

Write-up: Samuels, Stich, and Tremoulet 1999 'Rethinking Rationality'

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Main issues/questions/problems:

human rationality: humans are apparently intrinsically rational, but they fail on certain tasks to make the correct rational decisions, i.e., reasoning through problems involving statistical inference or deduction

modularity: is the cognitive architecture humans are equipped with modular in nature, i.e., composed of a set of special purpose information processing organs; is modularity peripheral or central to the cognitive architecture

Main claims/conclusions:

Given two positions on rationality:

- bleak implications view: inability of normal humans to make the correct rational decisions reflects a lack of competence for human reasoning; instead humans have a set of simple heuristics that are not sophisticated enough to make the correct decisions in all contexts
- evolutionary psychology view: the mind is massively modular, composed of a myriad of special purpose information processing algorithms that evolved by natural selection; when the problems are presented to humans in ways that these modules are designed to deal with, humans are intrinsically rational

it appears that the failure of humans to make certain decisions is not uniform and absolute, and depends in part on the way the problem is presented; the evolutionary psychology view is a way of explaining this variation in performance by showing humans are better at processing information that their mind, i.e., a set of computational modules, is geared to process, but the implications of this theory have not been fully tested, and it does not really rule out alternative approaches

Foundational concepts

competence vs. performance: the unconscious knowledge of some cognitive ability vs. the interaction of the productive use of said cognitive ability with other cognitive mechanisms (attention, memory, perception, etc.); important to determining if humans are rational, because errors in reasoning could be performance errors and not necessarily indicative of an impoverished competence for reasoning; also not clear how competence is formalized

modularity of the mind: the contention that the mind is made up of one or more domain specific information-processing organs; there is a distinction between an internal system, or body of mentally represented knowledge (Chomskian module) and a more paired down notion that essentially entails a kind of symbol-manipulating computational device (computational module)

Methodologies

Experimental: a variety of experiments are used to probe human reasoning; many provide a background that establishes certain rules or instructions, and then subjects are given a problem to solve that is intended to access cognitive capacity for reasoning; controls are introduced that relate to hypotheses about computational modules, including:

dependent variable: correctness of decision on reasoning problem

independent variables: presentation of statistical info (frequentist vs. probabilistic)

Theoretical: a plausibility argument is structured to support the contention that the mind is massively modular; somewhat conjectural, not the result of logical deduction (see below)

Summary of principal arguments

Bleak implications argument:

humans are ill-suited to the task of many problems requiring reasoning because they simply lack the cognitive capacity to make rational decisions

Premise 1: humans fail miserably, under normal conditions, to account for crucial information when making rational decisions

- Miss logic of implication (The Selection Task)
- Unable to reason using probabilities (conjunction fallacy, base-rate neglect, overconfidence)

Premise 2: mistakes in reasoning could only be due to an underlying competence for reasoning, or performance on reasoning tasks

Premise 3: irrational decisions not performance errors; can't be accounted for with limits on attention, constraints on perception, etc.

Conclusion: humans aren't equipped with the right tools to make rational decisions; their competence for reasoning is defective, and while it may work in some situations, it fails in others to make the correct decisions

Massive modularity argument:

human cognitive architecture is a collection of hundreds (maybe lots more) of domain specific computational modules designed to solve specific problems that were recurrent for our hunter-gatherer ancestors

Premise 1: Our hunter-gatherer ancestors were confronted with several adaptive problems, evolutionary recurrent problems whose solution promoted reproduction (e.g., finding a mate, avoiding being killed by wild animals, avoiding starvation by finding food)

Premise 2: Highly specialized cognitive mechanisms are better than general purpose cognitive mechanisms because algorithms with more restricted inputs and output manipulations are faster, more efficient, and more reliable than algorithms that have to contend with a larger set of inputs and make bigger changes

Premise 3: Natural selection favors better solutions to adaptive problems

Premise 4: Our ancestors must have confronted large numbers of adaptive problems

Conclusion: our mind must be massively modular, because of our ancestors had to contend with hundreds of adaptive problems, and several domain-specific modules is favored by natural selection

Experimental evidence for evolutionary psych position

Part 1: evolutionary analysis of recurrent information-processing problem: examine the EEA (environment of evolutionary adaption) and identify a specific adaptive problem. Example: hunter-gatherer ancestors must have had to grapple with uncertainty and chance; EEA often presented statistical information in the form of frequencies

Part 2: Formulate a specific hypothesis and test it on modern humans. Example: (i) hypothesis: inductive reasoning about statistical information in humans takes as input information about frequencies, and maintains it as a frequentist representation, (ii) experimental results: testing shows that when presentation of information is controlled for and distinguishes frequency info from probabilities, humans do much better with frequency data than probabilities

Discussion

Computational modules vs. Chomskian modules

It's not clear from the evolutionary psych view the precise nature of mental modules. If innateness and restricted access are definitional for Chomskian modules, could evolution instead have favored the emergence of modules that became part of the human genetic make-up? Or are Darwinian computational modules more 'paired down' and simplistic, when compared to package of simpler modules implied by Chomskian linguistic modules? It seems that these questions can only be answered by actually formalizing the specific algorithms implied by evolutionary analyses. What are frequentist representations, how are they stored, and they limited to specific kinds of domains (e.g., gathering food), or more general? Because this is an overview article, these details are not discussed, but they seem to be important to answering more precise questions about the nature of modularity.

More on frequency

The experimental evidence on human reasoning shows that presentation of background information in terms of frequency significantly affected people's ability to make rational decisions. Could frequency be important in other cognitive capacities? For example, linguistic competence is often formalized as a set of symbol generating and manipulating rules that is devoid of statistical information. The rules and representation of linguistic forms exist in an isolated Chomskian module, apparently devoid of information about how commonly a form is used or a specific sentence pattern is used. Indeed, generalizations might also be possible in the 'mental lexicon' in terms of how frequent a pattern is in a language, e.g., words that begin with /br/ as opposed to /bn/. And, as a database of the words of the language, it constitutes a frequentist representation in a sense: it doesn't collapse statistical information into a probability. This raises the question of whether humans to have intuitions about language too that is sensitive to frequencies, but not probabilities. Perhaps this could be tested by presenting humans with a language processing task, like 'is this a possible word', and distinguish frequency and probability in some creative way.

Individual/group variation?

The article emphasizes that the psycho-logic competence relevant for human reasoning is different from linguistic competence because certain kinds of reasoning have normatively correct/incorrect answers. So psycho-logic is the same for all humans. Speakers of say French, on the other hand, have a different linguistic competence than the linguistic competence of English speakers—they have different internalized grammars. But are there certain principals or generalizations of language that are true of all humans? This question could be answered in two ways: there are certain structural properties of language that all languages share, so it is universal. Or, there are certain logically possible structures that no languages have, so it should be ruled out universally. It seems that answering this question would involve detailed cross-linguistic investigations of specific linguistic structures.