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Why game theory never will be anything but a footnote in the history of social science

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> "I have no fellow-feeling with those economic theorists who, off the record at seminars and conferences, admit that they are only playing a game with other theorists. If their models are not intended seriously … why do they expect me to spend my time listening to their expositions? Count me out of the game" (Robert Sugden).

Game theory is an axiomatic-mathematical theory that presents a set of axioms that people have to 'satisfy' by definition to count as 'rational.' This makes for 'rigorous' and 'precise' conclusions – but never about the real world. *Game theory* does not give us any information at all about the real world. Instead of confronting the theory with real-world phenomena it becomes a simple matter of definition if real-world phenomena are to count as signs of 'rationality.' It gives us absolutely irrefutable knowledge – but only since the knowledge is purely definitional.

> "Mathematical theorems are tautologies. They cannot be false because they do not say anything substantive. They merely spell out the implications of how things have been defined. The basic propositions of game theory have precisely the same character" (Binmore, 1994: 23).

Pure game theorists, like Ken Binmore, give us analytical truths – truths by definition. That is great – from a mathematical and formal logical point of view. From a scientific point of view, however, it is rather uninteresting and uninformative. Even if game theory gives us 'logical' truths, that is not what we are looking for as scientists. We are interested in finding truths that give us new information and knowledge of the world in which we live.

Scientific theories are theories that 'refer' to the real-world, where axioms and definitions do not take us very far. To be of interest for an economist or social scientist that wants to understand, explain, or predict real-world phenomena, 'pure' theories have to be 'interpreted' – they have to be 'applied' theories. A game theory that does not go beyond proving theorems and conditional 'if-then' statements – and do not make assertions and put forward hypotheses about real-world individuals and institutions – is of little consequence for anyone wanting to use theories for real-world purposes.

Although the critique put forward in this essay will be predominantly of a methodological ilk, much of it will also be substantive in nature. And much of what is discussed does not only apply to game theory, but to a large extent also to 'rational choice' theory. The reason is simple. Game theory rests on 'rational choice' theory. A deep, fundamental, critique of game theory has to be directed against the very foundations of its assumptions. Uncritically taking for granted and accepting the axiomatic status of those assumptions brings the critique to a halt, or forces the critique to address problems and anomalies of a second-order magnitude. The most reasonable procedure is arguably to follow Robert Solow's suggestion (Klamer ed. 1984: 146):

> "Suppose someone sits down where you are sitting right now and announces to me that he is Napoleon Bonaparte. The last thing I want to do with him is to get involved in a technical discussion of cavalry tactics at the battle of Austerlitz. If I do that, I'm getting tacitly drawn into the game that he is Napoleon. Now […] like nothing better than to get drawn into technical discussions, because then you have tacitly gone along with their fundamental assumptions; your attention is attracted away from the basic weakness of the whole story. Since I find that fundamental framework ludicrous, I respond by treating it as ludicrous – that is, by laughing at it – so as not to fall into the trap of taking it seriously and passing on to matters of technique."

Game theory's rational fools

Game theory is, like mainstream economics, model-oriented. There are many reasons for this – the history of the discipline, having ideals coming from the natural sciences (especially physics), the search for universality (explaining as much as possible with as little as possible), rigour, precision, etc. Most mainstream economists and game theorists want to explain social phenomena, structures and patterns, based on the assumption that the agents are acting in an optimizing (rational) way to satisfy given, stable and well-defined goals.

The procedure is *analytical*. The whole is broken down into its constituent parts so as to be able to explain (reduce) the aggregate (macro) as the result of the interaction of its parts (micro). Building their economic models, modern mainstream economists ground their models on a set of *core* assumptions describing the agents as 'rational' actors and a set of *auxiliary* assumptions. Together these assumptions make up the *base model* of all mainstream economic models. Based on these two sets of assumptions, they try to explain and predict both individual and social phenomena.

The core assumptions (cf. Pålsson Syll, 2016b) typically consist of completeness, transitivity, non-satiation, expected utility maximization, and consistent efficiency equilibria.

When describing the actors as rational in these models, the concept of rationality used is *instrumental* rationality – choosing consistently the preferred alternative, which is judged to have the best consequences for the actor given his in the model exogenously given interests and goals. How these preferences, interests, and goals are formed is not considered to be within the realm of rationality, and *a fortiori* not constituting part of economics proper.

The picture given by this set of core assumptions – 'rational choice' – is a rational agent with strong cognitive capacity that knows what alternatives she is facing, evaluates them carefully, calculates the consequences and chooses the one – given his preferences – that she believes has the best consequences according to her. Weighing the different alternatives against each other, the actor makes a consistent optimizing choice and acts accordingly.

Besides the core assumptions the model also typically has a set of auxiliary assumptions that spatio-temporally specify the kind of social interaction between 'rational' actors that take place in the model. These assumptions can be seen as giving answers to questions such as: who are the actors and where and when do they act, which specific goals do they have, what are their interests, what kind of expectations do they have, what are their feasible actions, what

kind of agreements (contracts) can they enter into, how much and what kind of information do they possess, and how do the actions of the different individuals interact with each other.

So, the base model basically consists of a general specification of what (axiomatically) constitutes optimizing rational agents and a more specific description of the kind of situations in which these rational actors act (making the auxiliary assumptions serve as a kind of restriction of the intended domain of application for the core assumptions and the deductively derived theorems). The list of assumptions can never be complete since there will always be unspecified background assumptions and some (often) silent omissions (usually based on some negligibility and applicability considerations). The hope, however, is that the 'thin' list of assumptions shall be sufficient to explain and predict 'thick' phenomena in the real, complex, world.

These models are not primarily constructed – especially not in game theory – for being able to analyze individuals and their aspirations, motivations, interests, etc., but typically for analyzing social phenomena as a kind of equilibrium that emerges through the interaction between individuals.

Now, of course, no one takes the base model (and the models that build on it) as a good (or, even less, true) representation of reality (which would demand a high degree of appropriate conformity with the essential characteristics of the real phenomena, that, even when weighing in pragmatic aspects such as 'purpose' and 'adequacy,' it is hard to see that this 'thin' model could deliver). The model is typically seen as a kind of thought experimental 'as if' benchmark device for enabling a rigorous mathematically tractable illustration of social interaction in an ideal-type model world, and to be able to compare that 'ideal' with reality. The 'interpreted' model is supposed to supply analytical and explanatory power, enabling us to detect and understand mechanisms and tendencies in what happens around us in real economies.

Based on the model – and on interpreting it as something more than a deductive-axiomatic system – predictions and explanations can be made and confronted with empirical data and what we think we know. The base model and its more or less tightly knit axiomatic core assumptions are used to set up further 'as if' models from which consistent and precise inferences are made. If the axiomatic premises are true, the conclusions necessarily follow. But if the models are to be relevant, we also have to argue that their precision and rigour still holds when they are applied to real-world situations. They often do not. When addressing real economies, the idealizations and abstractions necessary for the deductivist machinery to work simply do not hold.

If the real world is fuzzy, vague and indeterminate, then why should our models build upon a desire to describe it as precise and predictable? The logic of idealization, that permeates the base model, is a marvellous tool in mathematics and axiomatic-deductivist systems, but a poor guide for action in real-world systems, where concepts and entities are without clear boundaries and continually interact and overlap.

Being told that the model is rigorous and amenable to 'successive approximations' to reality is of little avail, especially when the law-like (nomological) core assumptions are highly questionable and extremely difficult to test. Being able to construct 'thought-experiments' depicting logical possibilities does not take us very far. An obvious problem with the mainstream base model is that it is formulated in such a way that it *realiter* is extremely difficult to empirically test and decisively 'corroborate' or 'falsify.' Such models are from a

scientific-explanatory point of view unsatisfying. The 'thinness' is bought at too high a price, unless you decide to leave the intended area of application unspecified or immunize your model by interpreting it as nothing more than two sets of assumptions making up a content-less theoretical system with no connection whatsoever to reality.

Ontology – the lacking dimension

What is lacking in the overly simplistic mainstream view on using mathematical modelling in game theory is an ontological reflection on the conditions that have to be fulfilled for appropriately applying the methods of mathematical modelling. Using formal mathematical modelling, one sure can guarantee that the conclusion holds given the assumptions. However, there is no warrant that the validity we get in abstract model worlds automatically transfer to real-world economies. Validity and consistency may be good, but it is not enough. From a realist perspective, both relevance and soundness are *sine qua non*. In their search for validity, rigour and precision, game theorists construct models that standardly assume things like 'perfect information,' 'consistently aligned beliefs,' backward induction,' 'common knowledge,' etc., etc. At the same time, the models standardly ignore things like complexity, diversity, genuine uncertainty, and expectations formation. Behavioural and experimental economics – not to speak of psychology – show beyond any doubts that peoples' preferences, choices, and forecasts, are regularly influenced by factors that are *not* incorporated into game theory.

So, in what way can one maintain that these models give workable foundations for explaining social interaction between different actors and decision makers? In game theoretical models – where the conclusions follow deductively – mathematics is the preferred means to assure that we get what we want to establish with deductive rigour and precision. The problem, however, is that what guarantees this deductivity are as a rule the same things that make the external validity of the models wanting. The core assumptions are not very many, and so, if the modellers want to establish 'interesting' facts about the economy, they have to make sure the set of auxiliary assumptions is large enough to enable the derivations. But then – how do we validate that large set of assumptions that give the game theorist her 'clarity' and 'consistency' outside the model itself? How do we evaluate those assumptions that are used for no other purpose than to guarantee an analytical-formalistic use of mathematics? And how do we know that our model results 'travel' to the real world?

On a deep level, one could argue that the one-eyed focus on internal validity and consistency make game theory irrelevant since its insistence on deductive-axiomatic foundations does not earnestly consider the fact that its formal logical reasoning, inferences and arguments show an amazingly weak relationship to their everyday real-world equivalents. Although the formal logic focus may deepen our insights into the notion of internal validity, the rigour and precision have a devastatingly important trade-off: the higher the level of rigour and precision, the smaller is the range of real-world application. The more game theoreticians insist on formal logical validity, the less they have to say about the real world.

Back in 1991, when earning his first PhD with a dissertation on decision making and rationality in social choice and game theory, yours truly concluded (Syll 1991:105) that

> "repeatedly it seems as though mathematical tractability and elegance – rather than realism and relevance – have been the most applied guidelines

> for the behavioural assumptions being made. On a political and social level, it is doubtful if the methodological individualism, ahistoricity and formalism they are advocating are especially valid."

Mainstream colleagues were – to say the least – not exactly überjoyed. But twenty years later, renowned game theorist Ariel Rubinstein (2012b), confirmed the doubts about the value of game theory:

> "Game theory is about a collection of fables. Are fables useful or not? In some sense, you can say that they are useful, because good fables can give you some new insight into the world and allow you to think about a situation differently. But fables are not useful in the sense of giving you advice about what to do tomorrow, or how to reach an agreement between the West and Iran. The same is true about game theory."

Expected utility theory and the behavioural challenge

In game theory, preferences are standardly expressed in the form of an expected utility function. Although the expected utility theory has been known for a long time to be both theoretically and descriptively inadequate, game theorists gladly continue to use it, as though its deficiencies were unknown or unheard of. But when models are plainly wrong, you have better replace them. As Matthew Rabin and Richard Thaler (2001: 230) put it:

> "It is time for economists to recognize that expected utility is an exhypothesis, so that we can concentrate our energies on the important task of developing better descriptive models of choice under uncertainty."

In a similar vein, Daniel Kahneman (2011) and Richard Thaler (2016) maintain that expected utility theory is seriously flawed since it does not take into consideration, e.g., the basic fact that people's choices are influenced by changes in their wealth. Where standard game theory assumes that preferences are stable over time, behavioural economists have forcefully again and again shown that preferences are not fixed, but vary with different reference points. How can a theory that does not allow for people having different reference points from which they consider their options have a (typically unquestioned) axiomatic status within economic theory?

Much of what experimental and behavioural economics come up with, is really bad news for mainstream economic theory, and to just conclude, as many mainstream economists do, that game theoretical insights can be applied to most decision-making areas, sounds, to say the least, somewhat lame, when the works of people like Rabin, Thaler and Kahneman, show that expected utility theory is nothing but transmogrifying truth.

If we cannot show that the mechanisms or causes we isolate and handle in our models are stable, in the sense that what when we export them from our models to our target systems they do not change from one situation to another, then they only hold under *ceteris paribus* conditions and *a fortiori* are of limited value for our understanding, explanation and prediction of our real-world target system.

Ken Binmore and other game theorists try to 'save' game theory by treating it as an axiomatic system and making all its claims into tautologies – 'true' by the meaning of propositional connectives. The problem is, of course, that 'saving' theories and models by this kind of immunizing strategy are totally unacceptable from a scientific point of view. If game theory has nothing to say about the real world, why should we care about it? As long as no convincing justification is put forward for how the inferential bridging between model and reality *de facto* is made, game theoretical model building is little more than hand-waving. The real challenge is to acknowledge and face real-world uncertainty and still try to explain why economic transactions and social interaction take place – instead of simply conjuring the problem away by assuming things like 'common knowledge' and 'perfect information,' or treating uncertainty as if possible to reduce to stochastic risk, or by immunizing models by treating them as purely deductive-axiomatic systems.

Nash equilibrium

Nash equilibrium has since it was introduced back in the 1950's (cf. Nash 1951) come to be the standard solution concept used by game theorists. The justification for its use has been mainly built on dubious and contentious assumptions like 'common knowledge' and individuals exclusively identified as instrumentally rational. And as if that was not enough, one actually, to 'save' the Holy Equilibrium Grail, has had to further make the ridiculously unreal assumption that those individuals have 'consistently aligned beliefs' — effectively treating different individuals as incarnations of the microfoundationalist 'representative agent.'

> "According to the way we normally use the common knowledge assumption along with that of symmetrically rational, and, for that matter, perfectly rational individuals, each and every individual is assumed to reason the same way about the game. We in effect have reduced the problem of reasoning in an interactive situation to the reasoning of a representative ideal individual who knows the game in full and shares this knowledge by virtue of the common knowledge assumption with each and every other participant. The game theorist and the participants in the game are in the same situation. Everybody comes exactly to the same conclusions as everybody else when thinking about the game before the specific play of the game starts.
>
> In sum, as far as the reasoning itself is concerned we are not talking about some interactive reasoning practice. It is rather an ideal type of reasoning to which all ideal type reasoners are assumed to 'converge.' It is the reasoning of a representative ideally rational individual" (Hartmut Kliemt, 2009:145f).

In the beginning — in the 1950s and 1960s — hopes were high that game theory would enhance our possibilities of explaining the behaviour of interacting actors in non-parametric settings. And this is where we ended up! A sad story, indeed, showing the limits of methodological individualism and instrumental rationality.

So why not give up on the Nash concept altogether? Why not give up the vain dream of trying to understand social interaction by reducing it to something that can be analyzed with models of instrumentally interacting ideally rational individuals?

> "We believe that a variety of contributory factors can be identified … It is possible that the strange philosophical moorings of neoclassical economics and game theory have played a part. They are strange in at least two respects. The first is a kind of amnesia or lobotomy which the discipline seems to have suffered regarding most things philosophical during the postwar period … The second is the utilitarian historical roots of modern economics … Thirdly, the sociology of the discipline may provide further clues … All academics have fought their corner in battles over resources and they always use the special qualities of their discipline as ammunition in one way or another. Thus one might explain in functionalist terms the mystifying attachments of economics and game theory to Nash" (Varoufakis & Hargreaves-Heap 1995: 108).

When criticising game theory you often get the rather uninformative and vacuous answer that we all have to remember that game theory – as is mainstream economics at large – is nothing but an 'as if' theory built on 'as if' rationality. But as Ariel Rubinstein (2012a:53) has it, this however only shows that "the phrase 'as if' is a way to avoid taking responsibility for the strong assumptions upon which economic models are founded."

The mathematical-deductivist straitjacket used in game theory presupposes atomistic closed-systems – i.e., something that we find very little of in the real world, a world significantly at odds with an (implicitly) assumed logic world where deductive entailment rules the roost. Ultimately then, the failings of game theory have their roots in a deficient ontology. The kind of formal-analytical and axiomatic-deductive mathematical modelling that makes up the core of mainstream economics is hard to make compatible with a real-world ontology. A game theory that is relevant to the world in which we live can never achieve the same degree of rigour and precision as in logic, mathematics or the natural sciences. In game theory, with its addiction to the deductivist approach of formal-mathematical modelling, model consistency trumps real-world coherence. That certainly is getting the priorities wrong. Creating models for their own sake is not an acceptable scientific aspiration – impressive-looking formal-deductive (mathematical) models should never be mistaken for truth.

On the limited applicability of game theory

Many mainstream economists – still – think that game theory is useful and can be applied to real-life and give important and interesting results (cf., e.g., Hausman 2005). That, however, is a rather unsubstantiated view. What game theory does is, strictly seen, nothing more than investigating the logic of behaviour among non-existant robot-imitations of humans. Knowing how those 'rational fools' play games do not help us to decide and act when interacting with real people. Knowing some game theory may actually make us behave in a way that hurts both ourselves and others (cf. Frank et al. 1993). Decision-making and social interaction are *always* embedded in socio-cultural contexts. Not taking account of that, game theory will remain an analytical cul-de-sac that never will be able to come up with useful and relevant explanations.

> "Imagine you and someone you do not know can share $100. It is up to you to propose how to divide the $100 between the two of you, and the other player will need to accept or reject your proposal. If he rejects the proposal, neither of you will receive anything. What sum will you offer the other player?

> I have data on the choices of about 12,300 people, most of them students, who were asked this question. Nearly half of the participants (49%) offered the other player the fair offer of $50 …
>
> The participants in the experiment who make the embarrassing offer of just $1 because they learned this in a game theory course are again the distinguished members of the Victims of Game Theory organization. And if they played the game in real life, their achievements would be inferior to those who had not become wise by studying game theory" (Rubinstein (2012a:111f).

Over-emphasizing the reach of instrumental rationality and abstracting away from the influence of many known to be important factors, reduces the analysis to a pure thought experiment without any substantial connection to reality. Limiting theoretical economic analysis in this way – not incorporating both motivational and institutional factors when trying to explain human behaviour – makes economics insensitive to social facts.

> "For certain specific, local problems, game theory is a very nice way of thinking about how people might try to solve them, but as soon as you are dealing with a general problem like an economy or a market, I think it is difficult to believe that there is full strategic interaction going on. It is just asking too much of people. Game theory imposes a huge amount of abstract reasoning on the part of people ... That is why I think game theory, as an approach to large scale interaction, is probably not the right way to go" (Kirman, 2011: 53).

Game theorists extensively exploit 'rational choice' assumptions in their explanations. That is probably also the reason why, as argued by Guala (2006:239), game theory has not been able to "accommodate the anomalies in its theoretical framework." That should hardly come as a surprise to anyone. Game theory with its axiomatic view on individuals' tastes, beliefs, and preferences, cannot accommodate very much of real-life behaviour. It is hard to find really compelling arguments in favour of us continuing down its barren paths since individuals obviously do not comply with, or are guided by, game theory. Apart from (perhaps) few notable exceptions – like Schelling's (1978) and Akerlof's (1970) explanations (although, as argued in (Rosenberg 1995:ch 6), actually only suggesting what *migh*t be the rationale behind these phenomena) of segregation and 'lemons' – it is difficult to find really successful applications of game theory. Why? To a large extent simply because the boundary conditions of game theoretical models are false and baseless from a real-world perspective. And, perhaps even more importantly, since they are not even close to being good approximations of real-life, game theory is lacking predictive power. This should come as no surprise. As long as game theory sticks to its 'rational choice' foundations, there is not much to be hoped for.

In an interview, Ariel Rubinstein (2012b) had the following to say on the question of the real-world value of game theory:

> "Is game theory useful in a concrete sense or not? Game theory is an area of economics that has enjoyed fantastic public relations. [John] Von Neumann [one of the founders of game theory] was not only a genius in mathematics, he was also a genius in public relations. The choice of the name "theory of games" was brilliant as a marketing device …

> I think it's a very tempting idea for people, that they can take something simple and apply it to situations that are very complicated, like the economic crisis or nuclear deterrence. But this is an illusion … I believe that game theory is very interesting. I've spent a lot of my life thinking about it, but I don't respect the claims that it has direct applications.
>
> The analogy I sometimes give is from logic. Logic is a very interesting field in philosophy, or in mathematics. But I don't think anybody has the illusion that logic helps people to be better performers in life …
>
> In general, I would say there were too many claims made by game theoreticians about its relevance. Every book of game theory starts with "Game theory is very relevant to everything that you can imagine, and probably many things that you can't imagine." In my opinion that's just a marketing device …
>
> I have not seen, in all my life, a single example where a game theorist could give advice, based on the theory, which was more useful than that of the layman …"

Game theorists can, of course, marginally modify their tool-box and fiddle with the auxiliary assumptions to get whatever outcome they want. But as long as the 'rational choice' core assumptions are left intact, it seems a pointless effort of hampering with an already excessive deductive-axiomatic formalism. If you do believe in a real-world relevance of game theoretical 'science fiction' assumptions such as expected utility, 'common knowledge,' 'backward induction,' correct and consistent beliefs etc., etc., then adding things like 'framing,' 'cognitive bias,' and different kinds of heuristics, do not 'solve' any problem. If we want to construct a theory that can provide us with explanations of individual cognition, decisions, and social interaction, we have to look for something else.

In real life, people – acting in a world where the assumption of an unchanging future does not hold – do not always know what kind of plays they are playing. And if they do, they often do not take it for given, but rather try to change it in different ways. And the way they play – the strategies they choose to follow – depends not only on the expected utilities, but on what specifics these utilities are calculated. What these specifics are – food, water, luxury cars, money etc. – influence to what extent we let justice, fairness, equality, influence our choices (cf. Yaari & Bar-Hillel 1984). 'Welfarism' – the consequentialist view that all that really matters to people is the utility of the outcomes – is a highly questionable short-coming built into game theory, and certainly detracts from its usefulness in explaining real-life choices made outside the model world of game theory.

Games people play in societies are usually not like games of chess. In the confined context of parlour-games – like in the nowadays so often appealed to, for 'defending' the usefulness of game theory, auction negotiations – the rather thin rationality concept on which game theory is founded may be adequate. But far from being congratulatory, this ought to warn us of the really bleak applicability of game theory. It is hard to see how the chess playing experience would help us in any substantial way to understand and explain strategic interaction between individuals in real-world social contexts. Game theory, with its highly questionable assumptions on 'rationality', equilibrium solutions, information, and knowledge, simply makes it useless as an instrument for explaining real-world phenomena.

Applications of game theory have on the whole resulted in massive predictive failures. People simply do not act according to the theory. They do not know or possess the assumed probabilities, utilities, beliefs or information to calculate the different ('subgame,' 'trembling-hand perfect') Nash equilibria. They may be reasonable and make use of their given cognitive faculties as well as they can (cf. Pålsson Syll 2007:ch 7), but they are obviously not those perfect and costless hyper-rational expected utility maximizing calculators game theory posits. And fortunately so. Being 'reasonable' make them avoid all those made-up 'rationality' traps that game theory would have put them in if they had tried to act as consistent players in a game theoretical sense.

The lack of successful empirical application of game theory shows there certainly are definitive limits of how far instrumental rationality can take us in trying to explain and understand individual behaviour in social contexts. The kind of preferences, knowledge, information and beliefs – and lack of contextual 'thickness' – that are assumed to be at hand in the axiomatic game theoretical set-up do not give much space for delivering real and relevant insights of the kind of decision-making and action we encounter in our everyday lives.

Where did game theory go wrong?

Instead of making formal logical argumentation based on deductive-axiomatic models the message, we are arguably better served by social scientists who more than anything else try to contribute to solving real problems – and in that endeavour, other inference schemes may be much more relevant than formal logic.

> "The weaknesses of social-scientific normativism are obvious. The basic assumptions refer to idealized action under pure maxims; no empirically substantive law-like hypotheses can be derived from them. Either it is a question of analytic statements recast in deductive form or the conditions under which the hypotheses derived could be definitively falsified are excluded under ceteris paribus stipulations. Despite their reference to reality, the laws stated by pure economics have little, if any, information content. To the extent that theories of rational choice lay claim to empirical-analytic knowledge, they are open to the charge of Platonism (Modellplatonismus). Hans Albert has summarized these arguments: The central point is the confusion of logical presuppositions with empirical conditions. The maxims of action introduced are treated not as verifiable hypotheses but as assumptions about actions by economic subjects that are in principle possible. The theorist limits himself to formal deductions of implications in the unfounded expectation that he will nevertheless arrive at propositions with empirical content. Albert's critique is directed primarily against tautological procedures and the immunizing role of qualifying or 'alibi' formulas. This critique of normative-analytic methods argues that general theories of rational action are achieved at too great a cost when they sacrifice empirically verifiable and descriptively meaningful information" (Habermas, 1988:48).

Game theoretical models build on a theory that is abstract, unrealistic and presenting mostly non-testable hypotheses. One important rationale behind this kind of model building is the quest for rigour, and more precisely, logical rigour. Instead of basically trying to establish a

connection between empirical data and assumptions, 'truth' has come to be reduced to a question of fulfilling internal consistency demands between conclusion and premises, instead of showing a 'congruence' between model assumptions and reality. This has, of course, severely restricted the applicability of game theory and its models.

The world in which we live is inherently uncertain and quantifiable probabilities are the exception rather than the rule. To every statement about it is attached a 'weight of argument' that makes it impossible to reduce our beliefs and expectations to a one-dimensional stochastic probability distribution. If "God does not play dice" as Einstein maintained, I would add "nor do people." The world as we know it has limited scope for certainty and perfect knowledge. Its intrinsic and almost unlimited complexity and the interrelatedness of its organic parts prevent the possibility of treating it as constituted by 'legal atoms' with discretely distinct, separable and stable causal relations. Our knowledge accordingly has to be of a rather fallible kind.

To search for precision and rigour in such a world is self-defeating, at least if precision and rigour are supposed to assure external validity. The only way to defend such an endeavour is to take a blind eye to ontology and restrict oneself to prove things in closed model-worlds. Why we should care about these and not ask questions of relevance is hard to see. We have to at least justify our disregard for the gap between the nature of the real world and the theories and models of it.

If the real world is fuzzy, vague and indeterminate, then why should our models build upon a desire to describe it as precise and predictable? Even if there always has to be a trade-off between theory-internal validity and external validity, we have to ask ourselves if our models are relevant.

'Human logic' has to supplant the classical, formal, logic of deductivism if we want to have anything of interest to say of the real world we inhabit. Logic is a marvellous tool in mathematics and axiomatic-deductivist systems, but a poor guide for action in real-world systems, in which concepts and entities are without clear boundaries and continually interact and overlap. In the world in which we live, we are better served with a methodology that takes into account that usually the more we know, the more we know we do not know.

Taking uncertainty seriously

Game theory has created its own 'as if' parallel world. To judge the whole game theoretical project one has to evaluate the relation between that model world and the real world. To our understanding of the way the world works, belongs a thorough recognition of the ontological restriction of the kind of cognitional and epistemological assumptions we can make about what kind of knowledge and information individuals can possibly have. It is important, not least since in a game theoretical – strategic – setting, knowledge and information are essential parts of the context in which individuals make their decisions and act.

Like the 'rational choice' theory on which it is based, game theory postulates that individuals are rational in the specific definitional meaning that they decide and act on given preferences through calculating expected utilities. To be able to make those calculations it is assumed that – besides actors having very strong logical and cognitional capacities – uncertainty conditions can be treated as risk equivalents.

Here you can, of course, question all the ingredients in that 'rationality' definition. But, for the moment, let us focus on the uncertainty issue, since if the reductionist view on uncertainty is untenable in real-world contexts, it is also not possible to consider individuals as behaving according to the definitional rationality. Facing genuine uncertainty, actors cannot, strictly seen, make any rational calculations at all, but rather have to (partly) base their decisions and acts on institutions, rule following, imitation, norms, conventions, 'animal spirits', etc., etc.

Facing genuine uncertainty the player in a game, when trying to act optimally given his preferences, cannot be sure that the genuinely uncertain – *ex ante* – consequences he decides and acts on will actually – *ex post* – materialize. In repeated games, game theorists usually assume that the new information that the players accumulate during the game will somehow solve the uncertainty problem. But it does not, at least not in a non-ergodic world, where the arrow of time makes the future – and the materialized consequences – different to the past.

> "If the actions that I undertake in t0 will have very different consequences according to the eventual state of the world in t1, it is crucial to gather reliable knowledge about these states. But how could I evaluate in t0 my beliefs about the state of the world in t1? If the world were repetitive (governed by immutable laws) and these laws were known, I could assume that what I find out about the present state is relevant to determine how the future state (the one that will prevail) will be. It would make then sense to apply a strategy for gathering empirical evidence (a sequence of actions to collect new data). But if the world is not repetitive, what makes me think that the new information may be at all useful regarding future events? ...
>
> Conceiving economic processes like sequences of events in which uncertainty reigns, where consequently there are "no laws", nor "invariants" or "mechanisms" to discover, the kind of learning that experiments or past experience provide is of no use for the future, because it eliminates innovation and creativity and does not take into account the arboreal character and the open-ended nature of the economic process ... However, as said before, we can gather precise information, restricted in space and time (data). But, what is the purpose of obtaining this sort of information if uncertainty about future events prevails?" (Marqués 2016: 118-9).

The effects of taking the concept of genuine uncertainty seriously are indeed far-reaching. Living in a world permeated by unmeasurable uncertainty – not quantifiable stochastic risk – forces us to make decisions based on anything but 'rational expectations' and 'expected utility.' In a genuinely uncertain world, we have to base our expectations and calculations on the confidence or 'weight' we put on different events and alternatives. The expectations we form and the calculations we make are (partly) based on weighing probabilities by 'degrees of belief,' beliefs that often have preciously little to do with the kind of stochastic probabilistic calculations made by the rational agents as modelled by game theory. Often we 'simply do not know,' and to assume – as is standard in 'rational choice' and game theory – that what has worked before, will continue to do so in the future, is unwarranted. One cannot simply project history onto the future.

Robert Lucas (1981: 223-4) once wrote that "in cases of uncertainty, economic reasoning will be of no value." Now, if that was true, it would put us in a tough dilemma. If we have

to consider – as Lucas – uncertainty incompatible with economics being a science, and we actually know for sure that there are several and deeply important situations in real-world contexts where we – both epistemologically and ontologically – face genuine uncertainty, well, then we actually would have to choose between reality and science. And that cannot be right. We all know we do not know very much about the future. We all know the future harbours lots of unknown unknowns. Those are ontological facts we just have to accept. Looking the other way and assume a lot of known to be utterly and ridiculously unreal things – as in game theory – is not the right way to tackle the problems uncertainty poses for social sciences.

Under uncertainty, individuals make mistakes, and not only of the usual 'white noise' kind assumed by 'rational choice' and game theory, but even systematic ones, because of the inherent uncertainty of the probability judgments individuals have to base their decisions and acts on in real-world contexts without the possibility to reduce uncertainty to risk. In real-world situations – where there are few, if any, 'nomological machines' – every day is different and without much hopes of making improvements by learning. Of course, you may learn things, in a historical sense, about things that have already taken place, but since there is no possibility of learning much about the future in an uncertain non-ergodic world without stability and invariance, the learning you do will not help you make decisions and act on 'rational' calculations. In an uncertain world ontologically characterized by non-repetitiveness and emergence, there is very little that can justify the assumptions of expected utility calculations on which 'rational choice' and game theory is founded. With uncertainty, the definitional rationality that game theory presumes simply is not to be had. And hence game theory becomes irrelevant. Irrelevant and useless.

Game theory – not really explaining decision-making and acting at all

In game theory, although it 'describes' strategic interaction between 'rational' individuals, the decisions made by those individuals are always seen as completely independent decisions. Game theory is not really interested in if individuals *actually* behave in accordance with its axioms and assumptions. It only cares about the possibility of describing the behaviour *as if* they maximize their expected utility.

Game theoretical rationality is at its core defined as a player being able to choose the 'best' action given the beliefs she has about the beliefs, preferences and possible actions of other players. The individual depicted in game theory is an unbearable inhuman robot-imitation, but in real life we all err, and we do it in systematic ways (cf. Kahneman, 2011; and Thaler, 2016).

So – again – why assume individuals are 'rational'? Mostly because game theorists want to be able to make behaviour predictable. It would have been much better if they had stuck more to real-life persons and accepted that these to a large extent are unpredictable creatures trying to cope with living in a largely genuinely uncertain world. Game theory takes for granted that every player has the ability to put herself in the shoes of other players. In reality, that is not so. One size does not fit all, and that goes for game-theoretical shoes too.

There do exist innumerable considerations that influence decision makers and that are contrary to the 'rational choice' assumption used in game theory. And with the restricted conception of human behaviour and far-reaching tractability assumptions on which game theory builds, most people are probably forgiven for not regarding its achievement as a big deal. Its 'rational choice' foundations – with its definitional consistency-reduced view of

'rationality' – makes much of it a platitude. Telling us that individuals choose the preferred alternatives in their preference orderings is rather uninformative – and empirically shown over and over again to be far from true. The close link that is presumed between expected utility and the choices individuals make is often severed in real-world settings. No man is an island. Actors and decision makers – as repeated experiments with 'dictator' and 'ultimatum' games have shown (cf. Carmichael (2005), Rubinstein (2012), Frank et al. (1993), Hausman (2005), Kahneman et al. (1986) – often do care about commitments, which involve them in making counter-preferential non-expected-utility-maximizing choices based on ethics, solidarity, mutual trust, duty, obligation, morals, norms, social positions, reputation, rules of conduct, imagination, gut feeling, ambiguity, etc., etc. Individuals do – more or less often – choose to act in ways that give them less personal expected utility than other available alternatives. What an individual regards as good from a 'social' point of view may not be the same as what he regards as good from a 'private' point of view. Individuals are often ambiguous and succumb to *akrasia*. Individuals do frequently make unselfish choices. Although our choices and acts may have bad anticipated consequences, we sometimes prefer to go beyond the limited and mute 'rationality' that consequentialist expected utility calculations prescribe. Real-world individuals have richer and more complex preferences than those that are posited in the game theoretical behavioural axioms.

> "The traditional theory has *too little* structure. A person is given *one* preference ordering, and as and when the need arises this is supposed to reflect his interests, represent his welfare, summarize his idea of what should be done, and describe his actual choices and behavior. Can one preference ordering do all these things? A person thus described may be 'rational' in the limited sense of revealing no inconsistencies in his choice behavior, but if he has no use for these distinctions between quite different concepts, he must be a bit of a fool. The *purely* economic man is indeed close to being a social moron. Economic theory has been much preoccupied with this rational fool decked in the glory of his *one* all-purpose preference ordering. To make room for the different concepts related to his behavior we need a more elaborate structure" (Sen, 1977: 335f).

As we have seen, there simply are no 'objective' probability distributions out there for individuals to build expectations and utility calculations on. That also makes the kind of calculations and predictions that game theory presupposes more or less impossible. Keynes' (1936) famous beauty test illustrates part of the problem. To solve this kind of almost self-referential vicious circle reasoning, instrumental logic has to be supplanted by other kinds of logic if we want to be able to explain the final expectations on which people decide to act on.

Game theoretical 'solutions' critically presuppose that players are rational and know that other players are rational, and so on. The moment the slightest doubt about that knowledge about other people's beliefs (and, strictly seen, the process through which they are reached) creeps in, the theory could become seriously misleading.

Most of the mathematical reasoning (especially on the cognitive capacities of the players) that lies behind game theoretical results are beyond the formal comprehension of most real-world decision makers and players. If 'rational' at all, most of them are only 'boundedly' so and frequently use different kinds of pragmatic 'heuristics' or 'rules of thumb.'

Beliefs and preferences *per se* do not in any substantial meaning explain anything, unless one is able to show that those beliefs and preferences also are the *de facto* driving causal reasons behind the decisions and acts of individuals. That also applies to game theory. Finding people in game-like situations acting like game theory predicts does not *per se* constitute a vindication of game theoretical explanations. The players may have acted out of quite different reasoning and beliefs than those stipulated by game theory. If so, game theory still does not explain the behaviour in any meaningful way.

The ideally 'rational' agent in game theory is an extremely idealized one. In our imperfect and genuinely uncertain world we never – never – run into anyone equipped with that kind of consistent preferences, information, knowledge or calculating abilities. We are humans and not 'players' in the ideal-type world of game theory. If we are found to maximize any expected utilities at all, it is (probably) only by chance.

In game theorists' famous apophthegm, words are nothing but 'cheap talk.' Motivation is purely forward-looking and bygones are bygones. But in real-life situations, we do usually find people having a duty or obligation to stand by their words. History matters and investments we have made in the past do influence our present and future behaviour. Reasons can be backwards-looking. Promises made have a binding power on most of us. That game theory, footed on its instrumental rationality concept, cannot accommodate those facts, only shows that its notion of rationality is too restricted.

'Common knowledge' means that anything known to anyone is also known by everyone else. From a realist point of view, this is such a ridiculous assumption to make, that one wonders how anything concluded from this assumption could ever be imagined to travel from the model world to the real world. It is an assumption dictated purely out of tractability considerations, and without that assumption, game theory cannot come up with equilibrium solutions to many of its games. But so what? More than anything else it just underlines how useless the theory is for explaining real-world phenomena.

Since game theory does not incorporate real-world psychological or social factors, what *realiter* rule or influence many decisions and acts of individuals are *de facto* treated as totally irrelevant. In that sense, and contrary to what many economists applying game theory may think, game theory is not at all a theory of how individuals make decisions and act. It is not a descriptive theory. It is rather a normative deductive theory telling us that if we want to behave 'rational' we have to do so in a way consistent with game theory. But – people seldom act in the way prescribed by game theory. They do not cohere with all or any of those 'rationality' assumptions, and so the real normative force of game theory is close to zero. Even if this to game theorists is of no interest – the 'if' clause is not satisfied, and so the 'then' clause may be whatever – negative empirical observations certainly detract from the purported value of game theory. If the impressive precision of the game theoretical solutions has to be bought at such a high price, most people are probably not prepared to pay for being considered 'irrational'.

Game theoretical obscurantism

In game theory, agents do not only have beliefs about each other, but also have to have beliefs about beliefs, and so on. To somehow short-circuit the infinite regress problem inherent in this strategic uncertainty situation, one standardly appeals to the equilibrium

notion. That is, as we already know, a standard tractability assumption in mainstream economics for closing the models, but even this evasion does not work when we have multiple equilibria (cf. Hargreaves-Heap ed. 1992: 107f).

Individuals outside these 'as if' models – with their purely instrumentalist justification – simply do not possess the cognitive capacity to make the kind of expected utility calculations game theory presupposes. Although this is a *sine qua non* for constructing the games analyzed in game theory, it has very little justification or warrant for analyzing real-world behaviour or decision making. The game theoretical 'as if' model results simply do not bridge to the real world.

So why should we care about 'as if' results derived in the extremely narrow framework of a game theory erected on 'rational choice' pillars? Why, indeed, should we, in the words of Elster (2015:453), care about mending an 'obscurantist' theory with its

> "uncanny combination of mathematical sophistication on the one hand and conceptual naiveté and empirical sloppiness on the other, [and in which] the mathematics, which could have been a tool, is little more than toy?"

You could probably try to give answers in terms of the aesthetics of mathematical model-building, but it would be more fair to just admit that, from the point of view of social science, there is absolutely no reason at all why we should care about game theory simply because it is of no value at all – beyond some few very restricted contexts such as, e.g., auctions – for explaining real-world decision making and behaviour. Science fiction can sure function as an inspiration to all of us, but to use it as a building block for a relevant and realistic social science is hardly tenable. "Mit der Dummheit kämpfen Götter selbst vergebens," but we still have to leave the pointless excessive deductive-axiomatic formalism of game theory behind, and instead reorient our endeavours into building a more modest, relevant, realistic and robust social science.

Outside the confines of the model world, game theoretical findings seem to have very little relevance. Under genuine uncertainty, game theory does not offer any advice at all, since game theory is founded on assumptions that are known to be patently surreal in most interesting economic contexts. No wonder then that its real-world value has to be seriously questioned – models that only make sense when we accept assumptions that over and over again have been shown by psychologists and behavioural scientists to be ridiculous, is no more valuable to us than Walt Disney fictions.

All theories and models have to use sign vehicles to convey some kind of content that may be used for saying something of the target system. But purpose-built tractability assumptions – like the modelling assumption that "an analysis of complex structures by parts is possible" (Kliemt, 2009: 125) – made solely to secure a way of reaching deductively validated results in mathematical models, are of little value if they cannot be validated outside of the model.

Models do not only face theory. They also have to confront the world. But being able to model a 'credible world,' a world that somehow could be considered real or similar to the real world, is not the same as investigating the real world. Questions of external validity, the claims the extrapolation inference is supposed to deliver, are important. It can never be enough that models somehow are regarded as internally consistent. One always also has to pose

questions of consistency with the data. Internal consistency without external validity is worth nothing.

The links between real-life situations and the abstract formulation of problems in game theory are often difficult to discern. The values of individualism and competitiveness that are embedded in game theory are in many decision contexts at odds with reality. If individuals' decisions and beliefs cannot be reduced to a common measuring stick – expected utility– they cannot be translated into numbers, and so 'disappear' from the game theoretical analysis (cf. Rapoport 1962:113). Ignoring much of what *realiter* influence individual behaviour in real-life situations, applying the narrow and artificial perspective of game theory outside the model world is more likely to obscure the deliberations behind individuals' decisions and acts than to reveal them. Game theory simply does *not* elucidate real-life problems. On the contrary. It is probably mostly unhelpful and harmful. Analyzing and trying to explain individual interaction in complex social contexts is a daunting task. Solving it by making absurd 'as if' simplifying assumptions, as in game theory, cannot, however, be the right solution. By applying game theory in real-world contexts we often end up thinking like game theorists and incorporate the values inherent in the theory – with often terrible results (as shown e.g. by the experiments reported in Frank et al., 1993).

In many situations what matters is not outcomes, but intentions. Fairness considerations do influence how we decide and act in many situations, and if we think those we 'play' with are pursuing unfair strategies, we are as a rule prepared to let them pay for that, even if it also 'hurts' ourselves. Even if that behaviour does not comply with game theoretical 'rationality,' it certainly complies with most people's ideas about fairness and reciprocity.

Game theory may devise models – 'nomological machines' – in which it is possible to derive law-like regularities: 'Satisfying all the core and auxiliary assumptions in the base model, players will decide …, act … and do …' The problem with these logical model deductions is, of course, that the game theoretical assumptions and results do not in any obvious way represent or relate to real-life situations. The game theoretical results may be law-like, rigorous, precise, and exact – but what good does that do if it comes at the cost of real-world irrelevance? If the assumptions on which game theory builds do not fit, to any considerable degree, with the world around us, well, then we certainly have to wonder what use is game theoretical 'Glasperlenspiel.'

Conclusion

Heavy use of formalism and mathematics easily foster the view that a theory is scientific. But although game theory may produce 'absolute truths' in imaginary model worlds, in the real-world the game theoretic models are nothing but – as Rubinstein (2012a) puts it – fables. Fables much reminiscent of the models used in logic, but also like them, delivering very little of value for social sciences trying to explain and understand real-life phenomena. The games that game theory portrays are model constructs, models without significant predictive capacity simply because they do not describe an always much more complex and uncertain reality.

Being at its heart a sub-discipline within pure mathematics, game theorists are not overly concerned with whether game theory represents real-world phenomena. Fine. But since most social scientists are of a different opinion, game theorists also have to accept that to most

social scientists, game theory is deemed useless for explaining interaction between individuals in the real world.

According to Morgenstern (1964:8) game theory was "designed to give meaning to what common sense vaguely calls rational behavior." It is difficult to concur. Game theory may be very rigorous, but it certainly also has many evident shortcomings and defects. As the famous 'prisoner's dilemma' poignantly shows, game theory has deep problems explaining social facts by its individualistic and egocentric 'rational choice' models (cf. Luce & Raiffa, 1957; Rapoport & Chammah, 1965; Kreps, 1990; Axelrod, 1984). Social interaction cannot be exhaustively described as strategic interaction. Posited behavioural regularities are nothing but illegitimate generalizations based on taking for granted that a theory that is able to explain has to be a universal theory with an unlimited domain as long as the core assumptions of 'rationality' are fulfilled. Without other forms of interaction, society as we know it would not be possible. Maybe this is the only real usefulness, if any, of game theory: it shows the severe limits of 'rational choice' and strategic interaction in explaining social interaction.

Although some economists consider it useful to apply game theory *and* use game theoretical definitions, axioms, and theorems and (try to) test if real-world phenomena 'satisfy' the axioms and the inferences made from them, we have argued that that view is without warrant. When confronted with the real world we can (hopefully) judge if game theory really tells us if things are as postulated. The final court of appeal for models is the real world, and as long as no convincing justification is put forward for how the inferential bridging *de facto* is made, model building is little more than hand-waving that give us rather little warrant for making inductive inferences from the model world to the real world.

The real challenge in social science is to accept uncertainty and still try to explain why different kinds of transactions and social interactions take place. Simply conjuring problems away by assuming patently unreal things and treating uncertainty as if it was possible to reduce to stochastic risk, is like playing tennis with the net down. That is not the kind of game that scientists working on constructing a relevant and realist science want to play.

Half a century ago there were widespread hopes game theory would provide a unified theory of social science. Today it has become obvious those hopes did not materialize. This ought to come as no surprise. Reductionist and atomistic models of social interaction – such as the ones mainstream economics and game theory are founded on – will never deliver sustainable building blocks for a realist and relevant social science. That is also the reason why game theory never will be anything but a footnote in the history of social science.

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