Design transformation group

Dr Claudia Eckert
The Open University

• UK distance education university
  – Founded in 1969
  – To address social inequality and give people a new chance
• Students – Open to all
  – 1.8 million OU graduates
  – 240 000 students
  – 16 000 post graduates
  – 22 722 OU MBA students
  – UK + international
  – 71% work part-time or full-time
  – 45% have entrance qualification lower than for other universities
The Open University

• Courses and qualification
  – 600 courses for 200 qualifications
  – Course is equivalent to 1 semester or ½ semester
  – Students need 6 semesters worth of teaching (like most UK)

• Organisation of teaching
  – high quality teaching materials
  – locally-based learning support
  – first class research and scholarship
  – highly professional logistics to deliver and support courses
  – and most of all, commitment from the students
The Open University

- **Regions**
  - 13 regions across the UK
  - Local tutor for tutorials, day school, questions
  - Tutors marks assessment and gives personalised feedback

- **Staff**
  - 7,000 tutors
  - 1,100 full-time academic staff
  - 3,500 support staff
  - 554 PhD students: FT 315 + PT 239

- **Headquarters in Milton Keynes**
  - Course development
  - Research (including PhD students)
  - Admin
Design in the Open University

• After a lot of internal mergers
  – In Faculty of Mathematics, Computing and Technology
  – In Department of Design, Development, Environment and Materials

• Design at the Open University is one of the leading design research groups in UK

• Spread of design perspectives in one group
  – Social science
  – Humanities
  – Engineering
  – Product design
  – Architecture
  – Mathematics
Design in the Open University

- Research Themes
  - Design Processes
    - Design transformation group
    - Design ethics
    - Design theory
  - Sustainable Design
    - Transport
    - Attitudes to sustainable technology
  - Complexity
Design transformation group

- Prof Chris Earl
- Dr Claudia Eckert
- Dr Iestyn Jowers (in June)
- 7 full time students
- 6 part time students
Methodological approach

Eckert, C.M., Stacey, M.K., Clarkson, M.K. (2003), ‘The spiral of applied research: a methodological view on integrated design research’, ICED 03
Theme and Topics

• Theme
  Understanding and supporting how products evolve from each other in a range of domains

• Topics
  – Engineering change
  – Modelling and managing design processes
  – Refurbishment
  – Inspiration and creativity – next Thursday
  – Design across domains
  – Generative design
Engineering Change

- Customisation in helicopters 1999
- Versions in diesel engines 2001
- Conceptual design in jet engines 2002
- Freezes in diesel engines 2004
- Knowledge requirements for long life products 2006
- Refurbishment of buildings 2011
- Testing as a driver of change 2012
- Change margins 2013
Engineering Change

- Empirical studies of engineering change processes
- Change prediction
- Role of margins in change management and prediction
Causes of Change

- *Initiated changes*
  - Past designs
  - Innovations
  - Customers
  - Certification
  - Off-sets

- *Emergent changes*
  - Problems in designs
  - Problems in prototyping
  - Problems in testing
  - Problems in manufacture
  - Problems in use
  - Recent innovation
  - New requirement
  - Retrofit
  - New version

Occurrences of change

Product 1

Design 1

Product
Maintenance 1

Product
Upgrade 1

Product 2

Design 2

Product
Maintenance 2

Product
Upgrade 2

Product 3

Design 3

Product
Maintenance 3

Product
Upgrade 3
Change prediction

- Knock-on effects of changes
- Abstract probabilistic model
  - Impact
  - Likelihood

A generic model of margins

- Margin: parameter value beyond requirements
- Changes occur if margins are exceeded
- Margins are kept for multiple reasons

Testing in design processes

- Intertwining of testing and product development
- Planning of testing processes

Process Modelling

- Empirical studies of process modelling and planning
- Process modelling tool
- Modelling of specific processes
- Process planning algorithms

Functional Modelling

- Notions of function in engineering practice
- Requirements for functional modelling

Design Communication

• Problems in design communication
• Communication across supply chain partners
• Role of physical objects in design communication
• Effect of characteristics of representations on design communication

Formality in Design Communication

- Different representations for different audiences
- Role of sketches in design communication
- Transformation in and through sketches

Sustainable Fashion

Making fashion consumption more sustainable

• Understanding users
• Tools for designers

Fashion is

• Engineering in a nutshell
• The writing on the wall

Considerate Design

Generating designs that impact less on the environment and are closer to the user needs

Understanding environmental impact

Comparing this impact for different designs

Generating designs that meet the needs of users

Economical Customisation
The Simulated Process

Wynn, D., Eckert, C.M., Clarkson, P.J., (2011), Simulating intertwined design processes that have similar structures: A case study of a small company that creates made-to-order fashion products, *International Journal of Product Development*, 14, 1–4, 118-146
Refurbishment

Refurbishment of hospitals
• Changes in refurbishment projects
• Decision making processes
• Energy efficiency

Domestic buildings

Comparisons between Design Domains

• Differences and similarities across design domains
• Transfer of best practise across domains
• Application of tools and methods
• Design theory

Design Theory

- Predicting behaviour of design processes across domains
- Causal theory fragments in terms of theories and constraints
Generative design

- Transformations of form – seeing + doing
- Integrating physical and digital descriptions in design process
- Transformations of descriptions (form + motion + material)
- Rules for kinematic designs
- Rules for material – attributes & selection
Shape Grammars

- Generation of designs
- Structure of design problems

Generative tools in craft

• Role of tools in craft
• Rapid prototyping / manufacturing in craft processes
• Shape grammars as tools
Generative structures

- Mobility and variable spatial relations
- Shape and material
- Explanation and exploration