



harnessing the power of formalism for understanding interaction

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www.hiraeth.com/alan/tutorials/formal

sources

- Upside down \forall s and algorithms - computational formalisms and theory. In *HCI Models, Theories, and Frameworks: Toward an Multidisciplinary Science*. John Carroll (ed.). Morgan Kaufman, 2003. pp. 381-429
- A. Dix, J. Finlay, G. Abowd and R. Beale (2004). Chapters 16, 17 & 18. In *Human-Computer Interaction, third edition*. Prentice Hall.
- A. J. Dix (1991). *Formal Methods for Interactive Systems*. Academic Press



for i

green letters tumble against black glass and dim pizza filled rooms tremble with heavy intonations, fingers drum whilst a single screen reflects a bespectacled face on plastic rimmed spectacles, seeing clearly four eyes doubled and redoubled by interactions of photons, words form from the void within
for i =

it is done

language is the ultimate formalisation tying patterns of electrical and chemical activation, spaghetti wrapped neurons, discretised to token sounds, virtuosity to vocabulary; in writing digitised as fingers scratch ink upon parchment or softly caress smooth worn key tops

before I continue let us reflect, for i can only tell my story, but the words are our own, for eye to eye and voice to voice the tokens were formed, even though sheet to sheet or screen to screen we use them now

and we have found ways to bare our soul and transport our listeners through simple words, and to, in turn, reflect and talk about the talking, formalising the understandings we have about words in words

the hard edged symbols cut upon stone, dark text stamped from lead, and pixelated poetry touch our very heart

is it surprising that silicon and liquid crystal should be no less richly understood

outline

- setting the scene
 - what is formal? – first examples
 - types of formalism – placemat maths
- models of systems
 - dialogue notations – modelling state
 - generic models of interaction
- why do it?
 - it works! - a formal methods success story
 - formal futures - ubiquity and physicality

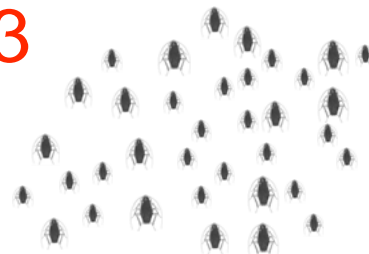
what is formal?

- dinner jacket and bow tie
 - outward appearance of things – the form
- in maths and computing ...
 - representations (diagrams, formulae, etc.)
 - analysed and manipulated separate from meaning
 - how?
 - faithfully encapsulate significant aspects of meaning



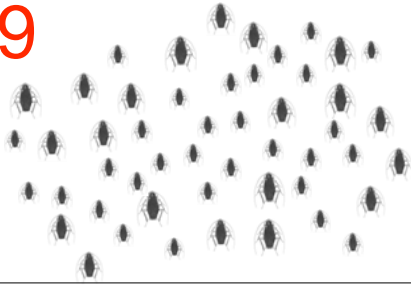
counting cockroaches - first night

213



counting cockroaches - second night

279



which night had more?

- second night: $279 > 213$
- how can you be certain?
 - count faithfully represents significant feature
- but not everything ...
 - cockroaches on first night may be:
 - bigger, different colour, more friendly



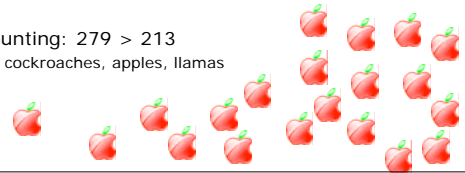
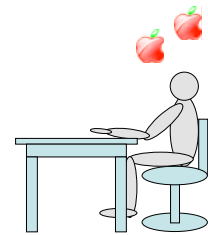
representing things absent

- symbols, icons, words
 - stand for things not present
- simulated screen shots
 - represent the unrealised designs
 - (N.B. no dynamics – limited meaning)
- counting cockroaches
 - keep in a jam jar? disrupts the world
 - numbers make the impossible possible



placeholders

- homunculus – any person
 - not just someone, anyone
- maths: $\forall n: n+1 > n$
 - saying an infinite amount
- counting: $279 > 213$
 - cockroaches, apples, llamas



abstraction

- increasing abstraction
 - screenshot – one screen
 - storyboard – single sequence of interaction
 - navigation diagram – potential paths
- and further ...
 - work on UNDO
 - any system with particular properties ...

forcing you to think

when you count cockroaches
you have to decide
what counts as a cockroach

baby or adult



live or dead



the myth of informality

- spiritus mundi
 - formality, precision = reductionism, positivism = BAD
- focus (rightly) on
 - context, situatedness, contingency
- BOTH needed
 - the world is rich and complex
 - but computers are formal (as is language)
 - key is choosing the right abstractions
 - and knowing what is left out

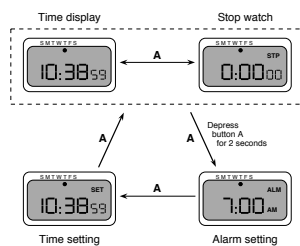


early examples

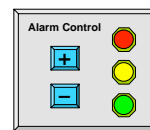
formalism in action

digital watch - user instructions

- two main modes
- limited interface - 3 buttons
- button A changes mode
- state transition network (STN)

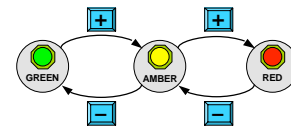


example - nuclear control



- what happens if we press '+' in red mode?

N.B. question from form only

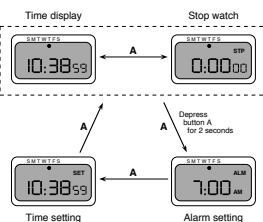


digital watch - user instructions

"depress button A for 2 seconds"

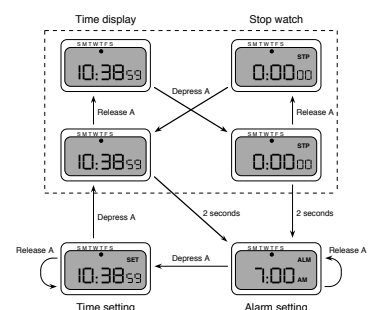
so ...

- time important
- distinguish depress A and release A



designer's instructions

and ...
that's just one button



lessons

- formal analysis
 - ask questions based on *form* of diagrams
- early analysis
 - catch problems even before prototyping
- lack of bias
 - usually test what we expect, analysis breaks this
- alternative perspective
 - different representations show different things
- forcing design decisions
 - did watch designer make these decisions or programmer?