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Guest lecturer: Simon Wheatcroft

How IBM's app helped a blind ultra-marathon runner cross the Namib desert



WRITTEN BY
[Aaron Lee](#)

[Case Studies](#)

4 Jul, 2016



Armed with only a smartphone, blind racer Simon Wheatcroft ran 100 miles across a desert

Running a marathon is a colossal test of endurance for trained athletes. So imagine running four of them in a row without being able to see.

That's what blind ultra-marathon runner [Simon Wheatcroft](#) recently achieved, with the help of IBM's Platform-as-a-Service cloud, Bluemix Garage, when he took on the unforgiving conditions of the Namib desert for a 150-mile challenge.

Preparing for this test of endurance, Wheatcroft, who has been blind since the age of 17, worked with IBM's EMEA Bluemix team to work out how he could stay on track.

COM2002/3002/6222

Human Centred Systems Design

HC Lecture 7

Designing Interaction



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COM2002/3002/6222 structure



1. People and Technology
2. Human-Computer Interaction
3. Designing Interaction (Simon Wheatcroft)
4. Guest lecture: Sebastian Conran
5. HCI and Software Engineering



The ‘Execution-Evaluation Cycle’

Norman, D. A.
(1988). *The Psychology of Everyday Things*. New York: Basic Books.

EVALUATION EXECUTION

Norman's model of a user's behaviour during an interaction ...

1. *establishing the goal*
2. *forming the intention*
3. *specifying the action sequence*
4. *executing the action*
5. *perceiving the system state*  feedback
6. *interpreting the system state*
7. *evaluating the system state with respect to the goals and intentions*



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when was the last time that Denmark won the european championships



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[UEFA Euro 1992 - Wikipedia](#)

https://en.wikipedia.org/wiki/UEFA_Euro_1992 ▾

It was the ninth European Football Championship, which is held every four years and supported by UEFA. Denmark won the **1992** championship. The team had qualified only after Yugoslavia was disqualified as a result of the breakup and warfare in the country. Eight national teams contested the finals tournament.

[UEFA Euro 1988](#) · [UEFA Euro 1996](#) · [UEFA Euro 1992 Final](#) · [Henrik Larsen](#)

[Denmark at the UEFA European Championship - Wikipedia](#)

https://en.wikipedia.org/wiki/Denmark_at_the_Uefa_European_Championship ▾

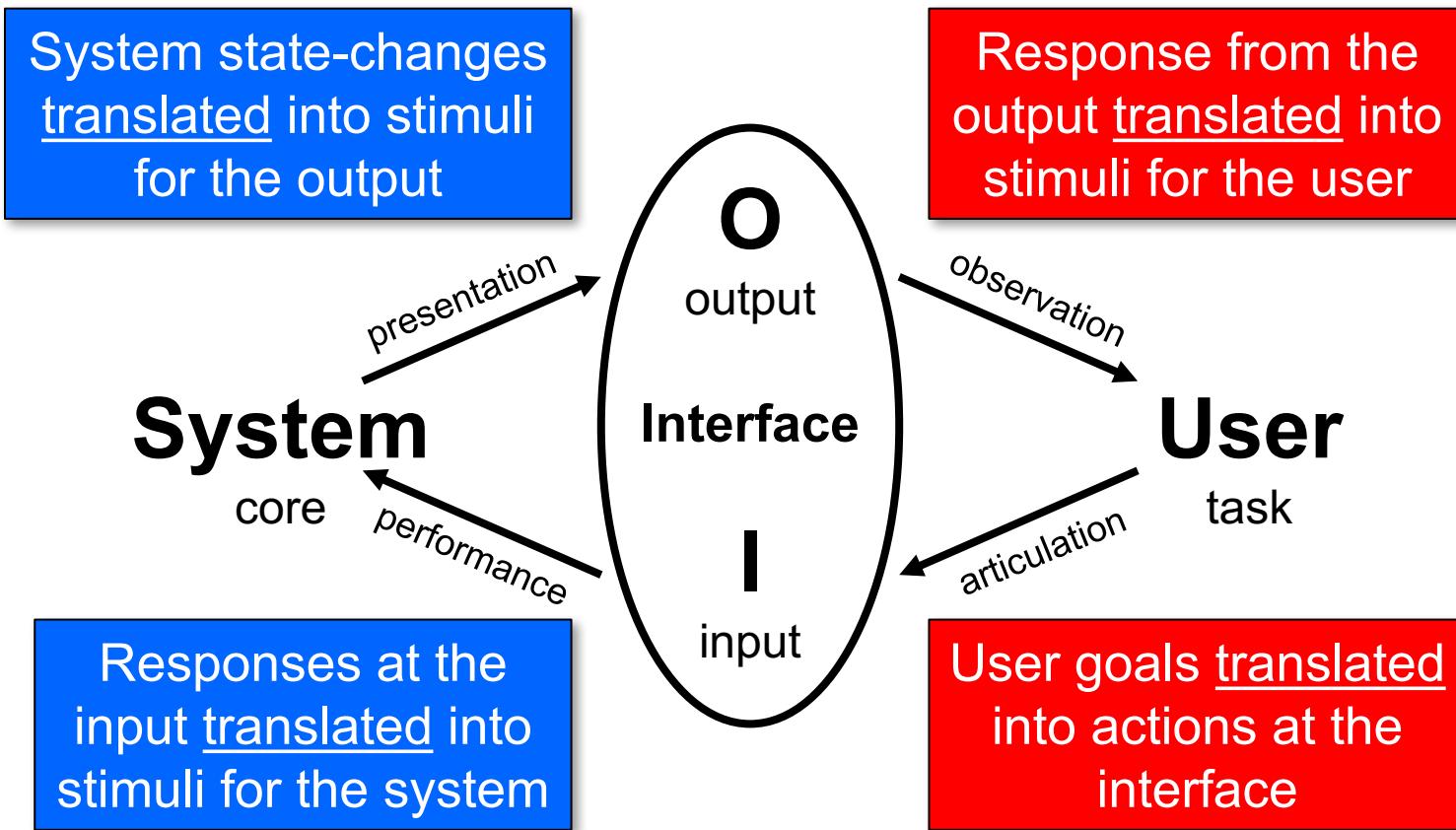
Denmark at the UEFA European Championship. Denmark have participated in eight UEFA European Football Championships, and won the tournament once. In the final of Euro **1992** in Sweden, their 2–0 victory over Germany resulted in their first major tournament title.

[Euro 1964](#) · [Euro 1984](#) · [Euro 1992](#) · [Euro 2004](#)

[UEFA Euro 1992 Final - Wikipedia](#)

https://en.wikipedia.org/w/index.php?title=UEFA_Euro_1992_Final&oldid=111111111

The ‘Interaction Framework’



This week: Designing the interaction

- Norman's principles of design
- The design process
- User-centred approach



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Guest interfaces



Week1:



Week2:



Week3:



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Online polling/clicker system



TurningPoint



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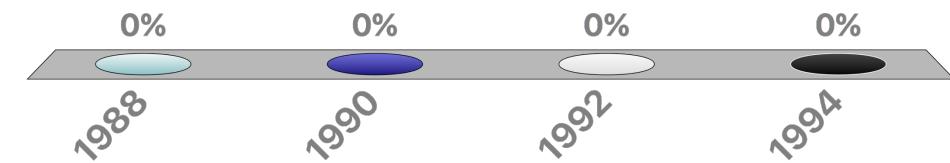
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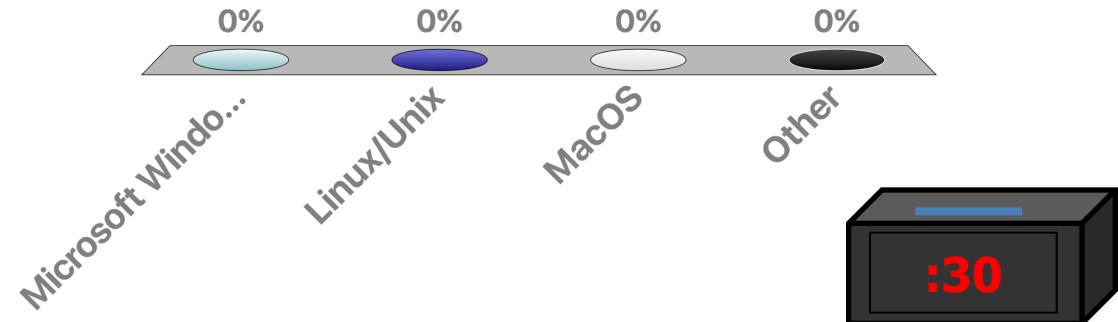
Which year did the Danish Male Football team win the European Championship?

- A. 1988
- B. 1990
- C. 1992
- D. 1994



What's your favourite OS?

- A. Microsoft Windows
- B. Linux/Unix
- C. MacOS
- D. Other



What is Design?

- A creative process
- A social activity (*with social consequences*)
- A conscious change
- A communication between designers and users

“Messy”, David Kelly,
founder of IDEO
(pronounced “eye-dee-oh”))



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What is Design?

- Goals
 - what is the purpose of the design?
 - who is it for?
 - why do they want it?
- Constraints
 - what materials must be used?
 - what standards must be adopted?
 - how much can it cost?
 - how much development time is there?
 - are there health and safety issues?
- Trade-Offs
 - which goals and/or constraints can be relaxed so that others can be met?



What Makes a Good Interface Design?

- Make it easy to determine what actions are possible at any moment
- Make things ‘visible’ ...
 - the conceptual model of the system
 - the alternative actions
 - the results of actions
- Make it easy to evaluate the current state of the system
- Follow natural mappings between intentions and the required actions ...
 - between actions and the resulting effect
 - between the information that is visible and the interpretation of the system state



Norman, D. A. (1990). *The Design of Everyday Things*. New York: Doubleday.

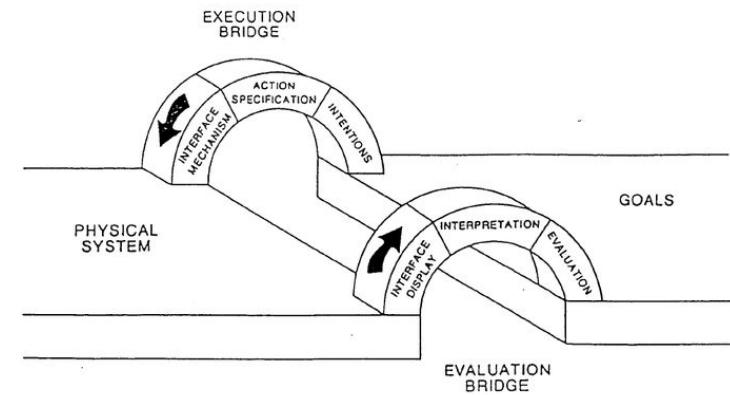


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Reminder of the Gulfs

The gulf of execution is the difference between the intentions of the users and what the system allows them to do or how well the system supports those actions (Norman 1988)

The gulf of evaluation is the difficulty of assessing the state of the system and how well the artifact supports the discovery and interpretation of that state (Norman 1991).

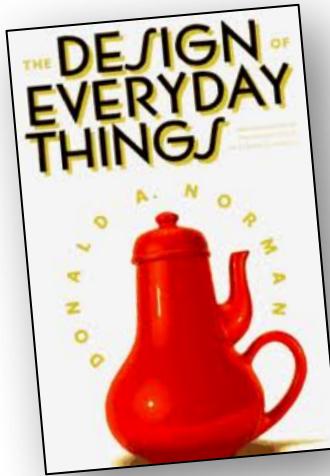


Designing a *Usable* Interaction

- Local structure
 - knowing where you are
 - knowing what you can do
 - knowing where you are going (*or what will happen*)
 - knowing where you've been (*or what you've done*)
- Global structure
 - functional hierarchy
(*linking screens, pages or states into logical groupings*)
 - dialogue network
(*describing the pattern of movements between main states of a device*)
- Designs are often not ‘stand-alone’, so there are ...
 - style and consistency issues
 - functional interaction issues
 - navigation linkage issues



Norman's Principles of Design



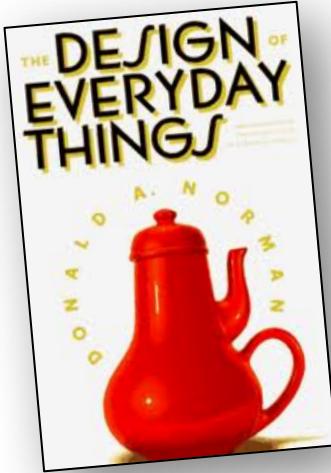
Norman, D. A.
(1990). *The
Design of
Everyday
Things*. New
York: Doubleday.

1. Use both **knowledge** in the world and in the head ...
 - by building conceptual models, write manuals that are easily understood and that are written before the design is implemented
2. Simplify the **structure** of tasks ...
 - make sure not to overload the short-term memory, or the long-term memory of the user
 - on average, the user is able to remember five things at a time
 - make sure the task is consistent and provide mental aids for easy retrieval of information from long-term memory
 - make sure the user has control over the task
3. Make things **visible** ...
 - bridge the gulfs of Execution and Evaluation
 - the user should be able to figure out the use of an object by seeing the right buttons or devices for executing an operation



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Norman's Principles of Design



Norman, D. A.
(1990). *The
Design of
Everyday
Things*. New
York: Doubleday.

4. Get the **mappings** right ...
 - one way to make things understandable is to use graphics
5. Exploit the power of **constraints**
(both natural and artificial) ...
 - give the user the feel that there is one thing to do
6. Design for **error** ...
 - plan for any possible error that can be made, this way the user will be allowed the option of recovery from any possible error made
7. When all else fails, **standardise** ...
 - create an international standard if something cannot be designed without arbitrary mappings



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Books
Sports & Outdoors

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RECOMMENDED FOR YOU
Startup - Season 1

MUSIC

RECENTLY PLAYED
Classical for a Relaxing Bath

ALEXA

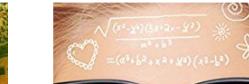
"Alexa, what's my sports update?"

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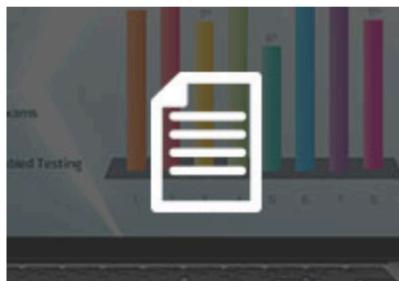
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Quick Start Guides



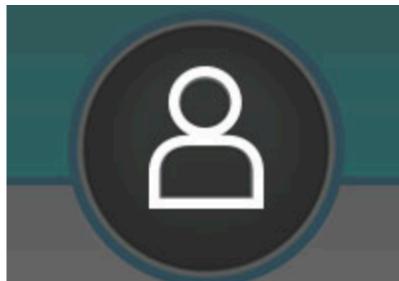
GETTING STARTED

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ANYWHERE POLLING

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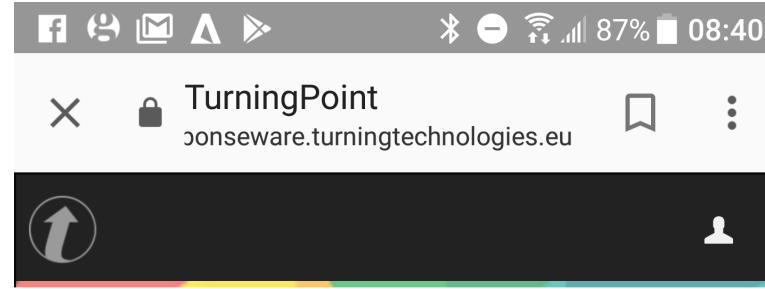
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INTEGRATIONS

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RESPONSE OPTIONS

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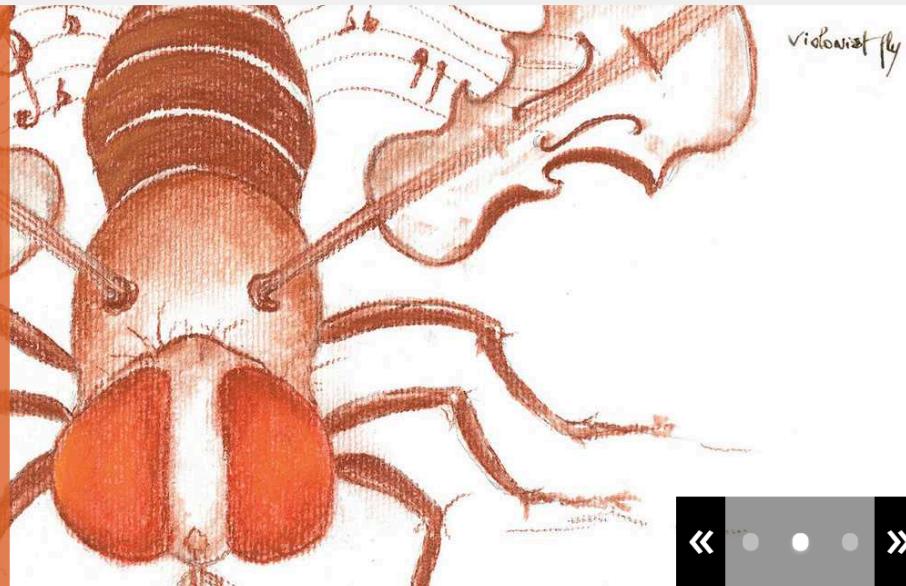
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INSECT EVOLUTION

The songs of insect love

Our scientists have revealed how male fruit flies evolved to sing powerful love songs when competing for female attention.

Influences on evolution →



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SHEFFIELD IN WORLD TOP 100 FOR SOCIAL SCIENCES

We're ranked as one of the best universities in the world for our pioneering research and innovative teaching in the social sciences.

Why we're 63rd
internationally →

Events





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Staff

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Portrait of a Woman

Dr Kathryn Riddle's portrait has been unveiled. She's the second inspirational woman to have her portrait hung in Firth Hall as part of the Portrait of a Woman prize.

[See Kathryn's portrait !\[\]\(d1558503c4af8d50d5e77a7a2317937c_img.jpg\)](#)

RESEARCH

Spotlight on the past

Grayson Perry to deliver Orwell Lecture

Artist Grayson Perry delivering first Orwell Lecture in the North for almost 20 years 

Off the Shelf

Many of our talented academics are on the lineup for this year's city-wide literary festival 7-28 October. 

Honorary degrees

MAKE A NOMINATION

Is there a former student, distinguished scholar or inspirational person you think has served the University or city? Nominate them for an honorary degree for 2019.

Nominate by 3 November 

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iSheffield app 



The ‘Golden Rule’ of Design

“Understand your Materials”

People



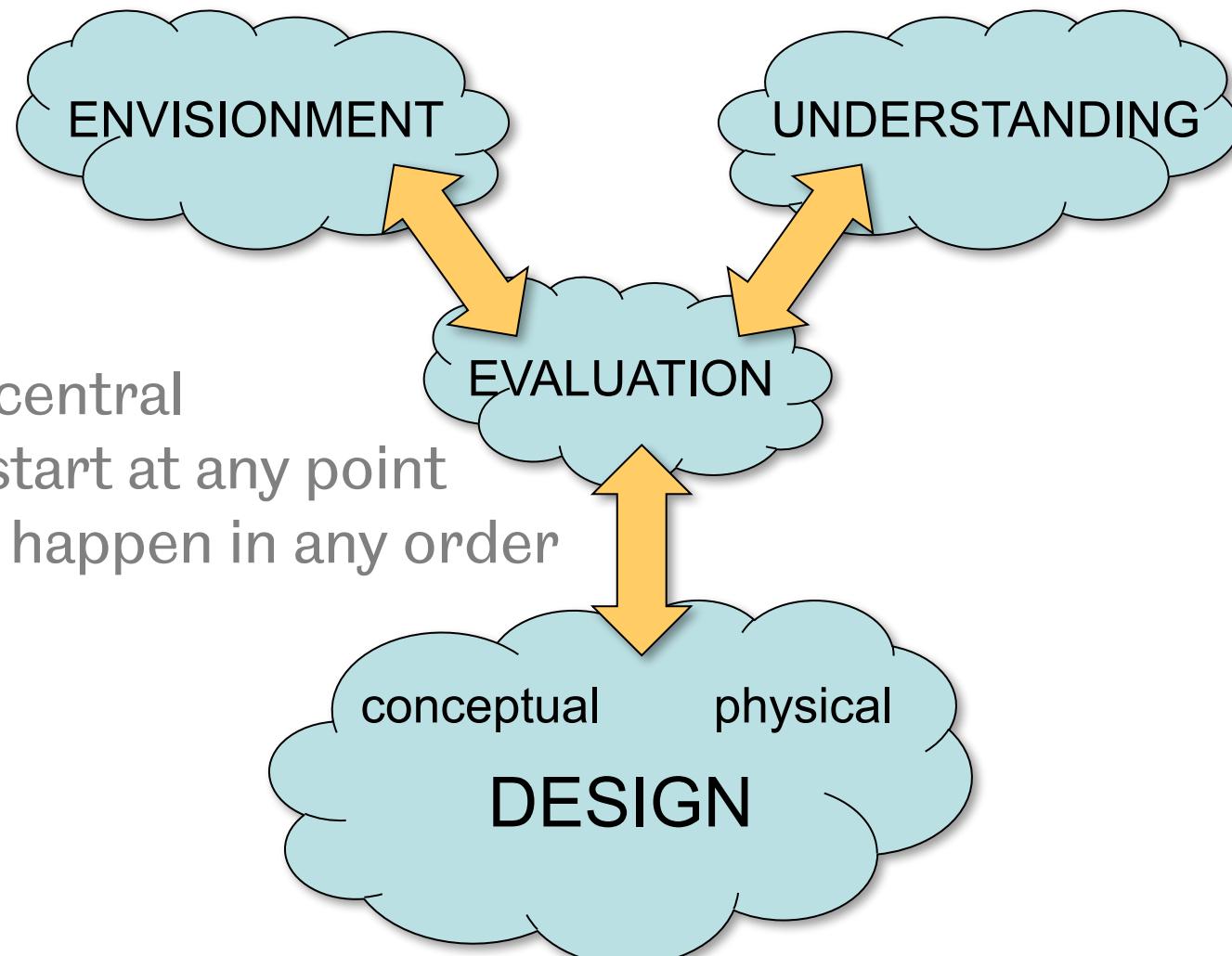
Technology



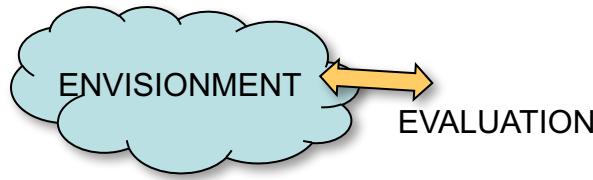
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The Design Process

- Evaluation is central
- Process can start at any point
- Activities can happen in any order



Envisionment



Visual exploration & presentation of key features of design

- allows for feedback from users and clients
- aids generation, communication and evaluation of ideas
- for different people at different stages of development

All aspects can & should be envisioned

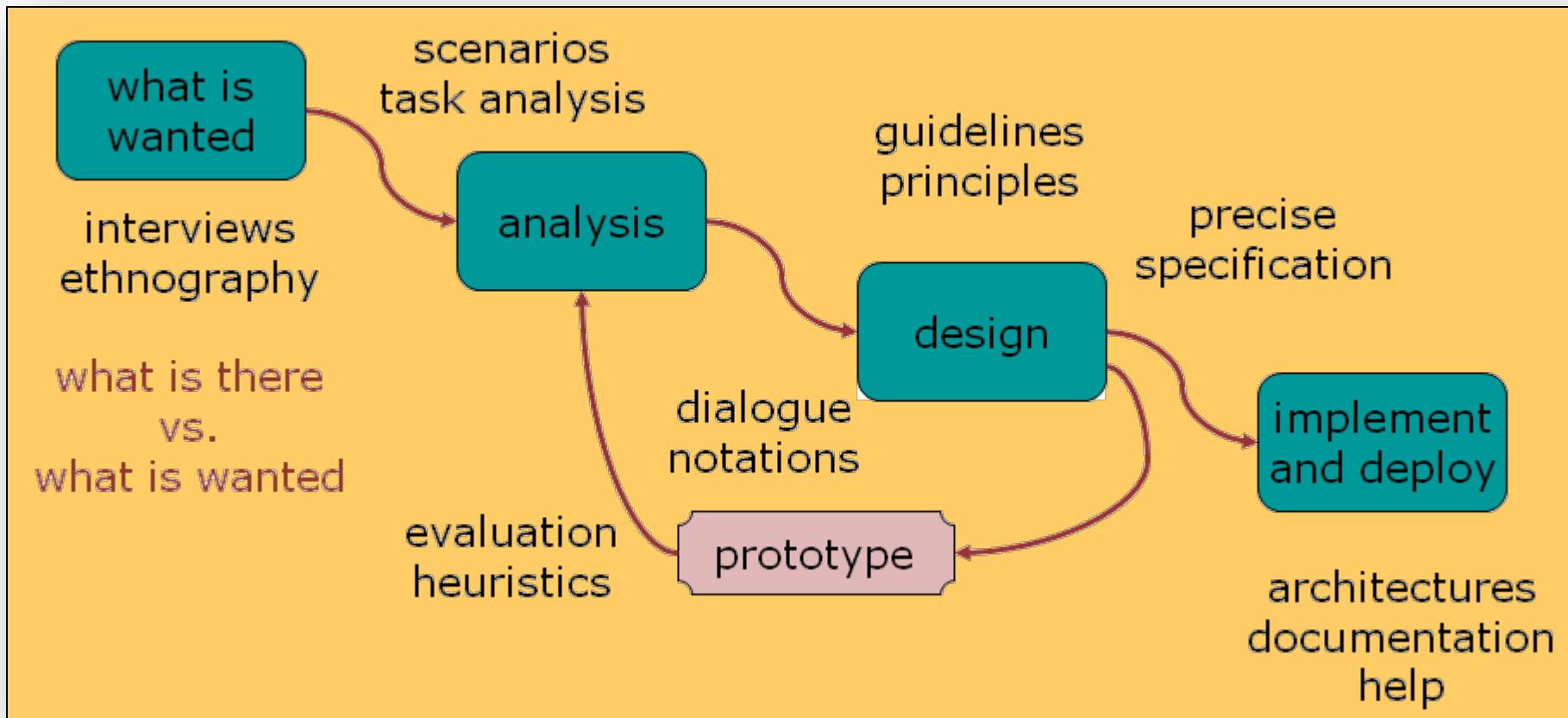
- Concepts
- Functions
- Structure
- interactions

Methods go from sketches ('back of the envelope') to full computer prototypes

- may focus on part or whole of the system
- may evolve into final product or be re-engineered



The Design Process

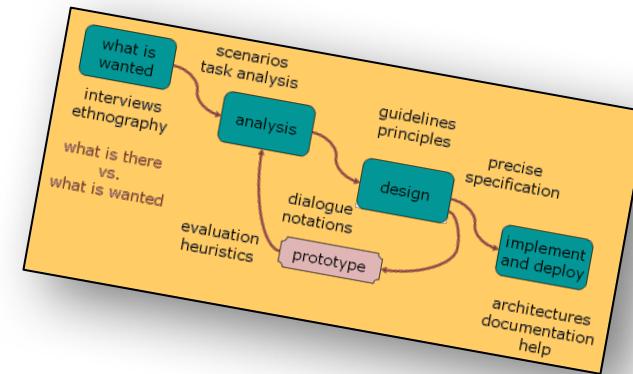


Dix, A., Finlay, J., Abowd, G., & Beale, R. (2004). *Human-Computer Interaction*. Harlow: Pearson Education Ltd.



The Design Process

- Requirements
 - what is there and what is wanted?
- Analysis
 - ordering and understanding
- Design
 - what to do and how to decide
- Iteration and prototyping
 - getting it right ... and finding what is really needed!
- Implementation and deployment
 - making it and getting it out there



Importance of Involving Users



- Expectation management
 - realistic expectations
 - no surprises/disappointments
 - timely training
 - communication (*but no hype*)
- Ownership
 - make the users active '**stakeholders**'
 - more likely to forgive or accept problems
 - can make a big difference to acceptance and success of product



Users/Stakeholders



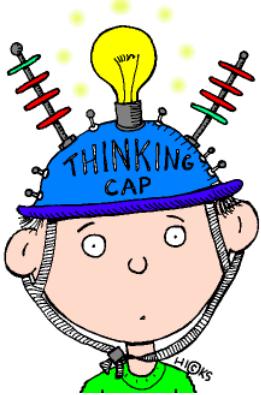
- Not as obvious as you think:
 - those who interact directly with the product
 - those who manage direct users
 - those who receive output from the product
 - those who make the purchasing decision
 - those who use competitor's products
- Three categories of user:
 - '**primary**': *frequent hands-on*
 - '**secondary**': *occasional or via someone else*
 - '**tertiary**': *affected by its introduction, or will influence its purchase*

Eason, K. (1987). *Information Technology and Organizational Change*. London: Taylor and Francis.



Exercise (*work in pairs*)

Think of a software system/app and identify the primary, secondary and tertiary stakeholders



Exercise (*work in pairs*)

Think of a software system/app and identify the primary, secondary and tertiary stakeholders



Name a primary user

Name a primary user

Name a secondary user

Name a secondary user

And finally, a tertiary user

And finally, a tertiary user

User-Centred Approach

- Early focus on users and tasks:
 - directly studying cognitive, behavioural, anthropomorphic and attitudinal characteristics
- Empirical measurement:
 - users' reactions (*and performance*) are observed, recorded and analysed to ...
 - scenarios
 - manuals
 - simulations
 - prototypes
- Iterative design:
 - when problems are found in user testing, fix them and carry out more tests



Ethnography

Ethno =
people;
Graphy =
describe
something

- Direct observation is sometimes hard
 - in the home
 - psychiatric patients
- Solution = '**probe packs**'
 - items to prompt responses
(e.g. *voice recorder, camera, postcard*)
 - given to people to open in their own environment and record what is meaningful to them
- Used to ...
 - inform interviews
 - prompt ideas
 - enculture designers



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Involving Users

Technique	Purpose	Stage
Background Interviews and questionnaires	Collecting data related to the needs and expectations of users; evaluation of design alternatives, prototypes and the final artifact	At the beginning of the design project
Sequence of work interviews and questionnaires	Collecting data related to the sequence of work to be performed with the artifact	Early in the design cycle
Focus groups	Include a wide range of stakeholders to discuss issues and requirements	Early in the design cycle
On-site observation	Collecting information concerning the environment in which the artifact will be used	Early in the design cycle
Role Playing, walkthroughs and simulations	Evaluation of alternative designs and gaining additional information about user needs and expectations; prototype evaluation	Early and mid-point in the design cycle
Usability testing	Collecting quantitative data related to measurable usability criteria	Final stage of the design cycle
Interviews and questionnaires	Collecting qualitative data related to user satisfaction with the artifact	Final stage of the design cycle

Rogers, Y., Sharp, H., & Preece, J. (2011). *Interaction Design: Beyond Human-Computer Interaction* (3rd ed.). John Wiley & Sons.



Users/Stakeholders

- Who are they?
 - young vs. old
 - experienced vs. novices
- Probably not like you!
- Talk to them
 - better ideas
 - ownership
- Watch them
 - notoriously difficult to introspect
- Use your imagination
 - invent several '**personas**' covering different types of users and roles
 - envisage '**scenarios**' that capture the relevant activities



Imaging you are designing an IVA-based (Intelligent Virtual Agent) system to help people with COPD (chronic lung condition) to better deal with the situation when they are feeling anxious or unwell.

Who should we invite to the first design meeting?

Who should be at the meeting?

bungee jumping

kayaking running
ice fishing
jogging weight lifting

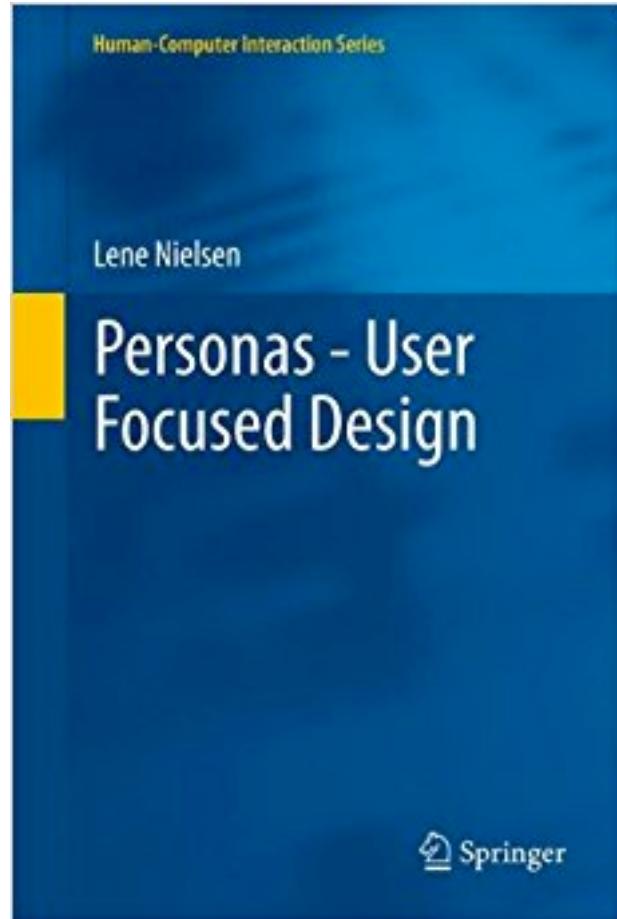
video games

swimming

hiking

rock climbing

'Personas'

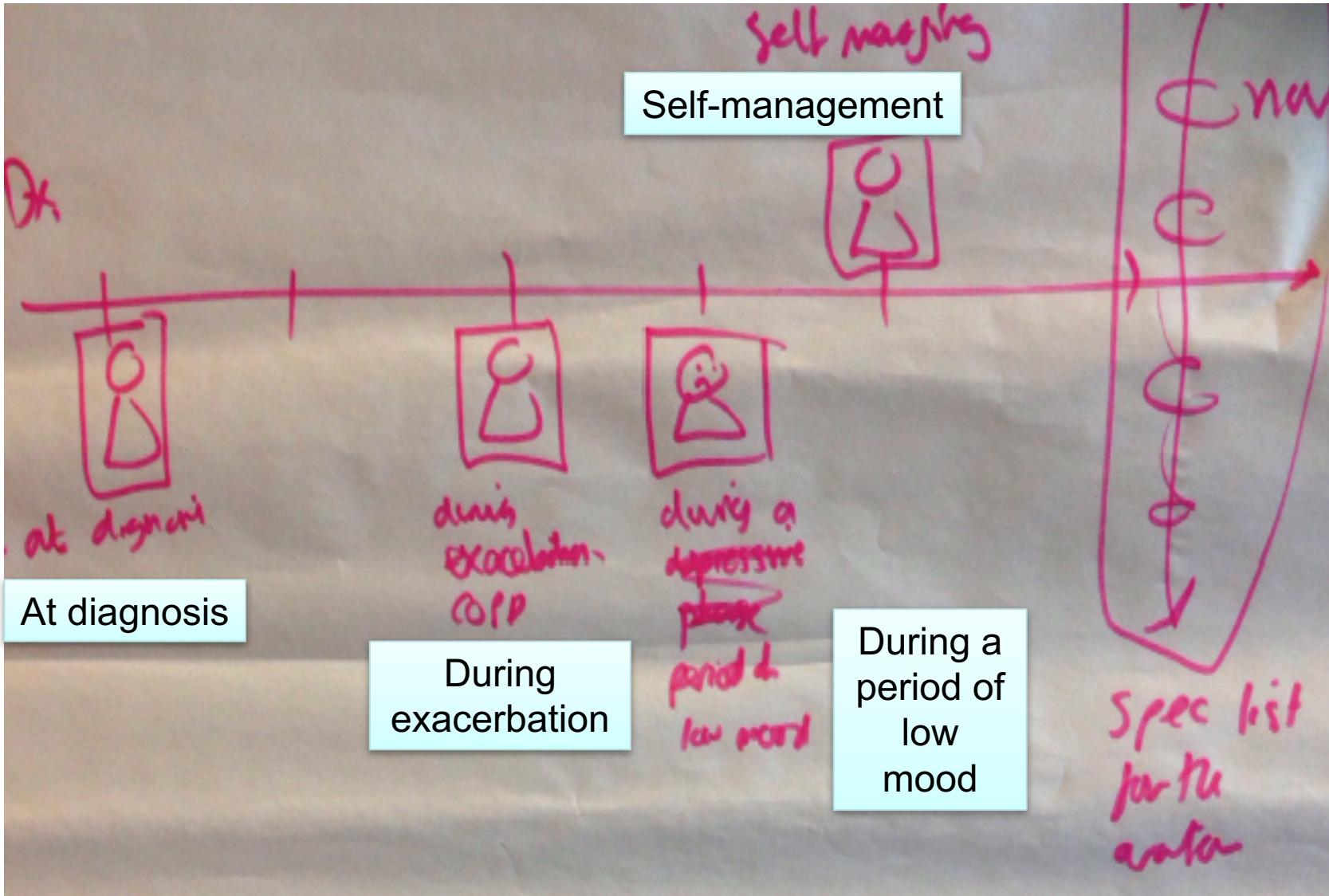


- A '**persona**' is a description of an example user
 - not necessarily a real person
- Use as surrogate user
 - what would 'xxxx' think?
- Details matter
 - makes them 'real'



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Persona development for AvaChat: COPD self-management project



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Full Name



"A quotation that captures the essence of this person's personality."

Age: 1-100

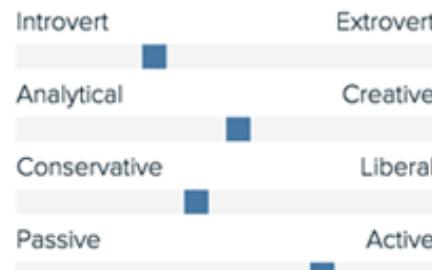
Work: Job title

Family: Married, kids, etc.

Location: City, state

Character: Type

Personality



Trait Trait Trait Trait Trait

Goals

- The goals this user hopes to achieve.
- A task that needs to be completed.
- A life goal to be reached.
- Or an experience to be felt.

Frustrations

- The frustrations this user would like to avoid.
- The obstacle that prevents this user from achieving their goals.
- The problems with the solutions already available.
- The product or service that currently does not exist.

Bio

The bio should be a short paragraph to describe the user journey. It should include some of their history leading up to a current use case. It may be helpful to incorporate information listed across the template and add pertinent details that may have been left out. Highlight factors of the user's personal and of professional life that make this user an ideal customer of your product.

Motivations

Incentive

Fear

Achievement

Growth

Power

Social

Brands



Preferred Channels

Traditional Ads

Online & Social Media

Referral

Guerrilla Efforts & PR



Example ‘Persona’



Andy is 37 years old, He has been Warehouse Manager for five years and worked for Simpkins Brothers Engineering for twelve years. He *didn't go to university*, but has studied in his evenings for a business diploma. He has two children aged 15 and 7 and does not like to work late. He did part of an introductory in-house *computer course some years ago*, but it was interrupted when he was promoted and could no longer afford to take the time. His *vision is perfect*, but his *right-hand movement is slightly restricted* following an industrial accident three years ago. He is enthusiastic about his work and is happy to delegate responsibility and take suggestions from his staff. However, he does feel *threatened by the introduction of yet another new computer system* (the third in his time at SBE).

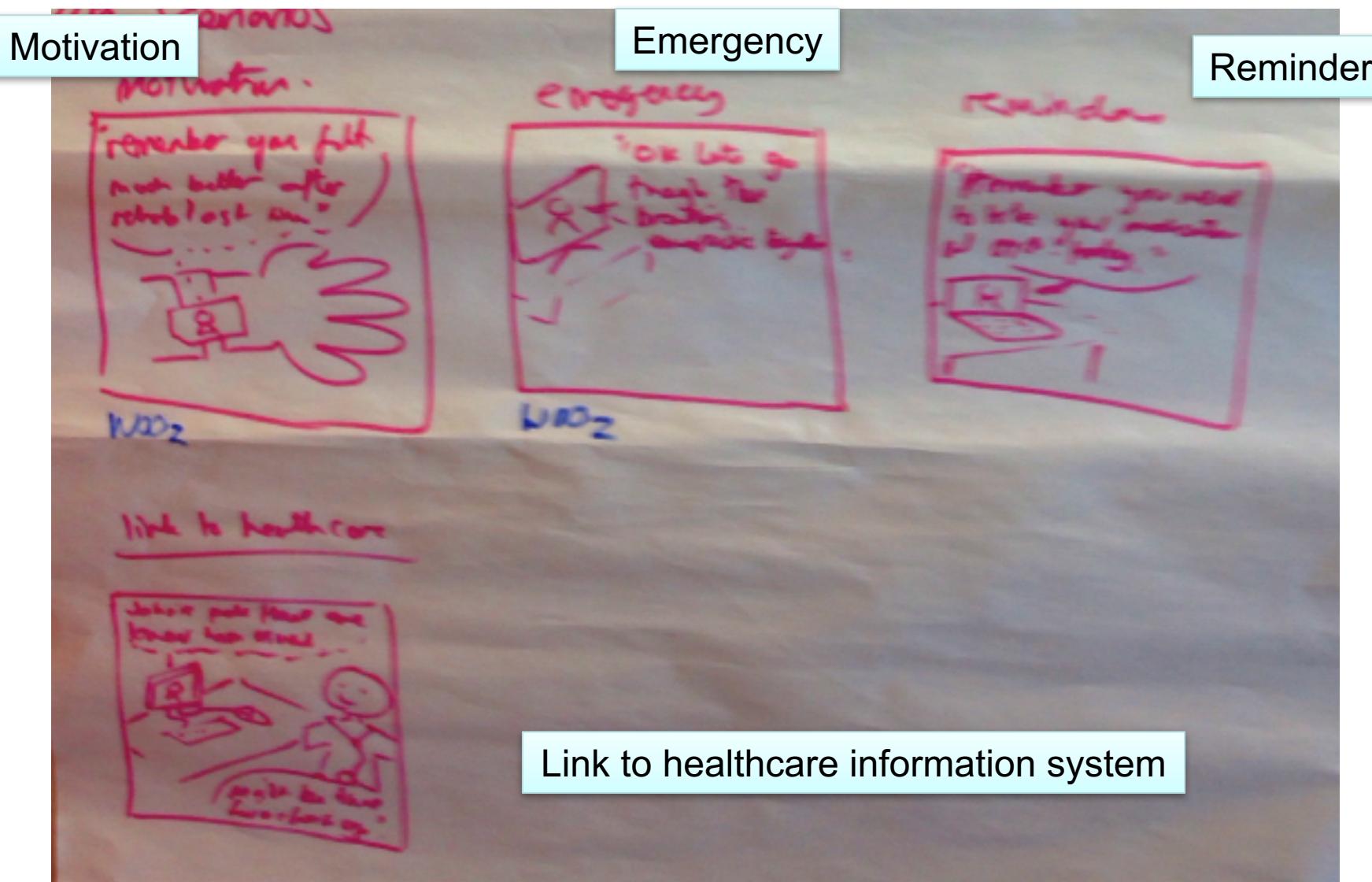


'Scenarios'

- 'Scenarios' are stories for design ...
- What will users want to do?
- Step-by-step walkthrough
 - what can they see?
(*sketches, screen shots*)
 - what do they do?
(*keyboard, mouse etc.*)
 - what are they thinking?
- Use and reuse throughout design



Scenarios – co-design workshop



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Use Scenarios to ..

- Communicate with others
 - designers
 - clients
 - users
- Validate other models
 - ‘play’ it against other models
- Express dynamics
 - screenshots (*appearance*)
 - scenario (*behaviour*)
- Explore
 - interaction (*what happens when?*)
 - cognition (*what are the users thinking?*)
 - architecture (*what is happening inside?*)



search ID: hsc4018



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Linearity

- Scenarios represent one linear path through system
- Pros:
 - life and time are linear
 - easy to understand (*stories and narrative are natural*)
 - concrete (*errors less likely*)
- Cons:
 - no choice, no branches, no special conditions
 - miss the unintended
- Solution ...
 - use several scenarios
 - use several methods



Using Scenarios

- Scenarios (*and their associated personas*) are a core technique for interactive systems design
- Types of scenario:
 - ‘**stories**’
(real-world experiences of people)
 - ‘**conceptual scenarios**’
(more abstract descriptions in which some details have been stripped away)
 - ‘**concrete scenarios**’
(generated from abstract scenarios by adding specific design decisions and technologies)
 - ‘**use cases**’
(formal descriptions that can be given to programmers)



‘Stories’

- ‘**Stories**’ are people’s ...
 - real-world experiences
 - ideas
 - anecdotes
 - knowledge
- These may be captured in any form and comprise snippets of **activities** and the **contexts** in which they occur, e.g. ...
 - videos of people engaged in an activity
 - diary entries
 - photographs
 - documents
 - the results of observations and interviews
- People’s stories are rich in context
- Stories also capture many seemingly trivial details that are usually left out if people are asked to provide more formal representations of what they do



Example ‘Story’



I needed to make an appointment for Kirsty, my little one. It wasn't urgent – she had been having a lot of bad ear-ache every time she had a cold – but I did want to see Dr Fox since she's so good with the children. And of course ideally it had to be when Kirsty was out of school and I could take time off work. I rang the surgery and the receptionist told me that the next appointment for Dr Fox was the next Tuesday afternoon. That was no good since Tuesday is one of my really busy days so I asked when the next one was. The receptionist said Thursday morning. That meant making Kirsty late for school but I agreed because they sounded very busy – the other phone kept ringing in the background – and I was in a hurry myself. It was difficult to suggest a better time without knowing which appointments were still free.



'Conceptual Scenarios'

- 'Conceptual scenarios' are more abstract than stories
- Much of the context is stripped away during the process of abstraction and similar stories are combined together
- Conceptual scenarios are particularly useful for ...
 - generating design ideas
 - understanding the requirements of the system
- Once the designer has accumulated a collection of stories, common elements will start to emerge



Example ‘Conceptual Scenario’

Booking an appointment: *People with any degree of basic computer skills will be able to contact the doctors' surgery at any time via the Internet and see the times which are free for each doctor. They can book a time and receive confirmation of the appointment.*

- Note that there is little or no specification of precise technologies or how the functions will be provided
- The scenario could be made more ...
 - abstract
(by not specifying that the Internet should be used)
 - concrete
(by specifying that the booking should be made from a computer rather than a mobile phone)
- Finding an appropriate level of abstraction for a given purpose is a key design skill



‘Concrete Scenarios’

- One reasonably abstract scenario may spawn several more concrete elaborations which are useful for exploring particular issues
- Concrete scenarios begin to dictate ...
 - a particular interface design
 - a particular allocation of functions between people and devices
- The prescriptive nature of concrete scenarios makes them particularly useful for ...
 - prototyping
 - envisioning design ideas
 - evaluation



Example ‘Concrete Scenario’

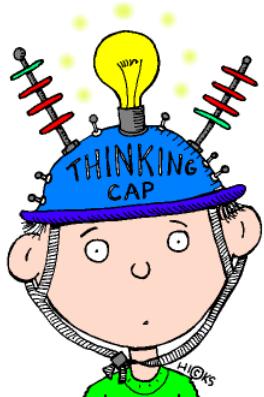


Andy needs a doctor's appointment for his young daughter Kirsty in the next week or so. The appointment needs to be outside school-time and Andy's core working hours, and ideally with Dr Fox, who is the children's specialist. Andy reluctantly uses a PC and the Internet at home, so he manages to run up the appointments booking system. He logs in¹ and from a series of drop-down boxes, chooses to have free times for Dr Fox² displayed for the next two weeks [the scenario would continue to describe how Andy books the appointment and receives confirmation]

1. Is logging in necessary? (*probably, to discourage bogus access to the system, but check with the surgery*)
2. Free times can be organised by doctor, by time of day, or by next available time (*drop-down boxes will save screen space but may present problems for less experienced users or those with poor eyesight*)



Exercise (*work in pairs*)



Draft a *concrete scenario* for a disabled person interacting with an ordinary vending machine



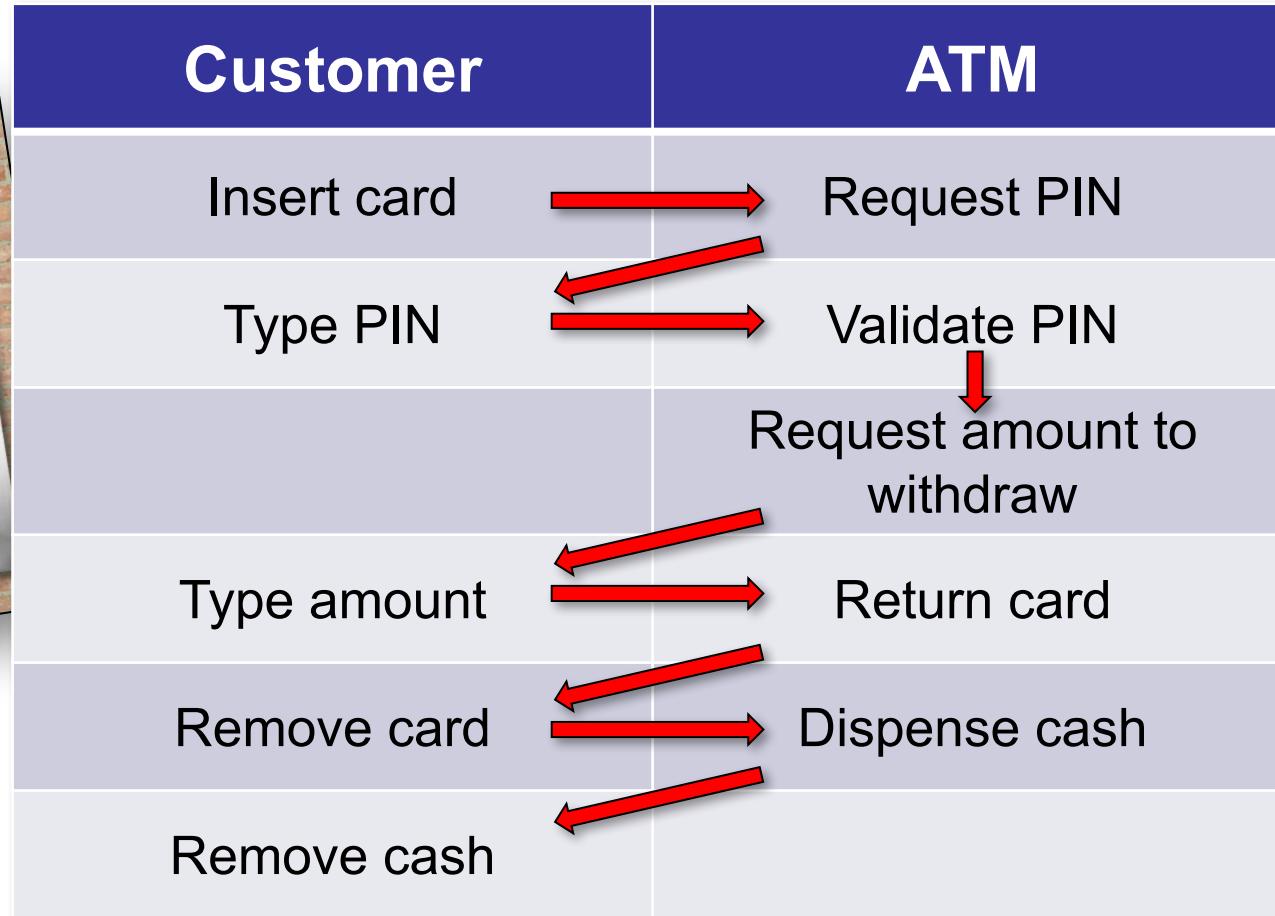
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‘Use Cases’

- A ‘use case’ describes the interaction between people (or other ‘actors’) and devices
- It is a case of how the system is used and hence needs to describe what people do and what the system does
- Each use case covers many slight variations in circumstances
- Before use cases can be specified, tasks and functions have to be allocated to humans or to the system
- The specification of use cases both informs and is informed by the task/function allocation process
- A set of use cases can be produced which specify the complete functionality of the system and the interactions that will occur
- There are a number of different ways of representing use cases (*from very abstract diagrams to detailed ‘pseudo code’*)

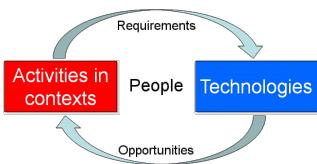


Example ‘Use Case’



Developing Personas & Scenarios

- Personas and scenarios are developed through undertaking a '**PACT analysis**' ...
 - the people who will use the system are represented by '**personas**'
 - activities and the contexts in which they will occur are envisioned through '**scenarios**'
- Almost inevitably personas and scenarios evolve together ...
 - thinking about people involves thinking about what they want to do
 - thinking about activities involves thinking about who will be undertaking them



Pros/Cons of User-Centred Design

Advantages	Disadvantages
Products are more efficient, effective, and safe	It is more costly
Assists in managing users' expectations and levels of satisfaction with the product	It takes more time
Users develop a sense of ownership for the product	May require the involvement of additional design team members (<i>i.e.</i> <i>ethnographers, usability experts</i>) and wide range of stakeholders
Products require less redesign and integrate into the environment more quickly	May be difficult to translate some types of data into design
The collaborative process generated more creative design solutions to problems	The product may be too specific for more general use, thus not readily transferable to other clients; thus more costly

Abras, C., Maloney-Krichmar, D., & Preece, J. (2004). User-centered design. In W. Bainbridge (Ed.), *Encyclopedia of Human-Computer Interaction*. Thousand Oaks: Sage Publications.



Next week's guest interface and guest lecturer: The MiRo Robot and Sebastian Conran



This lecture has covered ...

- Norman's principles of design
- The design process
- The user-centred approach
- Personas, scenarios and use-cases



Any Questions ?



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Next time ...

Sebastian Conran – guest lecture



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