Lecture 4: The Frame Problem

Learning goals

- Understand some of the logical and psychological implications of the Frame Problem

The Frame Problem

McCarthy Hayes, 1969

- The robot, the room and the bomb
- Relevant and irrelevant implications
- Intelligence involves planning
- AI makes this issue apparent
- Storing and accessing facts in short real-time spans
- AI sees deliberate, conscious planning as the model for unconscious planning
The Frame Problem

McCarthy Hayes, 1969

- The monotonicity of classical logic
- Development of non-monotonic reasoning formalisms
- The distinction between the technical problem and the epistemological problem

The Frame Problem

- The Frame Problem is independent of issues of induction
- Toy problems and brute force may offer a limited escape
- Ceteris paribus clauses
- Schank and scripts
The Frame Problem

- The computational theory of mind (e.g. Fodor – computational inferences over a set of propositions) is threatened by the Frame Problem
- Fodor and “isotropy”
- Modularity and informational encapsulation
- Bounded rationality offers one real-world escape
- Frame Problem still a dilemma for idealised rationality

Fodor and Modularity

- Recent interest in modularity stemmed from psycholinguistic experiments
- Informational encapsulation for more peripheral processing
- No informational encapsulation for central processing (“isotropy”) – broadcasting, content addressability need to be effective. Informational encapsulation is not necessary
Relevance in the brain

Burgess & Simpson, 1988

- Cross-modal priming – spoken words prime visually-presented words
- Ambiguous spoken words (*bank*) can prime both meanings
- … only in the right hemisphere

Relevance in the brain

Beeman *et al*, 1994

- Summation priming – consecutive visually presented words “stack up” their subsequent priming effect
- … only in the right hemisphere
Coarse coding
e.g. Beeman, 1998

Coarse-coding in receptive field terms

- Coarse coding can still make precise distinctions
- The right hemisphere of the brain seems predisposed to coarse coding
- There are many levels at which this distinction may operate
Coarse coding
Mevorach, Humphreys & Shalev, 2005

- Identifying local representations is affected by Transcranial Magnetic Stimulation applied to the parietal lobule
- The effect flips over depending on handedness
- The fine/coarse coding distinction may be more complex than thought
Asperger’s Syndrome
Gillberg, 1992

- Delayed development
- Superficially perfect expressive language
- Formal pedantic language
- Odd prosody, peculiar voice characteristics
- Impairment of comprehension including misinterpretations of literal/implied meanings
- (...and in autism) less effective visual processing of, e.g., coherent motion

Conclusions

- The Frame Problem has been adequately resolved for logic-based AI research
- The epistemological version of the Frame Problem survives for idealized rationality
- Modularity has been an explicit theme of cognitive research from 1979 onwards
- The brain treats inference and context differently in the left and right hemispheres
- Fine/coarse coding is a productive low-level distinction