There is more than one way of skinning a cat: dual processes in taxidermy

in taxidermy

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www.hcrc.ed.ac.uk/~keith/dualprocesses.pdf

But are they the same cat?

Where did we get the idea there was just one cat?

- originating observations are failures on 'logical' tasks: deductive, probabilistic, decision, ...

- violations of classical competence theories (classical logic, classical probability, ...)

- Hypothesis: Beast (System 1) is interfering with Beauty (System 2), or rational thought

- the common assumption is that the Systems are trying to skin the same cat—reaching the conclusion in logic tasks, making the decision in decision tasks, ...

- it's just that System 1 is making a hash of it (or not, as takes one's fancy)

Two cats: Interpretation and Derivation

- both are varieties of reasoning—reasoning *to* vs. reasoning *from* an interpretation

- credulous and sceptical stances toward discourse

  - credulous: find the speaker's single intended model using all available knowledge/guesswork

  - sceptical: find a countermodel to only the explicit premises (where failure justifies conclusion)

- there can be no doubt these cats exist—interpretation and derivation are facts

- natural languages require ongoing interpretation

- so do formal ones

- two cats with different goals need two competence theories

Competence Theories—who needs 'em anyway?

- original proposal: System 1 processes are associative

- for example, language (the processes implementing it—parsing, speech production, etc. etc.) is a System 1 process

- but parsing natural language is *not* an associative process

- so ... YOU need them!

- specifically, a competence theory specifying what the interpretative System 1 is 'trying to do'

A competence model for System 1: the theorist's impasse

- Cognitive Systems:

  - 2: slow, effortful, deliberate, knowledge-insulated, . . .

  - 1: fast, cheap, automatic, inaccessible, knowledge-rich, . . .

- Logics:

  - Classical Logic: slow, effortful, deliberate, knowledge-insulated, . . .

  - Defeasible logics (pre-1990): even slower, more effortful, deliberate, . . .

  - but defeasible logics were *intended* as models of knowledge-rich interpretation (McCarthy 1980), and *expected* to be more tractable

A brave new millenium

- post-late-90s logic programing and extensions: fast, cheap, automatic, knowledge-rich, quite expressive, but not totally, . . .

- models of System 1 processes such as 'smooth' credulous discourse interpretation

This logic comes with a 'psychological' schema

- the cognitive set-up (for a discourse comprehender):

  - a Long Term Memory database of conditionals (enviromental regularities)

  - Working Memory for representation of 'the intended model' of the discourse to current point on the basis of activation of the relevant LTM conditionals

  - because the logic is neurally implementable, the 'logical processes' have direct cognitive analogues

  - new sentences come in, pieces of network are added/subtracted, and the model is defeasibly updated as the network's stable state

  - depends crucially on the three-valued semantics whereby 'indeterminate' propositions sometimes are computed to be 'true' or to be 'false', but not *vv*.

Progress so far

- a logical model of the 'suppression task'

- with a neural implementation [6]

- predictions and evaluations of outcomes for Wason's selection task in terms of the semantics of such defeasible NL conditionals [5]

- predictions of syllogistic reasoning from quantifier interpretation data showing a majority of subjects interpret credulously [3]

- recasting of the 'psychology of deductive reasoning' literature through 'interpretative' eyes [4]

- this defeasible logic is competence model for System 1

- with a neural implementation

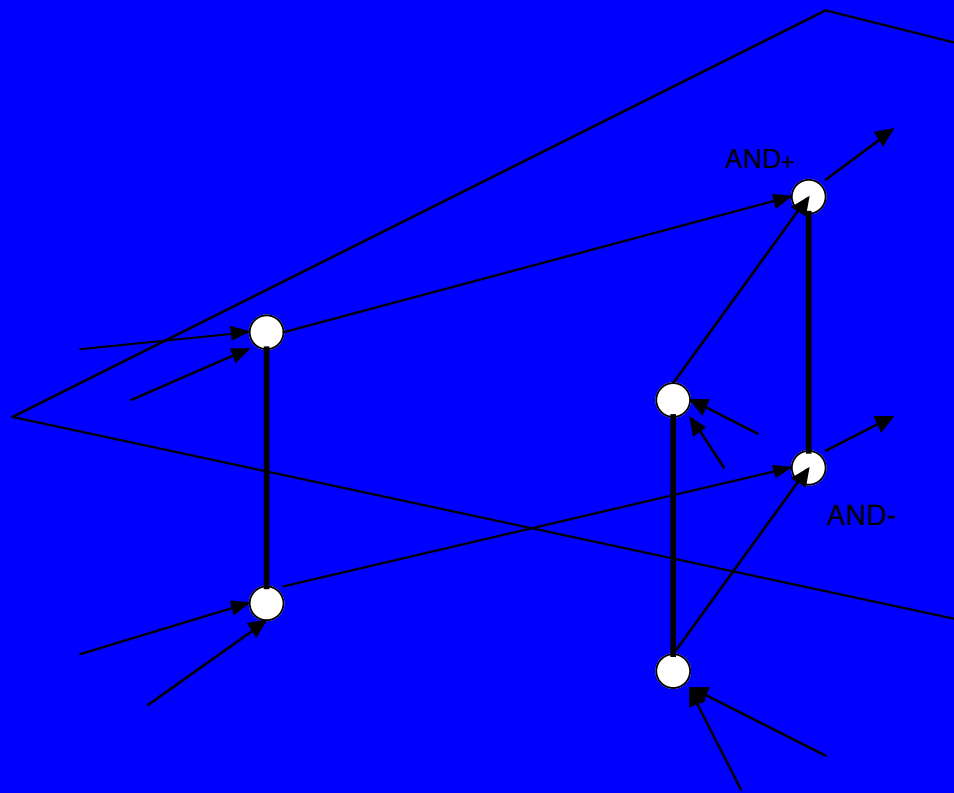- also applicable to study of planning ('executive functions') [4]

Figure 1: Between the sheets

How can two such different cats be confusable

- defeasible implication is:

  - SYNTAX: *not* a connective

  - SEMANTICS: three-valued non-truthfunctional semantics

  - VALIDITY: truth-in-preferred-model

- but in natural language, *If she has an essay, then she's in the library* has the same surface form, and only the goal-directed task in which it is embedded differentiates the logical forms

Three considerations from a two-cat perspective

- what price speedy-frugality?

- how did System 2 arise from System 1?

- rationality in a multiple-logic world

What price speedy-frugality?

- two kinds of impasse in credulous discourse processing—no models, or two evenly balanced models

- syntactic restrictions avoid these—at a price

- most of psycholinguistics can be understood as the study of how discourses succeed or fail to be 'smooth' as a function of relation between speaker and hearer's current contextual construction

- 'Parsing is a reflex'—Merril Garrett

- but some 'repair processes' require more expressive power—System 2?

How did System 2 arise from System 1?

- proposed basis of evolutionary continuity—planning motor action

- so recursion is old—defeasible planning is already recursive

- so what *is* the human innovation?

  – increasingly strategic non-linguistic planning

  – expression and recognition of plans in social interaction

- and with it comes the problem of aligning interpretations

- hypothesis: System 2 arose as as a process for supervising repair

- ancestor critter: WM holds current best guess of here-and-now plus goals

- when WM can hold future/past/possible/impossible/fictional models, then interpretative problems arise—especially in social interaction

Rationality in a multiple-logic world

- Stanovich, Evans and others have suggested System 2 flouts natural selection and requires different concept of rationality [2, 1]

- classical and defeasible logics require different notions of validity corresponding to different reasoning goals

- but can then accept the same notion of rationality: good interpretation and good reasoning contribute to the same global rationality

- System 2 is critical in argument where parties are misaligned

- success in argument/communication across misalignement is rather strongly naturally selected

Professors who deny that education happens

- Beauty is a Beast to attain: skilled flexible conscious control of System 2 processes is a central occupation in education

- why is this process not a central focus of psychology?

- because it is unnatural? cultural? literate? applied? recent?

- these dissmissals of Beauty hang on a misconception—that logic is a language

- we had System 2 a long while before we had a theory of System 2 (classical logic) or present social arrangements for education, politics, etc.

- at least as soon as we had language, culture and religion

- as soon as we were us
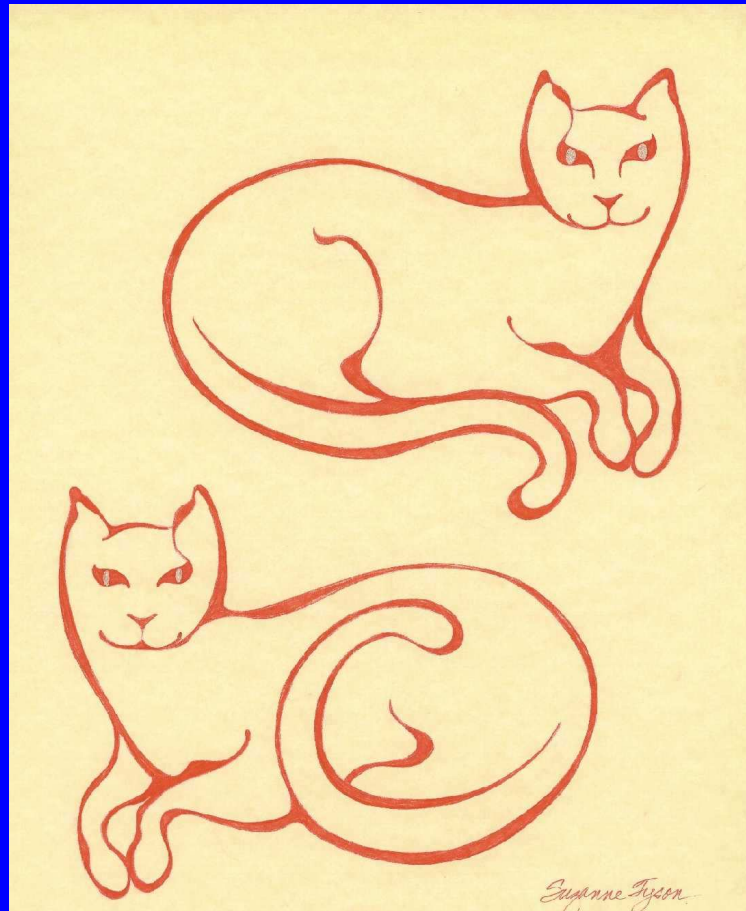
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