1) Developments in the field of HCI, ICT & Media Technology
2) Design Methods to IoT Design and Creative Technology
3) Educating Creative Technology for IoT Design Development in Media Tech (DevThis) Ambient and Pervasie Design (AmbiPerv)

Bachelor Media Technology @ Rotterdam University of Applied Sciences

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(1) Modelling HCI/ICT developments: which topics to teach?

- Mainframe - mini - pc - internet - web - mobile - iot
- functional usable personal ux ecology
- Printing - web - cms - mobile web - apps - services
- information interactive code mashups
- loss of external, explicit, formal/well-defined goals
- how to model trends for education?

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eg. Harper: Being Human - HCI in 2020

- GUIs to Gestures
- VDUs to Smart Fabrics
- Handsets to the World in our Hands
- Simple Robots to Autonomous Machines That Learn
- Hard Disks to Digital Footprints
- Shrink-Wrapped to Mash-Ups
- Answer-Phones to Always-On

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eg. de Haan: DevThis topics

- HCI
- ubiquitous/ambient/pervasive computing
- location and context sensors
- visual systems and object recognition
- augmented reality
- internet of things
- semantic web and metadata
- open data/city cloud
- exploratory, agile & co-design methods

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Trends in trend watching

- Trends are messy as technology is (Dourish)
- Trends are intertwined and not isolated

>> Analyse the factors as independent as possible
>> Identify a set of developments for teaching purposes
Content Developments

- **Tangible** interaction - touch, speech, gestures, sensing and recognizing
- **Mobile** networked applications
- **Smart** - intelligent/agency: personal, adaptive, smart, AI, persuasive, distributed intelligence, recommender systems
- **Sensitive** - intelligent/sensitivity: context sensitive, location-based, ambient/pervasive/ubicomp
- **Social** - collaborative - social media, h2h, crowd, social & affective bots
- **Connected** - oda, cloud, smart cities, services, mash-ups, rfid/nfc

Design Developments

- **User centredness**: co-creation, co-design, scenario-based design, participatory design...
- **Design exploration**: fab-, stads-, sensorlabs;
  - sensorlab: concept development
  - living labs: product development
- **Patterns & frameworks** (!?)
  - continuous higher-level specification
  - brainwave... myself: ‘exploratory design’
  - Co-design and co-creation (Sanders et al.)
  - Network focussed Design (Booreiland)

(2) Design Developments

- **User centredness**: co-creation, co-design, scenario-based design, participatory design...
- **Design exploration**: fab-, stads-, sensorlabs;
  - sensorlab: concept development
  - living labs: product development
- **Patterns & frameworks** (!?)
  - continuous higher-level specification
  - brainwave... myself: ‘exploratory design’
  - Co-design and co-creation (Sanders et al.)
  - Network focussed Design (Booreiland)

Flexibility in HCI Design

- **Mash-up's**: a small central core with services as required, each linked in C/S manner.
  - Flexible choice of functionality
- **Front-end or MVC view**: all presentation aspects, allowing adaptation into maintenance
  - Flexible adaptation of presentation
- **true C/S**: implementation may be partial, incomplete, piecemeal. Coding specifications need not be complete, consistent or correct.
  - Flexibility in the design process

Mash-up architecture - flexibility

- a flexible, non-technical & creative assembly of independent elements

Flexible architecture

- Rob (2006): Object-Orientation freed the logical from the physical design order
**Ideation and implementation are separate design processes**

- Ideation / conceptualisation / design design: product is the user's view of the design
  - Designers mental model, user virtual machine
  - The meaning of the design to the user
- Implementation / coding / realisation: product is the machine's code how to do it
  - The workings of the design for the machine
- Each delineates the remaining design space

**Design Developments revisited**

1. **Waag Society: Users as designers**
   - Ask: inquiring - core users, exploratory play, context mapping ...
   - Make: thinking through making - idea's, demo's, prototyping
   - Try: testing in the field - engaging, tinkering, adapting ...

2. **Booreiland: Network Focused Design**
   - Investigate the design context: actors, relationships
   - Pick them out and rework them into novel and networked terms
   - Provide for excellent UX
   - Not new design but rearranging a situation into networked elements

3. **Living Labs and Exploratory Design**
   - Loose dependencies and non-strict order of design steps allow for exploratory design
   - Fablabs, sensorlabs, living labs allow for tweaking, finetuning and real-life testing

**In design ideation, 'enacting' is crucial**

- In sketching, role playing, demonstrating, etc.
- Persons, tasks, sketches, scenario's
- Video's, prototypes, working system as design specification (cf. van der Kooij and Retfalfi or art)
(3) Educating Creative Technology for the Internet of Things

1) Introduction
2) Human Centered ICT
3) Development in Media Technology (DevThis)
4) Human Centered Creative Technology
5) Ambient and Pervasive Design (AmbiPerv)
6) DevThis versus AmbiPerv
7) Lessons learned and not-learned

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Development in Media Technology = challenging course before final thesis in year 4 (8 cp's)
- full overview of IoT
- content based on developments in HCI & ICT
- form based on developments in (HCI) education
- prepare for research thesis, contribute 2 research

Ambient and Pervasive Design = creative kickstart course at the end of year 2 (2 cp's)
- accessible introduction to IoT
- guided introduction to basic IoT techniques (Arduino)
- apply the know-how to a novel problem

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DevThis: Human Centered ICT (2009)

- User Centered Design
- Look at the future and how to research it / IT
- HC-ICT is ICT for humane purposes:
  - social computing
  - support of everyday life
  - emotional support
  - calm computing (?)
  - ubiquitous computing (?) etc.
- but still: technology to support design

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Why dev devthis?

- Education - the web as old school
  - interactivity & networking
  - sensitivity & intelligence
  - social media, co-design
  - adaptive & adaptable

- Professional education
  - learn to do scientific research
  - teach new topics; ubicomp, IoT, sensors …

- Fun 2 Learn 4 Students
  - between internship & final thesis
  - do research with students

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Developments in (ICT) education

- wealth of internet sources
- lecturer as a facilitator
- inter-active role of students

DIY: own idea, design approach, knowledge about platforms, toolkits, SDK’s …
Classic: lectures, scientific papers, video’s …
Social: teams, mini-lectures, fablab …

(cf. paper @ EADiM 2012)

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Learning and Doing Research

- overview of ubiquitous computing
  - read classical and overview papers
  - learn to handle scientific sources
  - find, select, review, utilize papers (without google)
  - project plan based on publications
  - create a concept poster
  - requirements and technical specifications
  - build and present a demonstrator
  - write a project report
  - write a short paper
Learning 2Do Research

- Why do scientific research?
- Research: experiments, questionnaires, demonstrations
- Finding suitable papers, magazines, conferences etc.
- The structure of publications: where is what information?
- Quick-scanning, reading and selecting scientific papers
- How to review a paper
- Peer- and meta-reviewing publications for e.g. workshops
- Extracting and comparing ideas and concepts
- Fraud, plagiarism and data massage
- How to design a poster, a demonstrator or a (short) paper
- Formatting papers and using publication templates
- How, when and why to use references and how to format them (APA, Harvard)

Discussion - DevThis

- Students acquire research skills -> improved quality of BA theses
- DevThis developed - new developments by the field and greedy colleagues
- Need for Creative Technology: from UCD to applying technology to solve humane problems

Some projects
- Wi-Fi broadcasting
- Building-access control
- Mobile money with NFC
- Indoor climate control
- Bluetooth TV remote
- 3D aerial photography
- Sensing plant growth
- Ubiquitous gaming in & with the sensorlab
- Face recognition & authentication

Ambient and Pervasive Design: Human Centered Creative Technology (2013)

- Creative innovations through technology
- Beyond the desktop, tablet, smartphone
- Real life real people real context
  - smart objects
  - emotional interfaces
  - information ecologies
  - sensory interfaces
  - co-design etc.
  (cf. EYA: European Youth Award & Festival)

Ambient and Pervasive Design

- accessible introduction to IoT
- guided introduction to basic techniques
- apply the know-how to a novel problem

Lecture topics
- IoT and the future
- Arduino and electronics
- from web 2.0 to web 3.0
- the semantic web: machines talking
- IoT concept and software design

Accessible introduction IoT / Arduino

Massimo Banzi @ Ted - Arduino as open sourcing imagination

Bassett & Partners - Connecting the Film

Kevin Kelly @ Ted - The next 5,000 days of the web

Introduction to Arduino, IDE, Processing

- setup & connect Arduino (blink)
  http://arduino.cc/en/Tutorial/Blink
- extend with timing variation, button, potmeter, lightsensor, sound ....

```java
void setup() {
  // initialize the digital pin as an output.
  pinMode(13, OUTPUT);
}
void loop() {
  digitalWrite(13, HIGH);   // set the LED on
  delay(1000);              // wait for a second
  digitalWrite(13, LOW);    // set the LED off
  delay(1000);              // wait for a second
}
```
Guided Introduction to basic techniques
- **blink**, Sensor, Effector
- **button** -> effector
- **sensor** -> effector
  - [http://learn.adafruit.com/tmp36-temperature-sensor/overview](http://learn.adafruit.com/tmp36-temperature-sensor/overview)
- processing to connect arduino to / from pc or web

- arduino applications (how to)
- concept air quality (research)
- prototype (realization)

AmbiPerv: examples
- arduino applications (how to)
- concept air quality (research)
- prototype (realization)

DevThis versus AmbiPerv
- full and textual overview of IoT --> accessible and visual introduction to IoT
- teaching research using publications --> guided learning by demonstration
- doing research DIY --> apply basic know-how in a creative way
- knowledge-centric design --> design based on creativity + know-how

Discussion - incomplete
- AmbiPerv is much more fun teaching / learning but DevThis is more useful for learning & research
- Students prefer building over studying papers:
  - education 2 facilitate creativity (Brennan, 2013):
    - creativity lessons are hard but being creative works!
    - guided & accessible introduction accelerates
- Early introduction to new developments (sensors, IoT, 'make', smart objects ...): possibly more innovative graduates & theses
- Creative Technology design works!

Thank you!
Questions?
- IoT Comic Book
- Massimo Banzi @ TED ‘12
- Arduino Comic Book
- [www.connectingthefilm.com](http://www.connectingthefilm.com)
- Kevin Kelly @ EG ’07
- Waag Society: Users as Designers
- [www.studioroosegaarde.net](http://www.studioroosegaarde.net)
- fritzing.org

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