

JENA ECONOMIC RESEARCH PAPERS



2009 – 017

Psychology and Economics rather than Psychology versus Economics: Cultural differences but no barriers!

by

Hermann Brandstätter
Werner Güth
Hartmut Kliemt

www.jenecon.de

ISSN 1864-7057

The JENA ECONOMIC RESEARCH PAPERS is a joint publication of the Friedrich Schiller University and the Max Planck Institute of Economics, Jena, Germany. For editorial correspondence please contact markus.pasche@uni-jena.de.

Impressum:

Friedrich Schiller University Jena
Carl-Zeiss-Str. 3
D-07743 Jena
www.uni-jena.de

Max Planck Institute of Economics
Kahlaische Str. 10
D-07745 Jena
www.econ.mpg.de

© by the author.

Jena Economic Research Papers 2009 - 017

Psychology and Economics rather than Psychology versus Economics: Cultural differences but no barriers!

Hermann Brandstätter (Linz), Werner Güth (Jena), Hartmut Kliemt (Frankfurt) [1]

March 2, 2009

Abstract

During the last three decades the ascent of behavioral economics clearly helped to bring down artificial disciplinary boundaries between psychology and economics. Noting that behavioral economics seems still under the spell of the rational choice tradition – and, indirectly, of behaviorism – we scrutinize in an exemplary manner how the development of some kind of "cognitive economics" might mirror the rise of "cognitive psychology" without endangering the advantages of the division of labor and of disciplinary specialization.

Keywords: bounded rationality, game theory, satisficing, interdisciplinary research, experimental economics, economic psychology
JEL Classification: B31, B41, C72, C73, C78, D63

[1] Alphabetische Reihenfolge der Autoren

1. Introduction and overview

Economists endorse the ambition to form a “nomological science” (a science based on general laws) of human behavior. Many of them have claimed that their theory of individually rational choice could provide the general underpinning for all the more specialized theories of human behavior. However, describing observations as if they were the outcome of opportunity taking “rational” human behavior is not equivalent to explaining them nor does it amount to testing hypotheses about the mental processes responsible for the behavior observed. Well-tested empirical laws that can explain phenomena presented in rational choice terms are lacking.

The sometimes rather wild original aspirations of economists to integrate all social theory by means of economic imperialism (see for instance, Meckling, 1976; McKenzie & Tullock 1978) have been largely abandoned today. The relationship between economics and psychology is not anymore characterized by „suspicion and distaste“ (Lopes, 1994) or by „fear and loathing“ (see Handgraaf & van Raaij, 2005). Yet, the organization of “a common market of ideas” remains a non-trivial task. Any effort to facilitate exchange between the disciplines and to abolish artificial barriers must at the same time respect established research traditions and practices in the separate disciplines.

In our own plea for a law-based and inter-disciplinary approach to economic behavior we start with a stylized account of research traditions in economic psychology as well as economics. After short glances at experimental economics and at what we call “neuro-psycho-economics” we sketch some institutional aspects of interdisciplinary integration of economics and psychology (2.). Even though we believe that in the end the basic empirical laws explaining economic behavior are psychological in nature, the social capital of an established discipline like economics should not be thrown away lightly. It is essential to maintain as much of economics as possible in its move towards a psychological foundation. We try to demonstrate in an exemplary manner how that might conceivably be accomplished (3.). General observations conclude the paper (4.).

2. Coming together: Inter-disciplinary research traditions in economics and psychology

2.1. Behaviorism and beyond

In the first half of the 20th century a mistaken account of the role of theoretical concepts had led psychologists towards behaviorism. Referring to directly unobservable factors had become increasingly regarded as methodologically discredited altogether. This led into a dead end of research because it hampered the formulation of laws based on theoretical concepts. Eventually psychology, though retaining some of the behaviorist emphasis on observation and experiment, had to get rid of the shackles of behaviorism. After the heydays of behaviorism (shaping experimental psychology for about three decades, particularly in the USA) psychology in the late 50th of the past century (Miller, 2003) became less behavioral and much more concerned with theories of cognitive processes.

Economists had also come under the spell of observational positivism between the two World Wars. Eager to become “true scientists”, they intended to work exclusively on the basis of “hard” observational data as could be gathered from overt choice making. In the course of this development, preferences as revealed by observed choices became a very popular concept. In economics this behaviorist development culminated somewhat belatedly only in the late 40th. According to the view prevailing since then preferences can be “read off” from observed behavior and represented by a utility function u. Since this function can be viewed as the dual of a function p representing beliefs, even beliefs can be linked directly to overt choice behavior.

As we shall argue, the observational foundation of basic concepts, though in one sense undoubtedly a great intellectual accomplishment, has saddled economics with a behaviorist legacy that is still hampering its development as an empirical science of cognitive processes of real decision makers. Before we turn to the issue of how economics might move towards a cognitive approach integrating it with economic psychology more fully let us sketch how much of the way towards a truly interdisciplinary approach to economics and psychology has been accomplished.

2.2. Research traditions in economic psychology and experimental economics approaches

Neglecting more ancient thoughts about the role of human nature in economic affairs (see for example Wärneryd, 2008) and focusing on the past fifty years, we can identify three distinct research traditions and orientations that try to integrate theories and methods from both economics and psychology.

2.2.1 Economics as social science

The first research tradition is inspired by George Katona (1901-1981), a Hungarian who earned a psychology PhD in Göttingen and emigrated to the US in 1933 where he and his colleagues founded the Survey Research Center at the University of Michigan, Ann Arbor in 1946 (cf. Wärneryd, 1982).

In Germany, the economist Günter Schmölders (1903 – 1991), like George Katona committed to the psychological and sociological approach to economics (cf. for example Schmölders, 1978), founded 1958 the Forschungsstelle für empirische Sozialökonomik [The Office for Empirical Research on Social Economics] and 1960 the Zentralarchiv für empirische Sozialforschung [Central Archive for Empirical Social Science Research] in Cologne. Both, Katona and Schmölders, criticized the main-stream neo-classical economic theory for its systematic neglect of people's real experience (perceptions, expectations, motives, emotions) and people's actual behavior in their roles as consumers, entrepreneurs, financial investors, tax payers etc. Relying on social psychological concepts like attitudes, expectation, motivation, social learning rather than on more comprehensive theories, they were able to show that macro-economic "ups" and "downs" and the effects of economic policy on economic agents can be better understood and predicted by taking psychological variables into account.

Conceiving of economics as social science and taking advantage in particular of psychological concepts in economics and economic policy as well as of economic concepts in analyses of the various areas of social life also characterizes the writings of Bruno Frey (see for a most recent publication in this vein Frey, 2008). Frey's development is instructive in that he initially insisted that empirical economic explanations be in terms of relative prices (see Frey, 1990), originally published in the

70th). In that respect his approach is rather firmly rooted in the more traditional economic model. However, in other regards he has always advocated to integrate results of other sciences of human behavior, in particular of psychology, into economic analyses. In this his attitude is close to the older tradition of Schmölders as well as to the methodological positions adopted by Hans Albert (see Albert, 1967/1998). Like Albert with whom he collaborated (along with psychologists in an economic psychology group) over several years, Frey believes, that economics should not be used as an excuse for pursuing chiefly mathematical projects of an analytical nature but always focus on reaching better empirical explanations.

Although one of the earliest and later quite often quoted experiments (on individual indifference curves) was run by a psychologist (Thurstone (1931, cited by Roth [1993]), psychologists interested in economic affairs commonly followed the social science approach of George Katona (1951/1975). They relied mainly on questionnaires and interviews, preferably in representative surveys (the stated – articulated in words -- as opposed to the revealed – by overt choice behavior – preference perspective prevailed, see on the perspectives (Louvierre, Hensher et al. 2000)). For instance, the consumer sentiment index (CSI), initiated by Katona in the late 40ties (Katona, 1951; Wärneryd, 1982) and now regularly applied along with the business climate index (BCI) in many countries, succeeded in enhancing the validity (beyond the validity of macro-economic measures) of predictions of short term change in macro-economic variables.

2.2.2. The establishment of experimental economics

A second research orientation expects a steady progress in scientific knowledge from precise definitions of concepts, formal (mathematical and logical) representations of the relationships between the theoretical constructs, and step by step uses of experimental rather than questionnaire methods in hypotheses testing. The approach has its origin in models of individual and interactive decision making that were introduced by the seminal “Theory of Games and Economic Behavior” (Neumann & Morgenstern, 1944) and were picked up rather swiftly by psychologists (one culmination point of the absorption of the formalism into psychology being the “critical survey” by Luce and Raiffa (1957).

The axioms used in proving representation theorems of utility theory had moved centre stage in the 50th. Also then first experiments were run on games like Prisoner's Dilemma interactions (see, for instance, issues of Behavioral Science or slightly later Rapoport & Chammah, 1965). Some of the experiments were done by economists; however the experimental orientation of psychology was firmly established before economists started to run experiments in earnest. Experiments were adopted in economics as a legitimate research strategy – with exponentially increasing frequency – only since the 60th.[2]

In America experimental economics took off with the double oral auction experiments of Vernon Smith (see Smith, 1962). Inspired by his own participation in an early experiment by Chamberlin, Smith conducted these experiments to look more closely into the role that incentives and institutional rules play. Initially he had a hard time to get published what turned out to be a seminal paper. However, after sinking in, the experiment had a rather warm reception because the "free marketers" welcomed Smith's experimental results as confirming that "markets work". The experiment in itself should have made economists think twice, though, as far as their own methodologically individualist precepts are concerned: The empirical laws or regularities – amounting to the confirmation of the hypothesis that "markets work" – were ranging over institutional variables like "double oral auctions" rather than over individual behavioral variables.[3]

[2] Though the first experiment on markets was run in the late 40th (see Chamberlain, 1948) this may be neglected since it has been an isolated event without any impact on the profession.
[3] Ironically, the experimental results were robust because they were largely independent of specific assumptions about individually rational behavior (see for instance, Gode & Sunder, 1993).

Table 1. The exponential growth of economic psychology and behavioral or experimental economics during the past decades

	Experimental Economics OR Experiments in Economics	Economic psychology	Experimental Economics OR Behavioral Economics OR Economic Psychology	Ultimatum Experiments OR Ultimatum Games
2000 - 2008	1.217	570	1944	238
1990 - 1999	557	350	960	50
1980 - 1989	44	72	130	4
1970 - 1997	15	13	37	
1960 - 1969	7	8	13	
1950 - 1959	0	4	5	

Note. Frequencies according to web of science

The ascent of experimental economics had separate and independent roots in Germany (see on this the account in the introductory overview in (Kagel & Roth, 1995)). As chief initiators and promoters of this tradition one should think of Heinz Sauermann (1905 – 1981) and Reinhard Selten (research assistant of Sauermann at the University of Frankfurt 1957 – 1967). In 1977 Sauermann initiated the founding of the Gesellschaft für experimentelle Wirtschaftsforschung [Society for experimental economics]. The German society for experimental economics is still very active. Yet the younger generation is leaning quite strongly towards the American approach to experimentation.[4] According to this approach an evolution of the rational choice approach towards behavioral economics is all that is required whereas some of the

[4] Here American may be taken to include leading researchers like Aumann or Binmore.

older scholars like Reinhard Selten and Werner Güth (see, e.g. Selten, 1990; Selten, 1999; Güth, 2000) persist in emphasizing that a more radical paradigm shift towards bounded rationality (see Simon, 1985) is needed (see below 3.).

The fact that a Nobel price has been awarded to Vernon Smith and David Kahneman in 2002 testifies that experimental economics has firmly established itself as part of academic economics. As far as the relationship to psychology is concerned, it seems significant that a psychologist and an economist jointly received the price. That is not to say, though, that the two fields have merged now. Significant differences remain. The much stronger emphasis economists put on monetary payoffs and on rational equilibrium behavior is presumably at root of the most prominent such differences.

Daniel Kahneman comments on such differences with respect to selfishness, rationality, and unchanging preferences (see Kahneman (2003)). He reports that he realized for the first time in the early 70th (when reading a paper of Bruno Frey) the huge gap between economists' and psychologists' assumptions about human behavior. He mentions the ultimatum game (see Güth et al. (1982)) as influential in convincing quite a few economists – the social psychologists had never doubts about this – to take motives beyond (monetary) self-interest into account. Yet, other than the psychologists – economists tried to neutralize the impact of what first seemed to be a blow to their rational choice approach by modifying the maximand (see, among many others, for instance, Bolton (1991)). They gave up the view that the maximization of expected monetary income subject to external constraints would approximately represent preferences among (risky) prospects.[5]

Modifications of the utility function (see Fehr & Schmidt (1999); Bolton & Ockenfels (2000) and among the many criticisms a most recent one by Bergh (2008)) that allowed to uphold the traditional maximization framework were well received by greater parts of the profession. The modifications allowed keeping intact the analytical apparatus of economics. Merely somewhat more complicated utility functions were needed. Otherwise economists could go on with their narrative of the old maximization under constraints story.

[5] Beyond attitudes to risk motives relating to value dimensions completely distinct from personal income were allegedly revealed in choices.

The earlier prospect theory of Kahneman and Tversky (1979) and some of the subsequent research inspired by it are mainly of the same kind. Only later on these developments gave rise to a more fundamental change of emphasis. They led to an analysis of basic and generally effective cognitive processes that explain why and under what conditions human decision making does not follow clear cut rationality rules (see also Brandstätter, Gigerenzer, & Hertwig (2006)).

2.2.3. Neuro-psycho-economics

The third rather new orientation rests on an alliance of neuroscience, psychology, and economics (or neuropsychology and economics, see also the special issues of the journals “Analyse & Kritik” (Vol 29, 1, 2007) or Economics and Philosophy (Vol. 24, 3, 2008)). It is hoped that observing and measuring the neural processes (for example with functional magnetic resonance imaging fMRI) correlated with cognitive and behavioral processes would allow to differentiate more clearly between apparently (superficially) uniform, but actually heterogeneous mental processes (e.g., seeking impulsively immediate versus self-controlled delayed gratification could involve different brain regions). Moreover, subconscious mental processes that are not accessible to self-reports could be made visible.

There exists already an Association for NeuroPsychoEconomics founded in 2004. The (probably) first NeuroPsychoEconomic conference was held in Munich October 2008. Two journals: NeuroPsychoEconomics in German and Journal of Neuroscience, Psychology, and Economics in English deserve to be mentioned as well.

The inclusion of neurophysiology in such a multidisciplinary venture seems to convey the impression of a „real“ science (Naturwissenschaft). In that regard it is clearly most appealing to many economists who always felt a yearning for becoming part of so-called “hard science” and, for that matter, a mathematized variant of it. It fits in here that the new approach is presumably best classified as a brand of „neurophysiological behaviorism”. As such it is especially welcome to those researchers who are brought up in the economic skepticism about mentalistic concepts. As far as this is concerned it remains to be seen whether a „neuro-based“ multidisciplinary approach really leads to a less equivocal definition and measurement of causal and mediating variables.

In the future we will perhaps not only assess the adequacy of decision theoretic modeling in action, payoff and cognitive space but also in "neuro-space". Regardless of any reservations about the sometimes overblown expectations concerning neuro-psycho-economics the nascent field is at least heading in the right direction of integrating the disciplines. Such integration has been under its way also in the institutional and educational realm.

2.3. Institutional and educational aspects of the emergent field of "economics and psychology"

Research traditions establish themselves not only by means of paradigmatic studies. They do so also by means of institutions. Science is a social process itself (as pointed out most notably in Fleck (1935/1980) and later Kuhn (1962)). It has its own incentive structures and can be subject to institutional (economic) as well as organizational (psychology) scrutiny (see on this Albert (2006)). As far as the basic organizational structure of a discipline is concerned the process of recruiting adherents and the establishment of learnt societies and journals are crucial. Our account would be incomplete without drawing attention at least to some of these elements subsequently.[6]

2.3.1. Teaching new lessons

Within the tradition of Katona and Schmölders, at the then newly founded University of Augsburg a curriculum of socio-economics (with important contributions from social and economic psychology) was developed in the early 70ties. In 1972 the economist Burkhard Strümpel (for some years in the 60ties student and research assistant of Günter Schmölders) then senior researcher at the Institute for Social Research (ISR) at the University of Michigan in Ann Arbor, was visiting professor at the University of Augsburg. His experience in and enthusiasm for socio-economics helped very much in giving psychology and sociology the proper weight in the interdisciplinary cooperation between economics, business administration, sociology, and psychology.

[6] Some of the examples we selected simply because it so happens that we have some first-hand knowledge. Yet we do not claim that these are the ones deserving to be mentioned above all others.

The experience of the authors of this paper may be used to illustrate subsequent developments in teaching in an exemplary manner. For instance, at the University of Linz post-graduate Summer Schools in economic psychology took place in 1990 and 1993. Quite a few of the post-graduate participants later made remarkable careers as economic psychologists or behavioral economists. Renowned (mostly European) psychology and economics professors were recruited from both psychology and economics as teaching staff. Since 2007 the idea of bringing together economists and psychologists, occasionally joined by representatives of related disciplines, every year in a four week long Summer School for PHD students could be realized by the Max Planck Institute of Economics in Jena (in cooperation with several other research institutions). As this shows things are moving on at the inter-disciplinary frontier here.

2.3.2. Learnt societies and journals

2.3.2.1. Associations

Early in the 70ties Reynaud (Strasbourg) and Gery van Veldhoven (Tilburg) invited colleagues to participate in two first informal meetings of economic psychologists. An informal “European Research Group of Economic Psychology “ started annual colloquia in 1976.

As a consequence of these early meetings, the International Association for Research in Economic Psychology (IAREP) was founded in 1982 with predominantly European members. In the same year started the activities of the Society for the Advancement of Behavioral Economics (SABE mainly with North-American members). IAREP organizes annual colloquia and, since some time now, every second year together with SABE. Both societies characteristically approach economic behavior from the social science perspective with a great variety of topics and members from many different countries. Already in 1977 the Society for Experimental Economics (Gesellschaft für experimentelle Wirtschaftsforschung, had been founded by Heinz Sauermann attracting experimentally working economists from the German speaking countries as members.

2.3.2.2. The Journal of Economic Psychology (JEP)

The Journal of Economic Psychology, published under the auspices of the International Association for Research in Economic Psychology, was founded in 1981 and developed quite well during the past 28 years with an increasing variety of research topics. Consumer behavior, individual decision making, financial behavior and investment, cooperation and competition are the subject categories most frequently represented in JEP (cf. Kirchler & Hölzl (2006)). Netherlands, UK, Germany, Sweden, Belgium, and Austria (in that order) are the European countries with the highest number of contributions to the journal. The relative frequency of contributions from the German speaking countries has increased from 2 % (1981-1989) to 16 % (2000-2008) according to the Social Science Citation Index (SCCI) records.

Whereas Katona was most often cited in the early volumes of JEP, Kahneman and Tversky took the lead in the later volumes. The most cited psychology journals are Journal of Personality and Social Psychology, Psychological Bulletin, Psychological Review, and American Psychologist. The top economic journals (in terms of citations by JEP authors) are American Economic Review, Econometrica, Quarterly Journal of Economics, and Journal of Political Economy (cf. Kirchler & Hölzl (2006)). This obviously means that economic psychology, as understood by the editors and contributors of JEP, is a field of research common to psychologists and economists. The most often (132 times until 2005) cited JEP paper is that of Güth and Tietz (1990) on ultimatum bargaining. Experimental games attract the interest of increasing numbers of researchers in the field of economic psychology and behavioral economics.

That the psychological approach to the study of economic problems has matured by now is documented by books such as, “The handbook of economic psychology”, edited by Fred van Raaij, Gery van Veldhoven and Karl-Erik Wärneryd in 1988, “Wirtschaftspsychologie, Grundlagen und Anwendungsfelder der Ökonomischen Psychologie” [Economic psychology, basics and fields of application] written by Erich Kirchler (1995), and “The Cambridge handbook of psychology and economic behaviour” (Lewis, 2008). The experimental economics tradition in the German speaking countries is impressively documented by the collection of widely known

articles, edited by A. Sadrieh and J. Weinmann (2008) on behalf of the Society for Experimental Economics. Again the maturity of the research program seems obvious.

3. From abstract towards cognitive economics?

The precedingly sketched developments notwithstanding the behaviorist legacy lingers on in economics. It hampers the development of an empirical theory of decision making that could be put in place of the conventional "logic of rational decision making" (3.1.). We acknowledge, however, that the "logic of decision making" is not only the most developed part of economics as a discipline. It holds the discipline together by forming an integral part of the socialization process of any economist. On the other hand, the logical must be moved closer to a psychological theory of decision making if economics is to become a truly empirical science. Below (in section 3.2) we will outline such a move. Starting from one of the most abstract examples of an economic account of interactive decision making, the "strategic form" representation of a game, we ask how to re-interpret this in a cognitive economics way. If this can be plausibly done then it should be possible to move any less abstract model towards an interpretation in terms of cognitive processes as well.

3.1 Economists being of two minds

As mentioned above the development of economics in the first half of the 20th century was parallel to that of psychology as sketched above. There was first a move against free flowing speculation which led into some sort of behaviorism. Then, in particular in game theory, a full-fledged mathematical account of intentional optimization and of human reasoning about knowledge (see Fagin, Halpern, Moses & Vardi (1995)) in interactive situations was developed on amazingly short notice (most notably, of course, in Neumann & Morgenstern (1944)). However, other psychology economics could not rid itself of some of the more problematic methodological aspects of behaviorism.

In particular, according to the still prevailing economic point of view, it is not necessary to shed theoretical light onto the mental processes that lead individuals to generate the behavior that allegedly reveals their preferences along with their beliefs. Most economists are even today happy to treat preferences as a primitive that is "given". They claim that it is necessary to start from directly observable facts like

revealed individual preferences because otherwise the inter-subjectivity of their theory would be endangered.

More specifically, according to the standard economic view, the given preferences and beliefs of each individual i can be revealed in choice making and then stenographically be represented by a pair (u_i, p_i). Function u_i being a so-called "cardinal" representation of preferences of actor i and p_i his beliefs concerning states of the world. With this in hand, the results of idealized rational choice making could be predicted from an optimization under the structural constraints of the situation as imposed either by external scarcity constraints or by other individuals.

Quite tellingly, in the accompanying textbook illustrations the decision-making itself was described always "as if" the choice maker would choose an alternative x over y "because" x had the higher utility. That conveyed the mistaken impression that according to the underlying theory the mental representation of expected utility would "cause" the choice. However, in truth the revealed preference approach was completely silent on the factors that would in fact cause the observed choice making. On the basic level the assignment of utility was just representing the outcome of the causal processes leading to the observed choices (see for a criticism of revealed preference (Sen 1973/1982)).

Of course, economists knew that in the last resort the utility function assigns higher utility to x because x would be chosen in the presence of y (and not the alternative due to its higher utility). They understood that modern utility only represented the ranking of alternatives as revealed in choice. But they wanted to have it both ways, on the one hand, base their theories on observational data only and, on the other hand, describe individual behavior in teleological terms alluding to the common framework of – directly unobservable – intentions, desires, expectations etc.

Following the behaviorist precept of treating individuals as black boxes altogether would, however, not be in harmony with the traditional use of "teleological" terms in economics. If taken seriously, a behavioral or purely externalist interpretation of the utility function can not make use of the rankings provided by that function as reasons for action in internal decision-making processes. However, the latter use has been

made throughout in decision-models in particular of interactive decision-making. The prevailing way to describe observed behavior had it – and perhaps still is -- that the individuals would consciously choose according to the utility function. Contrary to the proper interpretation of the underlying utility concept they would choose x over y *because* x has the higher utility. Yet, adequately interpreted, the function is merely a stenographic representation of choices.

In view of the preceding, the complaint against the "optimization under constraints" approach endorsed by much of classical game theory as well as modern micro-economics is not merely that it ascribes super-human cognitive abilities to individuals. It also mixes externalist (or behaviorist) perspectives in which preferences (and the utilities representing them) do *not* serve as reasons for choice making, with perspectives in which they are used as reasons for choosing to act.[7]

To avoid making wildly unrealistic assumptions and the mixing of incompatible perspectives, developing something like "cognitive economics" seems to be required. According to our discussion in section 2 of this paper the development of such a research program seems under its way from the cognitive psychology side. To get it moving from the abstract economic modeling side seems desirable but a much more difficult task. So-called behavioral economics may be part of the story. However, it stays presumably too close to home with respect to the optimization under constraints paradigm. It tries to integrate the effects of the cognitive processes into the utility function rather than to incorporate them as such into the models. It is also still plagued by the ambivalence concerning the utility function and allegedly given preferences.

3.2. Starting from where we are?

The preceding remarks notwithstanding, like adherents of behavioral economics we acknowledge that the established abstract economic paradigm has "capital value". Rather than treating it as a sunk cost we suggest to take it as a starting point and see how we might move from where we are in economics towards where we might want

[7] On the one hand the use of reasons as causes of action is ruled out on the other hand action is seen as the outcome of reasoning and as being caused by the reasons showing up in reasoning.

to get. To do so we suggest to go back to the beginnings of the decision theoretic analysis of interactive decision making. Of course, this move back to the roots is merely conceptual since we cannot erase the intellectual history that brought as where we are. However, the conceptual exercise might help us to understand how some of the insights of the logic of decision making can be incorporated into a cognitive economics framework that is closer to real mental processes than the ideal type logic.

Looking back at the development of game theory the arguably most decisive innovation was the rather simple one of the then so-called “normal form” of a game (see instructively on the central role of the normal form representation, Aumann (2000), paper 1). The tabular representations of “(bi-)matrix” games furthered the ascent of game theory as a conceptual tool tremendously. Clearly the simplicity of that tool cannot completely be replicated within a cognitively richer framework incorporating psychological insights. Nevertheless, the question of how the logic of situations represented by a strategic form can be embedded into the richer framework as a kind of limiting case is crucial if we intend to show that there is a continuity of the old with the new and modified framework.

3.2.1. A satisficing approach

To reformulate the preceding section in methodological terms we can state that one central negative heuristic of the research program of neo-classical economics is the requirement not to fiddle around with the assumption of given and well-behaved preferences (see on negative heuristics, Lakatos (1978)). According to a central “do not of his trade” the economist has to accept preferences for what they are and must not look into the process of their formation. However, homo sapiens does not have well-behaved given preferences that can be represented by utility functions nor does he reason probabilistically such that standard expected utility theory can be applied to represent his ordering among risky prospects.

Homo sapiens is too constrained in his reasoning abilities to describe his choices in the standard way. This does not mean, however, that he does not reason at all. Quite to the contrary homo sapiens commands faculties of forward looking deliberation to a greater extent than any other animal. However, to acknowledge that, is not

tantamount to the claim that homo oeconomicus is a perfect reasoner. He is a boundedly rational one seeking to fulfill aspirations rather than to optimize.

In the following we will use the idea of satisficing (Simon (1957)) as our inspiration. The basic ingredients of that satisficing approach are

- aspiration formation, meaning that we specify discrete achievement levels for one or more objectives which we try to achieve (in our programmatic discussion we will confine ourselves to just one – numerically representable – goal),
- searching for decision alternatives which hopefully satisfy these aspirations, and
- aspiration adjustment (Sauermann & Selten (1962)) in the light of the search success, i.e., by forming more (less) ambitious aspirations when satisficing has been easy (not possible so far).

We submit that human individuals will use the three aforementioned sub-processes generally in the order they are presented. This is a weak empirical claim. Yet such weak claims not withstanding the satisficing approach is too flexible for deriving any substantive conclusions.[8] It has too little structure to rule out certain phenomena. Stated in as general terms as before almost anything goes. As described the satisficing process contains no basis for an inherent trial and error dynamic. Even as a metaphor it is non-suitable to support learning, teaching, or advising economic actors how to improve their behavior. A stronger concept of satisficing is necessary if a bounded rationality approach is to become more than another language to describe phenomena.[9] But that language at least can help to move economic rational choice approaches closer towards cognitive psychology. As a first step towards this end the language provided by ideal game theory needs to be re-interpreted. We try to do so for one of the most abstract and in that sense difficult uses of that language subsequently, a so called “strategic-form” game representation of a situation of

[8] It is in good company here. The classical and related Aristotelian views of the so-called topic and the topoi catalogues in forming arguments as well as passing judgments suffer from the same weakness of imposing practically no constraints on what is justifiable by them. It may also be observed the main methodological complaint about neo-classical economics is also that it does not have empirical content since it is too flexible a language for excluding anything from its accounts.

[9] Neoclassical economics and game theory provide a Lingua Franca that is understood by all economists. This is no small achievement but in view of the fact that the terms used have very little psychological content it is hard to relate the language to the actual processes of decision making. The problems that decision makers face from an internal point of view to their purposeful decision-making are much closer to the satisficing approach. Nevertheless, without additional structure the description in such terms does not provide testable and definitive hypotheses.

interactive decision making. If it can be done in this then it should be possible to do it in less hard cases.

3.2.2. Objects of knowledge

Interacting individuals influence each other causally. Their mutual influence is exerted according to “laws of nature”. Classical game theory conceptualizes the laws of nature as rules of a game. All facts that are relevant to the interaction and at the same time are beyond the strategic or intentional influence of the players in a game form part of the “rules of a game” G. As a set of rules G is determined by the laws of nature and other natural facts along with elements that in a more conventional sense of that term are conceptualized as rules of the game.

A causal analysis of a game might conceivably avoid all references to intervening “mental models”. However, the focus on law like statements does not imply that we go to such extremes as behaviorism. There can be causal analyses in which such intervening factors like mental models play a crucial role. In line with this, in cognitive psychology intervening explanatory variables based on theoretical concepts show up within law like (causal) regularities. More generally speaking, a model of how individuals reason is of the essence of adequate explanations of their choice making behavior. Instead of ascribing an ideal type of rationality to individuals and to assume – contrary to the facts – that they are led by the logic of the situation itself we should rather get handles on their less than ideal reasoning behavior. To that effect economics needs to locate itself on the middle ground on which cognitive psychology has already been established (Table 2).

Table 2. Game theory in perspective of psychological behaviorism and cognitive psychology

Behaviorism laws ranging over overt behavior	Cognitive psychology laws ranging over mental concepts "Cognitive economics"?	Game theory as logic or "reasoning about knowledge"

In orthodox (eductive) game theory, analyses of interaction are framed such that on the ultimate level the game becomes a well-defined common object of reasoning for which well-defined solution concepts can be developed (see Harsani & Selten (1988)). For that purpose the game must be commonly known to all individuals who participate: All players command the same theories of rational action and the same ideal capacities to reason along with a commonly shared perception of the game. Moreover, all this is common knowledge. Using $\hat{G}_i, i = 1, 2, ..., n$ as indicating the subjective perception of G by individual i we can state the crucial knowledge requirements of eductive game theory slightly more precisely in the following way (from now on variables with a "cap" relate to subjective perceptions of the variables without the cap):

(i) $\hat{G}_i = G$ for all *i = 1,…,n*

(ii) all *i = 1,…,n* believing in (i) and

…

(ik) all *i = 1,…,n* believing (i) to (ik-1) ad infinitum

According to (i) all players perceive game G properly,(ii) requires that they all are aware of (i), and (ik) that all believe in all former requirements (i) to (ik-1). The difficulty of forming a common object of knowledge has led to some of the philosophically most intriguing developments in (eductive) game theory. Except for extremely simple situations of interactive decision-making the assumptions of these theories are, however, not even approximately exhibited by actual human thought processes. They are contrary to fact all the way. Therefore the idealized reasoning

processes corresponding to the game theoretic logic of the situation clearly cannot serve as elements of factual explanations.[10]

As a response to this some game theorists again tried to eliminate all mental concepts, all intentions and reasoning from their explanations. Other than the older behaviorists they gave up on providing explanations in terms of proximate causes and turned to evolutionary game theory. This move may be adequate in answering some questions concerning "ultimate causes".[11] However, we are interested also in proximate causes. As far as proximate causes are concerned referring to mental processes and mental models seems unavoidable. Therefore the problem of how to include an appropriate cognitive element into game analyses does not go away.

3.2.3 The strategic form as a mental object

The most abstract description of a non-co-operative game is the strategic form representation. As opposed to extensive form representations of games, in the strategic form no information sets relating to states of knowledge that may be reached during the play of a game show up. To put it slightly otherwise, the states of information are concealed from our view. Therefore the natural way to locate reasoning entities at information sets is closed off. In this sense the strategic form representation is the hardest test for re-interpreting game theoretic concepts in a bounded rationality approach.

We confine ourselves to stochastic "strategic form games" without any common knowledge assumption. Our "objective strategic form games" are of the generic form $G = (S_1,\ldots,S_n;\ u_1(.),\ldots,u_n(.);Z)$.

This (objective) generic form G should be interpreted as a theoretical mathematical characterization of how "the world lies". Though the (objective) generic form is introduced merely as a conceptual link to formal game theory it should be kept in mind that other than in large parts of traditional mathematical game theory we do not make a claim to common knowledge of the full object. Human individuals – either as

[10] They may form potential explanations in the sense of Nozick though, see Nozick (1974).
[11] The proximate cause of arctic hares being white is rooted in the fact that their fur reflects light of a certain wave length; the ultimate cause is to be seen in the fact that predators will catch less of the lighter than of the darker hares in an arctic environment.

participants or as external onlookers – need not know all the details of the theoretical object G referring to the interactive situation. Bearing that in mind the following elements seem most relevant:

Table 3

$n(\geq 1)$	the number of players *i =1,…,n*
$S_i(\neq \varnothing)$	the set of player i's strategies $s_i \in S_i$
$s = (s_1,...,s_n) \in \underset{j=1}{\overset{n}{x}} S_j$	a strategy vector *s* specifying a unique strategy s_j for each player *j*
$u_i(s,z)$	player *i*'s payoff depending on $s \in \underset{j=1}{\overset{n}{x}} S_j$ and chance moves $z \in Z$
Z	the set of chance events $z \in Z$ and

We do not presuppose that objective or subjective priors for the chance events $z \in Z$ exist. Moreover, we will not confine ourselves to uncertainty with respect to chance moves. In case of $n \geq 2$ we include uncertainty concerning others' behavior.

According to the view endorsed here, G captures the objective structural aspects of the decision environment. In this environment the n interacting players who can be individuals or teams of individuals (e.g., firms competing on some market) are located. The players form a mental model of the environment in which they interact.

In general, each player *i*'s game representation may and will be a far cry of the full object G. Each individual player *i=1,…,n,* may perceive the game G differently by reducing it in his perception to an object of manageable complexity, i.e. a game $\hat{G}_i$.

This reduction need not be a conscious simplification at all. The reduced perception $\hat{G}_i$ simply emerges and as such may involve

- $0 < \hat{n}_i < n$. This reduction in the number of strategic actors in the representation can emerge because *i* may consider the possibility of strategic interaction with some players $j \neq i$ in G as too far fetched or may be oblivious of their existence as strategically reasoning entities (for example, a firm in its

seller role may not consider its customers as strategically deliberating in the interaction),

- $\varnothing \neq \hat{S}_i \overset{\subset}{\neq} S_i$. This reduction to a subset of strategies will occur should i neglect some of the choices available in G (for example, proposers in ultimatum games often consider only prominent choices like, 1/2, 2/5, 1/3 of shares of the pie when deciding how much to offer to the responder; see Güth, Schmidt, and Sutter (2007). for a large data set.)
- $\hat{u}_i(\cdot) \neq u_i(\cdot)$. This occurs if i relies on some conjectural payoff function that typically will be defined merely on a subset of the set $\underset{j-1}{\overset{n}{X}} s_j$ and may also be based on a misperception or neglect of certain dependencies (for example, by excluding feedback effects in partial equilibrium analysis), and
- $\varnothing \neq \hat{Z}_i \neq Z \wedge \hat{Z}_i \subset Z$. This emerges should i disregard some of the possible chance events (for example, if *i* leaves out of account events like rare catastrophes which did not materialize in the more recent past though such "black swans" may as well appear on the scene).

The preceding means that the true game G may be perceived as very different "games" $\hat{G}_i$ by the interacting parties $i = 1, . - .., n$. Whenever $n \geq 2$ is fulfilled at least two incompatible subjective models of the true interaction G may be around.[12]

The conceptualization of games used here does away not only with the conventional common knowledge assumption. It also avoids modeling ignorance up to the level on which common knowledge of strategic actors can be assumed. In the limit $\hat{n}_i = 1$ for all *i=1, 2,…,n*. Then none of the $n(\geq 2)$ interacting parties perceives the decision task as involving a strategic interaction in the proper sense[13].

[12] More traditional mathematical game theory acknowledges that as a matter of fact such differences in perception can have an impact on the course of the interaction itself. But it needs to capture them as commonly known levels of ignorance (including ignorance of player types). The presence of fictitious moves of nature leading to different games is assumed to be commonly known by all players such that on some ultimate level common knowledge of a game as an object of reasoning may be assumed and the reasoning process based on common knowledge may start. -- Admittedly the strategic form representation is from the outset less than ideal to capture such reasoning.

[13] In economics a case in point would be monopolistic competition (Chamberlain (1933); Robinson (1933)) where sellers compete in serving demand but neglect their mutual dependency (see Güth and

We will restrict our attention to mental representations $\hat{G}_i$ of the game G that differ for *i=1,…,n* from G merely in two exemplary ways:

- Player *i* does not take into account all the possible constellations
  $s_{-i} = (s_1, ..., s_{i-1}, s_{i+1}, ..., s_n) \in \underset{j \neq i}{X} S_j$
  of others' behavior. Restricting his attention on some non-empty subset $\hat{S}_{-i}$ of $\underset{\substack{j=1 \\ j \neq i}}{\overset{n}{X}} S_j$ *i*'s idiosyncratic expectations of others' behavior are of the form
  $\hat{s}_{-i} = \left(\hat{s}_1, ..., \hat{s}_{i-1}, \hat{s}_{i+1}, ..., \hat{s}_n\right) \in \hat{S}_{-i}$.
- For each player *i=1,…,n* it is possible that $\hat{Z}_i \neq Z$.
  The $\hat{z}_i \in \hat{Z}_i$ are the chance moves player *i* perceives as possible.

The preceding two ways in which the mental representations $\hat{G}_i$ of the relevant game G can deviate from each other and from G are obviously not the only conceivable ones. Other such restrictions must be taken into account. However for the purposes of illustration it suffices to focus on the two.

3.2.4 Non-probabilistic satisficing and equilibrium

Consider a player i in a game G whose mental representation $\hat{G}_i$ of G can differ according to $\hat{S}_{-i} \neq S_{-i}$ and $\hat{Z}_i \neq Z$ from that of other individuals $i \neq j$. We define $st_i = \left(\hat{s}_{-i}, \hat{z}_i\right)$ with $\hat{s}_{-i} \in \hat{S}_{-i}$ and $\hat{z}_i \in \hat{Z}_i$.

The state st_i is perceived as possible by player *i*. Accordingly

$$St_i = \left\{ st_i = \left(\hat{s}_{-i}, \hat{z}_i\right) : \hat{s}_{-i} \in \hat{S}_{-i} \text{ and } \hat{z}_i \in \hat{Z}_i \right\}$$

is the set of states st_i, envisioned as possible by player *i=1,…,n*. The set captures others' behavior as well as chance events as considered by *i*.

Huck (1997) for a more recent evolutionary justification). Likewise, many simple types of decision making advice in business administration and management science seem to be of the same kind.

Furthermore, it is assumed that each player *i=1,…,n* forms an aspiration profile $A_i = \left(A_i\left(st_i\right)_{st_i \in St_i} \right)$ of aspiration levels $A_i\left(st_i\right)$ for each of the states $st_i \in St_i$ whose emergence cannot be excluded by *i*. A specific choice $s_i \in S_i$ by player *i* satisfies A_i if

(*) $u_i\left(s_i, st_i\right) \geq A_i\left(st_i\right)$ for all $st_i \in St_i$.

Here $u_i\left(s_i, st_i\right)$ is the payoff resulting for the strategy vector $\left(s_i, \hat{s}_{-i}\right)$ and chance move $\hat{z}_i$, i.e., $u_i\left(s_i, st_i\right) = u_i\left(s_i, \hat{s}_{-i}, \hat{z}_i\right)$. For a given aspiration profile A_i of player *i* the satisficing choice set

$S_i^*\left(A_i\right) = \left\{ s_i \in S_i : s_i \text{ satisfies } A_i \text{ in the sense of (*)} \right\}$

is therefore the intersection of $\#St_i$ weak inequalities ($\#St_i$ = the number of elements of set St_i). Such a set $S_i^*\left(A_i\right)$ can be empty when *i*'s aspirations are too ambitious and quite large when *i*'s aspirations are very moderate. Whenever $s_i \in S_i^*\left(A_i\right) \neq \varnothing$, we say that the aspiration profile is "satisfiable", while, whenever player *i* chooses some element $s_i \in S_i^*\left(A_i\right)$, we say that player *i* is "satisficing".

The aspiration profile A_i^* is optimal if it is undominated in the set of satisfiable aspiration profiles A_i with $S_i^*\left(A_i\right) \neq \varnothing$, i.e., if

- $S_i^*\left(A_i^*\right) \neq \varnothing$, i.e., satisficing of player *i* is possible, and
- for alternative aspiration profiles $A_i\left(\neq A_i^*\right)$ with:

  - $A_i\left(st_i\right) > A_i^*\left(st_i\right)$ for some $st_i \in St_i$

  - $A_i\left(st_i\right) \geq A_i^*\left(st_i\right)$ for all $st_i \in St_i$

  one has $S_i^*\left(A_i\right) = \varnothing$, i.e., it is not possible to achieve more than aspired by A_i^* in some state st_i and not less in other states where we focus only on states which player *i* does not exclude.

For any optimal aspiration profile A_i^* of some player *i=1,…,n* we, furthermore, say that all the choices $s_i^* \in S_i^*\left(A_i^*\right)$ are optimal in view of our non-probabilistic approach. Note that both, expected payoff or utility maximization, imply our more basic concept

of optimality but not vice versa. This, however, does not exclude that for each $s_i^* \in S_i^*\left(A_i^*\right)$ one may find preferences predicting this choice s_i^* by player *i* (see Fellner, Güth & Maciejovsky, forthcoming, for such an attempt).

How is this related to game theory, especially to its familiar equilibrium concept (Cournot (1938); Nash (1951))? For $\#\hat{S}_{-i}=1$, i.e., player *i* entertains only one expectation concerning others' behavior, $s_{-i} \in \hat{S}_{-i}$ where s_{-i} denotes others' true behavior, and $\hat{Z}_i = Z$ one can say that player *i* has rational expectations. Thus, if for all n players *i=1,…,n*, one has

- $s_i^* \in S_i^*\left(A_i^*\right)$, i.e., optimality, and
- $s*_{-i} \in \hat{S}_{-i}$, $\#\hat{S}_{-i}=1$, and $\hat{Z}_i = Z$, i.e., rational expectations,

the common optimality of $s^*=\left(s_1^*,...,s_n^*\right)$ and the general rational expectations define some more general equilibrium concept than the traditional one of game theory. It is more general due to its non-probabilistic nature allowing the n players to disagree about and, even more dramatically, not to specify at all their idiosyncratic probabilities for the various chance moves $z \in Z$.

In case of $\#Z=1$, i.e., a game G without chance events, the two equilibrium notions coincide. This is admittedly an extreme case. Nevertheless, the preceding demonstrates that there is a continuity between a satisficing approach exhibiting some structure and an approach based on traditional equilibrium notions. Therefore we may conclude that pursuing empirical research within such a conceptual framework could be a matter of evolution of the original economic towards a cognitive economics framework.

Moreover, as far as the experimental rather than the merely conceptual is concerned, the approach is open to incorporate some of the insights of experimental economics along with the insights of psychologists who have always been relying on questionnaire responses concerning intentions, plans and aspirations. In testing satisficing as applied to decision theoretic problems without strategic interaction (Ajzen, 1991) it became clear that the predictive value of non-incentivized statements of aspiration levels was very poor. The same holds good with respect to interactive

decision making. Without incentivizing aspiration formation, i.e., when just asking for aspirations which have no direct material implications, the support of the satisficing hypothesis was at best “mixed” (about one half of the participants on average, see Güth (2007) as well as Güth, Levati & Ploner (2008)). However, by paying participants only the profit aspiration when it has been achieved by the actual profit or by the highest achieved profit aspiration results can be improved. At least in some new experiments the evidence confirms the satisficing hypothesis rather strongly – after some rounds of a repeated oligopoly experiment nearly all participants were satisficing although more than half of them did not meet our basic optimality requirement (see again Güth, Levati & Ploner (2008)). We conclude from the results so far that belief and aspiration formation should be incentivized when testing the satisficing hypothesis. This is similar to the tradition of monetarily induced choice elicitation which is predominant in experimental economics. This adds experimental economic experience to the conceptual continuity stated before.

4. Final observations

Neo-classical economists tend to believe that understanding the so-called “logic of the situation” and determining what was the rational choice in that situation can “explain” -- in the sense of an empirical science explanation -- how individuals act in such situations. However the argument, as it stands, neglects the fact that it can not be logic but must be (simple) empirical psychological laws that do the empirical explanatory work. If the argument from the “logic of the situation” is meant to become an empirical explanation meeting at least some rudimentary standards of the covering law model (see Hempel & Oppenheim (1948)) then there must be an empirical law involved. One such law could for example be: “human individuals can in general represent a situation in a cognitive model and thereby understand its full rational choice logic” (obviously true only for very simple situations).

Another example would be: “human individuals do in fact act according to the dictates of optimization under constraints in view of their cognitive models”. If valid, this “law” would yield correct empirical explanations. Yet this is a very big “if”. Acknowledging this, most economists argued that human individuals merely acted “as if” they were

reasoning in the complicated ways ascribed to them (see for instance Alchian (1950); Friedman, (1953/1966)).

In particular Hans Albert has attacked this view. Even within the more traditional context of economics as a study of market behavior he insisted that an empirical scrutiny of human behavior on markets cannot be based on a "logic of rational decision-making". It must rather become a "sociology of markets". However, the sociology of markets had to be based on psychological laws concerning the behavior of homo sapiens.[14] The "nomological" basis of empirical explanations will be the same laws of human behavior (as already required in Hume (1739/1978)). Those laws derive, in the last resort, all from psychological ones. The laws governing satisficing are no exception to this. They can and should be used such as to lead to an evolution of economics towards cognitive economics and thereby towards cognitive psychology rather than in a revolutionary effort to substitute economics by psychology.

[14] Lest they rejoice unduly here, traditional sociologists should be warned that Albert believes that there are no genuinely sociological laws either.

Table 4: Some central differences of psychology and economics

Aspect	Economic psychology	Economics
Main type of theory	Factual or positive (trying to explain actual behavior)	Contrary to Fact or Normative (trying to define perfectly rational behavior)
Main method	Range specific theory development in the light of empirical findings (mostly non-formal except when overlapping with mathematical psychology)	General axiomatic modeling of very complex situations (economies, markets, households, etc.)
Evaluation of theory	Statistical methods in particular applied to specific hypotheses	Standards of mathematical elegance, simplicity, and qualitative problem adequacy Statistical analysis mainly of whole models
Main type of data	Questionaire & experimental data	Official statistics if data were used at all, a few choice experiments to test assumptions

References

Ajzen, I. (1991). The theory of planned behavior. *Organizational Behavior and Human Decision Processes*, *50*, 179-211.

Albert, H. 1967/1998, Marktsoziologie und Entscheidungslogik. Zur Kritik der reinen Ökonomik, Tübingen.

Albert, H. 2006, Die ökonomische Tradition und die Verfassung der Wissenschaft. *Perspektiven der Wirtschaftspolitik,* 7, 113-131.

Alchian, A. A., 1950, Uncertainty, Evolution, and Economic Theory. *Journal of Political Economy,* 58, 211-221.

Aumann, Robert J., 2000, Collected papers I & II, Cambridge, Mass.: MIT Press

Bergh, A., 2008, A critical note on the theory of inequity aversion. *Journal of Socio-Economics*, 37.

Bolton, G. E. (1991). A Comparative Model of Bargaining: Theory and Evidence. *American Economic Review*, (5), 1096-1136.

Bolton, G. E. & Ockenfels, A. (2000). ERC: A Theory of Equity, Reciprocity and Competition. *American Economic Review,* 90.

Brandstätter, E., Gigerenzer, G., & Hertwig, R. (2006). The priority heuristic: Making choices without trade-offs. *Psychological Review*, 113, 409-432.

Brennan, G., Güth, W., & Kliemt, H. (forthcoming). Approximate Truth in Economic Modelling***,*** *Homo Oeconomicus*.

Chamberlin, E. H. (1948). An Experimental Imperfect Market. *Journal of Political Economy,* 56.

Chamberlin, E. H. (1933). The Theory of Monopolistic Competition – A Reorientation of the Theory of Value. Cambridge.

Chammah, A. M. & Rapoport, A. (1965). Prisonner's Dilemma. The University of Michigan Press, Ann Arbor.

Fagin, R., Halpern, J. Y., Moses, Y. and Vardi, M. Y. (1995). Reasoning about Knowledge, Cambridge, MA / London, MIT Press.

Fehr, E. & Schmidt, K. (1999). A Theory of Fairness, Competition, and Cooperation. *Quarterly Journal of Economics,*114.

Fellner, G., Güth, W. & Maciejovsky, B. Satisficing in Financial Decision Making – A Theoretical and Experimental Attempt to Explore Bounded Rationality. (forthcoming) in: *Journal of Mathematical Psychology*.

Fleck, L. (1935/1980). Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv, Frankfurt. Suhrkamp.

Frey, B. (1971/1990). Ökonomie ist Sozialwissenschaft. Die Anwendung der Ökonomie auf neue Gebiete. München:Vahlen.

Frey, B. S. (2008). Happiness: A revolution in economics. Cambridge, MA: MIT Press.

Friedman, M. (1953/1966). The Methodology of Positive Economics. Essays in Positive Economics. M. Friedman. Chicago, Chicago University Press**:** 3-46.

Gode, D. K. & Sunder, S., 1993, Allocative Efficiency of Markets with Zero Intelligence Traders: Markets as a Partial Substitute for Individual Rationality. *Journal of Political Economy*,101.

Güth, W. (2000). Boundedly Rational Decision Emergence - A General Perspective and some Selective Illustrations. *Journal of Economic Psychology*, 21, 433-458.

Güth, W. (2007). Satisficing in Portfolio Selection – Theoretical Aspects and Experimental Tests. *Journal of Socio-Economics* 36, 505-522.

Güth, W., & Huck, S. (1997). A new justification of monopolistic competition. *Economics Letters*, 57, 177-182.

Güth, W., Levati, M.V. & Ploner, M. (2008). Satisficing in strategic environments: a theoretical approach and experimental evidence. *W*orking paper series of the Max Planck Institute of Economics and Friedrich Schiller University of Jena, JERP#2008-078.

Güth, W., Schmidt, C., & Sutter, M. (2007). Bargaining Outside the Lab – A Newspaper Experiment of a Three-Person Ultimatum Game, *The Economic Journal,* 117, 449-469.

Güth, W., Schmittberger, R. & Schwarze, B. (1982). An experimental analysis of ultimatum bargaining. *Journal of Economic Behavior and Organization,* 3(4), 367-388.

Güth, W., & Tietz, R. (1990). Ultimatum bargaining behavior: a survey and comparison of experimental results. *Journal of Economic Psychology*, 11(3), 417–449.

Handgraaf, M. J. J. & van Raaij, W. F. (2005). Fear and loathing no more: the emergence of collaboration between economists and psychologists. The Tilburg

Symposium on Psychology and Economics: Games and Decisions. *Journal of EconomicPsychology, 26*, 387-391.

Harsanyi, J. C., & Selten, R. (1988). A general theory of equilibrium selection in games, Cambridge, Mass., MIT Press.

Hausmann, D. M. (1992/2003). The inexact and separate science of economics, Cambridge, Cambridge University Press.

Hempel, G., & Oppenheim, P. (1948). Studies in the Logic of Explanation. *Philosophy of Science*,15(2), 135-175.

Hume, D. (1739/1978). A Treatise of Human Nature, Oxford, Clarendon.

Kagel, J. H., & Roth, A. E. (1995). Handbook of Experimental Economics. Princeton University Press. Priceton New Jersey.

Kahneman, D. (2003). Maps of Bounded Rationality: Psychology for Behavioral Economics. *American Economic Review*, American Economic Association, vol. 93(5), pages 1449-1475.

Kahneman, D., & Tversky, A. (1979). Prospect theory in analysis of decision under risk. *Econometrica*, 47, 163-291.

Katona, G. (1951). Psychological analysis of economic behavior. New York: McGraw-Hill.

Katona, G. (1975). Psychological economics. Amsterdam: Elsevier.

Kirchler, E., & Hölzl, E. (2006). Twenty-five years of the Journal of Economic Psychology (1981 – 2005): A report on the development of an interdisciplinary field of research. *Journal of Economic Psychology*, 27, 793-804.

Kirchler, E. (1995). Wirtschaftspsychologie. Grundlagen und Anwendungsfelder der Ökonomischen Psychologie. Göttingen: Hogrefe.

Kuhn, T. (1962). The Structure of Scientific Revolutions. University of Chicago Press.

Lakatos, I. (1978). The Methodology of Scientific Research Programmes, Cambridge, Cambridge University Press.

Lewis, A. (2008). The Cambridge Handbook of Psychology and Economic Behaviour. Cambridge, UK: Cambridge University Press.

Lopes, L. L. (1994). Psychology and economics: Perspectives on risk, cooperation, and the marketplace. *Annual Review of Psychology*, 45, 197–227.

Louvierre, J. J., Hensher, D. A. & Swait, J. D. (2000). Stated choice methods: analysis and application, Cambridge, Cambridge University Press.

Luce, D., & Raiffa, H. (1957). Games and Decisions. Introduction and Critical Survey,

New York et al.

McKenzie, R. B., & Tullock, G. (1978). The New World of Economics. R.D. Irwin.

Meckling, W. (1976). Values and the Choice of the Model of the Individual in the Social Sciences. *Schweizerische Zeitschrift für Volkswirtschaft und Statistik*,112/4, 545-565.

Miller, G. A. (2003). The cognitive revolution: a historical perspective. *Trends in Cognitive Science*, 7, 141–144,

von Neumann, J. & Morgenstern, O. (1944). Theory of Games and Economic Behavior. Princeton: Princeton University Press.

Nozick, R. (1974). Anarchy, State, and Utopia., New York, Basic Books.

Raaij, F. van, Veldhoven G. van & Wärneryd, K.-E. (1988). The Handbook of Economic Psychology.

Reynaud, P.-L. (1954). La Psychologie Economique, Paris: Rivière.

Robinson, J. (1933). The Economics of Imperfect Competition. London.

Rosenberg, A. (1988). Philosophy of Social Science, Oxford.

Roth, A.E (1993). On the Early History of Experimental Economics. *Journal of the History of Economic Thought*, 15, 184-209.

Sauerman, H., & Selten, R. (1962). Anspruchsanpassungstheorie der Unternehmung. *Zeitschrift für die gesamte Staatswissenschaft,* 118, 577-597.

Smith, V. L. (1962). An Experimental Study of Competitive Market Behavior. *Journal of Political Economy,*70:2.

Schmölders, G. (1978). Verhaltensforschung im Wirtschaftsleben. Hamburg: Rowohlt.

Selten, R. (1990). Some Remarks on Bounded Rationality, Bonn. Sonderforschungsbereich 303. Information und die Koordination wirtschaftlicher Aktivitäten.

Selten, R. (1999). Game theory and economic behaviour : selected essays, Cheltenham, UK ; Northampton, MA, Edward Elgar.

Sen, A. K. (1973/1982). Behaviour and the Concept of Preference. Choice, Welfare and Measurement. Oxford, Basil Blackwell, 54-73.

Simon, H. A. (1985). Models of Bounded Rationality (1&2), Cambridge, MA.

Simon, H. A. (1957). Models of Man, New York.

Stöckler, M. (1991). A short history of Emergence and Reductionsism. The Problem of Reductionism in Science. E. Agazzi. Dordrecht, Kluwer, 71-90.

Sugden, R. (2002). Credible worlds: the status of theoretical models in economics. Fact and Foiction in Economics. U. Mäki. Cambridge, UK, Cambridge University Press.

Thurstone, L.L. (1931). The Indifference Function. *Journal of Social Psychology*, 2, 139-167.

Vanberg, V. (1975). Die zwei Soziologien. Individualismus und Kollektivismus in der Sozialtheorie. Tübingen, Mohr.

Wärneryd, K.-E. (1982). The life and work of George Katona. *Journal of Economic Psychology,* 2, 1-31.

Wärneryd, K.-E. (2008). The psychological underpinning of economics: Economic psychology according to Gabriel Tarde. *Journal of Socio-Economics*, 37, 1685-1702.