

**Max-Planck  
zur Erforschung  
von Wirtschaftswissenschaften**



**Max Planck  
for  
into Economic**

<b>Editorial</b>	3
<b>Strategic Interaction Group</b>	
Research Program	4
Conferences and Workshops	6
<b>Evolutionary Economics Group</b>	
Research Program	11
Theses Completed in 2002	14
Conferences and Workshops	29
International Research Cooperation	35
University Lectures and Seminar Presentations	35
<b>Publications</b>	37
<b>Preprints</b>	41
<b>Lectures and Lectiones Jenenses</b>	45
<b>Visiting Scholars</b>	49
<b>Directory</b>	52

The year 2002 has brought another breakthrough for our still young Institute. After a long search, the Humanities Section and the Senate of the Max Planck Society have offered Professor David B. Audretsch to become the Institute's third director. David B. Audretsch, presently at the Indiana University in Bloomington, is an expert of small business firms which are usually seen as the major driving force of innovative activities.

Needless to say, all people who have been working at the Institute, have been excited by this rapid development. Indeed, immediately after those decisions had been taken we started to expand the Institute's staff in the IT-service and the administration to meet the challenges of the growing scientific activities. For all upcoming activities, particularly the preview of lectures, seminars, workshops, and the visitor program in 2002 we refer the reader to our homepage as a source of continuously updated information (<http://www.mpiew-jena.mpg.de>).

In their move forward, the decision making bodies of the Max Planck Society have also confirmed the research agenda already established in the Institute which focuses on the change of modern economies. The Evolutionary Economics Group in the Institute, now active since seven years, has continued to work on the explanatory framework for the evolutionary transformations taking place on all levels of the economy and the newly established Strategic Interaction Group has heavily used its new computer laboratory. As reported in detail further below, several specific projects could be finished or made significant progress in 2002 and, as in the years before, we reached out to the scientific community by organizing several workshops and other activities like an international summer school in experimental economics (see this annual report). We were also able to strengthen our ties to the faculty of economics and business in Jena (with Werner Güth as another honorary professor) and undertook first steps towards establishing a European research consortium devoted to jointly studying the transformation of the European economy with researcher groups in Austria, Britain, Denmark, France, Israel, Italy, Spain, Sweden and the USA, but also with other German universities (Berlin, Freiburg, Karlsruhe, Magdeburg) or other academic institutions (e.g. the Berlin-Brandenburgische Akademie der Wissenschaften which has co-opted Werner Güth in 2002).

Concerning the third group we are confident to be able to inform our readers about the outcome of this exciting development in next year's annual report. For the time being – and looking back to the great leap forward we realized in the recent years – all longer standing members and friends of the Institute will surely join us in the hope that the Institute can soon live up to its full potential.

Jena, December 2002

Werner Güth  
Managing Director 2002

## Strategic Interaction Group

### Research Program

This group, which has started its life in 2001, is now complete. The computer laboratory, located near the campus of Jena University, is heavily used since spring 2002. The video & computer laboratory, to be installed in the basement of the Institute, is under way and expected to be ready in January 2003.

The group has the intention of studying strategic interaction theoretically and by performing experiments. In the latter case this means

- designing a game or market,
- deriving its benchmark (solution), normally by applying game theoretic concepts,
- developing the software for performing the experiment in the computer laboratory,
- inviting participants and running sessions so that one can analyse and test the data statistically.

The different tasks require various skills that are reflected by the variety in the background of the researchers (economics, business administration, game theory, statistics, social psychology, informatics, mathematics).

More specifically, the group studies the predictive appeal of orthodox game theory, bargaining and allocative behavior, risky decision making, e.g., on financial markets, trading via internet & e-commerce, and learning in more or less complex environments. Members of the group have published many articles in leading international journals. The theoretical work focuses on

- microeconomic theory in its more mathematical formulation,
- game theory and
- indirect evolution.

Although one usually expects only the qualitative effects of parameter changes to be reflected by experimental data, the standard in experimental research is to develop a rational benchmark solution. This requires rigorously defined (solution) concepts as in (mathematical) economics and game theory to be contrasted with concepts of (social) psychology, especially in the light of experimental data.

Indirect evolution allows the endogenous derivation of the rules or of the institutional setting, which are usually considered to be exogenously given. Special topics of indirect evolutionary studies by the research group are

- the evolution of moral preferences and emotions
- the timing of decisions
- the combination of learning and evolution and
- the co-evolution of various institutions.



*Students in the new computer laboratory*

The aim of the research is to advance the theory of boundedly rational decision making. So far this theory consists mainly of a more or less related collection of ideas (satisficing rather than optimizing, discrete aspirations rather than continuous utilities, behavioral repertoires rather than unlimited analytical skills, limited rather than unlimited memory capacity etc.) whose interaction and mutual consistency has not been rigorously explored. When trying to progress in this direction, the hope is to rely on inspiring and illuminating stylised facts, e.g., in the sense of field evidence and appropriate experimental findings, and on research in the neighbouring social sciences, e.g., in cognitive psychology.

The need to develop a theory of bounded rationality does not mean that the theory of perfect rationality, the traditional assumption in economics, is useless. However, bounded rationality theories allow to employ the natural categories which human (and even more so non-human) agents apply to make their decisions. Bounded rationality does, of course, imply that advice based on perfect rationality is questionable (it is hard to maximize utility when not knowing one's utility).

Theories of perfect rationality may, however, serve other purposes. Often we are not interested in why we have done something wrong but only in what would have been right. And as already indicated above, one way of interpreting experimental behavior is to compare it with rational behavior where, of course, ambiguity of rational behavior has to be avoided, e.g. by identifying utility with material reward and subjective beliefs by experimentally controlled probabilities. Thus the final goal is not to substitute the theory of rational behavior but to supplement it with a theory of bounded rationality which, if applicable, is better suited for behavioral advice, e.g. when comparing various institutional designs. The theory of optimal mechanisms, for instance, needs to be supplemented by one of reasonable mechanisms which perform reasonably when assuming boundedly rational agents. For example, in business administration, where consulting does not mean to assess cost, demand and finally profit functions but to suggest practical changes in management and labor relations, the behavioral approach to mechanism design will focus on institutional changes to which boundedly rational agents respond in promising ways.

The final state in the theory of boundedly rational decision making will be reached when such a theory can be absorbed. This means that when one expects all others to behave according to the theory, the advice given by the theory is still recommendable. In other words: if a theory is commonly accepted this should not question its advice. Note that this amounts to assuming rational expectations. Since a game theoretic equilibrium is based on rational expectations (plus optimality), this shows how close absorbable theories of bounded rationality are related to optimality, the traditional assumption in economics.

### Research Program

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## Conferences and Workshops

January 11, 2002

### Experimental Day

The strategic interaction group organized a local workshop on experimental economics in order to promote scientific exchange between different nearby research institutions and universities. The workshop addressed scholars with similar research interests, particularly in experimental economics and game theory.



*Özgür Gülerk*

The workshop was attended by researchers from the Humboldt-University at Berlin, the University of Bochum and the University of Erfurt. Özgür Gülerk (Erfurt) reported the results of an experimental study demonstrating that slight changes in the experimental procedure, such as presenting subjects with profit tables, can have a huge impact. Carsten Schmidt (MPI-Jena) reported about a newspaper experiment, conducted with readers from DIE ZEIT. The results indicate that different media, such as internet, fax or mail, triggers different behavior. Bernd Irlenbusch (Erfurt) talked about an experimental study on career concerns and showed that transparent worker abilities do not weaken, but strengthen career concerns incentives. Luis González (Bochum) presented an experimental study

on bribery and bureaucrat decision making. He shows that greasing bureaucrats is moderately efficient in speeding them up. Dennis Dittrich and Gerlinde Fellner (both MPI-Jena) talked about overconfidence and illusion of expertise in financial decision-making. The results of their experiments suggest that a non-negligible fraction of subjects are prone to systematic cognitive errors; they overestimate their own abilities and prefer their own choices, even if more costly, although alternatives yield equal payoffs. Bettina Rockenbach (Erfurt) presented a study on collusion under yardstick competition. Finally Andreas Stiehler (Berlin) talked about a public goods experiment, in which subjects are asked to increase/decrease their contributions across fixed time intervals, allowing studying conditional cooperation.



*Bernd Irlenbusch*

The presentations inspired lively discussions and exchange of research ideas. Some joint projects among the participants have been initiated. In view of the positive feedback further “experimental days” are planned.

*Workshop-participants:* Gerst, Dominikus (Berlin), González, Luis (Bochum), Greiner, Ben (Berlin), Gülerk, Özgür (Erfurt), Irlenbusch, Bernd (Erfurt), Ivanova-Stenzel, Radosveta (Berlin), Kröger, Sabine (Berlin), Renner, Elke (Erfurt), Rockenbach, Bettina (Erfurt), Stiehler, Andreas (Berlin).



*Luis González*

Conferences  
and Workshops

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**Summer School**

**July 22 - August 1, 2002**

The Strategic Interaction Group organized a 9-day Summer School in Experimental Economics from Monday, July 22 to Thursday, August 01. In charge of the organization were Vittoria Levati (research associate at the Institute) and the two secretaries of the ESI group: Sylvia Arnold and Karin Richter.

The aim of the school was two-fold:

1. teaching young social scientists to frame economic problems such that they can be tested experimentally, and
2. enabling them to use the experimental toolbox.



*Morning Lecture*

Twenty-seven international and national PhD students or Post-Docs participated in the Summer School. Besides nine participants from German Universities (Bonn, Erfurt, Göttingen, Paderborn, Karlsruhe, Magdeburg), all others were from overall Europe (Austria, France, Italy, Spain, Sweden, Switzerland, The Netherlands, United Kingdom), Israel (Haifa and Tel Aviv), and the United States (Stanford and Berkeley).

Most participants had a background in economics. But there were also researchers from other fields, such as business administration, mathematics, psychology, sociology and philosophy.

**Conferences and Workshops**

On the second day of the Summer School, as an opportunity to introduce themselves to the others, participants presented their own work and fields of interest in a poster session. The session was held in the library of the Max Plank Institute where twenty-seven white boards (one for each participant) were arranged. On each board, each student displayed both his/her prominent work so far and his/her future projects. Not all the (presented) work was experimental. Inexperienced participants presented their own research on their main field of interest together with an indication of their plans for experiments. The size of a poster was about 1 m x 1.5 m.

The two main aims of the school were accomplished by combining morning lectures with afternoon practical sessions.

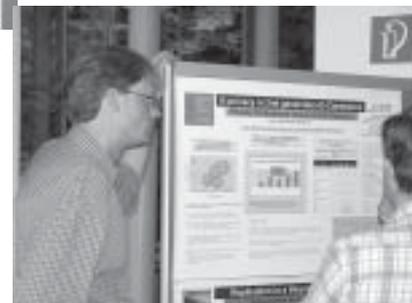
Each morning lecture was devoted to a specific topic. Starting from the afternoon of Monday, July 22 and ending on the morning of Wednesday, July 31 the topics were the following: Electronic market design; Game Theory and Bargaining Experiments; Fairness and emotions; Market experiments; Programming experiments; Behavioral finance; Psychology and economics; Public goods experiments.



*Marta Coelho explaining her poster*



*Gary E. Bolton admiring a poster*



*Axel Ockenfels during the poster session*

### Summer School

One (or two) worldwide famous theorist(s) and experimentalist(s) lectured on each topic for 3 ½ hours. More specifically, the introductory “Electronic market design” lecture was given by Axel Ockenfels, Elena Katok and Gary Bolton. The latter scientist also talked about “Game Theory and Bargaining Experiments”. The topic “Fairness and emotions” was taught together by Urs Fischbacher and Martin Dufwenberg. “Market experiments” were deeply explained by Hans Normann. Urs Fischbacher gave details about how to use his software z-Tree in the lecture devoted to “Programming experiments”. “Behavioral Finance” was lectured by Martin Weber. Rami Zwick explained the relationship between psychology and economics in the lecture devoted to this topic. Finally, Simon Gächter lectured on “Public goods experiments”.

In the afternoon practical sessions, students were divided in six groups of four to six people each in order to carry out an experimental study. To help them in performing such a task, at least two instructors guided each group. The instructors were: one of the morning teachers and some of the researchers at the SIG group. The experimental studies carried out during the afternoon sessions reflected the research interests of the participants and covered different topics, related however to the subjects of the morning lectures. The students worked really hard to set up their own project, develop it, write the computer program to implement the experiment in the laboratory, and finally analyze the data.



*Three participants enjoying the sun*

### Conferences and Workshops

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Each of the six groups ran their experiment on the afternoon of Tuesday, July 30 in the laboratory of the Max Planck Institute using the other students of the school as participants. One group experienced some technical problems during the running of their own experiment and had to repeat it. This trouble gave the students the opportunity to understand how important it is to take care of all possible details when writing a computerized program.

Each group presented their own study on the last day of the school (Thursday, August 1). The presentations revealed how serious all the students took the summer school: the developed projects were all well-thought both from a theoretical and an experimental point of view. Most students declared that they would remain in touch with the other members of their group in order to carry on the joint project started here.

Besides the group-discussions, exchanges of research ideas went on among students, teachers and (internal) researchers of the ESI group during the morning lectures and even during the meals (organized by the Cafeteria of our Institute). Further joint projects have in this way been initiated.



*Werner Güth shows the institute to some participants*

From the afternoon of Friday (July, 26) to the afternoon of Saturday (July, 27) we organized an experimental workshop which was open to the summer school participants. Besides the latter, the members of the ESI group and the summer school teachers, ten more researchers attended the workshop. They were above all national researchers (from the Humboldt-University of Berlin, the University of Bochum, the University of Bonn, the University of Erfurt, the University of Mannheim and the University of Magdeburg) but there were also Klaus Abbink from the University of Nottingham (United Kingdom) and Sabine Kröger from the University of Amsterdam.

Two recreational activities were also included in the program. On Saturday evening the Institute offered a typical German dinner to all participants. The dinner took place in the renowned restaurant "Ratszeise" in the center of Jena. Furthermore, to let students and professors know how beautiful Thüringen is Sylvia Arnold organized a trip to Weimar on Sunday afternoon. Almost all participants attended and made sure that the trip became a real success. Everyone enjoyed being there and walk on the streets where Goethe and Schiller walked.

Summer School

Workshop guests (students): Barrera, Davide, Utrecht (The Netherlands); Carman, Katherine, Stanford (USA); Castro, Massimo, Catania (Italy); Coehlo, Marta, London (United Kingdom); Elsehity, Tarek, Vienna (Austria); Fehr, Dietmar, Vienna (Austria); Gil Moltó, Maria Jose, Castellón (Spain); González, Luis, Bochum; Graefe, Gernot, Paderborn; Grossklags, Jens, Berkeley (United Kingdom); Güreker, Özgür, Erfurt; Herrmann, Benedikt, Göttingen; Hopfensitz, Astrid, Amsterdam (The Netherlands); Kircher, Philipp, Bonn; Leybman, Ira, Haifa (Israel); Ludwig, Sandra, Bonn; Maier-Rigaud, Frank Peter, Bonn; Martinsson, Peter, Göteborg (Sweden); Napel, Stefan, Karlsruhe; Nir, Arad, Tel Aviv (Israel); Onay, Selçuk, Fontainebleau (France); Ponsko, Pawel, Barcelona (Spain); Reuben, Ernesto, Amsterdam (The Netherlands); Staffiero, Gianandrea, Barcelona (Spain); Sturm, Bodo, Magdeburg, Sutan, Angela, Strasbourg (France); Thöni, Christian, St. Gallen (Switzerland); Van de Ven, Jeroen, Tilburg (The Netherlands).

Conferences  
and Workshops

Workshop guests (teacher): Abbink, Klaus, Nottingham (United Kingdom); Bolton, Gary E., Beam (USA); Brosig, Jeanette, Magdeburg; Dufwenberg, Martin, Stockholm (Sweden); Fischbacher, Urs, Zurich (Switzerland); Gächter, Simon, St. Gallen (Switzerland); Hennig-Schmidt, Heike, Bonn; Irlenbusch, Bernd, Erfurt; Ivanova Stenzel, Radosveta, Berlin; Katok, Elena, Beam (USA); Kirchkamp, Oliver, Mannheim; Normann, Hans, Egham (United Kingdom); Renner, Elke, Erfurt; Rockenbach, Bettina, Erfurt; Stiehler, Andreas, Berlin; Weber, Martin, Mannheim; Zwick, Rami, Kowloon (HongKong).

### ENDEAR Workshop

September 6 - 8, 2002

ENDEAR (European Network for the Development of Experimental Economics and its Application to Research on Institutions and Individual Decision Making) aims at the enlargement of academic knowledge regarding (1) the development and influence of institutions, and (2) fundamental aspects of decision making in economic situations, using experimental methods. In addition to the development and support of (joint) research activities, the network organizes workshops and summer schools which are open to all European young researchers, and in which experimental economics is taught by experts in the field. See <http://www1.fee.uva.nl/endeard/> for more details on the network.

The Strategic Interaction Group organized the 2002 Endear Workshop from Friday, September 6 to Sunday, September 8. In charge of the organization were Anthony Ziegelmeyer (research associate at the Institute) and Sylvia Arnold (one of the two secretaries of the ESI group).

Beside the members of the ESI group, nineteen scholars participated in the workshop. Claudia van den Bos, the administrator of the network, was in charge of the organization of the meeting of the coordinators which took place Saturday, September 7 during lunch time.

Most presentations were related to the two research themes on which the research undertaken in the framework of ENDEAR focuses; (1) Design and influence of institutions, and (2) fundamental aspects of individual decision-making. In the following lines, we provide a short summary of two presentations.

### ENDEAR Workshop

In their talk, Gary Bornstein and Tamar Kugler (Hebrew University, Jerusalem) drew a distinction between three *basic* types of decision-making agents - individuals, unitary teams, and non-cooperative groups - and outlined a taxonomy of games based on the types of players involved. The taxonomy serves as a framework for discussing the existing decision-making literature, the gaps that currently exist in this literature, and the authors' modest attempts to fill some of these gaps.

John D. Hey (Universities of Bari and York) asked whether it is possible to design an *Intentions Revealing Experiment* – that is, an experiment in which the early moves of the decision maker in a dynamic decision problem reveal the intentions of that decision maker regarding later moves in the decision problem. If such a type of experiment is possible, then it will enable economists to test whether individuals have plans and implement them – a basic assumption of all economic theories of dynamic decision making.



John D. Hey

### Conferences and Workshops

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Andreas Roider



Heike Hennig-Schmidt



Frans van Winden

The presentations were of high quality and joint projects among members and non-members of the network (members of the ESI group, for example) have been initiated.

Workshop guests: Abbink, Klaus, Nottingham (United Kingdom); Apestegua, Jose, Bonn; Berninghaus, Siegfried, Karlsruhe; Bornstein, Gary, Jerusalem (Israel); Bos van den, Claudia, Amsterdam (The Netherlands); Coricelli, Giorgio, Siena (Italy); Gächter, Simon, St. Gallen (Switzerland); Hennig-Schmidt, Heike, Bonn; Hey, John, York (United Kingdom); Hopfensitz, Astrid, Amsterdam (The Netherlands); Königstein, Manfred, Erfurt; Kröger, Sabine, Berlin; Kugler, Tamar, Jerusalem (Israel); Nagel, Rosemarie, Barcelona (Spain); Neugebauer, Tibor, Kiel; Roider, Andreas, Bonn; Seki, Erika, Aberdeen (United Kingdom); Vogt, Bodo, Bielefeld; Weizsäcker, Georg, Harvard (USA); Winden van, Frans, Amsterdam (The Netherlands).

## Evolutionary Economics Group

### Research Program

Ulrich Witt

The Evolutionary Economics Group focuses on the theory of technological, institutional, and commercial change that can be observed almost everywhere in modern economies. These apparently incessant changes become fully intelligible only, we believe, in a more comprehensive, long-term perspective. We expect many of the complex developments to follow regular patterns that should be accessible to systematic exploration and some generalizing theory. Our approach presumes a basic evolutionary continuity in reality. At any point in time, evolution generates the constraints and historically contingent specifications of the rules that determine its further change. In such a perspective - which we consider the proper foundation for an "evolutionary" approach to economics - the process of long-term economic change is as continuation of natural evolution on a different level, with different means, and according to its own regularities.

Given the complexity of the evolutionary transformations at all levels of the economy, a vast amount of historical material has to be mustered and interpreted. Before a coherent set of principles of economic evolution can be established a huge number of potential, complex causal relationships must be specified. With the limited resources of our group these tasks can best be pursued by exploring in an exemplary, comparative fashion a spectrum of diverse forms of economic change at different levels. The different problems on which the research group has accordingly focused in the year covered by this report can be characterized as follows.

*A first set of problems* relates to the attempt to bring to bear a natural sciences perspective to framing the problems and riddles posed by long-term economic development. In a sense, this amounts to extending a Darwinian world view to the interpretation of economic history and the development of human economic behavior vis à vis the constraints imposed by nature. The crucial feature of human behavior that comes to the fore in such a view is not so much economizing on scarce resources (as is usually presumed in economics), but cumulative problem solving and knowledge generation on the one side, and a successive creation of new problems on the other. On balance, the economy's growing capacity to enable its members to generate and/or activate knowledge has up to now increasingly allowed the natural constraints on the human economy to be shifted. Historically, the consequence has been an unprecedented enlargement both of the niche for the human species as such, and, for almost all its members currently alive, of their command over natural resources. On the other hand, this has triggered developments with a highly problematic longer term impact on nature, and how the balance between problem solving and problem generating will develop in the future is not known.

In this first set the problems chosen to be researched in a parallel fashion are:

- 1.1 a reconsideration of the theory of the factors of production informed by a natural science perspective on the changing physical conditions of economic production processes. A significant part of this reinterpretation concerns the qualitatively changing nature of human labor in the historical process and the understanding of the conditions under which the changing qualities have been socially produced.

### Research Program

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- 1.2 a theory of economically relevant human wants (or needs or preferences), their genetic foundations and the mechanisms of their development. Such a theory is necessary to explain both the absolute per capita increase of consumption and the growing product variety and has important implications for understanding the relationships between changing consumer behavior and economic growth.
- 1.3 an exploration of the relevance of sociobiological hypotheses for understanding economic behavior and institutions, particularly institutions with a long tradition of evolutionary change such as property right regimes. These institutions differ significantly, both historically and culturally as a result of innate and learned influences on collective behavior which, together with their varying impact, need to be reconstructed. The reconstruction helps to clarify the relationships between economics and anthropology (in which sociobiological arguments figure prominently in explaining property rights).
- 1.4 the assessment of the process of economic change and economic growth from the point of view of alternative (hypothetical) normative criteria. The core question here is under what conditions, if any, the processes and their results can be considered to imply "progress" and, if so, in what sense. This question transcends the framework of static economic welfare theory and, in relation to the positive theory under theme (ii) above, also the basic subjective value orientation of modern economics.

### Research Program

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*A second set of problems* deals with the adaptations which are occurring in economic behavior - a substantial part of the evolutionary dynamics in the economy. In accordance with the basic perspective that informs the research of the group, work in this cluster also rests on an interdisciplinary synthesis. At least in modern times, most of the evolution seems to be due to cultural adaptations in which the central part is played by learning and inventiveness. Accordingly, we use theories of learning coming from cognitive science and psychology to explain how the economic agents adjust, who are neither omniscient nor entirely autonomous individuals (as is still often assumed in economics). Constraints which express themselves in the selective perception and framing of information make our cognitive apparatus - and even its sensory, emotional, and motivational basis - dependent on inputs from communication and interaction with other human beings. As a consequence, there are social contingencies and biases not only in human beliefs and the conduct they "rationally" inform, but also in the way in which they are acquired and adjusted by learning. This has far reaching implications for explaining both the changes over historical time in typical forms of economic conduct and in the results of inter-individual interactions.

In this second set the problems chosen exemplarily revolve around the following themes:

- 2.1 a synthesis of diverse approaches to explaining behavioral adaptations in economic contexts, long term as well as short term. Individual learning, socially distributed (cultural) learning, and social cognitive learning appear as different, equally important sources of change. In a competitive environment with homogeneous groups of agents, all the forms of learning and the interactions between them may imply differential growth between the groups and, thus, explain why there may be forms of group selection.
- 2.2 an investigation of how learning and cognition affect strategic interactions in game-theoretic settings. In this context, particularly striking effects occur in games with systematically changing (history dependent) payoffs and action sets which are therefore made the main object of our investigations.
- 2.3 an assessment of the role of the cognitive level and social cognitive learning for systematic changes in firm organizations. The working hypothesis is that the way in which organization members are coordinated and motivated hinges on entrepreneurial regimes which, for cognitive reasons, vary systematically with the age and size of the organization, much as epitomized by the life cycle heuristic. On the conceptual level,

these processes are reminiscent of ontogenetic development, and the inquiry into a developmental approach to the firm may well serve as a model for theorizing about change in all forms of deliberately created institutions.

- 2.4 an exploration of the economic significance of scarce human attention, limited individual information processing capacity, and social cognitive learning in a world in which, due to vested interests in information emission and the propagation technology of the mass media, there is an overabundance of information.

Currently we also work on a *third set of problems* which are related to what may be called the “Schumpeterian agenda” in economics. These projects are closer to innovation and technology research that has come to be a substantial part of evolutionary economics. They are also closer to policy issues. In this third set of problems we focus on two topics:

- 3.1 the emergence and development of regional industrial clusters. Industrial clustering - a process usually closely tied to regionally concentrated innovative and imitative activities - often generates exceptional prosperity within a limited region. Although there is considerable work on the phenomenon of industrial clustering both inside and outside the evolutionary approach, the process of formation of an industrial cluster is still not very well understood in more general terms.
- 3.2 the role of basic research in national innovation systems. Its contribution to education, training, and the provision of commercially applicable knowledge is a significant element of the science driven modern development. We focus in an empirical study on the economic value created through the migration into the commercial sector of researchers who have acquired special skills during their involvement in basic research in selected institutes of the Max Planck Society.

The attempt to build an evolutionary theory of economic change involves many rather deep epistemological and methodological problems. Our resources do not allow to deal with those problems more systematically and in the interdisciplinary perspective which they suggest. However, in the context of each of the three problem sets just mentioned a good deal of work is nonetheless jointly being done on the following issues:

- 4.1 the benefits and detriments accruing to the attempt to identify the characteristics of evolution and evolutionary theories in economics by applying concepts, metaphors, and analogies which have their origin in biology and the theory of natural selection. A case in point at a more formal level is the transfer of replicator dynamics, evolution algorithms, and other modeling tools from biology to evolutionary economics.
- 4.2 the more general, abstract features of evolution. Evolution is an important phenomenon in several disciplines such as biology, linguistics, economics, and sociology. There may be a possibility of not only finding “consilience” between them, but also of identifying some basic common principles. A particularly intriguing role in an attempt to generalize may be played by a closer analysis of the emergence and dissemination of novelty as the driving force of evolution.

Obviously, the interpretations which we pursue in our research on evolutionary economics have a strong interdisciplinary flavor. Recognizing the problems and risks involved in interdisciplinary work, we have committed ourselves to produce a disciplinary output, i.e. a contribution to the theory of economic change. However, we have acknowledged the fact that a full understanding of the evolutionary process also requires scientific expertise from other fields. We have tried to integrate that expertise in our research by personal networks and by attracting scholars with background in, e.g., biology, physics, and psychology to join our team. In doing so we are glad to find us encouraged by, and to take advantage of, the innovative basic research philosophy of the Max Planck Society.

## Research Program

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### Theses Completed in 2002

#### **Existence, Emergence and Evolution of Local Industrial Clusters**

Thomas Brenner

The aim of the thesis is to increase the knowledge about why local industrial clusters exist, how, when and where they emerge and how this emergence can be influenced by policy measures.

Local industrial clusters are studied empirically and theoretically in the economic, as well as the geographic literature. The knowledge about such clusters, however, originates mainly from case studies in which specific clusters and their histories are analysed in detail. These case studies inform us about the specific circumstances and developments in the respective regions. Several approaches have been taken to generalise the experiences from these case studies. However, common perspective has not been established so far.

In this thesis a new approach is taken. The thesis aims to capture the general characteristics of and prerequisites for local industrial clusters on a theoretical and empirical level. A general approach is chosen that is based on the central common characteristics of local industrial clusters. Specific characteristics of individual clusters are deliberately ignored. Hence, the approach is complementary to the case studies in the literature. The results obtained in the thesis fit well to the findings in the case studies and both kinds of approaches can mutually benefit from each other.

Several methods are used in the thesis. First, a general theory of local industrial clusters is developed and mathematically formulated. This theory is used to deduce various insights into the evolution of local industrial clusters and to obtain some predictions about the spatial distribution of firms and the dynamics of this distribution. These predictions are tested empirically for the case of Germany. Furthermore, empirical data on Germany is used to identify and list all local clusters in Germany and to study the characteristics of those industries for which local clusters are found or which show dynamics that are typical for the emergence of local clusters. Finally, a simulation model is developed. The stochastic characteristics of clustering cannot be studied on the basis of empirical data. Therefore, a simulation model is used to analyse these characteristics.

Two kinds of results of the thesis can be distinguished. First, the work done shows that a general approach to the understanding of local industrial clusters is possible and fruitful. Second, a general structure is developed with respect to the questions of why, when and where local industrial clusters evolve. This structure can be used to classify the various specific findings from case studies with respect to their characteristics.

The three different methods used and the results that are obtained by using them are presented separately below. Subsequently, the policy implications that are drawn from the studies are summarised. Finally, some conclusions are drawn.

#### *Theory and predictions*

In this thesis a general approach is used. Through this almost all industrial districts, local clusters and innovative milieux that are discussed in the theoretical and empirical literature are captured by the theory developed here. In most of these approaches local synergies of one form or another are reported. Therefore, the theory is based on this common characteristic. The subject of the thesis is defined as those regions that contain an agglomeration of firms in one or a few related industries and in which the existence of the agglomeration is caused by local synergies. Such an agglomeration of firms is called a *local industrial cluster*.

There are many different causes of local synergies and their identification is an empirical task. Therefore, in developing a theory of local industrial clusters it is only assumed that local synergies exist and that these synergies have a positive effect on the number of firms in a region. On the basis of this assumption, a mathematical model is developed that describes the dynamics of the number of firms in a region.

The analysis of the model results in the identification of four stages in the evolution of local industrial clusters. In the first stage firms enter a region with a certain probability and stochastic growth in the firm population results. In the second stage the developments in the regions become different. There are regions in which the number of firms continues to grow, so that a local cluster emerges, while in other regions the number of firms stagnates or decreases. In the third stage the situation stabilises and one or a few stable local clusters exist. All other regions only contain a few or no firms in the industry under consideration. In the fourth stage the local cluster is dissolved or has to transform itself. However, this phase is not further analysed in this thesis.

For each of these stages predictions can be drawn from the theoretical modelling. These predictions concern the distribution of firms among regions or the change of this distribution. Two predictions are of specific interest in the thesis: the predictions about the distribution of firms among regions in the third stage, meaning during the existence of clusters, and the predictions about the change of this distribution in the second stage, meaning during the emergence of clusters. These two kinds of predictions allow the existence and emergence of local industrial clusters to be empirically identified.

Theses Completed in 2002

The analysis results in the prediction that the number of firms in regions has to be distributed as depicted in Figure 1 if local clusters exist. In this case there are many regions that contain only a few or no firms and a few regions that contain many firms.

The dynamics during the emergence of local industrial clusters is characterised by the fact that three kinds of regions can be distinguished. In regions that contain a small number of firms, this number increases on average. Regions that contain a medium number of firms experience, on average, a decrease in the number of firms. Finally, regions that contain many firms are characterised by an increasing number of firms on average. Both predic-

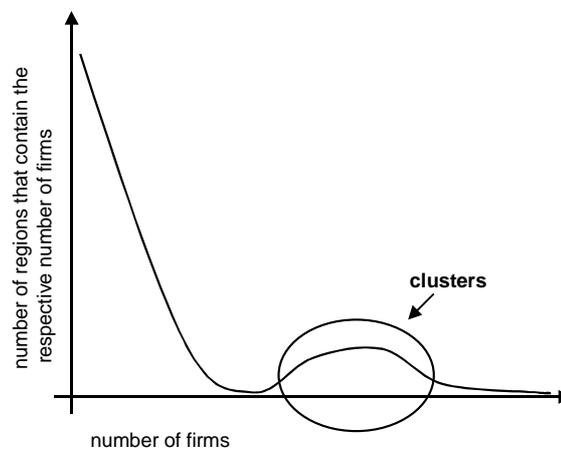


Figure 1

tions are tested in the empirical part of the thesis.

In addition, the dynamic modelling of local synergies allows the conditions necessary for the emergence of local industrial clusters to be identified. This identification is conducted on an abstract level. Therefore, it does not consider the specific conditions in each individual cluster that are reported in the literature. Instead, classes of conditions are defined. Within each of these classes the conditions are substitutes, so that only one of the conditions has to be satisfied. The classes of conditions themselves are complementary. Of each class at least one condition has to be satisfied for the emergence of a local industrial cluster. Three classes are identified in the thesis.

The first class of conditions is related to the existence of sufficiently strong local synergies. Such synergies might be caused by many different mechanisms. Examples are spillovers, coordination of local education, cooperation, lobbying and spin-offs. The local synergies are not sufficiently strong in all industries, hence, only some industries show clustering. In this context, it is not relevant which mechanism or mechanisms cause the local synergies. It might be that in one industry, clustering is caused by spin-offs, while in another industry, clustering is caused by local cooperation between firms. It is only necessary for the emergence of local industrial clusters that all existing mechanisms together cause sufficiently strong local synergies.

The second class of conditions concerns the market situation. For the emergence of local industrial clusters, the market situation has to be such that many new firms face a sufficiently large demand for their products. This condition is usually satisfied if demand increases tremendously, new markets emerge or technological changes occur, one of these market situations generally exists when local clusters emerge.

The third class of conditions is related to the characteristics of regions. Two kinds of characteristics have to be distinguished. First, there are regional characteristics that do not change over time or are almost constant during the emergence and evolution of clusters. Examples are the geographic location, culture, the existence of firms in other industries in the region and often also the existence of research institutes and universities. Second, regions are characterised by the people who live there. These people determine the events in the region, especially the foundation of firms, innovations and political actions. All these events are crucial for the development of regions and often one or a few persons matter. Together with the constant characteristics of a region they determine whether the industry-specific activities in a region exceed a critical mass, so that a local industrial cluster develops. The different factors add up, i.e. for the emergence of a local cluster it is necessary that the sum of these factors causes the critical mass to be exceeded.

In the thesis the alternative conditions and their identification in case studies and other empirical studies are discussed for each of the three classes. A complete picture of the conditions that have to be satisfied simultaneously and the conditions of which only one has to be satisfied for the emergence of local industrial clusters is given.

### *Empirical study of Germany*

The empirical study has three aims. First, the theoretical predictions are tested. Second, all industries for which local clusters can be shown to exist are identified and the locations of the respective clusters are listed. Third, the characteristics of these industries are studied in order to obtain an understanding of the prerequisites for clustering.

It is impossible to test the theoretical model directly. However, predictions have been obtained from the model that can be tested (see, e.g., Figure 1). These predictions are formulated as functions with several parameters, and then, whether these functions are able to describe the empirical data is statistically tested. The test is conducted separately for each 3-digit industry in Germany.

The theoretical predictions are only rejected for 17 of the 283 industries studied. Within the manufacturing sector there are only 2 industries for which the empirical distribution of firms among regions cannot be explained by the theory. The remaining 15 cases in which the theory fails belong to the service sector. However, the theory is developed on the assumption that firms in different regions compete with each other. This assumption does not hold in many of the service industries. In these industries, forces are active that are not considered

in the theory and that prohibit the emergence of local clusters. Further analysis shows that most service industries have very different characteristics from those of manufacturing industries. Therefore, the study is restricted to the manufacturing sector.

In the manufacturing sector the existence of local clusters can be confirmed for almost 50 % of the industries. All respective local industrial clusters are identified. The resulting list contains most of the case studies that are reported in the literature. It contains 400 local clusters in 158 regions.

The identified clusters belong to all kinds of industries, including high-tech and low-tech industries. Some of the clusters have existed for a long time while others have developed quite recently. While in the case of the more recent ones, the regions are typically characterised by high economic performance, this is often not the case for the older clusters. Nevertheless, these clusters still exist and are identified by the procedure used here. This implies that the impact of clustering on the economic performance of regions is short-lived, while the impact on the regional structure of industries remains visible for a much longer time.

The finding that local industrial clusters cannot be identified in all industries can be used to analyse the industrial characteristics that are responsible for the emergence of local clusters. However, the crucial characteristics might have changed since the local clusters emerged. Therefore, two approaches are taken. First, the characteristics of those industries for which local clusters have been shown to exist are studied. Second, predictions about the dynamics of the spatial distribution of firms are made from the theoretical model. These predictions are used to identify those industries in which local clusters emerged or clustering was strengthened during the period studied (1995 - 2000).

**Theses Completed in 2002**

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Both approaches lead to a list of industries that satisfy the respective conditions and a list of the remaining industries. With the help of a logistic regression several characteristics of these industries are compared. The characteristics studied are, the importance of innovations, the relevance of external sources of information, the employment of human capital, the share of local cooperation and the number of spillovers. It is found that a high number of process innovations is related to the occurrence of clustering dynamics, while it is not related to the existence of local clusters. This implies that more process innovations occur during the emergence of local industrial clusters. For other measures of the innovative activity, including the number of product innovations, no similar effects are found. For the local cooperation with universities and suppliers the same result is obtained as for process innovations. Spillovers are related to clustering dynamics and the existence of clusters. Hence, they might also be a result of clustering instead of a cause of clustering. For all other studied characteristics no significant relations are found.

#### *Simulations of clustering*

Empirical studies allow a good deal of understanding about the emergence and evolution of local industrial clusters to be obtained. Nevertheless, they are restricted by the fact that history provides us with exactly one possible realisation of a stochastic process. Other histories would have also been possible, even if we assume the same initial situation. Hence, it is impossible to obtain statements about the stochastic characteristics of processes on the basis of empirical studies.

Examples of questions that cannot be answered empirically are the questions of whether local industrial clusters emerged at a certain location by chance and whether the number of emerging clusters is determined by the characteristics of the industry and the respective

market. In general it is difficult to distinguish between the results of initial conditions and chance. Simulations are very helpful in this context. They allow history to be run repeatedly and the stochastic characteristics of the processes involved to be studied.

Therefore, a simulation model is developed in the thesis. The aim is not to reproduce history. Instead, general questions are answered. Nevertheless, the simulation model is set up such that it fits reality as well as possible. To this end, the spatial structure of regions in Germany is used and the numbers of inhabitants and students in each region are taken from German statistics. Furthermore, most processes that are repeatedly connected to the emergence of local industrial clusters in the literature are included in the model. These are innovations, firm entry and exit, education, the mobility of human capital and spillovers. The functional forms of the respective processes and the parameters are fixed on the basis of existing empirical studies. Often the parameters vary between industries. Hence, ranges are defined for each parameter according to the empirical findings. The parameters are varied within these ranges and the respective variation of the simulation results is studied.

Three questions are addressed with the help of this approach: Do industrial characteristics determine unambiguously whether local clusters emerge? Is the number of local industrial clusters determined by the initial conditions? Is the location of the emerging clusters determined by the initial conditions? To answer these questions simulations are run repeatedly. The results are analysed with the same method that has been applied to the empirical data. They are quite similar, except for a smaller share of cases in which local clusters are obtained. This confirms the simulation approach because the simulation model was not designed to reproduce empirical stylised facts but was built as a combination of processes. Hence, it is shown that putting together different processes, with their modelling based on independent empirical studies, can lead to a realistic representation of the spatial development of an economy.

The study of around 500 simulation runs shows that there are many parameter sets for which local clusters do not occur. However, there are also many parameter sets for which local clusters might, but do not necessarily, emerge. For only a few parameter sets do local clusters emerge in every simulation run. It can be concluded that there are industries in which local clusters will not occur, even if history were rerun many times. In many industries, however, the industrial characteristics allow for clustering but do not automatically lead to the emergence of local clusters.

Similar findings are obtained for the number of local clusters. Even for the parameter sets that cause clustering in every run, the number of local clusters varies tremendously between simulation runs. Hence, the number of clusters that emerge depends crucially on random events and is not determined by industrial characteristics.

The location of clusters is also found to be, to a large extent, randomly determined. There are places in which local clusters emerge with a higher probability than in other places. However, local characteristics only influence this probability but do not determine the location of clusters. In addition, the simulations show that it is nearly impossible for regions lagging behind to catch up with well developed regions with respect to a certain industry once the market for the industrial products has increased for some time. The developments in the first few years of an industry are at least as important for the location of the industry as the local circumstances.

### *Policy implications*

In the final chapter of the thesis the results are summarised and some implications for the design and use of policy measures are discussed. Three topics are addressed: the potential effects of policy measures, the necessary conditions for their success and the design of adequate policy measures.

One result of the thesis is that local industrial clusters cannot be created at will. All that policy can do is to increase the likelihood of their emergence. This means that the effects of policy measures cannot be evaluated in a deterministic way but have to be accepted as being stochastic in nature. Nevertheless, policy measures might cause either the emergence of additional local clusters or the emergence of clusters in places other than the ones where they would have emerged without policy measures. Since the latter effect is more likely, simultaneous support of several regions implies that the effects of policy measures neutralise partly each other.

Policy measures can only be successful if several conditions are satisfied. It has been shown in the thesis that clustering does not take place in some industries. This fact can rarely be changed by policy measures. Furthermore, market and technological changes are important for the emergence of local industrial clusters. Therefore, clusters emerge at certain points in time. Consequently, there are windows of opportunities for each industry in which policy measures can be launched effectively. Finally, there are regional characteristics that make the emergence of local clusters in the respective region impossible or at least unlikely. Thus, the regions in which policy measures are applied have to be chosen carefully.

Since a general approach is taken in the thesis, the question of what policy measures have to be applied can only be answered on a general level. In principal, all activities that increase the attractiveness of a region with respect to the industry under consideration or that support local synergies increase the likelihood of the emergence of a local cluster if they are conducted at appropriate periods of time. The factors that determine the attractiveness of regions vary strongly between industries and are discussed in detail in the literature. In a region the self-augmenting processes, caused by local synergies can be supported by enhancing coordination and cooperation in the region, including the existence of research and education institutes, by increasing the number of spin-offs, by improving knowledge flows and by influencing local public opinion. Most promising are policy programmes that affect all these factors and that are, at the same time, restricted to one region and one industry. If, in addition, the combination of time, industry and region is adequately chosen, the probability of the emergence of a local industrial cluster can be significantly increased.

#### *Conclusions*

Two kinds of results are obtained in the thesis. First, it is shown that a general approach on local industrial clusters is possible. A general theory is developed that can be used as a framework for existing and further studies. This framework allows different processes and conditions in the context of the emergence of local clusters to be distinguished. As a consequence, it is possible to structure the findings from case studies and to answer the questions of why, when and where local industrial clusters emerge.

Second, the general theory that is developed here can be used to answer various questions about the details of the emergence of local industrial clusters. In the thesis the existing local clusters in Germany are identified and the results are used to analyse the industrial characteristics that are related to the existence and emergence of these clusters. Furthermore, the theory is used to develop a simulation model that is used to study the stochastic characteristics of clustering.

Many further studies can be conducted on the basis of the theory developed here. Hence, the thesis also paves the way and supplies a framework for future research.

**Theses Completed in 2002**

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### Energy Use in Production: A Long-Term Analysis

Guido Bünstorf

What role does energy use play in economic production processes? How is long-term economic development affected by changes in the availability of energy inputs? Debates on these questions have a long tradition in economics, yet no conclusive answers have been reached. Most economists do not assign an explanatory role to energy use when they study production and economic growth. Within academic economics, discussion of energy-related issues is largely restricted to resource economics, with little effect on economic theory more generally. At the same time, a long standing tradition of heterodox approaches suggests that energy is both a crucial factor of production and an important driver of growth and development. The present study argues for a third way that is capable of reconciling the controversial positions; one that does justice to the physical preconditions of production without reducing economics to the level of physics. In developing this alternative approach to the role of energy in production, the notion of factors of production is re-interpreted. The study moreover suggests a new conceptual framework to study production, emphasizing the sequential character of production. The new framework can serve as a starting point for bridging the divide between theories of production and innovation studies.

#### Theses Completed in 2002

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##### *Three levels of studying production*

To make sense of the different views on the role of energy in production, it is helpful to distinguish between three different levels at which production processes are studied. Economic production theories tend to study production at the price-theoretic level. They try to identify the optimal use of scarce inputs, and are not normally interested in the technical detail of production processes. Accordingly, they have no need to develop a faithful representation of the processes studied. Nor do they have to specify in a general way the nature of inputs into production, i.e. to develop a substantive theory of factors of production. Rather, the selection of factors of production included in a particular model depends on the interests of the researcher and on the cost structure of the process under investigation. Given their small cost share in most real-world production processes, energy inputs are rarely taken into account as a separate factor category.

By contrast, most theories that stress the economic role of energy analyze production at the physical level. Based on findings from physics, they derive fundamental conditions for and constraints on human economic activities. From this perspective, production processes can be understood in terms of thermodynamic concepts, implying energy (in more precise physical terms, exergy) and matter as the relevant factors of production (Ayres, 1994, 1998; Faber, Proops and Baumgärtner, 1998).

The physical perspective on production is limited, however, in that it cannot distinguish production, i.e. processes from which a useful and potentially valuable good results, from other anthropogenic modifications of the physical environment. To improve upon this situation, the present study argues at yet another level of analysis: the level of goods. This is an intermediate level of analysis which on the one hand goes beyond the physical level, but on the other hand antecedes the price-theoretic level. In effect, the present analysis takes up the old economic issue of use value. It is asked how a good attains the characteristics that make it useful, and how energy use contributes to the production of use value. To be able to answer these questions, the characteristics of goods and of the ways they are produced have to be of sufficient regularity to allow for the development of material hypotheses on energy use in production. As is shown in the study, such material hypotheses can be derived from engineering concepts.

*Factor services in sequential production processes*

Production processes normally consist of a multitude of individual operations that successively modify the object of production (the “workpiece”). In the stylized conceptual framework adopted here, a workpiece is characterized by a bundle of properties. Some of these properties determine the use value of the finished product (Lancaster, 1966). It is the purpose of the production process to change these user-relevant properties in the desired way. Other properties are relevant for the production process itself because they affect the feasibility and/or cost of operations without necessarily affecting the use value of the final good. For example, the choice of materials frequently falls into the latter category of production-relevant properties. The various operations making up the stages of the production process can be described in terms of their effect on the properties of the workpiece. They fulfill specific, identifiable functions (such as various changes in geometry) that follow from the properties desired in the end product.

In engineering, elaborate classifications of manufacturing operations have been developed according to how they modify the workpiece (e.g., Todd, Allen and Alting, 1994). These classifications are independent of the particular production process, so that they provide the basis for a phenomenological identification of the functions of production operations. The engineering classifications also show that for each specific function to be fulfilled in a production process, there is only a limited number of suitable kinds of operations. For each of these kinds of operations, the services of a specific bundle of complementary inputs is required. Moreover, starting from the bundle of required factor services, the factors of production can be derived for any operation. Each entity is a factor of production in a particular operation which is capable of rendering a factor service required in that operation.

This method of identifying factors of production from the factor services utilized in actual production processes has a number of implications. First, factors of production may differ among different kinds of operations. Second, since factor services are more heterogeneous than the broad factor categories of traditional economic production models, they provide a more disaggregate level at which production processes can be described. Third, the heterogeneity of factor services limits the substitutability of factors. Two factors are substitutes in a particular operation only if they are both capable of rendering the specific factor service required in that operation. And finally, factor services depend on the level of technological knowledge and are therefore variable in time. This also implies that the factors of production are not given once and for all, but are knowledge-dependent and time-varying.

In spite of their heterogeneity, factors of production can nonetheless be grouped into four broad categories which closely resemble the traditional factor aggregates of economic theory: tools, labor, materials and energy. Tools are non-human inputs that are not used up in a single production process, but render their services in a multitude of identical production processes. The services of a specific tool can be described in terms of technical criteria. However, an aggregation of different kinds of tools into a single quantity (analogous to the capital concept of economics) is not possible at the present level of analysis. Similar to tools, the factor services of human labor fall into a variety of categories. Classifications of the various services have been developed by labor economists. Materials provide services based on properties such as hardness, machinability or electrical conductivity.

*The factor services of energy*

The different factor services provided by energy can be classified according to the various physical forms in which energy occurs: mechanical, chemical, thermal, electrical, nuclear and radiant energy. Any of these forms of energy is a factor of production to the extent that it can provide useful services to operations in actual production processes.

**Theses Completed in 2002**

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But how can these services be identified? Two methods are discussed in the study. First, the user-relevant properties of some goods can only be produced with inputs of a specific energy form. As an example, consider the necessity of light for photosynthetic processes upon which all production of energy-rich nutrition depends. This way of identifying required factor services is of rather restricted applicability, however, since most goods can be produced in alternative ways using different kinds of energetic factor services. Accordingly, a second identification method is utilized in the study, which starts from the energy-dependence of individual operations rather than of properties of goods. Again making use of concepts from engineering, it is shown that classes of operations can be characterized by the particular form of energy that is applied to the workpiece (referred to as the "process energy" (Alting, 1994) of the respective operation). The process energy of manufacturing operations can be of mechanical, thermal or chemical form. Other energy forms (e.g., electricity) can provide the energetic factor services for these operations only if they are transformed into the process energy.

The implications of the present approach are twofold. First, the recourse to engineering concepts allows material hypotheses on energy use in the production of useful goods to be derived. And second, no wholesale argument is made for energy as a factor of production. Rather, the factor quality of energy depends on the form in which it is available, the production task which is to be fulfilled, and the set of available transformation technologies. From this it also follows that energy forms are no perfect mutual substitutes. Their substitutability depends on the technical feasibility and efficiency of transformation.

#### Theses Completed in 2002

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It is moreover illustrative to relate the long-term trends in human energy use to the theoretical concepts derived above. For this purpose, the study reviews the most important historical energy innovations. It is shown that for all energetic factor services, new ways of provision were developed over time. Some of the novel energy technologies were based on first learning how to utilize a form of energy (e.g., nuclear energy), some were based on the first use of a new fuel (e.g., coal, oil and natural gas), some were based on new transformation technologies (such as the steam engine or the photovoltaic cell). Frequently, new ways of energy provision did not entirely replace older energy technologies, but superseded them in only some of their applications. Accordingly, the history of human energy use is largely a history of increasing specialization. At the macro level, four "stylized facts" in the development of human energy use emerge: quantitative growth in overall energy use (at the per-capita level as well as the level of the entire economy), increasing energetic efficiency of providing individual factor services, increasing variety of energy forms and fuels in use, and persistent use of old fuels and old transformation technologies. Due to the interplay of these developments, "old" ways of providing energy services (e.g., the use of coal for provision of thermal energy for heating and for thermal electricity generation) may quantitatively increase in spite of increasing efficiency and partial replacement by other fuels and transformation technologies.

#### *Interdependence of operations in the production process*

In addition to investigating the nature of factor inputs into individual operations, the conceptual framework used here also lends itself for discussing the interrelations among the various operations of a production process. In particular, the study discusses one issue in depth: the repercussions that changing the execution of one operation may have on the feasibility and costs of executing other operations in the process. From this perspective, a basic distinction is made between technological changes that modify the effect of the operation on the workpiece properties, and changes that leave the effect of the operation unaltered. Changes of the first kind have potential repercussions on other operations. They may either open new opportunities for executing other operations, i.e. give rise to complementarities

between operations. Or they may cause difficulties elsewhere in the production process, because they make operations impossible or more expensive to execute than before. In the latter case, they create incompatibility problems.

It is shown in the study that the above distinction of different kinds of technological change is useful for integrating a variety of economic concepts into a single framework. Notions such as localized technological change (Atkinson and Stiglitz, 1969) and general purpose technologies (Bresnahan and Trajtenberg, 1995) can be accommodated in the present conceptual framework, and different levels of interdependence between technological changes can be discriminated.

#### *Historical energy innovations in light of the present framework*

The study closes by discussing three major historical innovations in energy use on the basis of the theoretical perspective developed earlier: the introduction of coal, the steam engine, and the electrification of manufacturing.

The transition from wood to coal, starting in Britain in the 16<sup>th</sup> century, illustrates the potential of the concepts outlined above. In spite of economic incentives strongly in favor of coal use, replacing wood by coal was delayed by severe technical problems stemming from the differences between the two fuels. Coal did not provide energetic factor services in exactly the same way as wood, and the replacement of wood by coal frequently had adverse effects on the properties of the workpiece under production. In thermal uses of coal, major problems were caused by higher combustion temperatures and by emissions of smoke and soot. Solutions to these problems required numerous innovations, including coking, covered crucibles and heat-reflecting furnaces that separated the workpiece from the fuel. In chemical uses of coal, most importantly in endothermic iron smelting, further obstacles resulted from the chemical impurities of coal, particularly silicon and sulfur. Coal use in iron making was moreover frustrated by massive incompatibilities between individual operations: coal-based iron smelting increased the costs of subsequent refining into wrought iron, and coal-based refining produced an iron that was too brittle to be hot-worked in further form-giving operations. Learning how to solve these problems took several decades of technological changes.

What this example shows is the significance of heterogeneity of energy forms and fuels. The heterogeneity translates into differences in the provision of energetic factor services, which in turn give rise to differences in the way a production operation modifies the object of production. The significance of these differences may vary among different energetic factor services. Finally, the differences may cause incompatibility problems with other operations, thus frustrating attempts to replace an energy form or fuel by another one.

#### *Broader implications of the study*

The present study is part of an ongoing research project which aims at understanding the conditions and effects of long-term economic development. To this purpose, it is necessary to develop and test material hypotheses on the objects of human economic activities. In other words, an extension of economics beyond the subjectivist realm of price theory is called for. The present study contributed to this endeavor by suggesting a new way of analyzing production and by developing material statements about the role of energy in production processes. At the same time, by analyzing production processes at the level of use value, it established common ground with concurrent work on consumer theory (Witt, 2001).

The framework developed here can be extended and refined in various dimensions. For example, the factor services concept suggested here can be generalized to other categories of inputs. Factor services provided by other inputs can be disaggregated in a similar way to what was done here for energy, thus moving towards a comprehensive dynamic

Theses Completed in 2002

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theory of the factors of production. Another fruitful extension would be to study more complex structures of operations than the strictly sequential framework assumed here. Finally, although the disaggregated view of production processes adopted here is a step toward an integration of production and innovation theories, further efforts are required to achieve this integration.

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### Theses Completed in 2002

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## **Changing Structure Keeping Location The Evolution of Local Industrial Clusters**

Deborah Tappi

### *Research question*

During the recent decades the spatial dimension of innovation has been acknowledged and clusters have increasingly attracted attention among economists. The evidence of the uneven distribution of economic activities and of the presence of several agglomeration economies in different regions in the world suggests developing a theory on their emergence and evolution over time. Indeed, notwithstanding the great emphasis in the economic literature on the globalization phenomenon and on the role of information and communication technology in speeding up the diffusion of technological knowledge, most clusters and local agglomerations maintain an unusual competitive advantage. This suggests that local relationships and the participation of actors in local networking still represent a source of competitive advantage. However, the regular and frequent interaction with national or international non-local partners avoids the risk of being misled by local demand behavior which deviates from global trends.

The research project aims to understand the conditions under which local industrial clusters can change their structure to maintain competitive advantage over time in a changing environment. A local industrial cluster is here defined as a group of geographically proximate

interconnected firms and other economic organizations in a particular field. These firms and organizations are linked together by input-output and knowledge interrelations. Knowledge and those processes that allow a local cluster to learn about external market opportunities for local skills are the main focuses of the project.

The thesis is put forward that in a local cluster the division of labor among agents is associated with the division of knowledge. The study distinguishes the roles of different local actors in accessing external knowledge and in integrating it into the local production process according to the production function they display and to the interaction they establish. Indeed, knowledge is generated through own experience, but also through the interaction among agents. Interactions among economic agents can be local and non-local, e.g. local agents who are involved in interactions with non-local actors. Therefore production and learning can take place among geographically proximate individuals, but also among geographically distant ones.

#### *Unit of Analysis*

The literature on local clusters (and industrial districts) identifies localized clusters as the units of analysis according to the characteristics displayed by them in a particular stage of their development. This choice has led to the underestimation of the number and successes of local clusters. Indeed many clusters have been eliminated from the classifications as they changed some characteristics displayed which scholars chose as identifying criteria for the clusters. For instance the choice of the high specialization in one industry excluded from the classification all those clusters which recently differentiated their production. In this project learning and production connections among agents, i.e. networks, are chosen as the units of analysis in the study of developing clusters. This choice makes it easier to give a dynamic portrait of clusters that accounts for changes in their structure.

The development of a theory accounting for the transformation over time of local clusters of production must build upon the study of localized and non-localized social learning processes. To do so the study focuses on production and knowledge networks as the unit of analysis and on their spatial dimensions.

The focus on networks is motivated by the acknowledgement of the fact that individuals are boundedly rational. This implies that not every piece of information is accessible by every individual, and that single agents or firms are, in many cases, not able to autonomously generate knowledge. The cognitive frameworks through which individuals connect, classify and understand information, ideas and phenomena, depend on the knowledge accumulated through their own experience, the observation of behaviors displayed by other agents, and interactions with these agents. Cognitive frames, which are built consciously or unconsciously, are the basis for the selection of new pieces of information. This means that in order to understand the mechanisms through which information can be acquired, selected and successfully exploited, we may find it interesting to study how different cognitive frameworks emerge through network interactions. In particular, in the case of local clusters, their network structure suggests studying the extent to which selective interactions and their spatial dimensions affect the selection of information by local actors.

The study also explores the role of space for the study of clusters. It explains what kind of space shapes the learning processes and to what extent physical space coincides with economic space in the study of local economies. It is argued that other spatial dimensions are needed to account for changes in local clusters. The other spatial dimensions that are considered here as playing a role in shaping the learning pattern of a local cluster are: cognitive space and the value chain. While cognitive space is the space in which learning

**Theses Completed in 2002**

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takes place and where the cognitive proximity among actors is measured, the value chain is the locus where the specific functions of actors within the production and learning process are allocated.

The extent to which the knowledge accumulated by local actors is the result of social local learning or the integration of external knowledge is examined. In the literature the role of non-local networking has been highlighted with reference to clusters specializing in high-tech industries. By contrast, the importance of non-local networking is assessed in this study for very traditional Italian local clusters and even for the early stages of their development. In particular, the study of the interplay among global market changes and localized learning processes provides insights into changes in the clusters' production structures.

*Approach*

The study of local clusters highlighted the inadequacy of the mainstream body of explanation to provide a theory of the emergence and transformation over time of these systems. For this purpose the study approaches local industrial clusters from a developmental perspective. This implies that the different typologies of clusters identified in the literature (such as the Marshallian industrial district or the innovative milieu) are here proposed as different stages of the development of an economic form, the local industrial cluster.

**Theses Completed in 2002**

The development of clusters can be seen as divided into different stages: the origin, the growth and the advanced phase (as figure 1 shows). The succession of these stages is neither an automatic process nor is it exclusively time-driven. On the contrary, the possibility that a cluster reaches one subsequent developmental stage from the one it is going through depends on the interplay of different conditions and the presence of some key actors. Each developmental stage can often be associated with a particular organizational and production structure of the cluster.

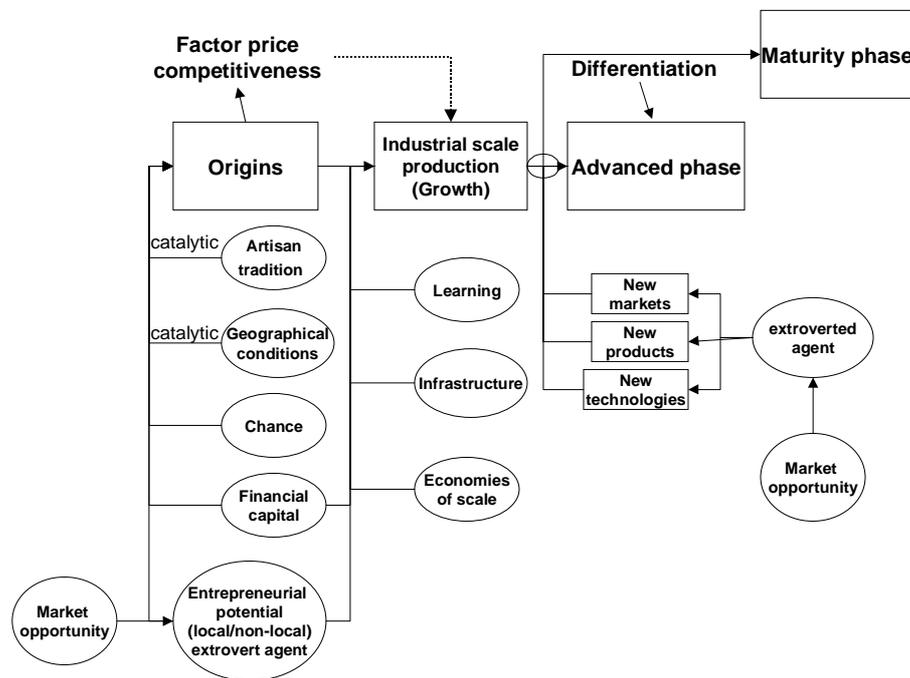
	<b>Origin</b>	<b>Growth (Industrial Scale Production) Marshallian ID</b>	<b>Advanced Phase</b>
<b>Size of firms and organizational form</b>	Very small firms, family ownership and management (by the entrepreneur her/himself)	SMEs, family ownership and management more distributed among family members	Large local firms: some firms become multinationals. Separation btw. ownership and management
<b>Production and relational structure among firms</b>	Pioneer entrepreneurs trigger spin-off process to benefit from complementary product and service (network)	Vertical disintegration, high division of labor and specialization among firms	Re-integration of production phases and diversification; emergence of different production networks

*Figure 1: Organizational changes during the development of a cluster*

The study suggests a theory on how new market opportunities for local accumulated skills and knowledge may reach a local specialized cluster. Location is seen as a constraint and an opportunity at the same time. The local specialized knowledge and skills may represent a source of rigidity if local actors can not easily obtain external knowledge about possible new complementary paths of change. The theory builds on some hypotheses on the role of key actors in connecting local competence with external information and opportunities.

This project is also an inquiry into the determinants of the search path for new market opportunities in a local cluster. It explores what local and non-local factors and processes affect the path of change in a local cluster. The role played by different actors in searching and discovering processes is distinguished and related to their role in the social learning

processes in which they are involved. Their ability to explore new learning and production avenues by virtue of their capacity to understand external information and to find similarity and complementarity with local knowledge is highlighted. Furthermore, their ability to transmit their business vision among local actors is identified as a necessary condition for pursuing the new venture in the cluster. A prominent role in the introduction of new business models into the local cluster is attributed to entrepreneurs and managers of firms with non-local branches as well as to transport and logistics providers. By virtue of their familiarity with the local learning process and knowledge accumulated locally and of the external networking function they perform, these actors can see and are able to exploit new external business opportunities.



Theses Completed in 2002

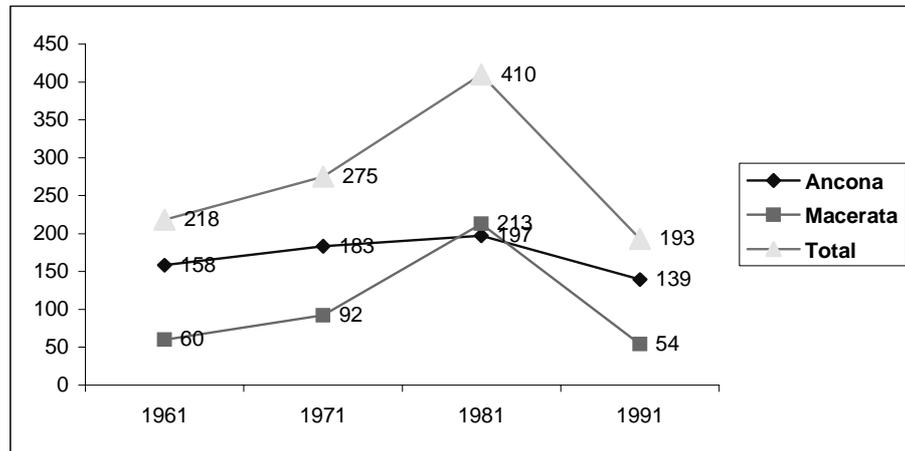
Figure 2: Factors allowing the transition from one stage to the next

Not every local actor in a local cluster follows a new business model that has been introduced. Indeed, the most likely case in which new behavioral models enter the local cluster is that in which different models coexist. As networks are here defined as the virtual structure of social learning relationships, the participation in a network implies that either network partners share a business model or that they at least pursue models that can be coordinated among them. For this reason, from the organizational viewpoint, the introduction of a new model may affect the relational structure of a local cluster from a single-network to a multi-network cluster.

*The case study*

A case study on the musical instrument industry cluster of Ancona (Italy) is conducted to test the hypotheses developed. The case study is based on 21 semi-structured interviews and the collection of historical material. The cluster studied experienced a transition from a very traditional production structure to a very innovative and high-tech production structure. The cluster emerged from an artisan tradition, i.e. accordion production, developed into a

cluster producing electronic musical instruments, and then turned to the production of electronics, such as electronic circuits and ISDN systems. The changes in product performed have been accompanied by changes in the relational structure among local agents and in the structure of internal elements, e.g. local firms. The two figures below show how the degree of specialization in musical instruments within the cluster decreased.



Theses Completed in 2002

Figure 3: Firms producing musical instruments and accessories in the LIC

	1961		1971		1981		1991	
	Firms	Employees	Firms	Employees	Firms	Employees	Firms	Employees
Ancona	1	1	2	0	4	4	0	0
Camerano	9	60	5	61	4	27	2	11
Castelfidardo	54	90	40	67	31	44	24	19
Loreto	10	76	7	12	25	39	2	1
Osimo	6	22	5	10	9	16	65	7
Sirolo	0	0	19	39	21	36	1	1

Source: ISTAT 1997, I sistemi locali del lavoro 1991, ISTAT, Rome

Figure 4: Musical instrument industry in the cluster as a percentage of the whole industry

The interviews highlighted that the transition from each developmental stage to the next by the cluster was made possible by the extroversion of some local actors. By virtue of their familiarity with non-local markets and networks, these actors were able to recognize and understand market signals and not to be misled by local deviating demand.

## Conferences and Workshops

### Life Cycles in Firms and Industries

April 11 - 13, 2002

This workshop brought together researchers from various disciplines to explore the dynamics of firms and industries. To describe these dynamics, many works refer to the life cycle metaphor, i.e. the birth, aging and decay of firms, technologies and whole industries. In the opening presentation Klaus Rathe (MPI Jena, discussant Jukka Kaisla, MPI Jena) argued that most economic theories use only one part of biological evolution, i.e. Darwinian selection. To be complete, evolutionary theories have to explain both developmental processes (defined as processes of progressive, irreversible change) and evolution, i.e. changes in populations of individual organisms over time. In spite of important differences between biological and economic evolution, it is obvious that many changes in firms and industries are developmental in character. Therefore, it was argued that the analysis of firm development and industry evolution should be undertaken as an interactive process of resource dynamics.

The standard economic explanation for related diversification is that firms can reap benefits from economies of scope. These economies are intra-temporal, i.e. there is no time dimension to them. Constance Helfat (Dartmouth, with Kathleen Eisenhardt, Stanford, discussant Guido Bünstorf, MPI Jena) showed that related diversified firms can also achieve inter-temporal economies of scope by transferring resources and capabilities within the firm over time. Doing so allows the firm to effectively utilize its resources in fast changing environments, exiting from declining product markets and entering promising ones. A modular, decentralized organizational structure supports these recombinations of resources which might also result in economies of growth. A case study demonstrated the evolution of a high-tech firm along the identified inter-temporal dimension of economies of scope.



*Constance Helfat*

### Conferences and Workshops



*Ulrich Witt*

The life cycle metaphor refers to the development of individual organisms over time. Applied to firm growth, it postulates morphological stages through which firms proceed during their growth. Ulrich Witt (MPI Jena, discussant Silke Scheer, MPI Jena) put forward a more general theory of firm development along these lines. In essence, young firms are shaped by the entrepreneurial business conceptions that firm founders pursue. The further fate of the firm depends on the successful communication and adoption of this business conception by the members of the firm through 'cognitive leadership'. Since this adoption process can only be partly controlled by the entrepreneur, organizational development becomes a contingent ontogeny in terms of changing regimes: from successful cognitive leadership to a regime of close monitoring. Instead of non-contingent, time-driven life-cycles of biological organisms, firm development is a contingent succession of organizational stages in a large morphological space.

### Life Cycles in Firms and Industries

Paul Robertson (Wollongong, with Eduardo Pol, Wollongong, and Peter Carroll, Tasmania, discussant Constance Helfat, Dartmouth) investigated the mutual relationship between relatively mature and innovative industries. He argued that the importance of diffusion processes is often neglected when looking at innovation and intergenerational flows of knowledge. In particular, in mature economies most economic growth comes from established/mature industries. These serve as major customers of innovative industries. Therefore, innovative industries are dependent on mature industries and their ability to improve the existing production technology by absorbing components from the innovative industries. An important policy conclusion derived from this argument is that neglecting diffusion processes can hamper the effects of innovation policies. Besides that, established industries are not a barrier to economic growth but enable it because they provide the markets and economies of scales needed by innovating firms to prosper and grow.



*Paul Robertson*

### Conferences and Workshops

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*Peter Thompson*

Peter Thompson (Carnegie Mellon, discussant Peter Murmann, MPI Jena, and Paul Robertson, Wollongong) documented the role of pre-entry experience in post-entry performance in the US Iron and Steel Ship-building Industry during the 19th century. A model of firm experience and survival was presented which tests the influence of pre-entry experience on firm survival. The most important finding refers to the long-term impact of pre-entry experience: while survival is also affected by firms' initial capacity choice, pre-entry experience persistently reduces exit probability even in the face of decades of post-entry experience.

David Audretsch (Indiana, with Adam Korobow, National Research Council, discussant Max Keilbach, ZEW Mannheim) emphasized the wage-size relationship as a long-overlooked measure of differential firm performance over time. He analyzed the relationships between age, size and wages in different stages of the firms' and industry life cycle. The empirical analysis confirms the stylized facts from the life cycle literature. Wage trajectories are higher in the early stages of both the firm and the industry life cycle and lower in the mature stages of the firm and industry life cycle. Furthermore, differences in knowledge intensities between different industries and in different stages of the industry life cycles were analyzed. The knowledge intensity of an industry was found to be positively related to the magnitude of wage performance among new and small firms. A static framework of wage differentials comes to the conclusion that small and new firms pay lower wages. In contrast, the evolutionary framework presented suggests that in early stage industries, the low wages of today become the high wages of tomorrow.



*David B. Audretsch*



Dennis Müller

Dennis Müller (Vienna, with Dylan Supina, discussant Hagen Worch, MPI Jena) presented a theory and evidence of goodwill capital which is usually neglected in economic theory. Goodwill capital can be defined as an intangible asset which is not attributable to past expenditures. A firm's capital stock then consists of its physical capital stock, the stock of intangible R&D capital, the stock of intangible advertising capital, and the goodwill capital. As an approximation Müller proposed measuring goodwill capital as the residual of the difference between the market value of a firm and its other three stocks of capital. It turns out that while for some firms goodwill capital is high as expected, it is low or even negative for other firms. Although it is difficult to measure goodwill capital precisely, it seems that it is a large and persistent part of a firm's capital stock, the emergence of which has yet to be explained.

The final presentation highlighted the role of entrepreneurial decisions in international trade and growth, shaping international comparative advantage. Leonard Dudley (Montréal, with Johannes Moenius, Northwestern) presented evidence of shifts in international trade which cannot be explained by conventional trade theory. The underlying cause for these shifts, he argued, lies in entrepreneurial responses to factor shortages in local markets. Firms facing factor shortages in local markets have an incentive to innovate to augment the scarce factor. As a result, country-specific endogenous technological change leads to increasing competitiveness in the sectors intensive in the augmented factors and vice versa. This can explain shifts in relative commercial strength, e.g. between Japan and the USA during the 1990s.



Leonard Dudley

Life Cycles in Firms  
and Industries

**Conferences  
and Workshops**

### **The Role of Labour Mobility and Informal Networks for Knowledge Transfer**

**December 5 - 7, 2002**

The motivation for this workshop comes from the observation that empirical studies of knowledge transfers tend to use indicators that are based on flows of codified knowledge from academic institutions into firms as well as among firms, in order to measure these flows and the outcomes. At the same time, there is rich empirical evidence emphasising the importance of informal network structures and the mobility of highly-skilled labour for the initiation and facilitation of such transfers. These two aspects of the study of knowledge transfers – one focusing on measuring outcomes and the other analysing the dynamics of the underlying structures – have been addressed somewhat separately in the literature, even though they appear to be closely related. Since there is strong international academic and political interest shown in the role of knowledge transfer between organisations on economic development, this workshop and the twelve papers presented aimed at gaining some deeper insights and bridging the artificial gap that has developed in the literature. Thus, the emphasis was on contributions that explicitly focus on the dynamics of the informal structures that

### The Role of Labour Mobility and Informal Networks for Knowledge Transfer

### Conferences and Workshops

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enable and condition the effective transfer of knowledge across organisational boundaries. Presentations covered a wide range of perspectives and included theoretical as well as empirical material.

The workshop was opened by David Audretsch's (Bloomington) keynote lecture on "The Mobility of Economic Agents as Conduits of Knowledge Spillovers", departing with an exposition of how mobility in general relates to theories of economic growth. Audretsch then proposed to move from the macro level to a focus on individual knowledge workers, arguing that mobility is conditional on individuals' decisions about investing in their knowledge as well as the appropriation of the returns to these investments. Moreover, attention was drawn to many of the closely related aspects such as the geographical dimension of embodied knowledge spillovers and the relationship of mobility to the broader issue of entrepreneurship.



*Stefano Breschi, Oded Stark*

The second presentation by Stefano Breschi (Milano; discussant: Sven Pinkert, MPI Jena) addressed the local dimension of knowledge spillovers, drawing on Italian patent data. In their paper, Breschi and his co-author Francesco Lissoni replicated Jaffe, Trajtenberg and Henderson's (1993) results with Italian data, and extended them by adding new variables measuring social proximity between inventors as well as inventors' mobility. They argued that labour mobility acts as a constraint on knowledge flows,

suggesting that knowledge flows are localised to the extent that labour mobility also is.

The work presented by Paula Stephan (Atlanta; discussant: Thomas Brenner, MPI Jena) specifically focused on the mobility of PhDs into the top R&D departments, drawing on data from the Survey of Earned Doctorates (SED). Stephan's findings show that public knowledge sources are less geographically concentrated than university R&D expenditure data would suggest and that knowledge spillovers embedded in new hires are less geographically bounded than one might expect from earlier work. In terms of the industries PhDs migrate to, the main destinations were shown to be telecommunications, computers, semiconductors, pharmaceuticals, electronics, transportation, and glass. Interestingly, it turns out that top R&D firms are more selective in their hiring than are "other" firms, overwhelmingly recruiting talent from programs ranked highly by the most recent National Research Council rankings.



*David B. Audretsch, Paula E. Stephan*

The nature of knowledge that is transferred when scientists migrate from basic research institutions into industry was subsequently explored in detail by Christian Zellner (MPI Jena; discussant: Saradindu Bhaduri, New Delhi). He presented the results of a survey among scientists formerly employed by the Max Planck Society, a basic research organisation in Germany. Besides a higher propensity to transfer specific scientific knowledge among those migrating into R&D departments, he found that what appears to be most relevant are elements of knowledge that are not necessarily restricted to any one scientific discipline, and are relevant to the activities in various destination sectors. The main conclusion of this work is that knowledge developed and individually accumulated in the context of curiosity-driven research is in many instances a vital input into commercially motivated search activities.

Olav Sorenson (Los Angeles; discussant: Guido Buenstorf, MPI Jena) studied the relationship among informational complexity and industry concentration, analysing the question of when social networks play a role in structuring industrial geography. He argued that social networks become increasingly important for the transmission of knowledge as the complexity of the underlying knowledge increases. This leads to the expectation that industries based on more complex knowledge will geographically concentrate. Sorenson explored that hypothesis by investigating patent data estimating the effect of knowledge complexity on geographic dispersion of future citations. Moreover, he looked at the industry-level correlation between the distribution of knowledge complexity in the industry and the degree of geographic concentration of production, demonstrating that both these approaches lend support to his hypothesis.

The Role of Labour  
Mobility and Informal  
Networks for Know-  
ledge Transfer



*Guido Bünstorf, Paolo Seri*

Michel Quééré (Sophia-Antipolis; discussant: Paolo Seri, Ancona) analysed the developments that have taken place in French science-industry relationships over the past two decades, adopting an Austrian economic perspective. The central message of his study was that policy should shift away from approaches devoted to encouraging established forms of science-industry relationships to policies aimed at encouraging entrepreneurial conduct. With regard to academic entrepreneurship, Quééré argued that much of it is in fact due to opportunistic responses of scientists to

changes in environmental conditions, rather than to new individual entrepreneurial mentality.

Dirk Fornahl (MPI Jena; discussant: Anja Kettner, Berlin) addressed the question of how informal regional networks in which agents are embedded can influence regional entrepreneurial activities. As a starting point, the development of an agent through different stages until becoming an entrepreneur was analysed. In a next step the peculiar features of and processes in social regional networks was presented. The processes described have specific local features and are shaped by proximity effects, understood in cognitive and cultural terms, and spatial specificity. These networks provide access to resources as well as to information, facilitating the diffusion of mental models inside the population. During the developmental process a network can serve different functions or different networks are utilized in different stages of the process.

Jacek Lipiec (Gdansk; discussant: Annamaria Inzelt, Budapest) changed the perspective to the firm level and dealt with the question of which factors influence the mobility of workers and, thus, the associated knowledge transfer. He especially focused on the aspect of the temporary mobility of workers inside multinational enterprises. Lipiec analysed different factors that influence the labour mobility of workers and presented reasons for relocation from the view of the employer and the employee as well as barriers to mobility. In the final part of his presentation he suggested how the mobility of workers could be encouraged.

Donald Patton (Davis; discussant: Eric Lehmann, Konstanz) presented, in his study, ways in which different agents are linked to each other. In this case study he used IPO data in order to explore the links between newly established semiconductor firms, firm lawyers and investment bank lawyers (as a proxy for the investment bank's location) as well as venture capital directors and non-



*M. Fritsch, D. B. Autdretsch,  
E. Lehmann, P. E. Stephan*

**Conferences  
and Workshops**

### The Role of Labour Mobility and Informal Networks for Knowledge Transfer

VC directors. Since the spatial locations of these agents were identified, Patton was able to analyse the pattern of network linkages and the geographical distance between the agents involved. A strong cluster in Silicon Valley was identified, which supported previous findings on clustering, but he also found that long-distance links can play an important role.

In addition to the theoretical and empirical approaches, Robin Cowan (Maastricht; discussant: Katinka Pantz, MPI Jena) used a simulation in order to gain some insights into the processes of knowledge production and diffusion within the scientific community. In this model two ways of knowledge diffusion exist: the job market and networking. It is shown that both these processes are relevant for knowledge accumulation but that distinct mechanisms and dynamics take place. Cowan pointed out that there is an optimum amount of networking and that a too highly skewed distribution of networking activity hinders knowledge production. Furthermore, network linkages lead to more specialisation because the agents can profit from the adjacent knowledge other agents hold that can lead to positive feedback.



*Robin Cowan*

### Conferences and Workshops

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*Jan Vang-Lauridsen, Florian Arun-Täube*

Florian Arun-Täube (Frankfurt; discussant: Jan Vang-Lauridsen, Copenhagen) drew attention to the international dimension by analysing the linkages between India and Silicon Valley. He focused on the impact of transnational networks on developing countries and used the Indian software industry as an example. He showed that an important channel for knowledge and resource transfer to India is the link between overseas Indians working in Silicon Valley and organisations located in India. Such support takes place by the return of émigrés, technical

assistance, venture funding or actual business outsourcing to India. Furthermore, he analysed the influence of cultural factors on knowledge transfer and on the likelihood of starting a software firm. He found the software industry to be dominated by South Indian Brahmins.

Oded Stark (Tel Aviv; discussant: Michael Fritsch, Freiberg) added to this international perspective by trying to shed some light on the debate on the international brain drain. A critical reflection on the present state of research into brain drain was the starting point for his presentation. He developed a mathematical model by which he showed that a strictly positive probability of migration to a richer country can enhance welfare toward the social optimum, because of the positive effect on individual human capital accumulation. The level of human capital formed by optimising individuals as well as the average level of human capital in general rises.

## International Research Cooperation

In 2002, the Evolutionary Economics Group participated as a founding member in a European research cooperation initiative, the ETE (Economic Transformation in Europe) -Network. Participating research groups in Britain, Denmark, France, Italy, Norway, Sweden and Germany have a mutual interest in the ongoing transformation of the modern European economy and its sustainability. The intention is to establish a programme of fundamental conceptual and empirical work under this general theme. A co-disciplinary approach, centered around economics, sociology and management sciences, has been chosen to investigate the changing relationships between service and manufacturing activity in relation to innovation and the dynamics of growth; the role of wants and consumption behavior in the innovation process; the emergence of new institutional structures to guide the accumulation and application of innovative knowledge, the scientific and technological capacity to implement sustainable development in Europe and globally.

In addition, the Evolutionary Economics Group joined the European research network DIME (Dynamics of Institutions, Markets and Economies). This network includes research groups in Britain, the Czech Republic, Denmark, France, Germany, Greece, Hungary, Italy, The Netherlands, Portugal and Spain. Its goal is to understand economic systems as evolving systems composed of heterogeneous and strategic agents and to improve the understanding of economic and social processes underpinning the evolution of economic agents, markets, industries, technologies, and institutions. The network uses an interdisciplinary and evidence-based approach that focuses on the co-evolution of technologies, corporate organizations and institutions as the fundamental driving process of economic change.

**International  
Research Cooperation**

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## University Lectures and Seminar Presentations

### Summer Term 2002

Ulrich Witt and Thomas Brenner: *Technology Networks and Innovation Systems*

### Winter Term 2002/03

Ulrich Witt: *A Course in Evolutionary Economics*

### January 23, 2002

Klaus Rathe: *Industrial Dynamics and Firm Development*

Christian Zellner: *Basic Research and Career Mobility*

### January 30, 2002

Dirk Fornahl: *Hypotheses*

Deborah Tappi: *Towards a Theory of Change and Evolution in LICs*

### April 17, 2002

Silke Scheer: *Organizational Structure, from a Psychological Point of View*

Hagen Worch: *Findings on Organizational Development from the Stanford Project of Emerging Companies*

### **July 03, 2002**

Peter Murmann: *The Complex Role of Patents in Creating Technological Competencies*

Silke Scheer: *Building up the Basis: 'Administrative Behavior' by Herbert A. Simon*

Hagen Worch: *Organizational Development in Growing Firms*

Ulrich Witt: *Conceptions vs. Routines – On the Development of Firms and the Evolution of Markets*

### **August 28, 2002**

Christian Zellner: *Scientists' Careers in Industry: Evidence for Embodied Knowledge Transfer from the Max Planck Society*

### **September 25, 2002**

Uta-Maria Niederle: *From Possession to Property: Preferences and the Role of Culture or: The Origin of Property: An Anthropological Account*

### **October 16, 2002**

Jukka Kaisla: *A Constitutional Approach to the Open Source Software Development*

Silke Scheer: *Integrating Cognitive Leadership Theory*

Hagen Worch: *Organizational Development in Growing Firms*

### **October 29, 2002**

Christian Zellner: *Evaluating the Contribution of Basic Research to Systemic Innovative Capacity*

### **December 05, 2002**

Guido Bünstorf: *Getting Focused: A First Progress Report on Industrial Dynamics in the German Laser Market*

### **December 12, 2002**

Thomas Brenner: *The Dependence of Innovativeness on the Local Firm Population – An Empirical Study of German Patents*

Andreas Gildner: *Determinanten der räumlichen Verteilung von lokalen Clustern*

## Publications

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The Evolution of the US Automobile Industry and Detroit as its Capital

## Visiting Scholars

In 2002 we were happy to host the following guest scholars in our institute for a more extended period of time and for lot of interesting exchange and mutual research; the shortterm guests are listed under "Lectures".

**Andreozzi, Liciano**

(University of Cassino, Italy)

October 1 – December 31, 2002

**Apesteguia, Jose**

(University of Bonn, Germany)

April 4 – 11, 2002

**Avrahami, Judith**

(University of Jerusalem, Israel)

February 18 – 28, 2002

**Belussi, Fiorenza**

(University of Padova, Italy)

January 31 – March 2, 2002

## VISITING SCHOLARS

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### Visiting Scholars

<b>Berninghaus, Siegfried</b> (University of Karlsruhe, Germany)	February 14 – 15, August 5 – 19 and September 2 – 7, 2002
<b>Bolton, Gary</b> (University of Beam, USA)	June 14 – July 27, 2002
<b>Dieckheuer, Gustav</b> (University of Münster, Germany)	June 28 – 30, 2002
<b>Dudley, Leonard</b> (University of Montreal, Canada)	August 1, 2001 – July 15, 2002
<b>Eichberger, Jürgen</b> (University of Saarbrücken, Germany)	March 4 – 5, 2002
<b>Emons, Winand</b> (University of Bern, Switzerland)	November 13 – 14, 2002
<b>Fehr, Dietmar</b> (University of Vienna, Austria)	December 9 – 13, 2002
<b>Folkers, Cay</b> (University of Bochum, Germany)	August 15, 2002
<b>González, Luis</b> (University of Bochum, Germany)	January 9 – 17, 2002
<b>Grossklags, Jens</b> (University of Berkeley, USA)	June 3 – 6, 2002
<b>Iida, Yoshio</b> (University of Kyoto, Japan)	November 11 – 16, 2002
<b>Kareev, Yakov</b> (University of Jerusalem, Israel)	February 18 – 28, 2002
<b>Katok, Elena</b> (University of Beam, USA)	June 14 – July 27, 2002
<b>Kirchsteiger, Georg</b> (University of Vienna, Austria)	February 1 – 6, 2002
<b>Kirstein, Annette</b> (University of Karlsruhe, Germany)	February 14 – 15, 2002
<b>Klepper, Steven</b> (Carnegie Mellon University, USA)	June 25 – July 2, 2002
<b>Kliemt, Hartmut</b> (University of Duisburg, Germany)	February 14 and August 6 – 7, 2002
<b>Knudsen, Thorbjørn</b> (University of Southern Denmark, Denmark)	November 9 – 17, 2002
<b>Kocher, Martin</b> (University of Innsbruck, Austria)	March 18 – 22 and May 21 – August 15, 2002
<b>Kovácz, Judit</b> (University of Debrecen, Hungary)	January 5 – 11, 2002
<b>Kröger, Sabine</b> (Humboldt University Berlin, Germany)	March 19 – 21, April 2 – 10 and November 10 – 14, 2002
<b>Kwasnicki, Witold</b> (University of Wrocław, Poland)	May 27 – 31, 2002

<b>Llorente, Loreto</b> (University of Pamplona, Spain)	March 4 – May 31, 2002
<b>Loasby, Brian</b> (University of Stirling, Scotland)	May 9 – 17, 2002
<b>Maier-Rigaud, Frank P.</b> (Max Planck Project Group Common Goods, Law, Politics and Economics, Bonn)	November 10 – 15, 2002-12-04
<b>Margreiter, Magdalena</b> (University of Innsbruck, Austria)	February 25 – April 22 and May 21 – 25, 2002
<b>Maug, Ernst</b> (Humboldt University Berlin, Germany)	July 9, 2002
<b>McDaniel, Tanga</b> (University of Barcelona, Spain)	June 3 – 20, 2002
<b>Murmann, Peter J.</b> (Northwestern University, USA)	February 10 – September 2, 2002
<b>Oses Eraso, Nuria</b> (University of Pamplona, Spain)	May 20 – 26, 2002
<b>Pelikan, Pavel</b> (KTH-INDEK Stockholm, Sweden)	May 2 – 9, 2002
<b>Pezanis-Christou, Paul</b> (University of Barcelona, Spain)	June 3 – 30, 2002
<b>Pull, Kerstin</b> (University of Trier, Germany)	March 19 – 21 and October 4 – 5, 2002
<b>Ritzberger, Klaus</b> (Institute for Advanced Studies, Vienna)	December 2 – 6, 2002
<b>Sausgruber, Rupert</b> (University of Innsbruck, Austria)	September 1 – December 31, 2002
<b>Saviotti, Pier Paolo</b> (Université Pierre Mendès-France, France)	November 1 – February 29, 2003
<b>Schmidt, Tino</b> (University of Dresden, Germany)	August 1 – September 30, 2002
<b>Sunder, Shyam</b> (Yale University, New Heaven, USA)	November 25 – 26, 2002
<b>Sutter, Matthias</b> (University of Innsbruck, Austria)	March 17 – 22, 2002
<b>Tyran, Jean-Robert</b> (University of St. Gallen, Switzerland)	December 10 – 12, 2002
<b>Valente, Marco</b> (University of Aalborg, Denmark)	January, 28 – February 3, 2002
<b>Vogt, Bodo</b> (University of Bielefeld, Germany)	August 15 and September 2 – 9 December 8 - 9, 2002
<b>Willinger, Marc</b> (University of Strasbourg, France)	April 15 – 19, 2002
<b>Zultan, Ro'i</b> (University of Jerusalem, Israel)	February 15 – 22, 2002 and November 11, 2002 – October 2003

## MPI - Directory

### Strategic Interaction Group

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#### Werner Güth



Scientific Member of Max Planck Society, Director Strategic Interaction Group

#### *Curriculum Vitae*

Werner Güth has studied economics at the University of Münster where he also received his doctoral degree (1972) and habilitation (1976). He was professor for economic theory at the University of Cologne (1977 – 1986), the University of Frankfurt (Main) (1986 – 1994) and Humboldt-University of Berlin (1994 – 2001) before becoming the director of the Strategic Interaction Group of the Max Planck Institute for Research into Economic Systems in Jena in 2001. Since 2002 he is honorary professor of economics at the Friedrich Schiller University of Jena and a member of the Berlin-Brandenburg Academy of Sciences. His research topics are game theory, experimental and micro-economics with strong leanings towards (social) psychology, philosophy, (evolutionary) biology and the political sciences.

#### *Research Topics*

game theory, experimental economics, (indirect) evolution, (un)bounded rationality, microeconomics

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#### Sylvia Arnold and Karin Richter

Secretaries to Werner Güth

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#### Susanne Büchner

Research Fellow

#### *Curriculum Vitae*

Susanne Büchner studied Sociology, Psychology and English at the University of Leipzig. In 2000 she finished her studies with a degree as Magister Artium (MA). Since January 2002 she is working in the team of Werner Güth at the Max Planck Institute.

#### *Research topics*

fairness and solidarity

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**Giorgio Coricelli**

Research Fellow

*Curriculum Vitae*

Has been studying economics at the University of Rome "La Sapienza" (B.A., 1995), University Carlos III, Madrid (M.A., 1996), and University of Arizona (M.A., 2001, and Ph.D. in Economics, minor in Psychology, 2002). Professional experience: research fellow at the "Istituto di Studi per la Programmazione Economica", Rome (1997); Economic Science Laboratory, University of Arizona, Tucson (1998 - 2002); Centre for Experimental Economics (EXEC), York, UK (2001 - 2002); and Department of Economics, University of Siena, Italy (2002).



*Research Topics*

experimental economics, behavioral economics, game theory, cognitive psychology, and cognitive neurosciences.

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**Dennis Alexis Valin Dittrich**

Research Associate

*Curriculum Vitae*

Born in 1975 in Berlin, Dennis Dittrich received a degree as Diplom-Volkswirt (M.A. in economics) in 2001 from the Humboldt University of Berlin. Since September 2001 he has been working at the Max Planck Institute in Jena. In September 2002 he took on the honorary office of moderator of the international newsgroup sci.econ.research.

*Research Topics*

(evolutionary) game theory, local interaction, principal / agents relations, experimental economics, behavioral economics, emotions, heuristics and biases, microeconometrics, time series analysis

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**Gerlinde Fellner**

Research Associate

*Curriculum Vitae*

Born in 1977 in Neunkirchen (Austria), Gerlinde Fellner studied economics and psychology (with main focus on economic and organizational psychology) at the University of Vienna. She received her diploma in economics (Mag. rer. soc. oec.) in June 2001 and graduated with honors in psychology (Mag. rer. nat.) in March 2002. Since September 2001 she is working in the team of Werner Güth at the Max Planck Institute.



*Research Topics*

behavioral finance, psychology and economics, public goods and social dilemmas

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**Sven Fischer**

Research Fellow

*Curriculum Vitae*

From 1994 to 1998 Sven Fischer studied geography and from 1996 to 2001 economics at Johannes Gutenberg-University Mainz, Glasgow University and Humboldt-University of Berlin. He obtained a degree as Diplom-Volkswirt (M.A. in economics) from the Humboldt-University of Berlin in January 2002 and joined the team of Werner Güth at the Max Planck Institute in Jena at the same time.

*Research Topics*

He is involved in several research projects ranging from questions on bargaining behavior, theory of public choice and (evolutionary) game theory.

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**Luis González**

Research Fellow

*Curriculum Vitae*

Luis Gonzalez obtained a BA in Economics in 1995 and a MSc in Applied Statistics in 1999, both at the Instituto Tecnológico y de Estudios Superiores de Monterrey, in México. From 1999 to 2002 he was enrolled in the joint Graduate Program on Allocation Theory, Economic Policy and Collective Decisions of the University Dortmund and the Ruhr-University Bochum in Germany, where he has submitted his Ph.D. thesis. He is at the Max Planck Institute since August 2002.



*Research Topics*

economics of corruption and democracy, institutional economics, game theory, bargaining experiments

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**Ben Greiner**

Research Fellow

*Curriculum Vitae*

1995-2002: Business Administration, Humboldt University of Berlin (degree as Diplom-Kaufmann). At the Max Planck Institute since March 2002.

*Research Topics*

game theory, experimental economics, trust and reciprocity, fairness, rationality, cooperation, bargaining

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**Maria Vittoria Levati**

Research Associate

*Curriculum Vitae*

Maria Vittoria Levati studied economics at the University of Siena where she received her degree with highest honours in July 1993. Beginning Winter term 1994/95 she started the master program in economics at the Bocconi University in Milan, where she was awarded the M.A. in economics in July 1995. Beginning spring term 1996, she started her PhD studies at the Department of Economics and Related Studies at the University of York. She received her doctoral degree in economics in 2000. From January 1997 to December 1999 she was research fellow at the Centre for Experimental Economics at the University of York. From January to December 2000 she was co-worker of the TMR network "Living Standard, Inequality and Taxation" at the Institute for Finance and Social Policy at the University of Kiel and from January to September 2001 she worked for the TMR network "ENDEAR" at the Institute for Economic Theory at the Humboldt University of Berlin.



*Research Topics*

behavioral economics and public goods

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**Boris Maciejovsky**

Research Associate

*Curriculum Vitae*

I graduated from the psychology department (Mag. rer. nat.) as well as from the business administration department (Mag. rer. soc. oec.) at the University of Vienna (Austria) in 1998, and received my Ph.D. in psychology (Dr. rer. nat.) at the same university in 2000. After my graduate studies I worked at the economic theory department at the Humboldt-University of Berlin with Werner Güth. In October 2001 I joined the Strategic Interaction Group at the Max Planck Institute.

*Research topics*

behavioral decision making, psychology and economics, and behavioral finance.

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**Andreas Nicklisch**

Research Fellow

*Curriculum Vitae*

Born 1975 in Cologne, I received the degree as a Diplom-Economist in 2002 from the Friedrich-Schiller-University of Jena. Since June, 2002 I am Research Fellow at the Max Planck Institute for Research into Economic Systems, Strategic Interaction Group, Jena.



### *Research Topics*

game theory, experimental economics, economics of innovation and cognition theory, statistical theory of causality

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### **Axel Ockenfels**

Research group leader (startet at the institute in February 2002)

#### *Curriculum Vitae*

I graduated from the economics department at the University of Bonn (Germany) in 1994, and received my Ph.D. in economics (1998) and Habilitation (2002) from the Faculty of Economics and Management at the University of Magdeburg (Germany). After extended research stays at Penn State University and Harvard University I am now concentrating my research at the Max Planck Institute on market design issues. I am also head of a research group funded by the German Science Foundation (DFG) that focuses on the economic design of online markets and the efficiency of online reputation mechanisms. Utilizing game theoretical and experimental methods I explore, for example, the economic design of auctions, the evolution of reciprocity in anonymous communities, and the nature of fairness.

### *Research Topics*

game theory, experimental economics, market design & auctions, microeconomics & industrial organization, reciprocity & fairness, bounded rationality

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### **Katinka Pantz**

Research Fellow

#### *Curriculum Vitae*

After her graduation from the philosophy department at Humboldt University of Berlin (Magister Artium in Philosophy, Politics, Economics) in April 2002, Katinka Pantz has joined the Strategic Interaction Group at the Max Planck Institute in Jena.

#### *Research Topics*

social networks and social contract theory

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### **Carsten Schmidt**

Research Associate

#### *Curriculum vitae*

Ph.D. in Economics and Information Systems (Dr. rer. pol.), Humboldt University of Berlin, 2001. Diplom in Economics (Dipl.-Volkswirt), Humboldt University of Berlin, 1998. Since 10/2001: Research associate, Max Planck Institute for Research into Economic Systems, Stra-

tegitic Interaction Group. 1/2000-9/2001: Research Associate, National Research Center "Quantification and Simulation of Economic Processes" (Sonderforschungsbereich 373), Humboldt University of Berlin, Project C5, Experimental Economics. 11/1998-12/1999: Research Associate, National Research Center "Quantification and Simulation of Economic Processes" (Sonderforschungsbereich 373), Humboldt University of Berlin, Project A3, Scientific Computing in Global Networks. 4/1995-9/1998: Graduate Research Assistant, Institute for Information Systems, Humboldt University of Berlin.

*Research Topics*

markets, auctions, experimental economics, and Internet economics

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**Anthony Zieglmeyer**

Research Associate

*Curriculum Vitae*

I graduated from the economics department at the University of Strasbourg (France), and received my Ph.D. in economics at the same university in January 2001. From October 2000 to January 2002 I visited the Hebrew University in Jerusalem (Israel) as a postdoctoral fellow (TMR grant). In February 2002 I joined the Strategic Interaction Group at the Max Planck Institute.

*Research topics*

social learning and behavioral economics

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### Ulrich Witt

Scientific Member of Max Planck Society, Director Evolutionary Economics Group, Professor of Economics University of Jena

#### *Curriculum Vitae*

Studies in economics in Göttingen, Würzburg, and Stockholm, 1966 -1972, Diplom-Volkswirt (M.A. in Economics) 1972 and Ph.D. in Economics 1979 at the University of Göttingen, Habilitation University of Mannheim 1985, Associate Professor of Economics, University of Mannheim 1985-86, Visiting Professor University of Southern California, Los Angeles 1986 -87, Professor of Economics and Director Institute for Study of Economic Evolution, University of Freiburg, 1988 -1995, Director Max Planck Institute for Research into Economic Systems and Professor of Economics in Jena, 1995 - present.

#### *Research Topics*

economic behavior and its biological and psychological foundations; long-term economic change; social- cognitive theory of institutional change; methodological and conceptual problems of theories of evolution

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### Inken Poßner and Karin Serfling

Secretaries to Professor Ulrich Witt

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### Thomas Brenner

Research Associate

#### *Curriculum Vitae*

Born in 1968, he received degrees as Diplom-Physiker (M.S. in Physics) in 1992 and as Dr.rer.nat. (Ph.D.) with a thesis on decision making and consumption behaviour in 1995 from the University of Stuttgart. In 1995 he worked as a research assistant in the Institute for Study of Economic Evolution, University of Freiburg. October 1995 he started to work at the Max Planck Institute on modelling learning in economics and received a degree as Dr. rer. pol. (Ph.D.

in Economics) in January 1998. October 1997 to February 1998 he was a visiting fellow at the Centre for Economic Learning and Social Evolution, University College London working on learning in game experiments. Since March 1998 he has been working on his habilitation project "Existence, Emergence and Evolution of Local Industrial Clusters". This thesis was submitted to the Jena University in June 2002.



*Research Topics*

localised industrial clusters, industrial spatial distribution, learning in economics, experimental economics, game theory, simulations, computational economics, economic psychology, consumption behaviour

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**Guido Bünstorf**

Research Associate / Coordinating Researcher

*Curriculum Vitae*

Studies in economics and political science at Freiburg University and at the University of Massachusetts (Amherst / U.S.A.). Diplom-Volkswirt (M.A. in Economics): Freiburg, 1996. PhD in Economics: Jena, 2002. At the Max Planck Institute since October 1996.



*Research Topics*

industrial evolution, user innovation, media economics, evolutionary economics

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**Christian Cordes**

Research Associate

*Curriculum Vitae*

In 1998 he received a degree as Diplom-Ökonom (MA in Economics) at the University of Hannover. Since then he has been at the Max Planck Institute.

*Research Topics*

evolutionary analysis of long-term qualitative change in human labor and labor supply (he has developed a taxonomy of human labor inputs reflecting the changing qualitative structure of human labor inputs in a historical perspective); genetic foundation of economic behavior (he puts the hypothesis that, to a great extent, human technology is the outcome of creative mental effort to avoid physical and mental effort. He argues, that the motivation of humans to utilize their growing knowledge is to reveal ways of alleviating the burden of physical and perhaps mental work in making a living.)

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**Dirk Fornahl**

Research Fellow

*Curriculum Vitae*

Born in 1973. Studies in economics and business administration at the Universities of Hannover, Dublin City University (Ireland) and the University of California (Berkeley, USA). 1999: Diplom-Ökonom (MA in Economics and Business Administration) at Hannover. MA thesis



(transl.): 'International Environmental Negotiations from the Perspective of the New Political Economy and the New Institutional Economics - Strategic behavior of selected actors'. Since 1999 he has been at the Max Planck Institute, working until May 2001 in the 'InnoRegio' program of the Federal Ministry of Education and Science. In his dissertation he analyzes how disparities in regional founding rates emerge and are caused by social-cognitive learning processes. The theoretical framework is complemented by an empirical study focusing on the region of Jena in order to verify the hypotheses.

### *Research Topics*

(regional) entrepreneurship, (regional) networks and cooperation, institutions and culture, international environmental policy, cognitive economics, evolutionary economics, ecological economics, (social) psychology

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### **Jukka Kaisla**

Research Associate

### *Curriculum Vitae*

Studies in economics at Turku School of Economics in Finland (M.Sc. in economics 1997), and at Copenhagen Business School in Denmark (Ph.D. in economics 2002). At the Max Planck Institute since April 2002.

### *Research topics*

austrian economics, constitutional economics, evolutionary economics.

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### **Uta-Maria Niederle**

Research Associate

### *Curriculum Vitae*

Born in 1968 she studied economics at the Friedrich-Alexander University of Erlangen-Nürnberg, Heriot-Watt University in Edinburgh, U.K., and Christian-Albrechts University in Kiel. She received her degree as Diplom-Volkswirt (M.S. in Economics) in 1994. From 1994 until 1999 she worked at the University of Rostock on a theory of institutions with special reference to insurance. 2000 degree as Dr. rer. pol. (PhD). Since 1999 she has been working as a Habilitand (post-doc) at the Max Planck Institute in Jena. Her project enquires into the substance of preferences as part of a new model of human economic behavior. Using an economic view on anthropological findings possessive behavior is related to the formation of property rights as well as to the development of consumption.

### *Research Topics*

cognitive models of human economic behavior and substantive preferences (esp. possessive behavior), concepts and models of evolutionary dynamics, general theory of institutions and institutional change, economic history (esp. emergence and evolution of insurance)

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**Klaus Rathe**

Research Associate

From 1991 to 1996 student of economics at University of St. Gallen (Switzerland) and Indiana University (Bloomington, IN); lic.oec. (MA in economics) awarded in 1996. Since 1996 work on a developmental theory of the firm at the Max Planck Institute in Jena.

*Research Topics*

theory of the firm, economics of organization, social psychology and economics, institutional economics, economic methodology

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**Silke Scheer**

Research Fellow

*Curriculum Vitae*

Born in 1974. 1994 to 2000: Studies in Psychology and Family and Elementary Education Sciences at the Otto-Friedrich University of Bamberg. 2000: Diplom-Psychologin (MA in Psychology). MA-thesis (transl.): "Who saves Robby? – An analytical comparison of strategies in corner-cases". 2000/01: Fellow at the University of Melbourne, Department of Industrial and Organizational Psychology. Since 2002 she is with the Max Planck Institute in Jena working on her doctoral thesis on the developmental (leadership-) patterns in growing firms.



*Research Topics*

theory of the firm, developmental regularities in firm growth, focusing on leadership; cognition, motivation, and emotion of the firm; strategies in problem-solving; human errors

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**Christian Schubert**

Research Associate

*Curriculum Vitae*

Born in 1971. From 1991 to 1998, he studied economics at the universities of Osnabrück and Lausanne (Switzerland). He received a degree as Diplom-Volkswirt (M.A. in economics) in 1998. From 1998 to 2002 he worked as PhD student at the Max Planck project group "Law of Common Goods" at Bonn, a group consisting of law students, political scientists and economists. His PhD thesis analyses the legal governance of processes of urban self-organization. In 2002, he joined a

research project on evolving preferences and welfare theory at the Max Planck Institute.

Research topics

evolutionary economics; new institutional economics (esp. economic analysis of law); constitutional and welfare economics

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### **Deborah Tappi**

Research Fellow

#### *Curriculum Vitae*

Born in 1973. Studied economics at the University of Ancona (Italy). 'Tilolo di Dottore in Economia e Commercio' (M.A. in Economics): Ancona 1999. June-December 1999 Research assistant at the Department of Economics, University of Ancona in the EU project 'Vision Planet: Institutional Change and Economic Development in Central, Eastern and Balcanic Europe'. At the Max Planck Institute since September 1999 with a PhD's thesis on the evolution of local industrial clusters.

#### *Research Topics*

local industrial clusters, industrial districts, local economic development, evolutionary economics

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### **Georg von Wangenheim**

Research Associate

#### *Curriculum Vitae*

Born in 1963, he received his degree as Diplom-Volkswirt (M.S. in economics) from the University of the Saarland, Saarbrücken, in 1988 and passed his "erstes juristisches Staatsexamen" (academic part of training as lawyer) at Freiburg im Breisgau in 1991. In 1994, he received his doctoral degree in Economics from Albert-Ludwigs University of Freiburg. His Ph.D. dissertation was on "The Evolution of Law" (translated title). From 1994 to 2001 he was "wissenschaftlicher Assistent" (Assistant Professor) at the Institute for Law and Economics at the University of Hamburg. 1998/1999 he was Visiting Scholar at the Law School of the University of California at Berkeley for one year and in 2001 he was Visiting Research Professor at the University Pompeu Fabra at Barcelona for one semester. From 2001 to 2002, he spent another year at Hamburg as Postdoc at the "Graduiertenkolleg Recht und Ökonomik" (Graduate School of Law and Economics). He finished and submitted his "habilitation thesis" (second Ph.D.) on "Strategic Interaction and Mutual Adaptation of Citizens and the State in Regulatory Licencing Procedures" in spring 2002 to the economics faculty of the University of Hamburg. He joined the Max Planck Institute in September 2002 where he is working on evolution of preferences and its impact on institutional and normative questions.

#### *Research Topics*

evolution of preferences, game theory, institutional economics, law and economics, public choice, welfare economics from an evolutionary perspective

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**Hagen Worch**

Research Fellow

*Curriculum Vitae*

Born in 1975, he studied economics at Friedrich-Schiller University of Jena, Martin-Luther University of Halle-Wittenberg and Jean-Moulin University of Lyon, France. He received his degree as Diplom-Volkswirt (M.A. in Economics) in 2001. Since January 2002 he has been working with the Max Planck Institute in Jena on developmental regularities in firm organizations.



*Research Topics*

theory of the firm, development patterns in firm organizations, cognitive leadership and motivation, evolutionary economics

**Christian Zellner**

Research Fellow

*Curriculum Vitae*

Born in 1976, he studied development economics at the University of Kent, UK and subsequently economics and development at the University of Cambridge, UK, where he received his Masters Degree (MPhil) in 1999. In February 2000 he joined the Evolutionary Economics Group of the Max Planck Institute where he works on his PhD thesis on basic research and embodied knowledge transfer.



*Research Topics*

economics of knowledge and innovation, evolutionary economics, development economics

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**Professor Emeritus Dr. Manfred E. Streit**

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**Manfred E. Streit**

Professor Emeritus, Founder of the Institute

*Curriculum Vitae*

Professor Dr. Manfred E. Streit (\*1939) studied economics and the basics of law at the University of the Saarland between 1959 and 1963. After graduating ("Diplom-Volkswirt"), he became collaborator of Prof. Dr. Drs. h.c. Herbert Giersch at the Institute for European Economic Policy at the University of the Saarland. He received his doctorate degree in 1966 (Dr. rer. pol.). Between 1966 and 1968 he

was scientific assistant to the German Council of Economic Advisors (Sachverständigenrat), between 1968 and 1971 lecturer in economics at the University of Reading (UK). He received his habilitation with the appointment to a chair of economics at the University of Mannheim in 1971. During a leave of absence between 1980 and 1983 he worked as professor at the European University Institute at Florence. He has further undertaken research stays at universities in Canada and Australia. In 1990, he accepted an appointment to the University of Freiburg where he continued research in the tradition of the Freiburg School of Law and Economics. In 1993 he founded the Max-Planck-Institute for Research into Economic Systems, Jena. He is authorized translator of "The Sensory Order" by F. A. Hayek and co-editor of "Gesammelte Schriften" by F. A. Hayek in German language (published by Mohr/Siebeck, Tübingen, 2001 et seq.) and of the *Jahrbuch für Neue Politische Ökonomie*. In 2001 he has been awarded the F. A. Hayek medal to acknowledge his research in the theory and policy of the economic order in the tradition of Hayek.

### *Scientific activities*

Edition of The Collected Works by F. A. Hayek in German language (with A. Bosch, V. Vanberg and R. Veit, Freiburg). So far have been published (publisher: Mohr Siebeck, Tübingen):

Vol. A IV, edited by M. E. Streit: Rechtsordnung und Handelsordnung, 2002; Vol. A V, edited by V. Vanberg: Grundsätze einer liberalen Gesellschaftsordnung, 2002; Vol. A VI, edited by V. Vanberg: Wirtschaft, Wissenschaft und Politik, 2001; Vol. B II, edited by V. Vanberg: Missbrauch und Verfall der Vernunft (forthcoming); Vol. B V, editor and translator M. E. Streit: Die sensorische Ordnung (The Sensory Order) (forthcoming).

### *Research Topics*

institutional economics, theory and policy of the economic order

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Born in 1968. 1990 -1996: Studies in mathematics, business administration and economics at Friedrich Schiller University Jena, Strathclyde University Glasgow and Nottingham University. 1996: Diplom-Kaufmann at Jena. Since September 2000 personal assistant to Prof. em. Dr. Manfred E. Streit, the founder of Max Planck Institute for Research into Economic Systems. Thesis completed in June 2002 'Voluntary Environmental Agreements - An Economic Policy Tool'.



#### *Research Topics*

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