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## Mathematical Game Theory

## Théorie mathématique des jeux

## Mathematische Spieltheorie

Game theory and in particular the modern version of 'evolutionary' game theory gives us advice, how to make favourable decisions in case of uncertainty. **Trading systems make use of game theory.** We can use pure or mixed strategies.

La théorie des jeux et en particulier sa version 'évolutionnaire' nous donne des conseils comment faire des décisions favorables en des situations de conflit. **Les systèmes à négocier utilise la théorie des jeux.** Nous appliquons des stratégies pures ou mêlées.

Die mathematische Spieltheorie und insbesondere die moderne 'evolutionäre' Spieltheorie hilft, in Konfliktsituationen guenstige Entscheidungen zu treffen. **Handels-Systeme wenden die Spieltheorie an.** Wir können reine oder gemischte Strategien verwenden.

We predict future market development according to models. Models denote here any structured and consistent form of ideas about how the market might behave. These models can fail at times. Maybe our models are valid no longer, maybe its only a transient disturbance. In these cases of uncertainty we must have a trading system to avoid the worst.

L'investisseur prédit le développement du marché à l'aide des modèles. Connaissons des modèles comme le résultat de toutes nos idées sur la fonction du marché. Les modèles n'ont pas toujours raison. Peut être elles ne sont plus valables ou ne marchent pas pour le moment. Ce sont des cas dont on a besoin des systèmes à négocier pour empêcher le plus mal.

Wir erwarten bestimmte Marktentwicklungen, weil wir Marktmodelle im Kopf tragen. **Damit sind strukturierte und widerspruchsfreie Ideen gemeint, mit denen wir uns das Funktionieren eines Marktes zu erklären versuchen.** Diese Modelle können dauerhaft ungültig werden, oder auch nur vorübergehend versagen. Handelssysteme können uns dann vor dem Schlimmsten bewahren.

Analysis and prediction are necessary, but not enough. A trading system must be ready to come to the rescue in case of emergency.

L'analyse et la prévision sont nécessaires, mais elles ne suffisent pas. **Un système de négociateur est pressant pour nous sauver en cas de danger.**

Analyse und Prognose sind notwendig, aber nicht hinreichend. **Ein Handelssystem ist zwingend, um uns im Notfall retten zu können.**

### References

### Références

### Referenzen

**John Maynard Smith:** *Evolutionary game theory* Physica 22D, pp. 43-49, 1986.  
John Maynard Smith, theoretical biologist " .. There are two main differences between classical and evolutionary game theory: 1) the replacement of 'utility' by fitness. the concept of utility attempts to place on a single linear scale a set of qualitatively distinct outcomes (e.g. losing £ 1000, losing one's girl friend, losing one's life) in a rather artificial way. Fitness or expected number of offspring, may be a difficult measure, but it is unambiguous; there is only one correct way of combining different components- for example, chances of survival and of reproduction. 2) The replacement of rationality by natural selection. **In classical game theory**, a 'solution' is one in which all **participants behave rationally**. This has two snags: it is hard to decide what is rational, and in any case **people do not behave rationally**. In contrast, a 'solution' in evolutionary game theory is simply a stable fixed point of the dynamics.... There are two extensions I must mention: the first is to 'games against the field';

the theory need not be confined to pairwise interaction, the second is to asymmetric games. (there may be a perceivable difference between contestants, which may affect their choice of strategy).

**Michael de la Maza and Deniz Yuret:** *A futures market simulation with non-rational participants.* pp.325-330 in "Artificial Life IV". Proceedings of the Fourth International Workshop on the synthesis and simulation of living systems. Editors: Rodney A. Brooks and Pattie Maes. MIT Press Cambridge, Massachusetts, 3rd Ed., 1996.

"..The dynamic and equilibrium behaviour of such a **complex adaptive system** (financial futures market) cannot be easily understood by straightforward application of traditional econometric analysis. In this paper we present a program that simulates an artificial futures market and describe several experiments designed to illuminate how differences among (non-rational) market participants can lead to consistent profits for some of the participants...."

**Mitchel Resnick:** *Learning about life.* pp.229-241 in "Artificial Life IV". Proceedings of the Fourth International Workshop on the synthesis and simulation of living systems. Editors: Rodney A. Brooks and Pattie Maes. MIT Press Cambridge, Massachusetts, 3rd Ed., 1996. Michael de la Maza from the Artificial Life Group of MIT: "..In recent years, a new set of models and metaphors has begun to spread through the scientific community, and gradually into the culture at large. **Many of these new ideas come not from physics but from biology.** In a growing number of disciplines researchers are now viewing the systems less like clockwork mechanisms and more like complex ecosystems. Ideas like self-organization and emergence are affecting the direction and nature of research in many other fields, from economics to engineering to anthropology. In general there is a pronounced shift from centralized models toward decentralized models in which patterns are not determined by some centralized authority, but by local interactions about decentralized components."

**Kristian Lindgren and Mats G. Nordahl:** *Cooperation and community structure in artificial ecosystems.* pp.15-37 in "Artificial Life IV". Proceedings of the Fourth International Workshop on the synthesis and simulation of living systems. Editors: Rodney A. Brooks and Pattie Maes. MIT Press Cambridge, Massachusetts, 3rd Ed., 1996.

"In biological applications of game theory, the analysis has often focused on finding **evolutionary stable strategies.** An evolutionary stable strategy (ESS) is a strategy that cannot be invaded by any other strategy present in arbitrarily small amounts. In the prisoners dilemma (a favourite model of game theorists) a number of results about ESS is known: In the error free case, no deterministic strategy or finite mixture of such can be an ESS in the infinitely iterated game. When mistakes occur, ESS can exist. ... Knowledge of the fixed points of a dynamical system and their stability is not the same as complete understanding of the system. The artificial life perspective could contribute to a greater understanding of the evolutionary dynamics of many different systems."

**Avinaish Dixit and Barry Nalebuff:** *Thinking strategically. The competitive edge in business, politics and everyday life.* W.W. Norton & Company, Inc. New York, N.Y. 1991. A.D. and B.N., both professors of economics: ".. The branch of the social sciences that deals with strategic decisions, is called **game theory.** Games according to this theory comprise poker and pedagogics, tennis and takeovers, advertising and arms race."