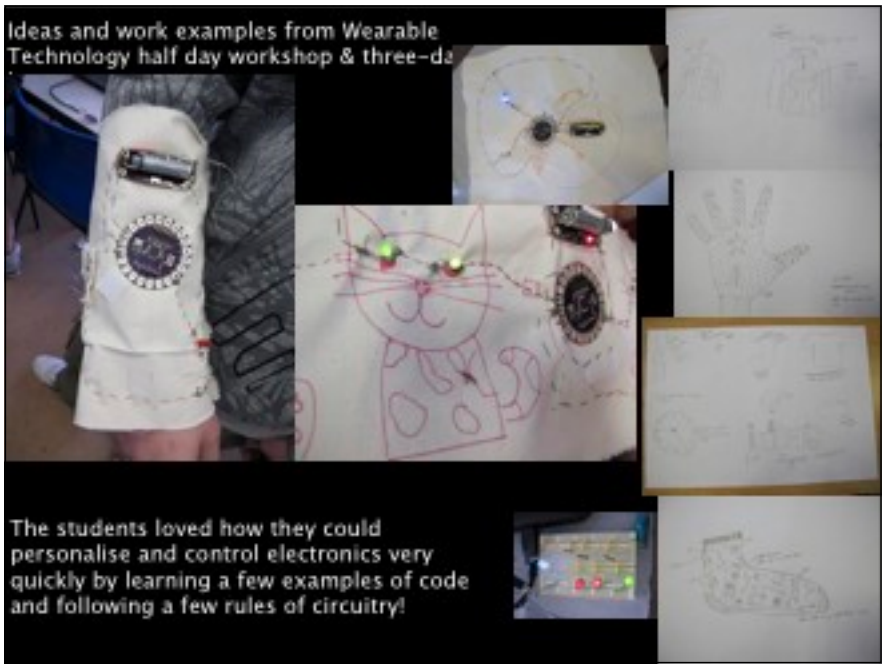
Summary: some challenges for wearable tech

- A lot of focus on the technology, but not enough on what the consumer might want : design, uses, size
- What ethical considerations do we need to think about? Who owns the data, who is looking at your data, what are they doing with it – problems?
- Washable circuits, sensors and microcontrollers – to gain acceptability they need robustness and longivity
- Battery / power supply tech: needs to be less bulky, better longevity, lighter, comfortable
- Interoperability – with so much proprietary devices being created simultaneously – how are they going to work together?
- Necessity for more standards and classifications
- Sustainability – recycling, reusing, repurposing – supply chain isn't yet set up for wearable tech
- Marketing focus – sales, dissemination, tech know how – how do we help the public understand and use?

Wearable tech workshops for 8-16 year olds for Technocamps, an initiative to encourage school children in Wales to try out various forms of computer & hardware based tech from robotics, game development, animation to


..for schools in Aberystwyth, Lampeter & Cardigan, homeschoolers (mums came too!) & Saturday drop in club.
Sophie & I show our Dragons to the MEP for
Wales, Aberystwyth University &
Technocamps dignitaries came to see what


A big list of stuff the students learnt about...
Intro to wearable tech
E-textiles
Intro to Arduino & LilyPad
Video examples by others
Communicating with computers via USB
Arduino IDE
Compiling
Uploading
Power & Ground
Ohm's Law
Resistors
Sensors
Actuators
Analogue vs Digital
PWM
Circuits, inc Parallel & Series circuits
Short circuits
Switches
Sewing with conductive thread
Functions
Variables
Numbers: eg Intergers
Delays can be so much fun!
True / False states
Conditional s: If / else statements
Loops
Formatting is important!
Serial monitor
Drawing simple circuits
Not to be afraid
Learn from things not working
Troubleshooting
Experimenting is good
Hacking isn't bad!
You can personalise your work
You can work on your own or with friends
Forget about stereotypes


Ideas and work examples from Wearable
Technology half day workshop & three-da
The students loved how they could
personalise and control electronics very
quickly by learning a few examples of code
and following a few rules of circuitry!

Summary: get coding and hardware hacking

- School age students enjoy investigating electronics & code via e-textiles and wearable tech
- Wearable tech as a vehicle fascinates school children as it allows them to use their imagination and come up with fantastic ideas
- Giving students project examples that they can personalise gets them interested
- Don't talk too long - show them straight away how to get a response from code and hardware
- Video examples give them ideas!
- Make workshops fun - find interesting analogies to describe what they're going to do
- Don't make lessons dull and worthy!