Constructivist computing

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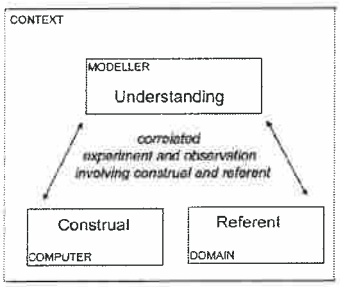
Constructivist perspective ...

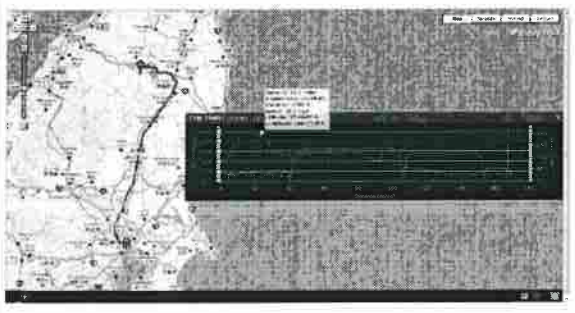
- **... humans generate knowledge and meaning from an interaction between their experiences and their ideas** [Wikipedia]
- ... computing gives us the power to generate experiences in unprecedented ways ...
- ... opening up new prospects for learning through construction with computers

Empirical Modelling as *Construction*

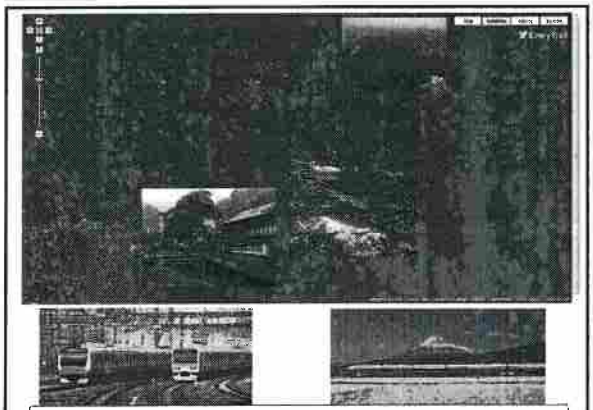


Second International Conference on *Cognitive Technology* (CT'97) : Humanizing the Information Age 25-28 August *1997* - *Aizu*, Japan

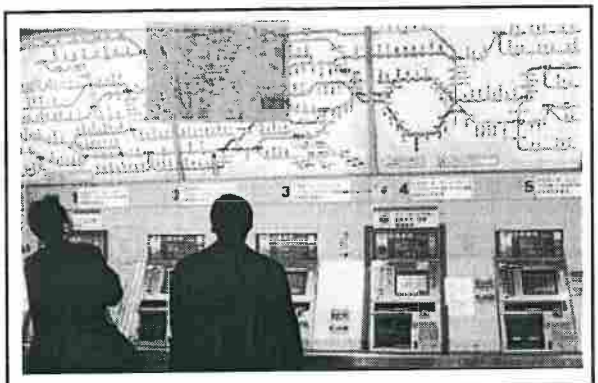
How to get there ... ?



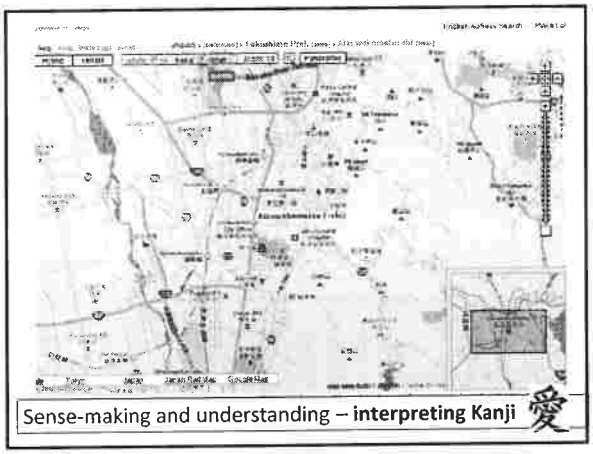
A sense-making artefact – or **construal**



The "reality" to which the construal refers – the **referent**

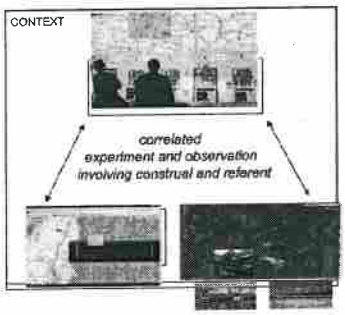


The human component – sense-making and **understanding**



Sense-making and understanding – **interpreting Kanji** 愛

Empirical Modelling as *Construction*



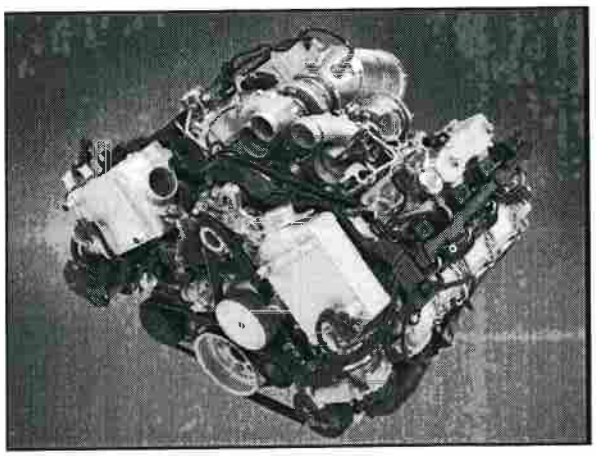
The significance of context ...

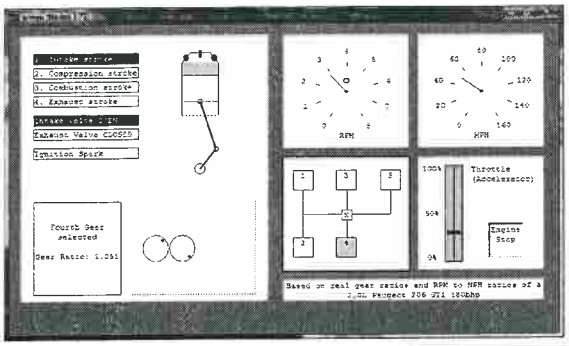
Classical computing ...	**Constructivist computing ...**
Clear explicit objectives	Ill-defined objectives
Engineered environment	Natural environment
Reliable responses	Partially reliable responses
Well-defined observables	Open-ended observables
Clear interpretations	Fuzzy interpretations
Recipes for action	Exploratory interaction
... goal: full automation	**... goal: fuller understanding**

Getting to Aizu in 1997

... and in March 2011

Some practical illustrations





Making sense of an internal combustion engine
Seb Sidbury 4th year MEng student

Points to note …

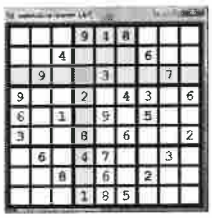
- Can study the engine mechanism
- Can observe what the driver sees
- Can experiment with the gears
- Can "crash" the model by "abusing" the engine
- Can switch off the engine and move the piston:

```
_piston_compression = 0.5;
```

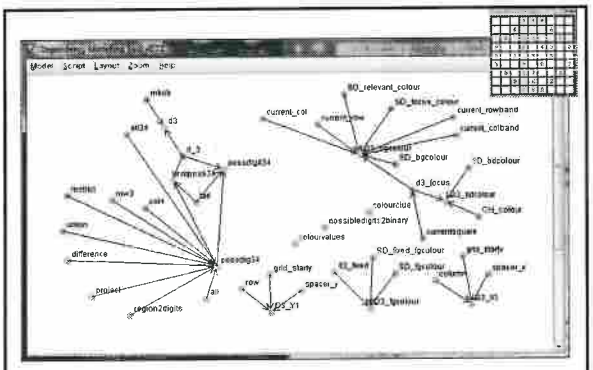
How EM construals are built

The Sudoku solving construal:

- built using the EDEN interpreter
- comprises c. 5000 observables
- can use to assist Sudoku solving
- can develop solution programs
- gives insight into human solving

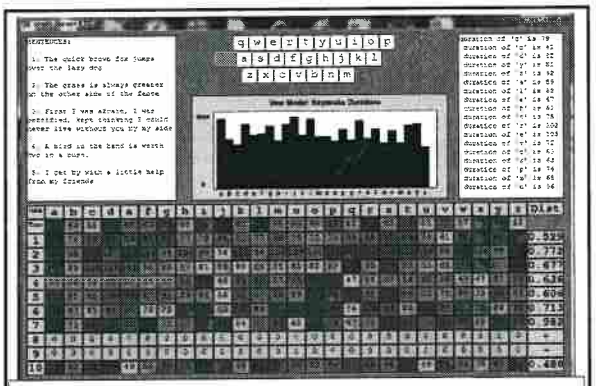


Why so many observables?



Observables associated with the grid cell D3 (lightblue)

Reconstruction from colour sudoku interaction history



Modelling of personal keystroke dynamics
Matthew Carter 4th year MEng student

Prospects for constructivist computing

- Classical accounts of computing focus on contexts where automation can be engineered
- Contexts for current and potential use go far beyond this scope in view of ...
  - the unfathomable richness of the natural world
  - the potential of/for new computing technologies
  - the diversity of human skill and imagination
- Topical areas transcend science in its narrow sense: learning, medicine, humanities, ...