University of
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PHIL 474/673 -NATURAL RATIONALITY – WEEK 8 – MARCH 1ST

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EMBODIMENT AND ECONOMIC RATIONALITY

The Rational Deliberator turns out to be a well-camouflaged Adaptive Responder
- Clark, 1997:33

1   3 attitudes

- **Classical** rationality: agents are rational. (OK, maybe they are not, but at least they *should*)

- **Bounded** rationality: agents are 'irrational' (fail to comply with rational-choice theory), and now we know why (heuristics, biases, etc.)

- **Ecological** rationality: agents are, after all, rational in certain environments.

- '**Situated**' rationality: agents may be described as following rational-choice theory (RCT) in certain contexts, even if they do not, *cognitively*, follow RCT.

    o   Non-individualistic, non-psychological interpretation of RCT.

2   'Beyond the brain' cognition

2.1   Classical cognitivism

- Rule-based, information-processing model of cognition that :

- 1) characterizes problem-solving in terms of inputs and outputs

- 2) assumes the existence of symbolic, encoded representations which enable the system to devise a solution by means of computation, and

- 3) maintains that cognition can be understood by focusing primarily on an organism's internal cognitive processes (i.e., specifically those involving computation and representation).

- (from http://www.iep.utm.edu/e/embodcog.htm *Embodied Cognition* [Internet Encyclopedia of Philosophy])

2.2   Historical roots

- Heidegger (situatedness)

- Piaget (development)

- Vygotsky (social learning)

- Merleau-Ponty (existential phenomenology)

- Dewey (pragmatism and naturalism)

- (in economics) Polanyi's "embeddedness": economics agents are located in social networks (Polanyi, 1944)

2.3   Main tenets

- Naturalism, empiricism, emergentism and contextualism (sometimes anti-representationalism)

- Cognition is sensorimotor, not abstract/symbolic deduction.

- Perception and action are tightly coupled.

- Cognition is adaptive, distributed, real-time control.

- Cognition is not just 'in the head': brain, body, environment, and artifacts are interwoven.

- Representations are not complete, amodal, explicit descriptions of external environment.

- Minds and environment are strongly coupled (dense, continuous interaction).

- Cognition is always embedded in ecological, social and cultural contexts.

- Much of cognition is offloaded: we have external sensors (satellites, microscopes), external memory (hard drive, books), external processors (logic, maths, computers), external effectors (cars, planes, etc.).

- The mind is made of "multiple, special-purpose problem solvers orchestrated by environmental inputs" (Clark, 1997, p.14).

- Higher-level cognition is grounded in lower-level mechanisms.

- External Scaffolding (Clark, 1997, p. 60):

  - *(We) may may often solve problems by `piggy-backing' on reliable environmental properties. This exploitation of external structure is what I mean by the term* scaffolding. *In any given circumstance, this external structure might include other people, linguistic tools (language), environmental aspects, and/or intrinsic bodily dynamics (e.g., the properties of muscles).*

2.4 Different sources:

- Robotics: reaction to the sense-model-plan-act model (Brooks, 1991a, 1991b; Pfeifer & Scheier, 1999). Subsomption architecture.

- Artificial intelligence: more than symbol manipulation, rejection of GOFAI (Good Old Fashioned Artificial Intelligence) (Anderson, 2003)

- Cognitive psychology: importance of sensorimotor processing (Barsalou, 2003) and the environment as a cognitive device (Kirsh, 1995, 1996; Kirsh & Maglio, 1994) (ex: 'Tetris cognition', 'Memento').

- Linguistics: the grounding of abstract concept in sensorimotor schemas (Lakoff & Johnson, 1999)

- Anthropology: the reliance on external social structures to guide behavior. (Hutchins, 1995)

- Philosophy: the mind as a real-time, situated controller, not just a mirror. (Clark, 1997a; Clark & Chalmers, 1998)

- Neuroscience: the brain recruits bodily structures for cognition (e.g. organs for affective cognition (Damasio, 1994, 1999)).

2.5 Distinctions

- **Embodied** cognition: cognition is not only 'in the head'.

- **Extended/Embedded** cognition: external resources can be used for cognition

- **Situated** cognition: one cannot understand the mind without its context

- **Distributed** cognition: cognition is distributed in the environment and in social groups.

3 Situated rationality (Clark, 1997b)

3.1 Standard interpretation: methodological individualism

- Internalist interpretation of RCT: probability → beliefs, utility → desire (e.g. (Elster, 1985)).

- Even Tversky&Kahneman, or critics of RCT or normative/descriptive grounds, always take RCT as an internalist theory.

- *[RCT is] a theory of social behavior whose distinctive theoretical assumption is that actors in the theory behave according to the rationality assumption. The rationality assumption consists of three components: **purposive action**, **consistent preferences**, and **utility maximization**. Purposive action posits that most social outcomes can be explained by goal-oriented action on the part of the actors in the theory, as opposed to being motivated by habit, tradition, or social appropriateness. Consistent preferences refers to preferences that are ranked, are transitive, and do not depend on the presence or absence of essentially independent alternatives. Utility maximization posits that actors will select the behavior that provides them with the most subjective expected utility from a set of possible behaviors. (MacDonald, 2003, p. 552)*

3.2 Alternative interpretation

- Substantive rationality work best in higly scaffolded choice situation.

- Ex: consumer vs. firms, voters vs. political parties,

- Difference: theory of interests. It is easier to impute preferences to constrained agents.

- Firms "preferences" does not come from their beliefs and desires, but can be derived from market embeddedness. Only maximizing firm survive in a competitive market.

- Profit-maximization is multiply-realizable, whether it is motivated by a desire for eternal salvation, crude materialism, propensity for innovation or risk-taking. RCT is not committed to any mechanism.

- Political parties are more constrainted than voter: parties seek votes and thus nonelectoralist parties will be eliminated.

- Thus, RCT might refers to agent/environment interactions, not to agents internal mechanisms.

- Externalist interpretation:

  o "rational-choice theory need not rest on either psychological or individualist foundations" (Satz & Ferejohn, 1994, p. 86).

  o "much neoclassical economics remains unaffected by assuming that individuals make decisions by flipping coins rather than by maximizing their preferences" (*Ibid.*, 76)

  o Rats follow RCT (Kagel *et al.*, 1995; Kagel *et al.*, 1975; Kagel *et al.*, 1981)

- 2 research programs: 1) how agents construct social/political scaffolding, and 2) how these scaffoldings constraint and help individual cognition

4   Distributed rationality

4.1   Cogs in the machine

- Individual agents need not be fully informed nor omnipotent.

- Agents attain market equilibriums faster when they have less information (Smith, 1991)

- Alchian's economic evolutionism (Alchian, 1950): Markets select firms and organizations that maximize utility. Rationality as a *consequence* rather than as an *assumption.*

- (Becker, 1962): downward-sloping demand functions and upward sloping supply functions are compatible with irrational behavior (e.g. habits or random behaviors). Economics is not endangered by individual irrationality: *households may be irrational and yet markets quite rational* (Becker, 1962).

4.2   Zero-intelligence traders

- Zero-intelligence traders (ZIT): computer simulation of simple trading agents in Continuous Double Auction. (Farmer *et al.*, 2005; Gode & Sunder, 1993)

- ZIT submit random bids and offers distributed independently, identically and uniformly over the entire feasible range of prices, subject to a budget-constraint and thus cannot quote loss-making bids or offers.. Thus the rule is : *anything but no loss*.

- Farmer *et al.* model explains 96% of the variance of the gap between the best buying and selling prices (the spread) and 76% of the variance of the price diffusion rate of the London Stock Exchange.

- Replacing ZIT by humans do not add much efficiency, but changing institutional settings do.

- "rationality of individual traders accounts for a relatively small fraction (...) of the efficiency" (Gode & Sunder, p. 120)

- Institutions allow us to offload our brains: "*Institutions strongly shape our behavior, so that some of the properties of markets may depend more on the structure of institutions than on the rationality of individuals.*" (Farmer *et al.*, 2005, p. 2259)

4.3   Path-dependant processes

- Economic agents and systems are dynamical systems that evolve in multi-attractor state spaces

- They process of attractor attainment will depend upon early feedback, the trajectory of the system (which is, in turn, determined by its internal mechanisms and its environment).

4.4   The Adaptive Responder

- If individual agents are cogs in leviathans, cognition is better conceived as sensorimotor control and pattern recognition.

- The brain allocate resources to many simple tasks

- "Individual brains should not take all the credit for the flow of thoughts or the generation of reasoned responses." (Clark, 1997, p. 69)

- Ex: complex multiplication is note made by internal symbol manipulation, but by visual-motor coordination (writing on a paper for instance).

- Rational behavior is realized through norms, routines, habits, conventions, policies, know-how, etc.

- Ex: ant colony optimization algorithm (Dorigo & Stützle, 2004) Swarm intelligence (Engelbrecht, 2005): simples agents following simple rule achieve collective efficiency.

4.5   Rationality and the embedded/situated/embodied/distributed mind:

- *it is curiously anthropocentric to limit oneself to what unaided human reasoning ability can achieve in practice. In these scientific contexts, what is important is what standards of rationality can be achieved when our natural reasoning devices are supplemented by the artificial computational devices now widely available to us. (Humphreys, 1995, p. 501)*

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