Epistemic Game Theory Lecture 13

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What is game theory trying to accomplish?

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R. Aumann. What is game theory trying to accomplish?. Frontiers of Economics, 1985.

"...in my view, scientific theories are not to be considered "true" or "false." In constructing such a theory, we are not trying to get at the truth, or even to approximate to it: rather, we are trying to organize our thoughts and observations in a useful manner."

"Truth, however, is not the issue. We discard a theory not because it has been "disproved," but because it no longer works, is no longer appropriate."

What difference does it make whether we are looking for the truth or for a workable model, as long as we are not dogmatic and are willing to consider new evidence or new ways of thinking? What difference does it make whether we are looking for the truth or for a workable model, as long as we are not dogmatic and are willing to consider new evidence or new ways of thinking?

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I think that the distinction is crucial for social science in general, and for game theory and economics in particular....People ask, since game theory offers a multiplicity of solution notions, what good can it be? Which solution notion is the right one? How do people "truly" behave? If one takes the point of view suggested above, this question loses much of its sharpness. None of the solution notions tells us how people truly behave....Rather, a solution notion is the scientists' way of organizing in a single framework many disparate phenomena and many disparate ideas."

Pitfalls of Taking it too Literally

...the validity of utility maximization does not depend on its being an accurate description of the behavior of individuals. Rather, it derives from its being the underlying postulate that pulls together most of economic theory; it is the major component of a certain way of thinking, with many important and familiar implications, which have been part of economics for decades and even centuries.

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... the validity of utility maximization does not depend on its being an accurate description of the behavior of individuals. Rather, it derives from its being the underlying postulate that pulls together most of economic theory; it is the major component of a certain way of thinking, with many important and familiar implications, which have been part of economics for decades and even centuries. Alternatives such as satisficing have proved next to useless in this respect. While attractive as hypotheses, there is little theory built on them; they pull together almost nothing; they have few interesting consequences. In judging utility maximization, we must ask not "Is it plausible?" but "What does it tie together, where does it lead?"

Thus we cannot expect game and economic theory to be descriptive in the same sense that physics or astronomy are. Rationality is only one of several factors affecting human behavior; no theory based on this one factor alone can be expected to yield reliable predictions. In fact, I find it somewhat surprising that our disciplines have any relation at all to real behavior. (I hope that most readers will agree that

there is indeed such a relation, that we do gain some insight into the behavior of *Homo sapiens* by studying *Homo rationalis*.)

Descriptively speaking, then, we can expect our disciplines only sometimes to explain or provide insights into "real" phenomena. Descriptively speaking, then, we can expect our disciplines only sometimes to explain or provide insights into "real" phenomena. We cannot expect them always to do so, because they are admittedly incomplete. We cannot even say beforehand when we expect them to do so, because we do not yet know how to integrate rational sciences like game theory and economics with non-rational sciences like psychology and sociology to yield accurate predictions. Descriptively speaking, then, we can expect our disciplines only sometimes to explain or provide insights into "real" phenomena. We cannot expect them always to do so, because they are admittedly incomplete. We cannot even say beforehand when we expect them to do so, because we do not yet know how to integrate rational sciences like game theory and economics with non-rational sciences like psychology and sociology to yield accurate predictions. The criterion for judging our theories cannot be rigid; we cannot ask, is it right or is it wrong? Rather, we must ask, how often has it been useful? How useful has it been? All this may sound very slippery and unsatisfactory. There are no firm predictions, no falsifiability. If our theory appears not to work, we don't lose any sleep. "Rationality is just one of the relevant factors," we say blandly; "here something else was at work."

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R. Aumann. Irrationality in Game Theory. 1992.

I. Gilboa. *Counter-Counterfactuals*. Games and Economic Behavior, 24, pgs. 175 - 180, 1998.

"It will definitely rain this morning. However, if it doesn't, it will definitely be very cold this afternoon."

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W. Spohn. How to make sense of game theory. in Philosophy of Economics, 1982.

"...game theory...is, to put it strongly, confused about the rationality concept appropriate to it, its assumptions about its subjects (the players) are very unclear, and, as a consequence, it is unclear about the decision rules to be applied.

"Game theory is decision theory about special decision makers, namely about decision makers who theorize decision-theoretically about the other persons figuring in their decision situations." The basic difficulty in defining rational behavior in game situations is the fact that in general each player's strategy will depend on his expectations about the other players' strategies.

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- Descriptive theories are concerned with empirical phenomena, but stop with a description
- ► Explanatory theories go further by addressing "why questions".
- Predictive theories discuss what behavior will be.
- ► Normative theories can be divided into two types of statements:
 - Speculative statements are nonoperational usually consisting of a goal or criterion with no precise instructions on how one might accomplish the goal
 - Prescriptions are operational in that they give both a goal and a feasible algorithm for achieving that goal.

". . . Experiments have been performed which show that individuals do not reason about uncertainty in the way described (by Bruno de Finetti in Theory of Probability). The experiments provide a descriptive view of man's attitudes: de Finetti's approach is normative. To spend too much time on description is unwise when a normative approach exists, for it is like asking people's opinion of 2+2, obtaining an average of 4.31 and announcing this to be the sum. It would be better to teach them arithmetic. I hope that (de Finetti's) book will divert psychologists' attentions away from descriptions to the important problem ... of how to teach people to assess probabilities. "

Objectives of Game Theory

"... it is crucial that the social scientist recognize that game theory is not descriptive, but rather (conditionally) normative. It states neither how people do behave nor how they should behave in an absolute sense, but how they should behave if they wish to achieve certain ends. It prescribes for given assumptions courses of action for the attainment of outcomes having certain formal "optimum" properties. These properties may or may not be deemed pertinent in any given real world conflict of interest. If they are, the theory prescribes the choices which must be made to get that optimum." (Luce and Raiffa)

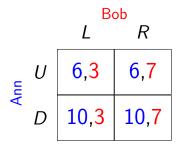
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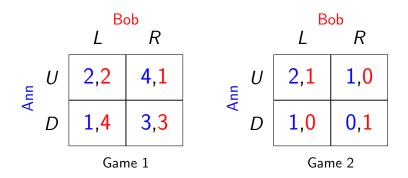
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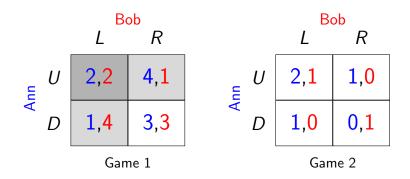
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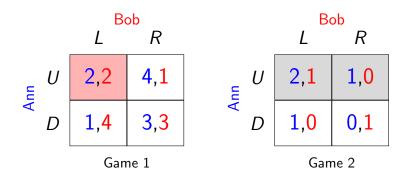
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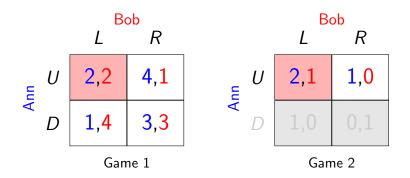




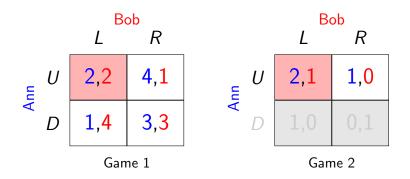




Game 2: U strictly dominates D



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Theorem. In all models where the players are *rational* and there is *common belief of rationality*, the players choose strategies that survive iterative removal of strictly dominated strategies (and, conversely...).

		Bob	
		L	R
Ann	U	<mark>3</mark> ,-3	-1,1
	D	-9,9	3,-3

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You may, as most game theorists do, postulate some form of rational behavior for both players as your explanatory/predictive theories. But, as a rational person, yourself, you should not, in light of a substantial body of experimental and natural evidence, expect these theories to work well predictively except in the most simple, contrived settings.

The Is-Ought Confusion

- 1. Introspective Theorizing
- 2. Objective and Subjective Rationality
- 3. The Third Party Perspective
- 4. Mathematical Tractability

Introspective Theorizing

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Objective and Subjective Rationality

Even in many of the relatively simple conflict situations created in the laboratory, subjects depart from optimal behavior as best it can be deduced in a particular game using particular assumptions about the rationality of subjects. These results need not be interpreted as evidence of irrational or nonrational behavior because subjects may still be behaving rationally in a weak personalistic sense (i.e., they are solving the problem they perceive in the best way they can devise).

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Mathematical Tractability

"Now it may be that the problems are intrinsically interesting, that the results are elegant and aesthetically pleasing, that the mathematics proceed are real contributions to the discipline of mathematics, and that proving theorems in game theory keeps a large number of academics and journal editors employed. It does not follow that the work is contributing to our knowledge of how individuals and organizations do and should behave in conflict situations." (Kadane and Larkey, pg. 1375)

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Negative Conclusions

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"Most of game theory is speculative-normative. The only standards that can be applied to this type of theory are the standards that apply to mathematics research: Is the logic correct (internally consistent)? Are the results new? Do the results suggest further work? Even if the answer to all three questions is "yes" and the results are published, researchers interested in prescription and prediction must then ask, "So what?" There is nothing in these standards to make us sanguine about the utility of accumulated game theoretic results in the short or long run. (Kadane and Larkey, pg. 1377) Taking the Bayesian norm as **prescriptively** compelling for my play leads me to want the best **description** I can find of my partner/opponent's play.

"Joseph B. Kadane and Patrick D. Larkey (1982) expressed a similar view, but unlike Luce and Raiffa (1957), they eschewed the "strategy aspects". This ignores *the* fundamental insight of game theory, an insight that is captured by the idea of rational expectations introduced here: that a rational player must take into account that the players reason about each other in deciding how to play. " (Aumann and Dreze, pg. 81)

R. Aumann and J. Dreze. *Rational Expectations in Games*. American Economic Review, 98:1, pgs. 72 - 86, 2008.

"...a rational player may or may not model his counterpart as rational. He does not violate the axioms of Bayesian rationality if he models his counterpart as not completely rational....players can have whatever models they may have of the other player, which however many uncertain parameters, again, on the marginal distribution of the other player's move affects the optimal decisions." (Kadane, pg. 407)

J. Kadane. Principles of Uncertainty. CRC Press, 2011.

"As the theories rise in strength, they require more and ore restrictive assumptions about what the players believe about each other. Thus more and more is placed into phrases like "common knowledge", "common knowledge of rationality", and "common priors." The usefulness of these special assumptions ahas to be determined case-by-case in applications." (Kadane, pg. 407)

J. Kadane. Principles of Uncertainty. CRC Press, 2011.