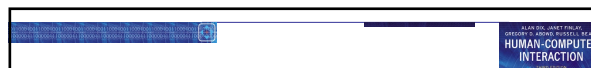


HUMAN-COMPUTER INTERACTION THIRD EDITION
DIX FINLAY ABOWD BEALE

Chapter 5

Interaction design basics


1



Interaction design basics

- Design:
 - what it is, interventions, goals, constraints
- The design process
 - what happens when
- Users
 - who they are, what they are like ...
- Scenarios
 - rich stories of design
- Navigation
 - finding your way around a system
- Iteration and prototypes
 - never get it right first time!

2



Interactions and interventions


Design interactions not just interfaces
not just the immediate interaction
e.g. stapler in office – technology changes interaction style

- manual: write, print, staple, write, print, staple, ...
- electric: write, print, write, print, ..., staple

Designing interventions not just artefacts
not just the system, but also ...

- documentation, manuals, tutorials
- what we say and do as well as what we make

3



What is design?

4

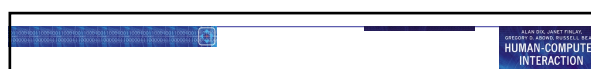


What is design?

Achieving goals within constraints

- Goals - purpose
 - who is it for, why do they want it
- Constraints
 - materials, platforms
- Trade-offs
 - choosing which goals or constraints can be relaxed so that others can be met

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Golden rule of design

Understand your materials

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For Human-Computer Interaction

Understand your materials

- Understand *computers*
 - limitations, capacities, tools, platforms
- Understand *people*
 - psychological, social aspects, human error
- And their interaction ...

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To err is human

- Accident reports ..
 - aircrash, industrial accident, hospital mistake
 - enquiry ... blames ... 'human error'
- But ...
 - concrete lintel breaks because too much weight
 - blame 'lintel error' ?
 - ... no - design error
 - we know how concrete behaves under stress
- Human 'error' is normal
 - we know how users behave under stress
 - so design for it!
- Treat the user at least as well as physical materials!

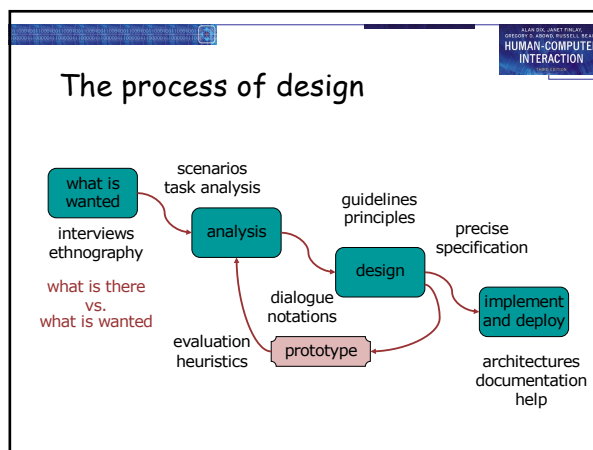
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Central message ...

The user

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Steps ...

- Requirements
 - what is there and what is wanted ...
 - interview people, videotape them, look at the documents and objects that they work with, observe them directly
- Analysis
 - ordering what has been observed and collected via interviews and understanding it
- Design
 - what to do and how to decide
 - apply rules, guidelines and design principles

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Steps ... (ctd)

- Iteration and prototyping
 - getting it right ... and finding what is really needed!
 - maybe use design on paper but more frequently use prototyping
- Implementation and deployment
 - making it and getting it out there
 - write code, even build hardware sometimes, produce documentation and manuals

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... But how can I do it all !!

- Limited time \Rightarrow design trade-off
- Usability?
 - finding problems and fixing them? **X**
 - deciding what to fix? **✓**
- A perfect system is badly designed
 - too good \Rightarrow too much effort in design

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User focus

Know your user
Personae
Cultural probes

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Know your user

- Who are they?
 - young, old, experienced, novices?
- Probably not like you!
 - don't think "but it's obvious to me"
- Talk to them
 - you can't read their minds, so ask them
 - structured interviews, open-ended discussions, involve them in the design process

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Know your user (ctd)

- Watch them
 - observe them and take notes, watch some of their activities
 - can be done informally or formally
 - a sticky note at a table is more than the display of some information: it is a reminder to do something
- Use your imagination
 - sometimes it is expensive or simply impossible to involve many users
 - think what *they* would do

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Persona

- Description of an 'example' user
 - not necessarily a real person
- Use as surrogate user
 - what would Betty think
- Details matter
 - makes her 'real'

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Example persona

Betty is 37 years old, She has been Warehouse Manager for five years and worked for Simpkins Brothers Engineering for twelve years. She didn't go to university, but has studied in her evenings for a business diploma. She has two children aged 15 and 7 and does not like to work late. She did part of an introductory in-house computer course some years ago, but it was interrupted when she was promoted and could no longer afford to take the time. Her vision is perfect, but her right-hand movement is slightly restricted following an industrial accident 3 years ago. She is enthusiastic about her work and is happy to delegate responsibility and take suggestions from her staff. However, she does feel threatened by the introduction of yet another new computer system (the third in her time at SBE).

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Cultural probes

- Direct observation
 - sometimes hard
 - in the home
 - psychiatric patients, ...
- Probe packs
 - items to prompt responses
 - e.g. glass to listen at wall, camera, postcard
 - given to people to open in their own environment they record what is meaningful *to them*
- Used to ...
 - inform interviews, prompt ideas, enculture designers



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Scenarios

Stories for design
Use and reuse

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Scenarios

- Stories for design
 - communicate with other designers, clients or users
 - being concrete examples are easier to understand than abstract ideas
 - validate other (formal) models such as dialog and navigation ones
 - express dynamics
 - compare with static screen shots and pictures which give a sense of what a system looks like, but not how it behaves

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Scenarios (ctd)

- Linearity – positive and negative
 - time is linear – our lives are linear and therefore we can understand easier linear narratives; they are also concrete and easier to understand
 - but doesn't show alternatives; real interactions have choices, made either by people or systems
 - easy to miss the unintended things a person may do

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Scenarios (ctd)

- 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

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Scenario - movie player

Brian would like to see the new film "Moments of Significance" and wants to invite Alison, but he knows she doesn't like "arty" films. He decides to take a look at it to see if she would like it and so connects to one of the movie sharing networks. He uses his work machine as it has a higher bandwidth connection, but feels a bit guilty. He knows he will be getting an illegal copy of the film, but decides it is OK as he is intending to go to the cinema to watch it. After it downloads to his machine he takes out his new personal movie player. He presses the 'menu' button and on the small LCD screen he scrolls using the arrow keys to 'bluetooth connect' and presses the select button. On his computer the movie download program now has an icon showing that it has recognised a compatible device and he drags the icon of the film over the icon for the player. On the player the LCD screen says "downloading now", a percent done indicator and small whirling icon.

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Also play act ...

- Mock up device
- Pretend you are doing it
- Internet-connected swiss army knife ...

but where is that thumb? 😞

use toothpick as stylus 😊

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... Explore the depths

- Explore interaction
 - what happens when
- Explore cognition
 - what are the users thinking
- Explore architecture
 - what is happening inside

26

Navigation design

Local structure – single screen
Global structure – whole site, movement between screens

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Different levels of interaction

- Widget choice
 - menus, buttons etc. help in choosing a particular selection or action
- Screen design
 - need to find things on the screen and understand the logical grouping of buttons
- Application navigation design
 - need to understand what will happen when a button is pressed
- Environment
 - other apps, O/S, cut-paste operations

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The web ...

<ul style="list-style-type: none"> • widget choice • screen design • navigation design • environment 	<ul style="list-style-type: none"> • elements and tags <ul style="list-style-type: none"> - • page design • site structure • the web, browser, external links
--	--

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Physical devices

<ul style="list-style-type: none"> • widget choice • screen design • navigation design • environment 	<ul style="list-style-type: none"> • controls <ul style="list-style-type: none"> - buttons, knobs, dials • physical layout • modes of device • the real world
--	---

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Think about structure

- Within a screen
 - later ...
- Local
 - looking from this screen out
- Global
 - structure of site, movement between screens
- Wider still
 - relationship with other applications

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Local

From one screen looking out


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Goal seeking

start

goal



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Goal seeking

start

goal

progress with local knowledge only ...



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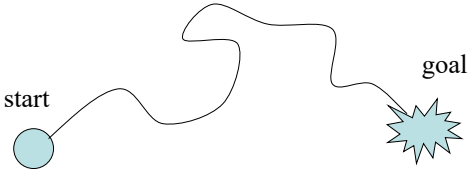
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Goal seeking

start

goal

... but can get to the goal



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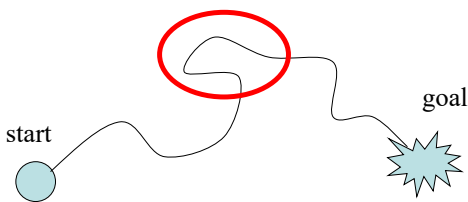
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Goal seeking

start

goal

... try to avoid these bits!



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Four golden rules

- 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

37

Where you are - breadcrumbs

shows path through web site hierarchy

live links to higher levels

Some common errors arise again and again in statistics. Here are some to watch m...

38

Beware the big button trap

- Where do they go?
 - lots of room for extra text, that explains each choice
 - maybe not very pretty but often useful

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Modes

- Lock to prevent accidental use ...
 - remove lock - 'c' + 'yes' to confirm
 - frequent practiced action
- If lock forgotten
 - in pocket 'yes' gets pressed
 - goes to phone book
 - in phone book ...
 - 'c' - delete entry
 - 'yes' - confirm
 - ... oops !

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Global

Between screens
Within the application

41

Hierarchical diagrams

```

graph TD
    A[the system] --> B[info and help]
    A --> C[management]
    A --> D[messages]
    C --> E[add user]
    C --> F[remove user]
    
```

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Hierarchical diagrams (ctd)

- Parts of application
 - screens or groups of screens
- Typically functional separation in logical groupings

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Navigating hierarchies

- Deep hierarchies are difficult to navigate, so better to have broad top-level categories
- Misuse of Miller's 7 ± 2
 - applies to working memory, not visual search
- Optimal?
 - many items on each screen, maybe 60 or more
 - but structured within screen, so the eye can find the right item

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Think about dialogue

What does it mean in UI design?

Minister: do you *name* take this woman ...
 Man: I do
 Minister: do you *name* take this man ...
 Woman: I do
 Minister: I now pronounce you man and wife

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Think about dialogue

What does it mean in UI design?

Minister: do you *name* take this woman ...

- Marriage service
 - general flow, generic - blanks for names
 - pattern of interaction between people
- Computer dialogue
 - pattern of interaction between users and system
 - but details differ each time

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Network diagrams

- Show different paths through system

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Network diagrams (ctd)

- What leads to what
- What happens when
- Including branches
- More task oriented than hierarchy

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Wider still

Between applications
and beyond ...

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Wider still ...

- Style issues
 - conform to platform standards (e.g. positions for menus) to ensure consistency between applications
- Functional issues
 - interact with files, read standard formats, cut and paste
- Navigation issues
 - allowing embedded applications
 - links to other apps ... the web

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INTERACTION

Dix, Alan
 Finlay, Janet
 Abowd, Gregory
 Beale, Russell



Screen design and layout

Basic principles
Grouping, structure, order
Alignment
Use of white space



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Basic principles

- Ask
 - what is the user doing?
- Think
 - what information is required, comparisons the user needs to make, order of things needed
- Design
 - form follows function: the required interactions drive the layout

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Available tools

- Grouping of items
- Order of items
- Decoration – fonts, boxes, etc.
- Alignment of items
- White space between items

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Grouping and structure

Logically together ⇒ physically together

Billing details:		Delivery details:	
Name		Name	
Address: ...		Address: ...	
Credit card no		Delivery time	
<hr/>			
Order details:			
item	quantity	cost/item	cost
size 10 screws (boxes)	7	3.71	25.97
.....

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Order of groups and items

- Think! - what is the natural order of doing things
- Should match screen order!
 - use boxes, space, etc.
 - set up tabbing right for data entry forms or dialog boxes!
- Instructions
 - may need to force a particular order, e.g. not forget the credit card details!

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Decoration

- Use boxes to group logical items
- Use fonts for emphasis, headings
- But not too many!!

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Alignment - text

- You read from left to right (English and European)
 - ⇒ align left hand side

Willy Wonka and the Chocolate Factory
 Winston Churchill - A Biography
 Wizard of Oz
 Xena - Warrior Princess

boring but readable!

Willy Wonka and the Chocolate Factory
 Winston Churchill - A Biography
 Wizard of Oz
 Xena - Warrior Princess

fine for special effects but hard to scan

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Alignment - names

- Usually scanning for surnames
 - ⇒ make it easy!

Alan Dix
 Janet Finlay
 Gregory Abowd
 Russell Beale

Dix, Alan
 Finlay, Janet
 Abowd, Gregory
 Beale, Russell

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Alignment - numbers

Think purpose!

Which is biggest?

532.56
179.3
256.317
15
73.948
1035
3.142
497.6256

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Alignment - numbers (ctd)

Visually:
 long number = big number

Align decimal points
 or right align integers

627.865
1.005763
382.583
2502.56
432.935
2.0175
652.87
56.34

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Multiple columns

- Scanning across gaps hard:
(often hard to avoid with large data base fields)

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

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Multiple columns (ctd)

- Use leaders

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

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Multiple columns (ctd)

- Or greying (vertical too)

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

63

Multiple columns (ctd)

- Or even (with care!) 'bad' alignment

sherbert	75
toffee	120
chocolate	35
fruit gums	27
coconut dreams	85

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White space - the counter

WHAT YOU SEE

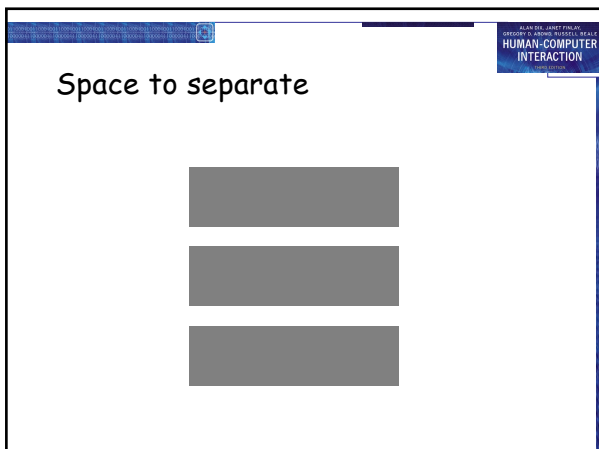
65

White space - the counter (ctd)

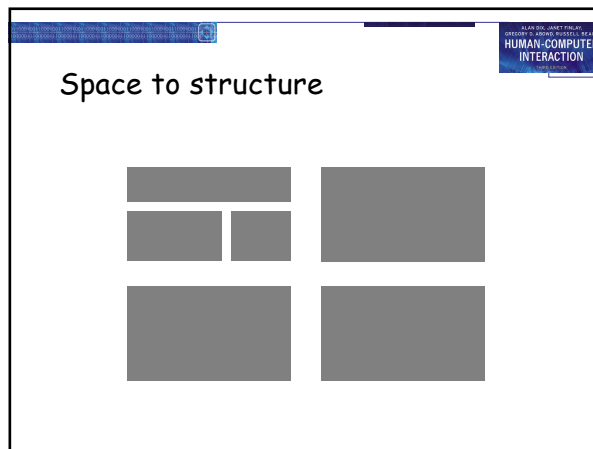
WHAT YOU SEE

THE GAPS BETWEEN

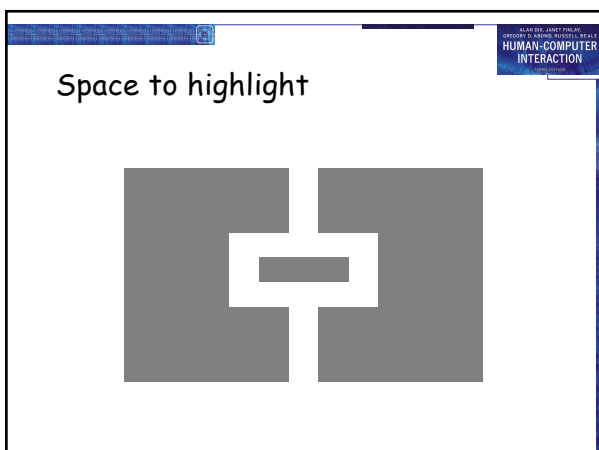
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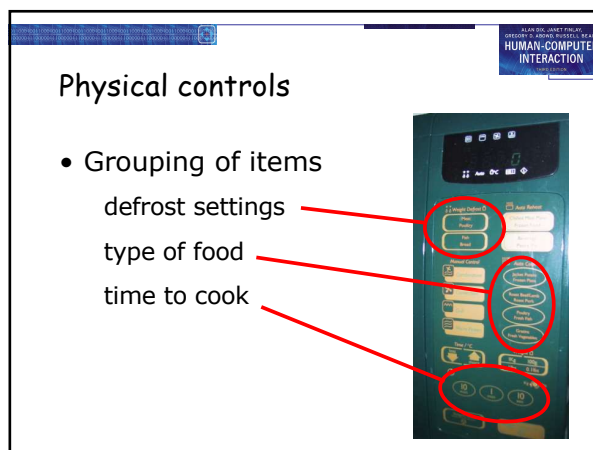
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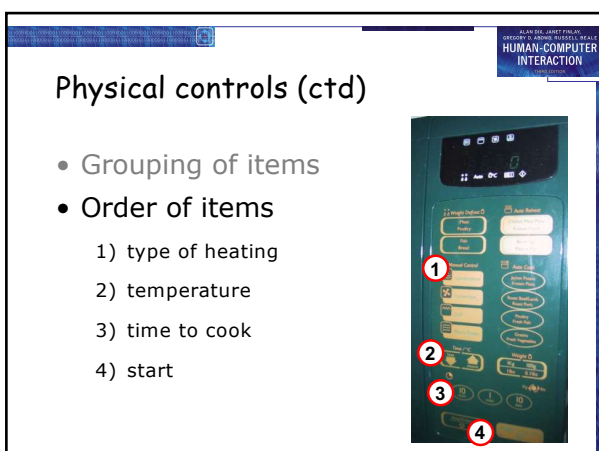
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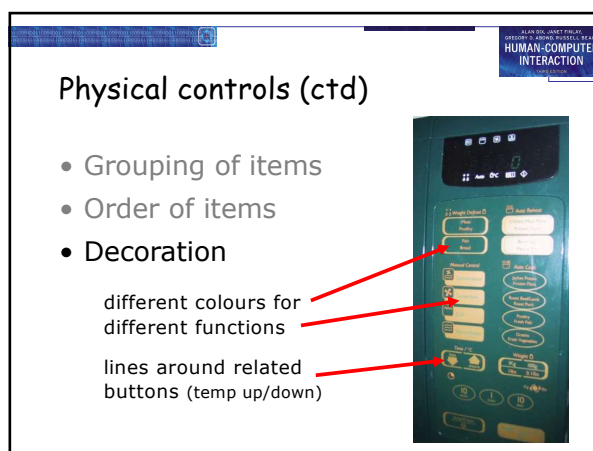
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Physical controls (ctd)

- Grouping of items
- Order of items
- Decoration
- Alignment

centred text in buttons
? easy to scan ?

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Physical controls (ctd)

- Grouping of items
- Order of items
- Decoration
- Alignment
- White space

gaps to aid grouping

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User action and control

Entering information
Knowing what to do
Affordances

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Entering information

- Forms, dialogue boxes
 - presentation + data input
 - similar layout issues
 - alignment - N.B. different label lengths
- Logical layout
 - use task analysis (ch15)
 - groupings
 - natural order for entering information
 - top-bottom, left-right (depending on culture)
 - set tab order for keyboard entry

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Knowing what to do

- What is active, what is passive
 - where do you click
 - where do you type
- Consistent style helps
 - e.g. web underlined links
- Labels and icons
 - standards for common actions
 - language - bold = current state or action

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Affordances

- Psychological term
- For physical objects
 - shape and size suggest actions
 - pick up, twist, throw
 - also cultural - buttons 'afford' pushing
- For screen objects
 - button-like object 'affords' mouse click
 - physical-like objects suggest use
- Culture of computer use
 - icons 'afford' clicking
 - or even double clicking ... not like real buttons!

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Appropriate appearance

Presenting information
Aesthetics and utility
Colour and 3D
Localisation & internationalisation

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Presenting information

- Purpose matters
 - sort order (which column, numeric alphabetic)
 - text vs. diagram
 - scatter graph vs. histogram
- Use paper presentation principles!
- But add interactivity
 - softens design choices
 - e.g. re-ordering columns
 - 'dancing histograms' (chap 21)

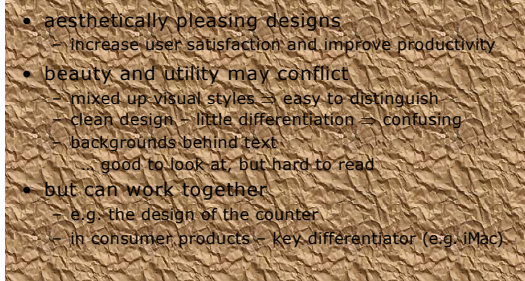
name	size
chap10	12
chap5	16
chap1	17
chap14	22
chap20	27
chap8	32
...	...

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Aesthetics and utility

- aesthetically pleasing designs
 - increase user satisfaction and improve productivity
- beauty and utility may conflict
 - mixed up visual styles ⇒ easy to distinguish
 - clean design - little differentiation ⇒ confusing backgrounds behind text
 - good to look at, but hard to read
- but can work together
 - e.g. the design of the counter in consumer products - key differentiator (e.g. iMac)




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Colour and 3D

- Both often used very badly!
- Colour
 - older monitors limited palette
 - colour over used because 'it is there'
 - beware colour blind!
 - use sparingly to reinforce other information
- 3D effects
 - good for physical information and some graphs
 - but if overused ...
 - e.g. text in perspective!! 3D pie charts



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Bad use of colour

- OVER USE - without very good reason (e.g. kids' site)
- colour blindness
- poor use of contrast
- do adjust your set!
 - adjust your monitor to greys only
 - can you still read your screen?

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Across countries and cultures

- Localisation & internationalisation
 - changing interfaces for particular cultures/languages
- Globalisation
 - try to choose symbols etc. that work everywhere
- Simply change language?
 - use 'resource' database instead of literal text ... but changes sizes, left-right order etc.
- Deeper issues
 - cultural assumptions and values
 - meanings of symbols
 - e.g. tick and cross ... +ve and -ve in some cultures ... but ... mean the same thing (mark this) in others

✓ ✗

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Prototyping

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Iteration and prototyping

Getting better ...
... and starting well

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Prototyping

- You never get it right first time
- If at first you don't succeed ...

```

    graph LR
      design[design] --> prototype[prototype]
      prototype --> evaluate{evaluate}
      evaluate -- OK? --> done[done!]
      evaluate --> re-design[re-design]
      re-design --> prototype
    
```

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Pitfalls of prototyping

- Moving little by little ... but to where
- Malverns or the Matterhorn?

- need a good start point
- need to understand what is wrong

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Summary

- Design is "achieving goals within constraints"
- Need to understand the materials and in the case of interaction design these are the computers, devices and humans
- The design process involves understanding the requirements, getting to know the users, use scenarios to explore the design space, set up carefully the navigation design at local and global level, set up the screen design and layout
- Use iteration to improve the original interaction design process

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