

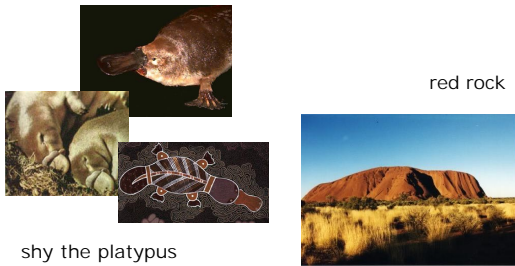
# getting physical

Alan Dix  
Lancaster University  
[www.hcibook.com/alan](http://www.hcibook.com/alan)

# rugby



# an uncle from adelaide



shy the platypus

red rock

# ... and a visit



hanging rock

# deep origins

- platypus – what is it?
  - bird, mammal, or reptile
- what about us
  - much shared
  - the animal within



### usability?

Some people say  
a child should be able to use it



I say  
a caveman should be able to use it



### evolutionary psychology

general principle ...

- major transition about 40,000 years ago
  - socio-linguistic eden
- not evolutionarily adapted (significantly) since then
  - neanderthals' within the skull

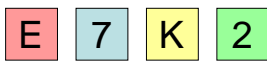
more contentious

- Cosmides, Toby, Pinker ...
- special purpose intelligences:
  - physical, animal, plant, social
- hard-wired
  - swiss army knife model

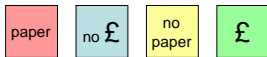


### special purpose intelligence

- rational
  - rule: vowel one side => even on other



- social
  - rule: take newspaper => pay for it



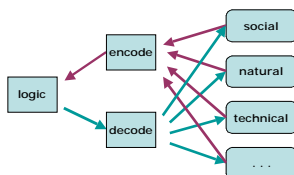
### coming together

- "The Prehistory of the Mind" (Mithen, 1996)
  - uses palaeontological record
- early animals and hominids
  - multiple intelligences there, but separate
  - intellectual development about linkage
- final link ...
  - 40,000 years - multi-part tools, social, artistic
  - N.B. no physiological change



### how linked?

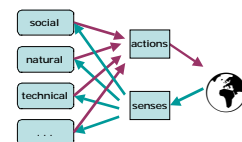
- logic and rationality
  - transform everything to propositional form
  - talking to yourself!



### how linked?

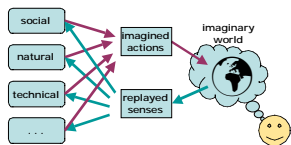
- logic and rationality
- the real world
  - doing things makes the links
  - the world kicks back

c.f. ...  
distributed cognition  
situated action



### how linked?

- logic and rationality
- the real world
- imagination
  - just like really doing it
  - it kicks back too!



### ... re-focus

- deep innate understanding
    - deals with the mundane
    - inflexible or slow to adapt
    - little attention (some at motor level)
    - fast
  - rich conscious intelligence
    - effective for the complex
    - adaptable to the novel
    - needs attention
    - slow
- } harness this for devices and low-level interaction  
 } free this for doing the real tasks

### the physical world

- we live in it
- we are good at it!
- we understand it

### properties of physicality

- directness of effect
  - push and it moves
- locality of effect
  - here and now
- visibility of state
  - small number of relevant parameters

### the physical world

- we live in it
- we are good at it!
- we understand it
- so harness it ...
  - direct manipulation
  - virtual and augmented reality
  - ... some ubiquitous computing
  - tangible interfaces
  - ordinary controls: knobs and switches

### study the old to design the new

- work with Masitah Ghazali
- look at ordinary consumer devices
  - washing machine, light switch, personal stereo
- why?
  - we are used to using them ourselves
  - they have been 'tested' by the marketplace
  - they embody the experience of designers



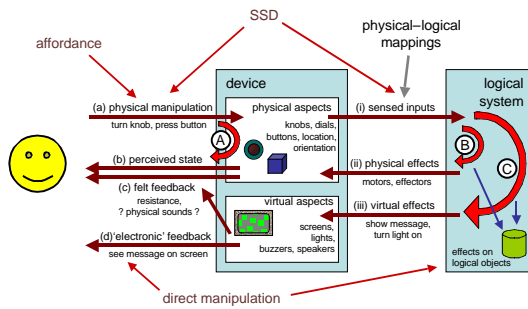
### half empty?

- not the first ...
  - Norman – DOET/POET
  - Thimbleby – FSM for video, microwave
- often used as HCI strawman
  - emphasise for design flaws
- we are looking for the good lessons
  - how mundane devices exploit physicality

### models of AR & tangibility

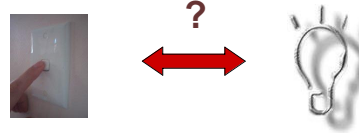
- Ullmer and Ishii – MCRpd
  - architectural interaction model
- Benford et al. – sensible/sensable/desirable
  - exploring design space
- Koleva et al. – TUI framework
  - 'coherence' between the physical and digital

### physical-logical connections

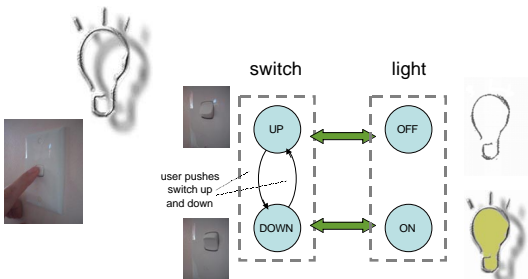


### fluidity

- 'naturalness' of device-logical mapping

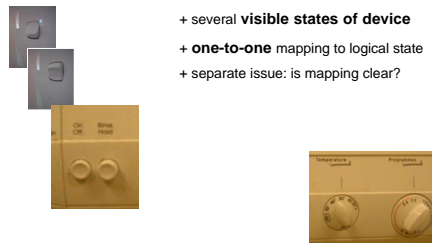


### device & logical states



### exposed state

- + several **visible states of device**
- + **one-to-one** mapping to logical state
- + separate issue: is mapping clear?



### hidden state



- + when **no exposed state**
- + may rely on **semantic feedback**
- + poor 'fixes' ... LEDs, separate display
- + but sometimes necessary: too many logical states, variable number of logical states, limited space
- + transitions become more important: natural felt bumps ... haptic feed back



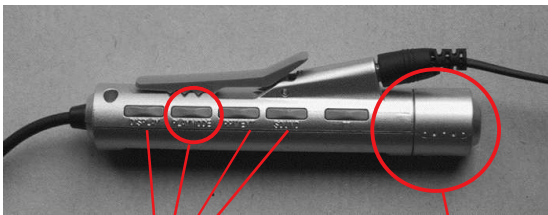
### inverse actions



- + speaker dial – exploits **natural physical inverse actions**: turn left/right
- + especially important if the user does not have a perfect knowledge of the **physical-logical mapping** unknown or mode-dependent
- + semantic **feedback** essential
- + issues: delays, obvious inverse?



### spring-back controls



series of spring-back controls  
each cycle through some options  
– natural inverse back/forward

twist for track movement  
pull and twist for volume  
– spring back  
– natural inverse for twist

### compliant interaction

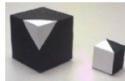
+ rotary knob exhibits **symmetry interaction**

+ user sets the program by turning the dial ... system state turns the dial ... program advances

+ expert users come to look for the natural spring-back interaction

### so what ... tangible interfaces

- apply to novel devices
  - with Masitah & Jennifer Sheridan
  - looking at cubicles (Gerd Kortuem)
  - e.g. how many states



- link to Koleva et al.'s TUI framework
  - e.g. configurability & natural inverse

### so what ... methodology

- ubicomp, tangibles
  - try to be useful ...
  - but rarely deployed



- mundane devices
  - already used
- artistic contexts ...
  - doesn't need to be useful
  - can be playful



... thePooch: ...

OZCHI  
2003

