

PROBLEM-SOLVING (PS), DECISION-MAKING (DM), and ARTIFICIAL INTELLIGENCE (AI)

The nature of problems

all thinking involves PS [Boden, 1987a] (e.g. perception)

Problems arise whenever a path to a desired goal is blocked

- belief perseverance
- entrapment
- over-confidence
- loss aversion/costs vs. losses
- expectations
- hindsight
- framing

Stages in PS

- defining/representing the problem
- generating possible solutions
- evaluating possible solutions

Classifying problems

adversary problems (e.g. chess)

non-adversary problems (e.g. 8-puzzle, missionaries & cannibals, Tower of Hanoi, cryptarithmic)

Puzzle vs. real-life

well-defined vs. ill-defined

Explaining PS

Behaviourist approach

- trial-and-error
- accidental success [Thorndike, 1911]

Gestalt approach

- functional fixedness ('fixity') = a type of mental (PS) set [Duncker, 1926, 1945; Luchins, 1942; Luchins & Luchins, 1959]
- mental set → **reproductive thinking**. PS requires **productive thinking**, which involves perceptual restructuring → insight.

Information-processing approach

Algorithms

Heuristics ('rules of thumb')

e.g. means-end analysis (MEA) ('working backwards') [Newell & Simon, 1972] (e.g. problem-reduction representation)

general-purpose (domain-independent heuristic) knowledge vs. domain-specific knowledge

experts

Expert systems (ESs)

transfer of expertise

(intelligent knowledge-based systems)

analogical thinking

(e.g. medical diagnosis - MYCIN, GUESSING)

Artificial Intelligence (AI)

Strong vs. Weak [Searle, 1980]

Chinese room

Are brains necessary for intelligence?

Can computers ever be like brains?

Computational theory of mind (CTM) [e.g. Boden, 1987a]

Turing test [1950]

'the science of making machines do the sorts of things that are done by human minds' [Boden, 1987b]

'the science of thinking machines' [Garnham, 1988]

digital computers

- binary code
- autonomous abaci [Gregory, 1981]
- general purpose symbol manipulating machines

- serial processors vs. parallel distributed processors (PDP)/connectionism

Decision-making (DM)

A special case of PS

Influences on DM

- belief perseverance
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Compensatory models

additive compensatory model

utility-probability model

Non-compensatory models

- Elimination by aspect
- Maximax strategy
- Minimax strategy
- Conjunctive strategy

Heuristics

Availability heuristic (or bias)

Representativeness heuristic (or bias)

Randomness bias

Illusory correlation

Flexible attributions

Illusion of control

Sunk-cost bias

gambling and risk-taking

(e.g. National Lottery)

The nature of problems

Artificial Intelligence (AI)

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