

The image features a minimalist, abstract design. A large, light grey shape, resembling a stylized letter 'A' or a similar geometric form, is positioned on the right side of the page. This shape is set against a white background. A white quarter-circle is cut out from the right side of the grey shape. At the bottom of the grey shape, there is a white, rounded rectangular element that overlaps the bottom edge of the page. The overall aesthetic is clean and modern.

Impressum

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Contents



Introduction	6
Highlights	14
Cooperation with Universities	18
Center for Adaptive Behavior and Cognition	22
Center for Educational Research	58
Center for Lifespan Psychology	120
Center for Sociology and the Study of the Life Course	168
Independent Research Group	208
Service Units	220
Appendix	230

Introduction





Introduction

The Max Planck Institute for Human Development is a multidisciplinary research establishment dedicated to the study of human development and education. Its inquiries are broadly defined, but concentrate on the evolutionary, social, historical, and institutional contexts of human development, as well as examining it from life-span and life-course perspectives. The disciplines of education, psychology, and sociology reflect the current directors' backgrounds, but the Institute's scholarly spectrum is enriched by the work of colleagues from such fields as mathematics, economics, computer science, evolutionary biology, and the humanities.

The Institute is one of about 80 research facilities financed by the Max Planck Society for the Advancement of Science (Max-Planck-Gesellschaft zur Förderung der Wissenschaften e.V.), the core support for which is provided by the Federal Republic of Germany and its 16 states. The total permanent staff at the Institute is 115, including 37 researchers, supplemented by a varying number of predoctoral, postdoctoral, and affiliate researchers and visiting fellows.

Research Centers

Research into processes of human development is conducted primarily from the theoretical vantage points offered by models of life-span psychology, bounded rationality and adaptive behavior, life-course sociology, and conceptions of social-historical change.

The Institute is organized into four research centers:

The **Center for Adaptive Behavior and Cognition** (Director: Gerd Gigerenzer) investigates human rationality, in particular decision-making and risk perception in an uncertain world. Current research focuses on (1) bounded rationality, that is, the simple heuristics—cognitive, emotional, and behavioral—that laypeople and experts use to make decisions under constraints of limited time

and knowledge, (2) social intelligence in cooperation and competition and (3) risk understanding and uncertainty management in everyday life, including applications in medicine, law, and education. Each of these research areas emphasizes the evolutionary foundations of behavior and cognition, in particular their domain specificity and functional adaptiveness.

The **Center for Educational Research** (Director: Jürgen Baumert) examines learning and development from an institutional point of view. Educational settings such as schools offer a variety of developmental opportunities, but at the same time exclude others. The impact of such settings is investigated from three perspectives: (1) the

long-term consequences of schools' opportunity structures on individual development in terms of cognitive competencies as well as motivational and social resources, (2) international comparison of the outcomes of schooling in the fields of reading comprehension, mathematics and science literacy, and cross-curricular competencies, and (3) improvement of learning and instruction in terms of the cognitive activation of students, mainly in science and mathematics.

The **Center for Lifespan Psychology** (Director: Paul B. Baltes) is characterized by a lifespan perspective and a concern with



The Max Planck Institute for Human Development, built 1971–73 by Hermann Fehling and Daniel Gogel. Main entrance.

the optimization of human potential. The studies of children, adolescents, adults, and the elderly concentrate primarily on the development of personality, motivation, selfhood, intelligence, memory, and information processing, as well as on various aspects of lifelong socialization including the family. In each of these areas, plasticity of human functioning and the conditions for successful development play an important role in the conceptual and methodological design of the studies. Theory, methodology and history of developmental psychology define an additional area of interest.

In the **Center for Sociology and the Study of the Life Course** (Director: Karl Ulrich Mayer), empirical research is oriented toward the analysis of social structure and institutions in a multi-

level, historical and comparative perspective. Currently, this research is organized around four major foci: (1) Education, Training, and Employment; (2) East German Life Courses after Unification (LV-Ost); (3) Welfare State, Life Courses, and Social Inequalities; and (4) Life-Course Research and Analysis: Theory, Methods, and Synthesis. The research centers on the degree of interdependence among the processes of family formation, educational careers, and occupational trajectories in the life histories of members of various birth cohorts that differ in their historical situation as well as in their sociopolitical contexts (e.g., former East vs. West Germany). The methodology of sociostructural analysis and the analysis of dynamic processes provide additional foci of activity.

Part of the interior.
Spiral staircase connecting project floors.



Governance of the Institute

The Institute is governed by a Board of Directors, currently consisting of the four members of the Institute who are fellows (Wissenschaftliche Mitglieder) of the Max Planck Society (Jürgen Baumert, Paul B. Baltes, Gerd Gigerenzer, Karl Ulrich Mayer). The board is augmented by one member from the Institute's research staff (Olaf Köller) and the head of administration (Nina Körner). Each of the directors is elected to serve as managing director for a two-year period on a rotating basis.

Several in-house committees composed of representatives elected by the entire scientific staff or by appointment advise the Board of Directors on mat-

ters of scientific research and policy. One of the major institute-wide committees is the scientific staff committee (Mitarbeiterausschuss) which is elected by all scientists.

The **International Board of Scientific Advisers** offers an important source of external review and advice to both the directors and the scientific staff on matters of research at the Institute. Members are selected from an international circle of distinguished researchers and appointed by the President of the Max Planck Society to four-year terms. They meet biannually to discuss completed, ongoing, and future research projects at the Institute. A list of the current members can be found

Rear view of the
Institute.





The Institute sponsors an ecological garden.

on the frontmatter of this report.

Organization of the Annual Report

This research report is organized in the following manner:

- The presentation of each research center begins with an introductory overview summarizing its program.
- The introduction is followed by descriptions of the center's research areas and selected projects along with a list of scientific publications.
- The supportive activities of the service units—library and computing services—are described in a special section at the end of the report.
- The appendix provides information on

the research colloquia held at the Institute, the visiting scholars, and the cooperation of the Institute's scientific staff with projects outside the Institute. It also includes an index of the scientific staff and their research interests.

Inquiries about publications should be addressed to the author(s) involved in the individual projects. Copies of the annual reports are available from the Publications Unit (Redaktion) of the Institute upon request.

Berlin, March 2001

For the Board of Directors:
Gerd Gigerenzer

Highlights



Honors and Awards

Corinne Alfeld-Liro Wilson C. Olson Award, School of Education, University of Michigan

Paul B. Baltes Member of the order Pour le mérite for sciences and arts

Paul B. Baltes Novartis Prize for Gerontological Research, International Association of Gerontology

Paul B. Baltes Longevity Prize, Fondation IPSEN, Paris

Paul B. Baltes Honorary Doctor, University of Geneva

Jürgen Baumert European Latsis Prize, European Science Foundation (ESF)

Felix Büchel DIW prize for best publication drawing on the data of the German Socio-economic Panel

Seth Bullock Leverhulme Study Abroad Studentship 1999

Mandeep K. Dhami Brunswik-Hammond Young Investigator Award of the Brunswik Society 1998

Mandeep K. Dhami Student Poster Award of the Society for Judgment and Decision Making 1998

Mandeep K. Dhami De Finetti PhD Student Prize, European Association for Decision Making 1999

Mandeep K. Dhami Jane Beattie Scholarship, Society for Judgment and Decision Making 2000

Alexandra M. Freund Member, Young Academy (Berlin-Brandenburg Academy of

Sciences and Deutsche Akademie der Naturforscher Leopoldina)

Gerd Gigerenzer Fellow, Berlin-Brandenburg Academy of Sciences

Gerd Gigerenzer John M. Olin Distinguished Visiting Professor, School of Law, University of Virginia, Charlottesville

Jutta Heckhausen Max Planck Research Prize for International Cooperation by the Max Planck Society and the Alexander von Humboldt Foundation

Ulrich Hoffrage Schloëßmann Prize, Max Planck Society

Lothar Krappmann Fellowship, Japanese Society for the Promotion of Science

Elke M. Kurz Schloëßmann Fellowship, Max Planck Society

Samuel Lindsey Schloëßmann Fellowship, Max Planck Society

Ineke Maas Fellowship, Royal Netherlands Academy of Arts and Sciences

Karl Ulrich Mayer Corresponding Fellow of the British Academy, London

Karl Ulrich Mayer Distinguished Scholar Award, American Sociological Association, Section on Aging and the Life Course

Karl Ulrich Mayer Fellow, European Academy of Sociology

Heike Solga Member, Young Academy (Berlin-Brandenburg Academy of Sciences and Deutsche Akademie der Naturforscher Leopoldina)

Independent Research Group "Lack of Training: Employment and Life Chances of the Less Educated" established by appointment of Heike Solga by the President of the Max Planck Society

Where Have Our Researchers Gone? New Positions 1998–2000

Note. For simplicity's sake, job descriptions have been standardized according to American usage.

Research Scientists

Wilfried Bos, 2000, University of Hamburg, Professor, Dept. of Education
 Martin Diewald, 2000, University of Duisburg, Professor, Dept. of Sociology
 Henriette Engelhardt, 2000, Max Planck Institute for Demographic Research, Rostock
 Peter A. Frensch, 1999, Humboldt University of Berlin, Professor, Dept. of Psychology
 Daniel Goldstein, 2000, Vice-President, Fatwire Corp., New York
 Sabine Gruehn, 1998, Humboldt University of Berlin, Assistant Professor, Dept. of Education
 Jutta Heckhausen, 2001, University of California, Irvine, Full Professor, Dept. of Psychology and Social Behavior
 Susanne Heyn, 1998, Forsa Institute, Berlin
 Ulman Lindenberger, 1999, University of Saarland, Professor, Dept. of Psychology
 Todd D. Little, 1998, Yale University, Assistant Professor, Dept. of Psychology
 Gabriele Oettingen, 2001, University of Hamburg, Professor, Dept. of Psychology
 Kai Schnabel, 2000, University of Michigan, Ann Arbor, Assistant Professor, Dept. of Psychology
 Knut Schwippert, 2000, IEA Data Processing Center, Hamburg
 Ursula M. Staudinger, 1999, Technical University of Dresden, Professor, Dept. of Psychology

Postdoctoral Research Fellows

Corinne Alfeld-Liro, 2000, National Science Foundation, Arlington
 Susan Bluck, 2000, University of Florida, Assistant Professor, Institute of Aging
 Seth Bullock, 1999, University of Leeds, Lecturer, School of Computer Studies
 Tak Wing Chan, 1998, University of Surrey, Assistant Professor, Dept. of Sociology
 Jennifer Davis, 1999, Humboldt University of Berlin, Assistant Professor, Theoretical Biology
 John C. Dencker, 1999, University of Illinois, Assistant Professor, Dept. of Business Administration
 Laurence Fiddick, 2000, Max Planck Project Group "Recht der Gemeinschaftsgüter," Bonn
 Susana Garcia Diez, 1999, Consejo Superior de Investigaciones Científicas, Madrid
 Adam S. Goodie, 1998, University of Georgia, Assistant Professor, Dept. of Psychology
 Patricia Hawley, 1998, Yale University, Assistant Professor, Dept. of Psychology
 Fabien Jobard, 2000, Centre Marc Bloch, Berlin
 Elke M. Kurz, 1999, Schloeßmann Scholarship, University of Tübingen, Dept. of Psychology
 Martin Lages, 1999, University of Glasgow, Assistant Professor, Dept. of Psychology
 Karen Z. H. Li, 2000, Concordia University, Montreal, Assistant Professor, Dept. of Psychology
 Bogdan Mach, 2000, Polish Academy of Sciences, Warsaw
 Heiner Maier, 1998, Max Planck Institute for Demographic Research, Rostock
 Jason Noble, 2000, University of Leeds, Lecturer, Informatics Research Institute
 Monisha Pasupathi, 1999, University of Utah, Assistant Professor, Dept. of Psychology
 Catrin Rode, 2000, University of Oregon, Assistant Professor, Dept. of Psychology
 Elwin Savelsbergh, 1999, University of Utrecht, Assistant Professor, Dept. of Physics Education
 Bettina S. Wiese, 1999, Technical University of Darmstadt, Assistant Professor, Dept. of Psychology
 Carsten Wrosch, 1999, Carnegie-Mellon University, Assistant Professor, Dept. of Psychology
 Zhu Liqi, 1999, Chinese Academy of Science, Peking

Predocctoral Research Fellows

Aleksej Bukov, 1999, Deutsche Post Direct GmbH, Bonn
 Valerie M. Chase, 2000, Manpower Demonstration Research Corp., New York
 Marten Clausen, 2000, University of Mannheim, Assistant Professor, Dept. of Education
 Mandeep K. Dhami, 1999, City University, London; 2001, University of Maryland, Postdoctoral Fellow, Dept. of Psychology
 Reiner Gilberg, 1998, infas Institute, Bonn
 Ingmar Hosenfeld, 2000, University of Koblenz-Landau, Assistant Professor, Dept. of Psychology
 Steffen Knoll, 1999, IEA Data Processing Center, Hamburg
 Susanne Koerber, 2000, Institute of Science Education at the University of Kiel
 Jutta Kray, 1999, Humboldt University of Berlin; 2000, University of Saarland, Assistant Professor, Dept. of Psychology
 Thomas Lampert, 1999, Institute for Health Sciences, Berlin
 Samuel Lindsey, 1999, Schloeßmann Scholarship, University of Freiburg, Dept. of Psychology
 Manuela Ullrich, 2000, Humboldt University of Berlin, Assistant Professor, Dept. of Psychology
 Brigitte Wanner, 2001, University of Montreal, Assistant Professor, Dept. of Psychology
 Sylvia Zühlke, 1999, State Authority for Data Processing and Statistics, Düsseldorf

Conferences Organized by Institute Researchers

Annual Conference of the Working Group "Stochastik in der Schule" of the German Society for Didactics of Mathematics," November 2000
(Organizers: Laura Martignon, Stefan Krauss, & Christoph Wassner)

The Future of Education and Work: Challenges for Vocational Training (Jacobs Foundation Conference), November 2000
(Organizers: Marlis Buchmann & Karl Ulrich Mayer, together with Michael Corsten)

16th Meeting of the Brunswik Society, July 2000
(Organizers: Ulrich Hoffrage, Ralph Hertwig, & Gerd Gigerenzer)

Low-Skilled = Low-Paid? Opportunities and Risks of a Low-Wage Sector in Germany (Conference of the Independent Research Group "Lack of Training" in collaboration with the LWBB), May 2000
(Organizers: Heike Solga, together with Jürgen Schupp, DIW)

Advances in Life Course Research (Ringberg Conference), April 2000
(Organizer: Karl Ulrich Mayer)

The Incomplete Unification: Social Inequalities and Occupational Trajectories in East Germany, November 1999
(Organizers: Karl Ulrich Mayer, Martin Diewald, & Heike Solga)

Fall Academy Graduate Program, October 1999
(Organizers: Paul B. Baltes & Jacquie Smith)

Bounded Rationality: The Adaptive Toolbox (Dahlem Conference), March 1999
(Organizers: Gerd Gigerenzer & Reinhard Selten)

Political Economy and the Life Course in Advanced Societies (POLIS Workshop), March 1999
(Organizers: Gosta Esping-Andersen, Trento, Karl Ulrich Mayer, and John Myles, Tallahassee)

German-American Frontiers of the Social and Behavioral Sciences (GAFOSS Symposium), March 1999
(Organizing Committee Members: Ulman Lindenberger, Heike Solga, & Julia Delius)

The Expert in Modern Societies: Historical and Contemporary Perspectives (Schloeßmann Seminar), November 1998
(Organizing Committee Member: Gerd Gigerenzer)

The Polarization of Occupational and Life Chances: Is Germany Establishing an Underclass? (LWBB Conference), October 1998
(Organizers: Felix Büchel, Martin Diewald, Antje Mertens, & Heike Solga, together with Peter Krause, DIW)

Motivational Psychology of Ontogenesis, May 1998
(Organizer: Jutta Heckhausen)



Cooperation with Universities

The Institute has always considered its cooperation with universities as very important, especially by participating in teaching activities. Researchers from our Institute teach courses at three universities in Berlin and at the University of Potsdam as well as at many other universities in Germany and abroad.

In the years 1998–2000, a total of 171 courses were taught by scientific staff members—directors, research scientists, postdoctoral as well as predoctoral fellows—of the Institute.

In addition, Institute members were supported in completing their academic degrees in cooperation with the universities in Berlin and elsewhere. In the years 1998–2000, 9 habilitations and 29 doctoral dissertations were completed by scientific staff members of the Institute. 19 student assistants associated with projects at the Institute completed Master's and diploma theses. All degrees are listed in the Appendix.

Institute researchers who taught at universities

Artelt, Cordula	Hertwig, Ralph	Maas, Ineke
Assmann, Wolfgang	Hess, Jürgen	Martignon, Laura
Baltes, Paul B.	Hillmert, Steffen	Mayer, Karl Ulrich
Baumert, Jürgen	Hoerning, Erika M.	Oettingen, Gabriele
Büchel, Felix	Hoffrage, Ulrich	Rieskamp, Jörg
Clausen, Marten	Hosenfeld, Ingmar	Rode, Catrin
Corsten, Michael	Jobard, Fabien	Rusch-Feja, Diann
Daniels, Zoe	Keller, Monika	Schnabel, Kai
Demmrich, Anke	Klieme, Eckhard	Seibert, Holger
Diewald, Martin	Köller, Olaf	Smith, Jacqui
Engelhardt, Henriette	Koerber, Susanne	Solga, Heike
Frensch, Peter	Krappmann, Lothar	Stanat, Petra
Freund, Alexandra M.	Krauss, Stefan	Staudinger, Ursula M.
Ghisletta, Paolo	Kreppner, Kurt	Stern, Elsbeth
Gigerenzer, Gerd	Kurz, Elke M.	Thußbas, Claudia
Glück, Judith	Kurzenhäuser, Stephanie	Trappe, Heike
Goedicke, Anne	Lages, Martin	Trautwein, Ulrich
Händle, Christa	Lenhardt, Gero	Watermann, Rainer
Hardy, Ilonca	Li, Shu-Chen	Wrosch, Carsten
Heckhausen, Jutta	Lindenberger, Ulman	

Universities where these courses were taught

Berlin	Frankfurt a.M.	Rostock
Freie Universität	Fribourg	São Paulo/Ribeirao Preto
Humboldt-Universität	Geneva	Tartu
Technische Universität	Leipzig	Utrecht
Berne	Mannheim	Vienna
Brasilia	Michigan, Ann Arbor	Virginia, Charlottesville
Bremen	Oldenburg	Zurich
Duisburg	Padova	
Florence	Potsdam	

The Graduate Program (Graduiertenkolleg) on the Psychiatry and Psychology of Aging

This special program for doctoral training in psychological and psychiatric gerontology located at the Free University of Berlin, was established in October 1998 by the late Margret M. Baltes and Hanfried Helmchen with funding from the German Research Council (DFG). Since March 1999, the program has been co-chaired by Hanfried Helmchen (Psychiatry, Free University) and Paul B. Baltes (Psychology, Max Planck Institute for Human Development). This program represents a cross-discipline collaboration between psychology and medicine and illustrates an important link between our Institute and the Free University of Berlin in fostering junior researchers. Four research groups are involved in the program: The Free University of Berlin, Psychology, the University Hospital Benjamin Franklin, Psychiatry and ENT, together with the Max Planck Institute for Human Development, Center for Lifespan Psychology. Their goals are (1) to integrate medical-psychiatric and psychological questions in research on aging and (2) to focus on issues of very old age.

In addition, the graduate program seeks to integrate gerontological research and themes with studies and theoretical frameworks from health psychology.

During 1998-2000, 7 doctoral fellows and 2 postdoctoral fellows from the Center for Lifespan Psychology have worked together with 10 fellows (of medicine and psychology) from the Free University to further their studies in gerontology. The Berlin Aging Study (BASE) serves as a context for these graduates to learn about the different theoretical and practice-related perspectives associated with the general field of gerontology (e.g., biology, public health, sociology, demography, history, adult education, economics). The graduate program involves regular seminars, workshops, and Fall academies in which international researchers and doctoral fellows from other universities participate.

www.fu-berlin.de/age





**Center for
Adaptive Behavior
and Cognition**

Contents

Introductory Overview	25
Bounded Rationality	27
Ecological Rationality	36
Social Rationality	39
Evolutionary Psychology	45
Methods, Metaphors, and Theory Construction	47
Publications 1998–2000	51

Scientific Staff 1998–2000

Gerd Gigerenzer, Daniel Goldstein (as of 2000: Fatwire Corp., New York), Ralph Hertwig, Ulrich Hoffrage, John M. C. Hutchinson, Monika Keller, Lothar Krappmann, Laura Martignon, Peter M. Todd, Oliver Vitouch

Postdoctoral Research Fellows

H. Clark Barrett, Seth Bullock (as of 1999: University of Leeds), Jennifer N. Davis (as of 1999: Humboldt-Universität zu Berlin), Laurence Fiddick (as of 2000: MPG-Projektgruppe "Recht der Gemeinschaftsgüter," Bonn), Adam S. Goodie (as of 1998: University of Georgia), Elke M. Kurz (Schloebmann Scholarship, Universität Tübingen), Martin Lages (as of 1999: University of Glasgow), Barnaby Marsh, Jason Noble (as of 2000: University of Leeds), Masanori Takezawa

Predocctoral Research Fellows

Valerie M. Chase (as of 2000: Manpower Demonstration Research Corp., New York), Mandeep K. Dhani (as of 1999: City University, London; as of 2001: University of Maryland), Thomas Dudey, Carola Faselow, Stefan Krauss, Stephanie Kurzenhäuser, Samuel Lindsey (Schloebmann Scholarship, Universität Freiburg), Jörg Rieskamp, Christoph Wassner

Long-Term Visitors

Andreas Ortmann, Jorge Simao, Elio Tuci, Szymon Wichary

Introductory Overview

The Center for Adaptive Behavior and Cognition (ABC) investigates reasoning and decision making under uncertainty, at the levels of both individuals and social groups. The research group consists of psychologists, mathematicians, computer scientists, evolutionary biologists, economists, and researchers from other fields. With different methodological abilities—such as experimental methods, computer simulation, and mathematical analysis—they cooperate on the same problems.

The ABC program combines a strong theoretical focus with practical applications. The research group works on the metatheory, on specific models, and on applications. The applications range from teaching statistical thinking to using heuristics to invest in the stock market, from improving statistical reasoning by particular representations of numerical information in AIDS counseling to improving statistical intuitions of expert witnesses in law courts.

The theoretical focus can be—albeit artificially—divided into three aspects.

Bounded rationality Models of bounded rationality try to answer the question of how real people with limited time, knowledge, money, and other scarce resources make decisions. This program is an alternative to the dominant optimization paradigm in cognitive science, economics, and behavioral biology that poses the question of how

Laplacean superintelligences and other heavenly beings would behave. We study the proximal mechanisms of bounded rationality, that is, the adaptive heuristics that enable decisions under uncertainty quickly and frugally. This collection of heuristics and their building blocks is what we call the adaptive toolbox.

Truth is ever to be found in
simplicity, and not in the
multiplicity and
confusion of things.
Isaac Newton

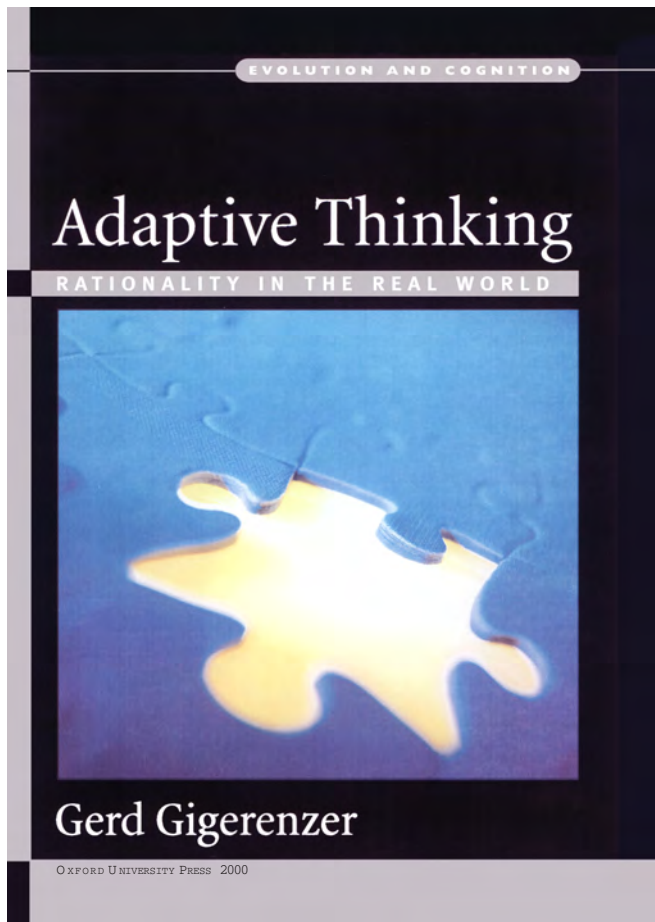
In this world
nothing is certain
but death and taxes.
Benjamin Franklin

Ecological rationality Models of ecological rationality describe the structure and representation of information in actual environments and their match with mental strategies, such as boundedly rational heuristics. To the degree such a match exists, heuristics need not trade accuracy for being fast and frugal—they can have it both ways. The simultaneous focus on the mind *and* its environment, past and present, puts research on decision making under uncertainty into an evolutionary and ecological framework, a framework that is missing in most theories of reasoning, both descriptive and normative. In short, we study the adaptation of mental and social strategies to real-world environments rather than compare strategies to the laws of logic and probability theory.

Social rationality Social rationality is a variant of ecological rationality—one for which the environment is social rather than physical or technical. Models of social rationality describe the structure of social environments and their match with boundedly rational strategies people use. Social environments increase the variety of goals in decision making and those of the heuristics. In addition to the goals that define ecological rationality—to make fast, frugal, and fairly accurate decisions—social rationality is concerned with more specific goals, such as choosing an option that one can defend with argument or morally justify, or that can create a consensus. Unlike the purely cognitive focus of most research on bounded rationality, socially adaptive heuristics include emotions and social norms that can act as heuristic principles for decision making.

These three notions of rationality converge on the same central issue: to understand human behavior and cognition as it is adapted to specific environments (ecological and social), and to discover the heuristics that guide adaptive behavior. Based on the findings of evolutionary psychology, researchers can suggest alternatives to tool-laden theories that tend to picture the mind as a computer equipped with the latest software. Finally, research on methodological, historical, and theoretical questions, in particular the influence of methodological preferences—such as linear models—on theories of cognition, constitutes a source of ideas that is of central importance to modeling visions of rationality.

These collected papers by Gerd Gigerenzer helped to build the theoretical and empirical foundations of the ABC research program. Here, the old view of the mind as an all-powerful statistician is overthrown, and rationality is reformulated instead as adaptive thinking: the way minds cope with their environments, both ecological and social.



The ABC program is an invitation to participate in a journey into largely unknown territory. The journey ventures into a land of rationality that is different from the familiar one we know from the many stories in cognitive science and economics—tales in which humans with unlimited time and knowledge live in a world where the sun of enlightenment shines down in beams of logic and probability. The new land of rationality

we set out to explore is, in contrast, shrouded in a mist of uncertainty. People in this world have only limited time, knowledge, and computational capacities with which to make inferences about what happens in their world. The notions of bounded, ecological, and social rationality are our guides to understanding how humble humans survive without following the heavenly rules of rational choice theory.

Bounded Rationality

Humans and animals do make inferences about unknown features of their world under constraints of limited time, knowledge, and computational capacities. Many models of rational decision making in cognitive science, economics, biology, and other fields, in contrast, tend to ignore these constraints. We, however, do not conceive of bounded rationality as *optimization under constraints*, nor do we think of bounded rationality as the study of how people fail to meet normative ideals. Rather, bounded rationality is the key to understanding how actual people make decisions without utilities and probabilities. Bounded rationality consists of simple step-by-step rules that function well under the constraints of limited search, knowledge, and time—whether or not an optimal procedure is available. Just as a mechanic will pull out specific wrenches, pliers, and spark-plug gap gauges to maintain an engine rather than just hit everything with a hammer, different domains of thought require different specialized tools. The notion of a toolbox full of unique one-function devices lacks the beauty of Leibniz's dream of a single all-purpose inferential power tool. Instead, it evokes the abilities of a craftsman or a used-parts dealer who can provide serviceable solutions to almost any problem with just the things at hand.

Bounded rationality is what cognitive psychology is all about.

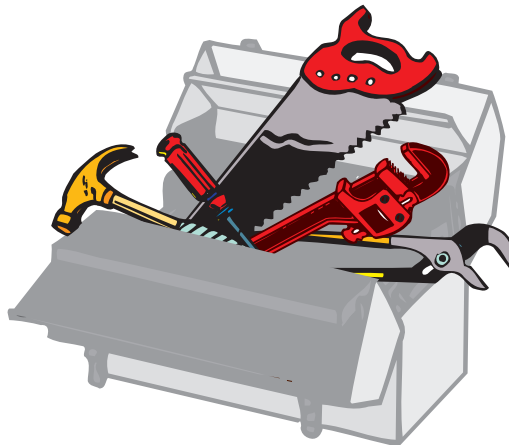
And the study of bounded rationality is not the study of optimization in relation to task environments.

Herbert Simon

The Adaptive Toolbox

This repertoire of specialized cognitive mechanisms that evolution has built into humans' minds for specific domains of inference and reasoning, including fast and frugal heuristics, is called the "adaptive toolbox." We clarify the concept of an adaptive toolbox as follows:

- It refers to a specific group of rules or heuristics rather than to a general-purpose decision-making algorithm.
- These heuristics are fast, frugal, and computationally cheap rather than consistent, coherent, and general.
- These heuristics are adapted to particular environments, past or present, physical or social.
- The heuristics in the adaptive toolbox are orchestrated by some mechanism reflecting the importance of conflicting motivations and goals.



Key References

Hertwig, R., & Hoffrage, U. (2001). Eingeschränkte und ökologische Rationalität: Ein Forschungsprogramm. *Psychologische Rundschau*, 52, 11–19.

Martignon, L., & Hoffrage, U. (1999). Why does one-reason decision making work? A case study in ecological rationality. In G. Gigerenzer, P. M. Todd, & the ABC Research Group, *Simple heuristics that make us smart* (pp. 119–140). New York: Oxford University Press.

Martignon, L., & Schmitt, M. (1999). Simplicity and robustness of fast and frugal heuristics. *Minds and Machines*, 9, 565–593.

Why Fast and Frugal Heuristics Work

- Fast and frugal heuristics exploit the structures of information in the environment. That means their rationality is a form of "ecological rationality," rather than one of consistency and coherence (Hertwig & Hoffrage, 2001; Martignon & Hoffrage, 1999).
- Simple strategies are robust compared to models with large numbers of parameters (Martignon & Schmitt, 1999).

The Multiple Meanings of "Bounded Rationality"

Some 40 years ago, the economist Herbert Simon challenged the models of rational decision making in cognitive science, economics, biology, and other fields that tend to treat the mind as a supercomputer or as a Laplacean De-

mon equipped with unlimited time, information, and computational capacities with his notion of "bounded rationality," often misinterpreted as optimization under constraints or human irrationality. The conception of bounded rationality is neither optimization under constraints (such as limited time or other limited resources) nor is it the study of how people fail to meet normative ideals.

Examples for Fast and Frugal Heuristics

Fast and frugal heuristics consist of three building blocks: simple rules for guiding search (in memory or external search), for stopping search, and for decision making. To illustrate, we present a few examples of fast and frugal heuristics:

SIMPLE HEURISTICS THAT MAKE US SMART

GERD GIGERENZER, PETER M. TODD,
AND THE ABC RESEARCH GROUP

In the past few years, the theory of rational (sensible) behavior has broken loose from the illusory and empirically unsupported notion that deciding rationally means maximizing expected utility. Research has learned to take seriously and study empirically how real human beings actually address the vast complexities of the world they inhabit. *Simple Heuristics* offers a fascinating introduction to this revolution in cognitive science, striking a blow for sanity in the approach to human rationality.

Herbert A. Simon, Nobel Laureate in Economics and Professor of Computer Science and Psychology at Carnegie Mellon University

This book is a major contribution to the theory of bounded rationality. It illustrates that the surprising efficiency of fast and simple procedures is due to their fit with the structure of the environment in which they are used. The emphasis on the ecological rationality is an advance in a promising and already fruitful new direction of research.

Reinhard Selten, Nobel Laureate in Economics and Professor of Economics at the University of Bonn

Gigerenzer & Todd's volume represents a major advance in our understanding of human reasoning, with many genuinely new ideas on how people think and an impressive body of data to back them up. *Simple Heuristics* is indispensable for cognitive psychologists, economists, and anyone else interested in reason and rationality.

Steven Pinker, Professor of Psychology at MIT and *How the Mind Works* and *Words and Rules*

How do people cope in the real, complex world of confusing and overwhelming information and rapidly approaching deadlines? This important book starts a new quest for answers. Here, Gigerenzer, Todd, and their lively research group show that simple heuristics are powerful tools that do surprisingly well. The field of decision

A body of results concerning fast and frugal heuristics has appeared in the book *Simple Heuristics That Make Us Smart* collectively written by the ABC research group. It mirrors the study of adaptive behavior and cognition within the constraints imposed by limited time and resources—one of the main goals of our research unit. The book reports the progress we have made in enhancing our understanding of how the mind can operate within these limitations.

The individual chapters are all multi-authored, reflecting the interdisciplinary collaboration among the researchers. The book exemplifies the fruitful interaction among

- computer scientists, who simulate how effective a heuristic is in real-world environments;
- mathematicians, who prove which environmental structures simple heuristics can exploit in order to be as accurate as complex "rational" strategies are;
- experimenters, who test whether a heuristic is actually used by people and when.

Most of the new results in this book would not have been obtained without the simultaneous input of and a healthy competition between these different methodological approaches.

Ignorance-based decision making:
The recognition heuristic Which city has a larger population, San Diego or San Antonio? If you are not American, you will probably guess San Diego. Why? Because you have heard of it, and chances are that you have never heard of San Antonio. If you are American, however, you probably recognize the names of both cities, and thus, cannot rely on the recognition heuristic to make your choice. In a study of Goldstein and Gigerenzer (1999) only 62% of the American students, but 100% of

the German students made correct inferences about population size. The recognition heuristic can produce the counter intuitive "less-is-more" effect. For instance, American students made more correct inferences about the relative size of the largest German cities than about the largest American cities (they had heard of all the American cities and thus could not use the simple recognition heuristic).

Key Reference

Goldstein, D. G., & Gigerenzer, G. (1999). The recognition heuristic. How ignorance makes us smart. In G. Gigerenzer, P. M. Todd, & the ABC Research Group, *Simple heuristics that make us smart* (pp. 37–58). New York: Oxford University Press.

Recognition heuristic:

If you recognize one object and not the other, then infer that the recognized object has the higher value on a criterion. This heuristic is ecologically rational when recognition correlates with the criterion.

BOUNDED RATIONALITY THE ADAPTIVE TOOLBOX

GERD GIGERENZER AND REINHARD SELTEN, EDITORS



DAHLEM WORKSHOP REPORTS

In 1999, a **Dahlem Konferenz** organized by Gerd Gigerenzer and Reinhard Selten focused around Bounded Rationality. A number of internationally well-known social scientists discussed issues such as the adaptive toolbox, fast and frugal heuristics, fiction of optimization, self-esteem, risk taking, Prisoner's Dilemma, social learning, emotions, and norms. The collected background papers and group reports, written by all participants, document the overall goal of the conference: (a) to provide a framework of bounded rationality in terms of the metaphor of the *adaptive toolbox*, (b) to provide an understanding about why and when the simple heuristics in the adaptive toolbox work, (c) to extend the notion of bounded rationality from cognitive tools to emotions, and (d) to extend the notion of bounded rationality to include social norms, imitation, and other cultural tools.

The **Dahlem Konferenzen** promote interdisciplinary exchange of scientific ideas and stimulate cooperation in research among international scientists. Dahlem Konferenzen proved themselves to be an invaluable tool for communication in science. Dahlem Konferenzen created a special type of forum for communication, now internationally recognized as the Dahlem Workshop Model. These workshops are the framework in which coherent discussions between the disciplines take place and are focused around a topic of high priority interest to the disciplines concerned.

Key Reference

Borges, B., Goldstein, D. G., Ortmann, A., & Gigerenzer, G. (1999). Can ignorance beat the stock market? In G. Gigerenzer, P. M. Todd, & the ABC Research Group, *Simple heuristics that make us smart* (pp. 59–72). New York: Oxford University Press.

Can ignorance beat the stock market? Will the recognition heuristic also lead to good decisions in a domain where the stakes are high, as is the case in the stock market? Borges, Goldstein, Ortmann, and Gigerenzer (1999) constructed investment portfolios consisting of firms highly recognized by American and German experts and American and German laypeople. Six of the eight portfolios beat professional funds as well as the Dax and the Dow. The striking returns generated by

recognition-based portfolios substantiate evidence that the recognition heuristic can make accurate inferences in real-world domains. In a portfolio competition organized by Capital, a popular German magazine, the portfolio we selected based on recognition values was ranked in the top 15% out of all participating portfolios. It is noteworthy that it substantially outperformed the portfolio selected by the editor-in-chief based on his professional expertise.

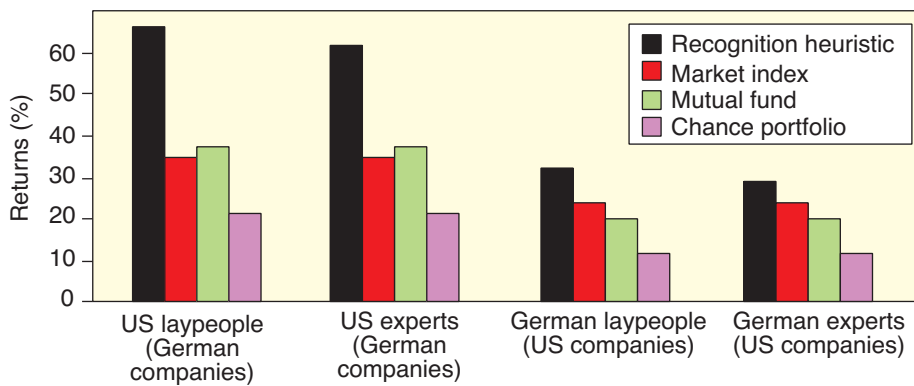
Manchmal bedeutet weniger Wissen mehr Profit

Wenn wir uns entscheiden, beherzigen wir oft Regeln, die einfach, schnell und effektiv sind – und mitunter bauen wir dabei auf Ignoranz

VON HARTMUT WEWETZER

Ein guter Handwerker braucht nicht 100 verschiedene Werkzeuge. Ihm genügen zehn wirklich wichtige Instrumente, um die meisten seiner Arbeiten rasch, zuverlässig und mit vertretbarem Aufwand zu erledigen. Genauso scheint unser Denken be-





Performance of the recognition heuristic for the recognition of domestic and foreign stocks. Results are for the 6 months following the date of the recognition test, December 1996 to June 1997. For comparison, the performance of unrecognized stocks (0% to 10% recognition rates), market indices (Dow 30 or Dax 30), mutual funds (Fidelity Growth Fund or Hypobank Equity Fund), and chance portfolios (average returns of 5,000 randomly drawn portfolios) are shown (Borges et al., 1999, p. 65).

The stock market may be a complex real-world environment in which lack of recognition is not completely random, but rather systematic and informative. In investments there could be wisdom in ignorance.

One-reason decision making: Take The Best If you have to make a choice between two objects when both are recognized, recognition heuristics cannot be applied and you have to retrieve information about the objects from your memory to make an inference. Take The Best, a simple lexicographic heuristic for pair comparison tasks, has simple structural features and "bets" that the environment will fit them. It is a non-compensatory strategy that is surprisingly fit when information is scarce and also when information is itself non-compensatory (Gigerenzer & Goldstein, 1996).

Imagine that we have a set of objects, all Chicago public high schools, and we want to predict which of two schools has the higher drop-out rate. Each school can be characterized by a number of binary (or dichotomized) cues, each of which predicts the drop-out rate to varying degrees, such as average SAT scores, teachers' salaries, and the percentage of non-white students. In Take The Best, the objects are compared on the most valid cue, the second most valid cue, and so on until a cue on which the objects differ is found. All that Take The Best needs to know is the rank order of cues by validity. Moreover, its stopping rule for information search is very simple: Take The Best cue (i.e., the most valid one that discriminates) and ignore the rest.

Czerlinski, Gigerenzer, and Goldstein (1999) have shown that Take The Best is comparable in accuracy to the com-

Take The Best:

If you recognize more than one object, take the one with the most valid cue that discriminates, and ignore the rest.

Key Reference

Gigerenzer, G., & Goldstein, D. G. (1996). Reasoning the fast and frugal way: Models of bounded rationality. *Psychological Review*, 103, 650–669.

Performance Across 20 Data Sets (Czerlinski et al., 1999)

Strategy	Frugality	Accuracy (% correct)	
		Fitting	Generalization
Minimalist	2.2	69	65
Take The Best	2.4	75	71
Dawes's rule	7.7	73	69
Multiple Regression	7.7	77	68

Key Reference

Martignon, L. (2001). Comparing fast and frugal heuristics and optimal models. In G. Gigerenzer & R. Selten (Eds.), *Bounded rationality: The adaptive toolbox* (pp. 147–171). Cambridge, MA: MIT Press.

plex models of classical rationality. It can outperform multiple regression, the normative benchmark in the class of linear models, and even compared to good Bayesian models, Take The Best is remarkably accurate (Martignon, 2001a).

As far as the empirical evidence for people's use of simple strategies is con-

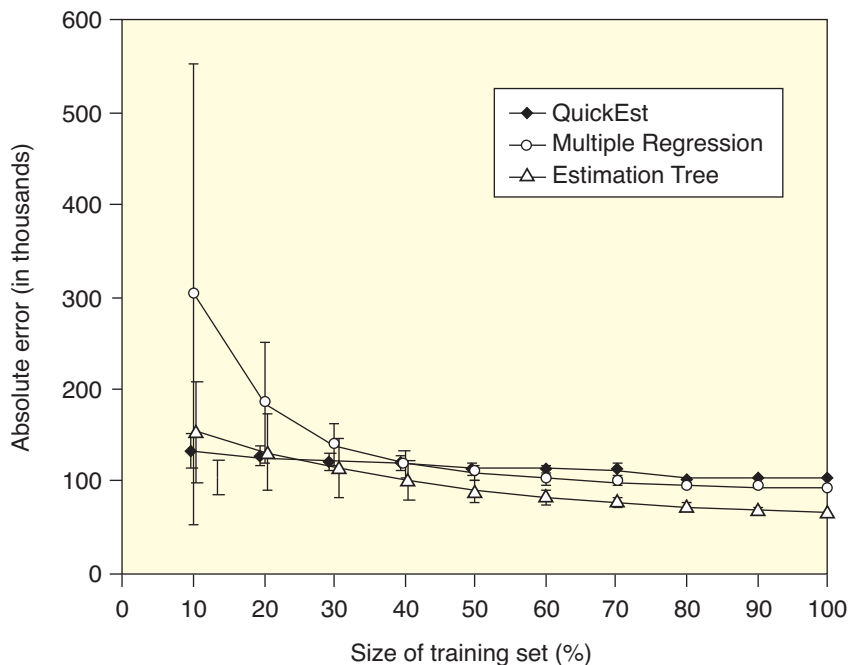
cerned, Rieskamp and Hoffrage (1999) showed that under time pressure humans use heuristics like Take The Best. Independent research by Bröder (2000) showed that in situations where search for information is costly, some two-thirds of participants' judgments followed Take The Best.

Key Reference

Hertwig, R., Hoffrage, U., & Martignon, L. (1999). Quick estimation: Letting the environment do the work. In G. Gigerenzer, P. M. Todd, & the ABC Research Group, *Simple heuristics that make us smart* (pp. 209–234). New York: Oxford University Press.

QuickEst The QuickEst heuristic is a fast and frugal heuristic for numerical estimation (Hertwig, Hoffrage, & Martignon, 1999). As does Take The Best, it has a simple search and stopping rule and it also has a simple rule for estimating the criterion value based on the retrieved information. To estimate the criterion value of a particular object, QuickEst looks through the cues or features that are ordered according to the average criterion value of the objects with which they are not associated until it comes to the first one that the object does not possess. At this point, it

stops searching for any further information. QuickEst then gives the mean criterion value of all objects that do not possess this particular feature as its final estimate. No cue combination is necessary, and no adjustment from further cues is possible. QuickEst proves to be fast and frugal, as well as accurate, in environments characterized by a distribution of criterion values for which small values are common and large values are rare (a so-called J-shaped distribution). Such distributions characterize a variety of naturally occurring phenomena, including many formed by



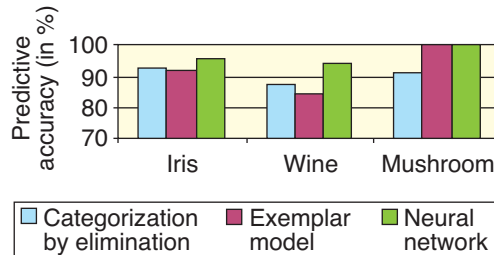
Mean absolute error (i.e., absolute deviation between predicted and actual size) as a function of size of training set (Hertwig et al., 1999, p. 230).

accretionary growth. This growth pattern applies to cities, and indeed big cities are much less common than small ones, allowing QuickEst to rapidly estimate the small size of most cities. In particular, when knowledge is scarce as it typically is the case in natural decision-making settings—QuickEst outperforms or at least matches the performance of more expensive methods such as *Multiple Regression* and a (Bayesian) *Estimation Tree*.

Categorization by elimination The tree building blocks of simple heuristics—fast and frugal search rules, stopping rules, and decision rules—were also used to specify a fast and frugal heuristic for Categorization. In a categorization task, one has to choose the one category from several possible ones that a given object falls into, for instance, as Dr. Seuss (the famous author of children's books) might ask: Is this particular fish we have caught a black fish, blue fish, old fish, or new fish? The simple Categorization by Elimination heuristic (Berretty, Todd, & Martignon, 1999) makes accurate category judgments by using each successive cue to whittle away the set of possible categories to which the object in question could belong until only a single possible category remains. Its performance comes within a few percentage points of the accuracy and frugality of traditional categorization algorithms including exemplar and neural network mod-

els, and yet it uses only about a quarter of the information that these other models employ.

In situations in which categorization must be performed quickly and searching for cues takes time, this fast and frugal approach has clear advantages.



Satisficing Satisficing is a method for making a choice from a set of alternatives encountered sequentially when one does not know much about the possibilities ahead of time. Here, alternatives themselves (as opposed to cue values) appear sequentially over an extended period or spatial region. In this type of choice task, a fast and frugal decision-maker needs not (only) limit information search but (also) a stopping rule for ending the search for alternatives themselves. In such situations there may be no optimal solution for when to stop searching for further alternatives. Satisficing takes the shortcut of setting an adjustable aspiration level and ending the search for alternatives as soon as one is encountered that exceeds the aspiration level.

Key Reference

Berretty, P. M., Todd, P. M., & Martignon, L. (1999). Categorization by elimination. Using few cues to choose. In G. Gigerenzer, P. M. Todd, & the ABC Research Group, *Simple heuristics that make us smart* (pp. 235–254). New York: Oxford University Press.

Hindsight Bias—A Price Worth Paying for Fast and Frugal Memory

Recently the work on fast and frugal heuristics has been extended to model a well-known phenomena of memory research, the hindsight bias. Hindsight bias can occur when people make a judgment or choice and are later asked to recall what their judgment had been. If, in the interim, they are told what the correct judgment would have been, their memory of their own judgment tends to become biased toward the new information. To explain this phenomena Hoffrage, Hertwig, and Gigerenzer (2000) developed RAFT (Reconstruction After Feedback with Take The Best).

The basic idea of the RAFT model is that any feedback or correct information a person receives after she has given her initial judgment automatically updates the knowledge base underlying the initial judgment. If a person cannot remember this initial judgment, she will reconstruct it from what she currently knows about the situation, and what

she currently knows is the updated version of what she used to know. So while feedback does not directly affect a person's memory of the original response, it does indirectly affect memory by updating the knowledge used to reconstruct the response. The RAFT model assumes that the mechanism underlying the original judgment, as well as the mechanism of the reconstruction process, is the same fast and frugal heuristic: Take The Best.

Hoffrage, Hertwig, and Gigerenzer (2000) tested the model in two studies and found that knowledge of cue values was in fact updated in a way making it more consistent with the feedback, whereas this knowledge remained unchanged when no feedback was given. Using this (updated) knowledge, the RAFT model was able to make precise predictions about when hindsight bias occurs. Moreover, assisting participants in recalling the cue values they had

Key Reference

Hoffrage, U., Hertwig, R., & Gigerenzer, G. (2000). Hindsight bias: A by-product of knowledge updating? *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 26, 566–581.

"Did you predict that the Berlin Wall would come down and that one day you could stroll through the Brandenburg Gate? With the benefit of hindsight you might have. Drs. Ulrich Hoffrage, Ralph Hertwig and Gerd Gigerenzer argue that knowledge updating explains hindsight bias."

The photo and the caption have been taken from the *APA Monitor*, May 2000, in which the article by Hoffrage, Hertwig, and Gigerenzer (2000)—on the photo from left to right—has been featured in the Science Watch column.



used to make their original decision, facilitated reconstruction and, as a consequence, reduced the hindsight bias.

Hindsight bias is not seen as a flaw in human cognition, but as a result of a cognitive mechanism that allows us to unclutter our minds by tossing out inaccurate information and embracing the right answers. According to the RAFT model, the hindsight bias is a by-product

of an adaptive mechanism, that makes human memory more efficient. It is a cheap price we have to pay for a much larger gain: a well-functioning memory that is able to forget what we do not need—such as outdated knowledge—and that constantly updates our knowledge, thereby increasing the accuracy of our inferences.

Fast and Frugal Heuristics in Emotional and Cultural Contexts

Fast and frugal heuristics are not restricted to cognition. Emotions such as disgust or parental love can provide effective stopping rules for search and the means for limiting search spaces. Similarly, in social species, imitation and social learning can be seen as mechanisms that enable fast learning and obviate the need for individual calculations of expected utilities. Social norms, too, can be seen as fast and fru-

gal behavioral mechanisms that dispense with individual cost-benefit computations and decision making. For instance, culture (as a system of values and beliefs) can help actual humans diminish the problem of combinatorial explosion as well as the related problem of how to make an infinite number of possible decisions in real time, which torment attempts at building intelligent machines and robots.

Key Reference

Ketelaar, T., & Todd, P. M. (in press). Framing our thoughts: Evolutionary psychology's answer to the computational mind's dilemma. In P. S. Davies & H. R. Holcomb III (Eds.), *The evolution of minds: Psychological and philosophical perspectives*. Norwell, MA: Kluwer.

Ecological Rationality

In the research on bounded rationality we found that the performance of several fast and frugal heuristics, by and large, matches that of algorithms that involve complex computations. Even if humans had the mental computational power to use such complex algorithms, they would not gain much—if anything at all. The astonishingly high accuracy of these heuristics indicates their ecological rationality; fast and frugal heuristics exploit the statistical structure of the environment and they are adapted to this structure. In a new book project the group recently started, a follow-up of *Simple heuristics that make us smart*, we will focus on this link between bounded and ecological rationality, that is, on the match between heuristics and environments.

Perhaps the organism could be seen as playing the role of the husband and the environment that of the wife, or the reverse may be argued as well.

Egon Brunswik

Human rational behavior (...) is shaped by a scissors whose two blades are the structure of task environments and the computational capabilities of the actor.

Herbert Simon

We have pursued the issue of ecological rationality in still another way, namely, by studying the question of representation. Representational formats constitute environments for cognition. This research has practical relevance in many domains such as diagnostic inference or risk assessment in legal cases, where the external representation of diagnostic information influences physicians', counselors' and lawyers' performances.

Information Needs Representation

Consider a situation in which a physician needs to infer the probability that an asymptomatic woman has breast cancer (C) after she received a positive test result (T+) in a routine screening. The relevant information (concerning a population of women aged 40) can be summarized as follows:

The probability of breast cancer is 1%; the probability of a positive test given breast cancer is 80%; and the probability of a positive test given no breast cancer is 10%.

Question: What is the probability that a woman who tests positive actually has breast cancer?

Whereas the Bayesian answer is 7.5%, typically most laypeople (and doctors as well) estimate this probability at about 80%. This result has been interpreted as "base-rate neglect."

To evaluate and understand the performance of the human mind, one needs to look at its environment and, in particular, at the external representation of information. Probabilities and percentages are representations of uncertainty that were devised only a few hundred years ago. For most of the time during which the human mind has evolved, information was encountered in the form of natural frequencies, that is, absolute frequencies as they result from observing cases that have been representatively sampled from a population. The same information represented in terms of natural frequencies is:

Ten of every 1,000 women have breast cancer; 8 of those 10 women with breast cancer will test positive, and 99 of the 990 women without breast cancer will also test positive.

Question: How many of those who test positive actually have breast cancer?

Key References

Gigerenzer, G., & Hoffrage, U. (1995). How to improve Bayesian reasoning without instruction: Frequency formats. *Psychological Review*, 102, 684–704.

Hoffrage, U., Lindsey, S., Hertwig, R., & Gigerenzer, G. (2000). Communicating statistical information. *Science*, 290, 2261–2262.

Hoffrage, U., & Gigerenzer, G. (1998). Using natural frequencies to improve diagnostic inferences. *Academic Medicine*, 73, 538–540.

Gigerenzer, G., Hoffrage, U., & Ebert, A. (1998). AIDS counselling for low-risk clients. *Aids Care*, 10, 197–211.

Natural frequencies simplify Bayesian computations and, as a consequence, help people gain insight into Bayesian reasoning. This was demonstrated both with laypeople (Gigerenzer & Hoffrage, 1995) and recently also in different fields of professional decision-making and educational contexts (Hoffrage, Lindsey, Hertwig, & Gigerenzer, 2000).

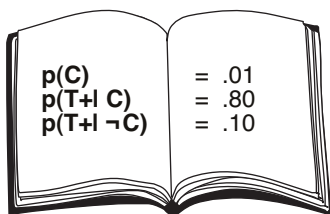
Applications in medical diagnostics
 Would presenting statistical information in natural frequencies rather than probabilities be effective with experts who make diagnostic inferences in daily practice? Hoffrage and Gigerenzer (1998) studied 48 physicians with an average of 14 years of professional experience. They were tested on four diagnostic tasks that the physicians perform on a regular basis (e.g., the diagnosis of colorectal cancer given a positive hemoccult test). In two problems, the information was presented in probabilities, and in two in natural frequencies. Results showed that the effect of natural frequencies on physicians was about as strong as for laypeople. Aver-

aged across the four diagnostic tasks, the proportion of Bayesian responses increased from 10% to 46%. These results can be generalized to cases where more than one piece of information, say mammography and ultrasound test in the breast cancer inference task, are provided. The facilitating effect of natural frequencies persists (Krauss, Martignon, & Hoffrage, 1999).

Applications in AIDS counseling
 Gigerenzer, Hoffrage, and Ebert (1998) investigated how information is communicated, and how good Bayesian reasoning is in real counseling sessions when the stakes are high, as in HIV testing. One of the authors went to 20 public health centers in Germany to take 20 HIV tests and use the mandatory pretest counseling sessions to ask the counselor questions about base rates, sensitivity, specificity, and his chances of having HIV were he to test positive. None of the 20 counselors communicated the information in natural frequencies; all used probabilities and percentages, and almost all got confused and were inconsistent. Fifteen of the 20 counselors estimated the chances that the client has HIV should he test positive as 99.9% or higher, three as higher than 90%, and two refused to answer this question. Note that a more realistic estimate of this probability is around 50%. Natural frequencies could have helped these counselors be both more consistent and more accurate.

Applications in law Judges, too, must make decisions based on probabilities. Does the representation of numerical information in natural frequencies foster Bayesian reasoning in court? Professionals and law students in Germany evaluated two criminal-

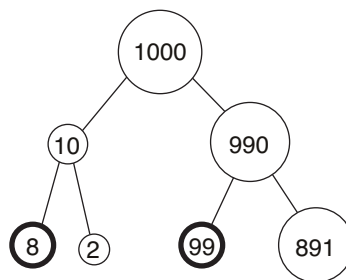
Probabilities



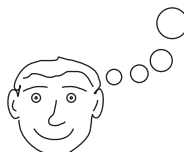
$$p(\text{Cancer} | \text{Test positive}) = \frac{(.01) (.80)}{(.01) (.80) + (.99) (.10)}$$



Natural frequencies



$$p(\text{Cancer} | \text{Test positive}) = \frac{8}{8 + 99}$$



court case files involving rape and forensic evidence of a DNA match. Expert testimony reported the statistical information of DNA-profiles and the rates of technical and human mishaps leading to false-positive results. This information was presented in two different formats; one stated it as probabilities and the other as natural frequencies. When these statistics were expressed as probabilities, only 13% of the professionals and under 1% of the law students correctly inferred the probability that the defendant was actually the source of the trace. But when the identical statistics were stated as natural frequencies, 68% and 44% of

these same participants made the correct inference. Perhaps more significantly, the different ways of expressing the same statistical information altered the verdicts in each case. When the information was presented as probabilities, 45% of the professionals and 55% of the students rendered a verdict of *guilty*, but only 32% and 33% did so when the same statistics were expressed as natural frequencies (Hoffrage, Lindsey, Hertwig, & Gigerenzer, 2000). When verdicts hinge on statistical evidence, understanding that evidence is crucial, and pursuing such simple methods of fostering statistical insight could contribute to that goal.

Implications for teaching Bayesian reasoning The beneficial effects of natural frequencies on statistical reasoning in the studies reported above occurred without training or instruction. More importantly, systematic training in the use of natural frequencies can even help people to reason with probabilities. The key is to teach representations rather than rules—that is to teach people how to translate probabilities into natural frequencies. Traditionally, however, students are instead taught how to plug probabilities into mathematical formulae such as Bayes's rule. We evaluated both teaching methods using a computerized tutorial (Sedlmeier & Gigerenzer, in press) and in a traditional classroom setting and found that teaching representations was more effective. Unlike in the studies reported earlier, all test problems were stated in probabilities. When tested five weeks after training, students who were taught how to translate probabilities into natural frequen-

cies could solve 90% of the new problems, whereas those who were taught rules could only solve about 20% (Sedlmeier & Gigerenzer, in press). Most of them probably had just forgotten the rules. Teaching representations rather than rules—and expressing statistical information in natural frequencies where appropriate—can help to foster the statistical reasoning needed to make sound decisions.

Base-rate neglect is just an example of so-called biases that can be demonstrated under conditions different from people's daily environments. By changing the experimental situation so that it better reflects essential features of this environment, the reasoning becomes not only more accurate but also more consistent with statistical or probability norms, such as Bayes's rule. Thus, if Brunswik's Mr. Cognition is brought together (again) with his wife, Mrs. Environment, they are able to produce sound reasoning.

Key Reference

Sedlmeier, P., & Gigerenzer, G. (in press). Teaching Bayesian reasoning in less than two hours. *Journal of Experimental Psychology: General*.

Social Rationality

Some of the most ambitious decisions faced by social species are those arising from an environment comprised of the decisions of conspecifics. Social environments are characterized by the speed with which they can change and by the need to consider the decisions being made by others. These two features make social rationality an important and distinct form of ecological rationality.

Social Cognition

Particular features of social environments can be exploited by fast and frugal heuristics that make rapid decisions rather than gathering and processing information over a long period during which a fleeter-minded competitor could leap forward and gain an edge. We assessed the obvious advantages of these heuristics in reproduction and survival tasks with simulation experiments. This is a first step in examining how the basic building blocks of social cognition can be studied through a combination of evolutionary principles, ecologically representative stimuli, human experimentation, and computer simulation.

Intention detection To ascertain the intentions of other animals (including humans) we happen to encounter, fast heuristics can be advantageous. If we can decide quickly and with few cues whether an approaching person or animal is interested in fighting or playing, we will have more time to prepare and react accordingly—and perhaps save our lives. Some of the most obvious cues of intention that can be assessed at a distance (as opposed to facial expression, e.g., which requires closer scrutiny) are contained in an organism's motion. Human subjects' motion trajectories were generated in the

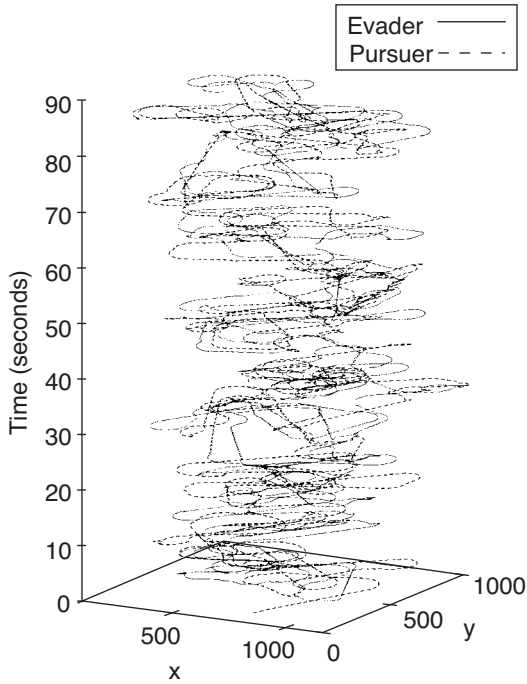
course of their playing computer mediated interaction games for pursuing, evading, courting, being courted, fighting, and playing. With this information (or evidence), we succeeded in uncovering a set of motion cues (including velocity, heading, and curvature of path) people can use along with the Categorization by Elimination heuristic to infer some major categories of adaptively important intentions (Blythe, Todd, & Miller, 1999). Categorization by Elimination uses only half of these cues and still correctly predicts two-thirds of the intentions, which is a better performance than human observers typically achieve.

Parental investment More important than survival is reproduction. How can simple heuristics, particularly one-reason decision making, be employed in the domain of parental investment. Specifically: How can a parent decide which of several offspring it should give resources to first? Parent birds, for instance, returning to their nest with a juicy bug, typically face a number of gaping mouths among which they must decide. The parent can use the weight, hunger, age, or fixed position of each chick in the nest when picking one to feed. Decision-making approaches based on traditional notions of rationality would dictate that the parent

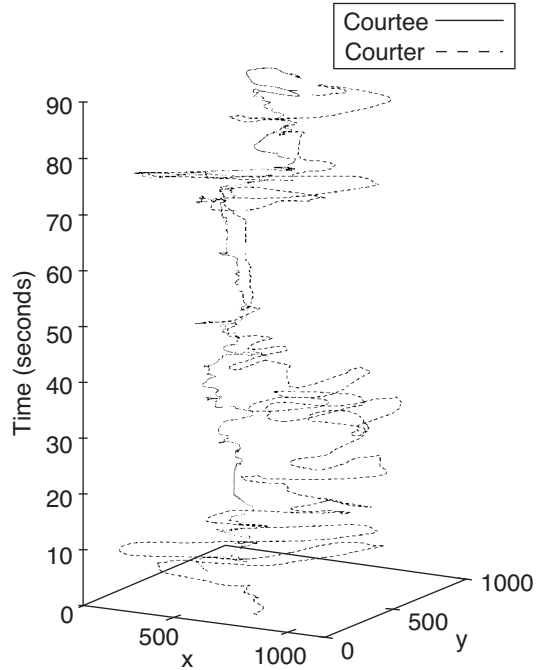
Key Reference

Blythe, P. W., Todd, P. M., & Miller, G. F. (1999). How motion reveals intention: Categorizing social interactions. In G. Gigerenzer, P. M. Todd, & the ABC Research Group, *Simple heuristics that make us smart* (pp. 257–285). New York: Oxford University Press.

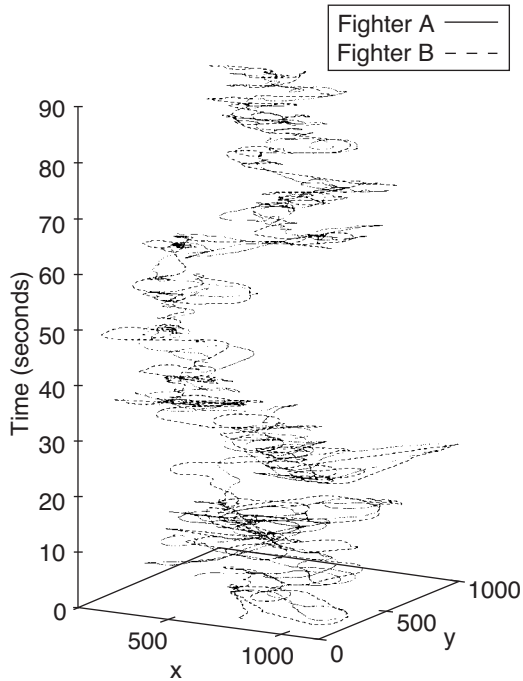
Prototypical trajectory for pursuit/evasion



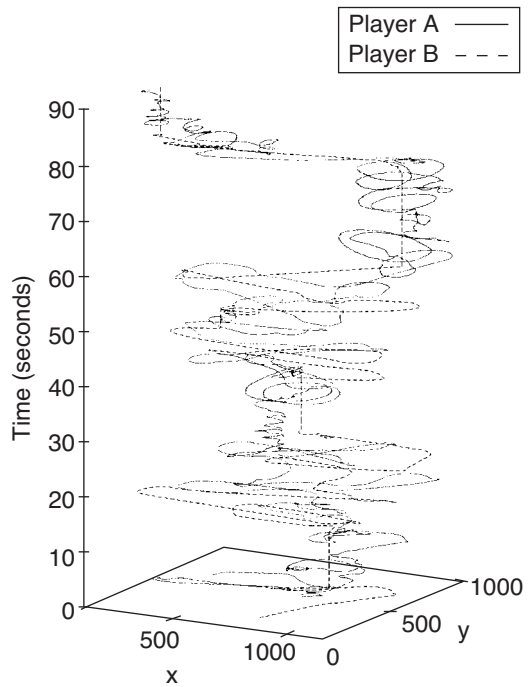
Prototypical trajectory for courtship



Prototypical trajectory for fighting



Prototypical trajectory for play



Sample trajectories generated by two participants who had to move an arrowhead on the computer screen, following various intentions (e.g., in the upper left panel, one had to evade, and one had to pursue the other). In each panel, 90 seconds of the interaction is represented, with time proceeding upwards and the on-screen position of each arrowhead plotted on the x-y plane.

assess and combine all of these cues to come up with the choice that will lead to the greatest growth of the nestlings. But because each of these cues provides a full ordering of all the chicks (e.g., one is heaviest, one is next heaviest, and so on), only one cue is necessary for an unambiguous decision.

Davis, Todd, and Bullock (1999) found that one-cue feeding rules are not only possible, but also advantageous—they perform significantly better than rules that combine all the available information in an attempt to look forward in time and predict the optimal course of action.

Humans, too, have multiple offspring to raise simultaneously. The equity heuristic is a boundedly rational decision rule specifying that parents should attempt to split resources equally among their children. But, whereas an equity motive produces a fair distribution at any given point in time, it yields a cumulative distribution of investments that is unequal (Hertwig, Davis, & Sulloway). Which birth rank suffers most from a resource handicap depends on which growth period, and thus, which kind of resource is considered most important. If the total amount of resource is crucial, then the equity heuristic creates a middle-child resource handicap. If, however, the first period is most important, this heuristic creates a later-born resource handicap. If one focuses on resources specific to the last period, then an earlier-born resource handicap occurs. Across all handicaps, middle-born children are never best off.

Thus, as Hertwig, Davis, and Sulloway concluded, the equity heuristic can provide an explanation of why the birth-order literature reports notoriously conflicting results and conclusions.

Mate choice A different strategy of socially rational heuristics is called



Wenn ich Sie frage: welche Stadt ist größer: San Antonio oder San Diego – was sagen Sie da? Dr. Laura F. Martignon schaut erwartungsvoll. Vielleicht haben Sie keine Ahnung, wie groß diese Städte sind und von San Antonio noch nie etwas gehört. Also entscheiden Sie sich womöglich für San Diego – und liegen damit richtig. »Sie haben sich dann nach dem recognition principle entschieden«, erklärt Dr. Martignon die Abläufe im Kopf. Soll heißen: Sie haben gewählt, was Sie kennen. Laura F. Martignon ist nämlich keine Geografie-Lehrerin, sondern Entscheidungsforscherin am Max-Planck-Institut für Bildungsforschung in Berlin. Als Mathematikerin untersucht sie zu-

sammen mit Informatikern, Ökonomen, Psychologen und Evolutionsbiologen im Forschungsbereich »Adaptives Verhalten und Kognition«, wie wir urteilen und Alltagsentscheidungen treffen.

Lange gingen Kognitionsforscher von unrealistischen Voraussetzungen aus. Sie betrachteten den menschlichen Geist als eine Art Supercomputer mit unbegrenzter Zeit, Wissen und Verarbeitungsleistung. Das Ziel eines jeden Denkprozesses sollte dementsprechend eine optimale Lösung sein.

Diesem Optimierungsparadigma setzte vor 40 Jahren der Psychologe Herbert Simon von der Carnegie Mellon University in Pittsburgh sein Konzept der »begrenzten Rationalität« entgegen: In der Realität ist Zeit knapp, sind Wissen und Hirnkapazität begrenzt. Menschen suchen daher nicht nach optimalen Strategien, sondern nach schnellen und pragmatischen Lösungen.

Natürlich können Menschen auch langwierige und komplexe Überlegungen anstellen. Doch den Luxus, uns auch die Zeit dafür nehmen zu können, verdanken wir unserer Kultur. Genau wie unser Körper ist auch unser Geist

Entscheiden leicht gemacht

Wie unser Gehirn trotz knapper Zeit und wenig Wissen schnell und gut Probleme löst.

ein Produkt der Evolution. Wir haben unsere Art zu denken von unseren Vorfahren geerbt, deren geistige Werkzeuge daran angepasst waren, in einer feindlichen Umwelt zu überleben.

Von diesen Voraussetzungen gehen auch Laura F. Martignon und ihre Kollegen am Max-Planck-Institut aus. Sie vergleichen unseren Geist mit einem Werkzeugkasten. Die Werkzeuge darin sind einfache Schritt-für-Schritt-Regeln, um Alltagsentscheidungen zu treffen.

Denken geht nicht in Prozenten

Diese einfachen Regeln – die Forscher nennen sie Heuristiken – wollen die Berliner Wissenschaftler finden. Die Regeln zu kennen bedeutet, menschliches Verhalten – und auch Fehlverhalten – besser zu verstehen. Denn das basiert letztlich auf Entscheidungsprozessen. Neben der Grundlagenforschung bearbeiten die Wissenschaftler auch sehr anwendungsbezogene Projekte.

Professor Gerd Gigerenzer, der Leiter des Forschungsbereiches, und sein Mitarbeiter Dr. Ullrich Hoffrage fanden beispielsweise heraus, dass Menschen nicht in Prozenten oder Wahrscheinlichkeiten denken. Unser Denkapparat ist auf natürliche Häufigkeiten eingestellt. So auch wenn es darum geht, Risiken abzuschätzen. Dieses Wissen

8

dimensionen

for when alternatives themselves (as opposed to cue values) take time to find, appearing sequentially over an extended period or spatial region. In this type of choice task, a fast and frugal reasoner needs not (only) limit information search, but (also) must have a stopping rule for ending the search for alternatives themselves. One instance of this type of problem is the challenge that faces individuals searching for a mate from a stream of potential candidates met at different points in time. Todd and Miller (1999) began their study of satisficing heuristics for mate search by simulating their performance in different mating environments, focusing on simple methods for setting the aspiration level. The goal was to find satisficing heuristics that would limit both the time needed to determine

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a good aspiration level and the average number of potential mates who had to be considered before one exceeding the aspiration level was found. They have identified a class of simple learning heuristics that do indeed determine such adaptive aspiration levels, while still coming close to the criterion-selection performance of more optimal (and much slower) search rules.

Social Networks

How is the human mind influenced by individuals' involvement in interactions and relationships with peers? It is assumed that processes of coordinating diverging expectations and intentions are shaped by structural and qualitative differences in interactions and relationships.

Friendships in primary schools Interviews with primary school children in Berlin revealed that most children have a network of several "best friends" rather than just a unique best friend. In their reciprocal perceptions, Brendgen, Little, and Krappmann (2000) found surprisingly little agreement among children in the assessment of many aspects

of their friendships. Although children establish their friendships relatively independently of parental control, some features of their relationship networks are shaped by qualities of their parents' social relationships (Krappmann & Uhlendorff, 1999), by educational attitudes of their parents (Uhlendorff, 2000) and by the sociocultural context in which the family is living (Little, Brendgen, Wanner, & Krappmann, 1999).

Contradicting orientations in children's interactions Classroom observations in the 1980s and 1990s demonstrate that children are affected by contradicting orientations when they try to coordinate differing expectations and intentions in their social interactions. On the one hand, they claim to respect each other as equals who must find acceptable solutions to conflicts. On the other hand, they use power and prestige in order to influence negotiation processes to their advantage.

Emergence of inequality In this project, funded by the German Research Foundation (DFG), Krappmann, Gürtler, and Schrenk in collaboration with Oswald (University of Potsdam) are testing the hypothesis that conceptions of inequality and competencies for dealing with inequality are acquired in interactions in which children long for the opposite, namely for mutual respect of each other's expectations and interactions and for egalitarian contributions to the process and the outcome of their interactions.

Overall, peer relationships present new challenges to children with regard to the reciprocal nature of relationships and the content of interactions. This is the place where the life of the autonomous as well as the socially responsible individual actually begins.

Report to the German parliament on the conditions of growing-up in Germany

The committee, headed by Lothar Krappmann analyzed many aspects of children's lives in daycare institutions, cultural and leisure programs, and community projects for the young, drawing attention to aspects of children's lives, that may influence the development of their capacities and orientations, not adequately taken into account by researchers in development or socialization. In reply to controversies about the extent and the quality of poverty among children in Germany, Krappmann explained in an additional expert statement how economic restrictions become relevant to children's development and learning.

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Social Contracts

Another important feature of human's social life and the constitution of its culture are moral norms. How do children, adolescents, and young adults from different Western and Asian cultures reason about morally relevant conflict situations in family and close friendship?

Intercultural differences in moral reasoning In their longitudinal cross-cultural studies Keller, Edelstein, Krettenauer, Fang, and Fang (2000) found interesting interaction effects among individual development, ecology, and culture. In moral reasoning about a parent-child dilemma intra-society differences in adolescents were greater than inter-society differences: Rural Icelandic subjects achieved an equally high level of sociomoral reasoning as Chinese urban subjects. Similarly, in moral decision making, the Chinese and rural Icelandic subjects were oriented towards parental authority, while Icelandic urban subjects were oriented towards autonomy and peer-solidarity.

Moral rules and emotions Our studies followed up on the so-called "happy victimizer" phenomenon according to which young children attribute positive feelings to a person violating a moral rule while older children attribute negative (guilt) feelings to such a person. Previous studies had produced inconsistent findings concerning this attributional shift. Our studies supported the happy victimizer phenomenon in young Chinese children. Older children, however, revealed a self-other differentiation in emotion attribution. They attributed positive feelings to a hypothetical rule violator and guilt feelings to themselves as violator. This effect was replicated with German and Portuguese children. The self-other differentiation may be an explanation for inconsistent previous research findings.

Contracts, perspectives, and emotions Two studies interconnect evolutionary cognitive psychology of deontic reasoning with theory of mind and moral development research. Keller, Lindsey, and Wang (2000), assessed

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Contract between friends



p/q



irrelevant

$\neg p/\neg q$

contract violations



$\neg p/q$



$p/\neg q$

How do young children understand contract violation when relevant information is presented in pictures?

If you help me in the garden, you may use my bike: Which pictures show a contract violation? (Keller et al., 2000)

children's understanding of a bilateral contract between a mother and her child and between two friends (see figure p. 43). All children attributed negative feelings to the victim of the contract violation. However, emotions attributed to a violator depend on age and perspective. In the peer relationship, older children attributed guilt feelings from both perspectives of violators. In the parent-child relationship, guilt feelings were attributed only to the

mother as violator. The child as violator felt good about receiving a benefit without having paid the cost. As far as cheating detection from different perspectives goes, the results revealed clear-cut developmental trends.

Social-moral reasoning about choices and consequences of contracts and its violation is influenced by individual development, ecological conditions, and cultural processes like modernization.

The ABC Research Group 2001



Left to right: (front row) H. Clark Barrett, Stephanie Kurzenhäuser, Laura Martignon, Monika Keller, Masanori Takezawa, Stefan Krauss; (middle row) Philipp Otto, Peter M. Todd, Szymon Wichary, Christian Gröschner, Barnaby Marsh, Ralph Hertwig, Gerd Gigerenzer, Thomas Dudey, Marianne Müller-Brettel, Jörg Rieskamp, Laurence Fiddick, Andreas Wilke; (back row) Oliver Vitouch, Ulrich Hoffrage, Carola Fanselow, Silke Atmaca; not pictured: Lothar Krappmann.

Evolutionary Psychology

Evolutionary psychology lies at the heart of many of the research projects undertaken by the ABC research group, providing a motivation for bounded rationality, supporting the significance of the environment in ecological rationality, and emphasizing the importance of the social interactions that lead to evolutionary change in social rationality. At the same time, evolutionary psychology is grounded in ecological rationality (Todd, Fiddick, & Krauss, 2000): It assumes that our minds were designed by natural selection to solve practical problems in an efficient and effective manner. However, evolutionary psychology focuses specifically on ancestral environments and practical problems with fitness consequences, while ecological rationality additionally encompasses decision making in present environments without privileging problems with fitness consequences.

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Evolutionary psychology is the search for the evolved “mental adaptations” that fill our behavioral repertoire. These psychological mechanisms were shaped over millennia of natural and sexual selection to solve the survival and reproduction problems that faced our hunter-gatherer hominid ancestors in Pleistocene Africa, and they continue to guide our decisions and preferences today. This does not mean that everything an individual does has been selected for, or even that those traits that have been selected for will necessarily confer some advantage on an individual expressing it in a modern environment. What it does mean is that the behaviors expressed by modern individuals are expected to be a result of the interaction between their evolved psychology and the environment in which they live.

Through the influence of cognitive science, mental adaptations are typically viewed as software modules designed

by evolution, specialized to process naturally occurring information about biologically important situations in ways that guide adaptive behavior. Thus, evolutionary psychologists tend to analyze adaptive problems such as mate choice, foraging, habitat selection, and the like in terms of the structure of the environment outside the decision maker, and the types of perception, computation, inference, strategies, and signals that the decision maker uses. Again, because of cognitive science (and particularly the influence of computer models), analyzing the environment often gets short shrift, while the computations assumed to be going on inside a person's head are typically intricate and involved.

But individuals in challenging situations must often make up their minds—make inferences, choices, and decisions—rapidly and efficiently, using only the information currently available and

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not spending much time deliberating. If they do not, they may lose their dinner to a competitor, their mate to a rival, or their life to a predator. Decision making had better be quick and easy in such situations (Todd, 2001), and evolution has acted to ensure that this is the case: Those organisms that had a rather difficult time of making up their minds would have been left behind, genetically speaking, by their more fleet-witted conspecifics.

Simple fast and frugal heuristics can help individuals make decisions quickly both by limiting the amount of information they use to select a course of action or choose an available option (Todd, 2000), and by focusing attention on just that information that will be most useful in making the choice. Thus, these simple evolved inference mechanisms can help organisms overcome one form of the classic frame problem plaguing any information-processing decision maker: How to avoid having to consider the infinite number of possible real-world options and their unlimited future consequences when choosing a course of action. Ketelaar and Todd (in press) demonstrate how simple satisficing mechanisms that stop search using an aspiration level can limit the

number of choices considered, and how emotions can focus information gathering on just those cues that will be most useful to the decision maker.

One of the most evolutionarily important decisions facing sexually reproducing animals, including humans, is mate choice. By definition, sexual reproduction entails combining one's own genes with another individual's genes to produce offspring. Through mate choice, individuals can influence the quality of the genes passed on to their offspring from their sexual partner, and the quality of the parental care those offspring will receive. Miller and Todd (1998) describe how evolutionary psychology has revolutionized research on human mate choice and sexual attraction in recent years, combining a rigorous Darwinian framework based on sexual selection theory with a loosely cognitivist orientation to task analysis and mechanism modeling. This approach has revealed the adaptive logic behind physical beauty, demonstrating that many sexual cues computed from face and body shape are not arbitrary but functioned in the past as reliable indicators of reproductive success.

A striking example of cues sent actively from one individual to another

are the melodies of songbirds. Some male songbirds attract female mates through the variety and length of songs that they produce. The same may be true in humans: Cultural displays, including musical ability, may serve to attract members of the opposite sex. Todd (1999) describes ways that such signals for mate attraction can evolve, while Bullock (1998) and Noble (in press) studies the evolution of signalling and communication more generally, and all three explore how computer simulations can be used to study the evolutionary processes involved (see also

Bullock & Noble, 2000).

In all of these domains, we have sought evidence for heuristics that can be used to make rapid choices in challenging situations. But jumping to a decision quickly does not do an individual much good if it is the wrong choice. Simplicity is well and good, but won't taking more information into account and doing more sophisticated analysis of it yield better decisions? If so, won't evolution balance the need for speed against the requirements of accuracy (i.e., the importance of ensuring adaptive choices such as consuming edible

fruits rather than poisonous ones) and end up building brains of some intermediate reasoning complexity? We have found intriguing hints that this trade-off often does not exist. Some complexity and structure in decision-making mechanisms can certainly be beneficial, in terms of increasing the inferential accuracy of those mechanisms. However, that structure need not lie entirely within the decision maker. Instead, evolution can rely on the structure inherent in the decision environment itself and build organisms whose very psychological simplicity takes advantage of that structure. Just what structure is present

in the environment will have profound effects on the kind (and accuracy) of decision making an individual can perform in that environment (see Barrett & Fiddick, 2000, and Fiddick, Cosmides, & Tooby, 2000, for examples of the range of issues involved in considering environment structure). Hence, one of the most important aspects of the perspective of evolutionary psychology is that it serves to remind us of the psychological impact of the environment in which we live and act.

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Methods, Metaphors, and Theory Construction

In spite of the fact that most scientists search for universal truths, scientific "truths" are contingent in important ways on the statistical and experimental tools used to discover and test them. From different starting points and based on different case studies, we converge on the same general issue in this project area, namely, the detection and understanding of the limitations and powers of scientists' tools.

... if the history of human achievement in knowledge proves anything, it is that the all-decisive discovery is that of an effective and fruitful method.

John Dewey

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Experimentation in psychology and economics

The core method in psychological research is experimentation. Ortmann and Hertwig (1998) observed, that the experimental practices in psychology and experimental economics differ. In particular, a frequently used methodological tool in psychological experiments, the deception of participants, is generally taboo in experimental economics. Further investigations revealed that, in contrast to psychologists, economists bring a precisely de-

defined "script" to experiments and ask participants to enact it using repeated experimental trials, allow participants to learn in the task environment, and generally pay participants on the basis of clearly defined performance criteria (Hertwig & Ortmann, in press). Do these methodological differences matter? Based on a review of empirical evidence, Hertwig and Ortmann argue that the practices in experimental psychology of not providing a precisely defined script for participants to enact, not re-

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peating experimental trials, and paying participants either a flat fee or nothing leaves the social situation "experiment" open to a variety of interpretations. The fact that psychologists are (in)famous for deceiving participants is likely only to magnify participants' uncertainty and second-guessing. The typical experimental practices in psychology increase rather than decrease the background of variation against which effects are appraised and thus reduce the replicability of results.

Hertwig and Ortmann conclude that by improving research designs (e.g., repetition of trials, performance-based payment), psychologists can increase their control of these sources of variation, thus increasing effect sizes and the power of statistical tests.

Adversarial collaboration A famous example that has often been used to illustrate human irrationality is the conjunction fallacy, that is, violations of the conjunction rule (if A includes B then the probability of B cannot exceed the probability of A). To debate controversial interpretations of the conjunction fallacy, a new approach called adversarial collaboration was adopted. It requires both parties to agree on a procedure for resolving a dispute and, with the help of an arbiter, conduct empirical tests.

Mellers, Hertwig, and Kahneman (in press) began their collaboration with Hertwig's claims that frequencies eliminate conjunction effects and that Kahneman and Tversky's (1996) results with frequencies were an artifact of some participants interpreting 'and' as a union operator. Hertwig proposed two conjunction phrases that were less ambiguous, and Kahneman predicted that conjunction effects would occur with one of them. Mellers served as arbiter. Frequencies by themselves did not eliminate conjunction effects, but, with filler items present, a comparative context is created in which the understanding of the item set and the choice of filler items are likely to determine whether conjunction effects occur. Although theoretical disagreements remain, the joint experiments have yielded theoretical progress and advanced the understanding of conjunction effects that would not have been achieved by working separately.

Tools-to-theories Where do new ideas come from? In his earlier work Gigerenzer (1991) spoke of scientific discovery in terms of heuristics of discovery and proposed that scientists often employ a tools-to-theories heuristic. This thesis predicted that new scientific tools, once entrenched in a scientist's daily practice, suggest new theoretical

Linda Problem

Linda is 31 years old, single, outspoken, and very bright. She majored in philosophy. As a student, she was deeply concerned with issues of discrimination and social justice and also participated in antinuclear demonstrations.

Rank the following statements by their probability:

Linda is a bank teller. (T)

Linda is active in the feminist movement. (F)

Linda is a bank teller and is active in the feminist movement. (T&F)

The typical result is that 80% to 90% of participants judged T&F to be more probable than T, a judgment inconsistent with the conjunction rule.

metaphors and concepts. It also predicted that once proposed by an individual scientist (or a group), the new theoretical metaphors and concepts are more likely to be accepted by the scientific community if the members of the community are also users of the new tools.

The employment of the tools-to-theories heuristic was applied to Regression Analysis, a statistical tool that is widely used in psychological research. Kurz and Martignon (in press) argue that owing to the institutionalization of regression analysis in the mid-twentieth century within and beyond psychology, the outcome of the computational procedure, that is, the regression equation, has been emphasized at the expense of the "performative components" of linear modeling, that is, weighting and summing. Analysis in light of the tools-to-theories heuristic can also be used to detect new lines of development in current cognitive theories. Thus, recent challenges to the two performance components of linear modeling, weighting and summing, have led to new models of human judgment. According to their analysis, Robyn Dawes challenged the weighting component of regression analysis by demonstrating that unit weighting (rather than calculating weights that minimize the error in the "least-squares" sense) yielded models that correlate highly with linear regression models. This finding can be used to model judgment and decision making in terms of a strategy like Dawes's rule, that simply adds up the number of positive cues and the number of negative cues and then subtracts the latter from the former. This strategy is fast (i.e., does not involve much computation) but not frugal (i.e., looks up all information).

Null-hypothesis testing In a discussion of the limitations of (some) sta-

16th Meeting of the Brunswik Society 20–22 July 2000

Max Planck Institute for Human Development,
Berlin, Germany

Ulrich Hoffrage, Ralph Hertwig, Gerd Gigerenzer

The Brunswik Society is an informal association of researchers concerned with understanding and improving human judgment and decision making. The Millenium Meeting of this Society was the first meeting held outside the U.S. In the pleasant setting at our institute, the 50 participants heard and discussed 20 research papers, including keynote addresses by Mitchell Ash, Gerd Gigerenzer, and Klaus Fiedler.

tistical tools, Gigerenzer (1998) predicted that future historians of psychology will be puzzled by an odd ritual: null-hypothesis testing. Although this ritual is camouflaged as the sine qua non of scientific method, Gigerenzer argued that it undermines theoretical progress in psychology by giving researchers no incentive to specify their hypotheses and by replacing statistical thinking with the application of a mindless statistical procedure.

Statistical rituals have been a characteristic of scientific methodology not only in psychology, but also in biology, and especially in the field of neurobiology. Synchronization of neural activation, postulated as the neural realization of feature binding in the brain, cannot be established by rejecting the null hypothesis of independence between neurons. Rejecting the null hypothesis of "chance" can lead to serious mistakes. The work of Martignon, Deco, Laskey, Diamond, Freiwald, and Vaadia (2000) proved how serious these mistakes can be and proposed efficient statistical methods for a parameterization of synchronization in terms of log-linear models.

Understanding and choosing among scientific tools requires thoughtful analysis, not methodological rituals.

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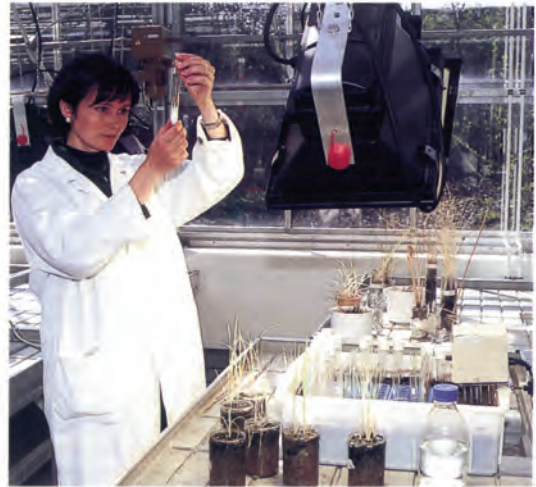
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**Max Planck Society for the
Advancement of Science**

Schloebmann Seminar

The study of scientific practice implicates accounts of the larger historical and societal context. The same holds for the study of expertise. "The expert in modern societies: Historical and contemporary perspectives" was the topic of the Schloebmann Seminar held in Berlin in November 1998. Papers presented by the invited young scientists (up to 40 years old) concerned the institutionalization and legitimation of experts, expert advisers in political contexts, and experts and science in the courtroom, as well as cognitive aspects of expertise. Kurz and Gigerenzer are currently working on the edition of a selected set of these papers.



Schloebmann Seminar on The Expert in Modern Societies: Historical and Contemporary Perspectives

Berlin, Germany
26 – 28 November 1998

The Schloebmann Seminar was a collaboration among 8 Max Planck Institutes.

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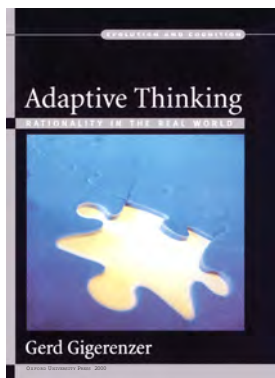
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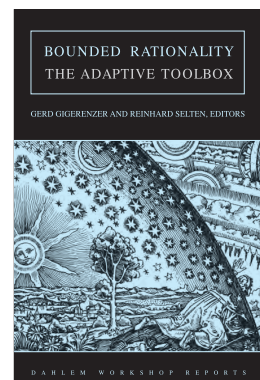
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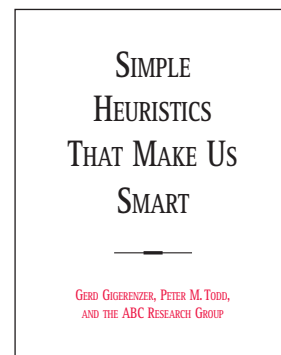
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**Center for
Educational Research**

Contents

Introductory Overview	61
Research Area I Opportunity Structures of School and Individual Development in Adolescence and Young Adulthood	64
Research Area II Establishing a Monitoring System for Educational Performance: Foundational Studies	73
Research Area III Learning and Instruction: Cognitive Activation and Cognitive Tools	89
Research Projects of the Director Emeritus Wolfgang Edelstein	106
Publications 1998–2000	110

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Introductory Overview

The Center for Educational Research was restructured in 1996 when Jürgen Baumert was appointed director. The Center's specific concern is research on development and learning from the perspective of institutionalized education. Educational settings such as schools are conceived as providing a specific structure of opportunities and constraints for learning and development. This structure offers a variety of developmental opportunities, but at the same time excludes others. How do aspects of schooling affect learning within and across subject domains, impact on the intra- and interindividual differentiation of personality traits, and guide career-forming processes? Such questions are explored by a multidisciplinary team which includes educational scientists, psychologists, mathematicians, and sociologists. A strong theoretical focus is combined with an applied approach in the fields of system monitoring, professionalization of teaching, and improvement of learning and instruction.

Conceptual Orientation: Schooling as a Cultural Artifact and an Authentic Part of Life

The Center's research program is institutional as well as developmental in orientation. This calls for a multilevel research perspective:

1. With regard to the social structure of societies, formal education can be conceived as a career-forming process, even in its initial stages.
2. From an institutional perspective, the focus is on facilitating and fostering cumulative learning within and

across subject domains.

3. From an individual point of view, learning development can be conceptualized as a process of inter- and intraindividual differentiation. The Center's research agenda is shaped by each of these perspectives.

It is a **structural paradox of formal education** that the experiences made available within institutions of formalized education are always vicarious—selected and prepared with the aim of facilitating learning processes which the learner must nevertheless perceive

as personal and authentic. The more educational institutions try to integrate authentic everyday experiences into their programs, the more obvious the paradox becomes. The acquisition of knowledge in educational institutions is confined by the structural properties of the institution, regardless of whether or not authentic learning is emphasized. This constitutes the difference between learning inside and outside of school-like institutions.

At the same time, however, school is a central part of the student's life, and impacts strongly on cognitive activities, beliefs, and behavior outside of school. Educational institutions command a large part of the time of children, adolescents, and young adults, and thus constitute **social environments in their own right**. The social rules and regulations of educational institutions not only create the conditions for systematic instruction and learning, but provide the setting for immediate everyday experiences. In our research program, this effect of schooling is taken into particular consideration in a longitudinal study exploring individual development in terms of cognitive competencies, motivational and social resources, and value commitment.

The way in which educational institutions have structured content areas into different academic subjects determines the **high domain-specificity of knowledge acquisition**. This is taken into account in our research on the structure of knowledge—including domain-specific epistemological beliefs—acquired in school. In large-scale assessment studies, classroom studies, and experimental training studies, **we focus on domains of knowledge which represent basic cultural tools** and, as such, are critical for individual development in modern societies. **Mathematics and science education and reading comprehension** constitute main areas

of research. Special emphasis is placed on the question of how cognitive activation and self-regulation can be stimulated and supported by instructional environments.

In all our research on the interaction between the individual learner and the institutional educational setting, the learner is perceived as the producer of his or her own development—not only in the constructivist sense of active and idiosyncratic acquisition of knowledge, but also in the sense that he or she proactively selects and shapes the developmental environment.

Summary Outline

The following summary of the Center's research program is not comprehensive. Rather, research projects have been selected to illustrate the major lines of inquiry pursued in the Center and provide a representative overview of the three areas of our current research.

Research Area I focuses on the relationship between the opportunity structure of schools and the optimization of individual development in terms of cognitive competencies, motivational and social resources, and value commitment. The basis for this research program is provided by a multiple-cohort longitudinal study which was initiated in 1991 with a sample of 13-year-olds. These main cohort participants, who are now aged 23, are currently taking part in a sixth wave of measurement (**Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood [BIJU]**). As far as the transition from school to work is concerned, Research Area I is smoothly interlinked with the project *Regulating Development by Controlling the Environment and the Self* of the **Center for Lifespan Psychology**.

Research Area II comprises studies which can be seen as representing the first steps in the establishment of a na-

tional monitoring system to gauge the performance of the German school system. These foundational studies combine basic research and system monitoring in an international comparative perspective. The most important projects in this research area are the **Third International Mathematics and Science Study (TIMSS)**, and the OECD's **Programme for International Student Assessment (PISA)**. These studies are complemented by the second **CIVIC Education Study** initiated by the International Association for the Evaluation of Educational Achievement (IEA). Together with a project on state schooling in the former GDR funded by the German Research Foundation (DFG), these studies provide a firm basis for the Center's **Report on Education (Bildungsbericht)**, which is published in collaboration with the **Center for Sociology and the**

Study of the Life Course. The report appears on a regular basis and has become established as a standard work.

Research Area III consists of projects on learning and instruction with an experimental or quasi-experimental approach. Most of these studies address research questions that have emerged directly from the first and second areas of research. They are conducted either in the laboratory (**ENTERPRISE**) or as video-based studies in school environments (**TIMSS-Video and Pythagoras**). In the field of mathematics education the Center closely collaborates with the **Center for Adaptive Behavior and Cognition**. Building on a strong theoretical background, these studies have practical implications for the optimization of classroom instruction and teacher training.

The Center for Educational Research 2001



Left to right: (front row) Rainer Watermann, Cordula Artelt, Ilonca Hardy, Ulrich Trautwein, Zoe Daniels, Luitgard Trommer, Mareike Kunter, Anja Felbrich, Anke Demmrich, Gundel Schümer; (back row) Jürgen Baumert, Helmut Köhler, Claudia Thußbas, Eckhard Klieme, Petra Stanat, Olaf Köller, Elsbeth Stern, Joachim Wirth, Oliver Lüdtke, Christa Händle.

Research Area I

Opportunity Structures of School and Individual Development in Adolescence and Young Adulthood

Educational Institutions as Developmental Environments The successful development of human beings across the entire life span is dependent both on their individual, internal characteristics and on external socializers such as significant others and social institutions. The relative importance of internal and external promoters varies across the life span and between the areas of individual functioning. While parents, for example, play a dominant role for their children's development during infancy, childhood, and early adolescence, their influence decreases during adolescence and often ceases entirely in adulthood. Particularly in the domain of academic learning and, more generally, cognitive development, the social institution of school plays an important role during childhood and adolescence. Furthermore, schools have an impact on the formation or development of motivation, emotions, attitudes, and other personal characteristics.

Inasmuch as the theoretical perspective of the Center for Educational Research highlights the institutional influence on human development, it requires **longitudinal multilevel studies** that collect data at school, class, and individual levels, cover more than one knowledge domain, and allow the investigation of intraindividual change across domains and of interindividual differences in the patterns of intraindividual change. For TIMSS population II (7th and 8th graders), for example, a repeated measurement design was implemented with additional measurement points at the end of grades 7

and 8 (see Research Area II). The national longitudinal project *Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood (BIJU)* does even more to fulfill the requirements of a multilevel longitudinal design in its investigation of the effects of school and class environments on human development. The **BIJU study** has **four guiding components**, each with specific tasks and addressing specific issues:

(1) provision of institutional and individual baseline data on the integration of the East and West German educational systems; description and analy-

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sis of the transformation of the East German educational system and the subsequent impact on system performance;

(2) analysis of domain-specific learning as dependent on social and cognitive resources, prior knowledge, motivational orientation, learning and processing strategies, quantity and quality of instruction, and general institutional conditions;

(3) analysis of long-term trajectories of psychosocial development in adolescence as shaped by varying conditions of schooling and instruction;

(4) analysis of ways of coping with the transition from school to vocational training and working life, taking into account the interplay of personal resources and the conditions of the vocational training system and the labor market.

The BIJU design—a two-cohort longitudinal study supplemented by a cross-sectional survey—makes it possible to simultaneously analyze aspects of individual development, the particular situation of different birth cohorts, and the impact of social change.

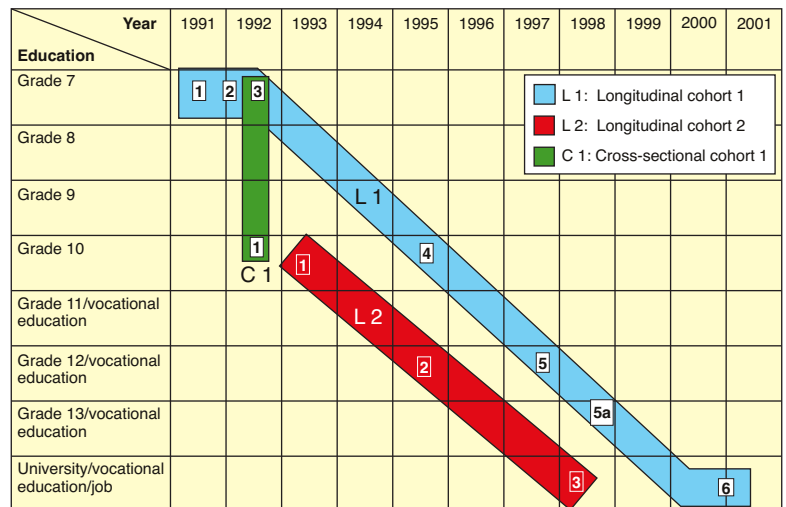


Figure 1. Research design of the BIJU project.

Thus far, research has focused mainly on the first three guiding components of the BIJU project. Because all the students in the sample have now left school, the theoretical focus is currently shifting to the fourth BIJU component, that is, more emphasis is being placed on students' ways of coping with the transition from school to work or university. In the following, two of the current research projects will be described in more detail.

The BIJU Study Data Collection

The longitudinal study began with a survey of the main cohort during the 1991/92 school year (see Fig. 1). Data was gathered from these 7th graders at three measurement points. The first point of measurement coincided with the transformation of the unitary school system of the former GDR to the tracked system adopted from West Germany. Thus, the first survey provides baseline data for the analysis of the situation at the end of the unitary system and the outset of the transformation process. The fourth wave of data collection was conducted in spring 1995, when the main cohort students were in the final grade of lower secondary school. The next follow-up survey took place in spring 1997, when the participants were either in the vocational education system or the academic track of upper secondary level. A new wave of data collection is currently in progress, focusing on how students have mastered the transition from school to university or from vocational education to the labor market.

The sample of school classes, disproportionately stratified according to state and type of school, comprises some 8,000 students from 212 schools of all secondary school types in the states of Berlin, Mecklenburg-West Pomerania, North Rhine-Westphalia, and Saxony-Anhalt. In order to separate school and classroom effects, two classes per school were included in the sample.

In spring 1993, the sample was supplemented by a second longitudinal cohort of 1,330 students in the final grade of lower secondary level. In order to provide a baseline for an East-West comparison at the end of lower secondary school, a separate cross-sectional study of the 10th grade (involving approximately 1,600 students) was also carried out. This study concentrated on issues of political socialization and the transition to vocational training and working life.

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Opportunity Structures, Academic Achievement, and Cognitive Development in German Secondary Schools

One of the basic assumptions of our research program is that schools represent learning environments in which cognitive development during adolescence may be promoted more or less successfully. Due to its long-term character, with five measurement points over a period of six years, **the BIJU project enables us to compare the learning trajectories of students in different types of secondary schools from grade 7 to grade 12.** The findings show quite clearly that the transition from elementary school to different types of secondary school has remarkable effects on domain-specific learning processes. The highest achievement gains are reached at the *Gymnasium*, followed by the *Realschule*, the *Gesamtschule* (comprehensive school), and finally the *Hauptschule*. Additional analyses show that learning differences across the school types are not only a consequence of reducing the achievement heterogeneity between students within classes, but are mainly **effects of different learning and teaching cultures in the different school types.** Interestingly, the different types of secondary school do not only influence learning trajectories in curriculum-based knowledge, as measured with standardized achievement tests, but also impact on nonverbal psychometric intelligence.

One guiding idea behind the early assignment to different school types in Germany is that learning and instruction are more effective in relatively homogeneous groups of students, in which teachers can adapt their instructional strategies according to the entry achievement levels of their students. It is, therefore, assumed that school types differ with respect to the demands made by instruction: The higher the track, the more demanding the classes. Being exposed to higher demands in class should lead to higher levels of

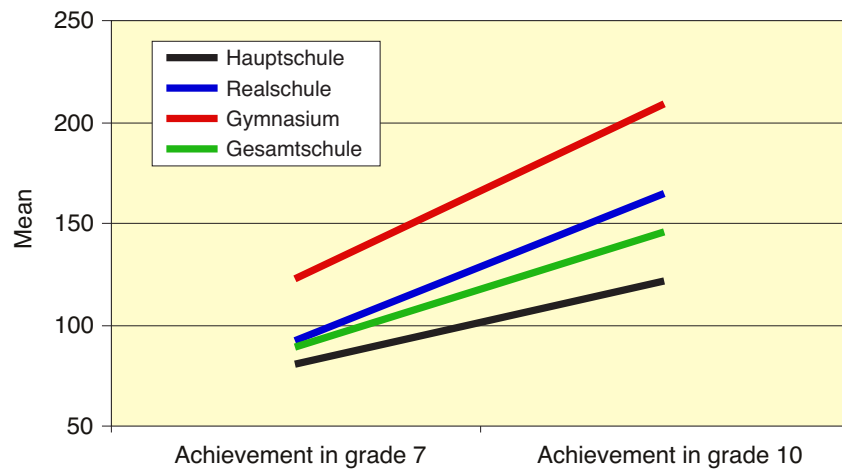
cognitive stimulation and higher gains in achievement. The different types of secondary school are thus assumed to provide specific learning environments that differ with respect to how much they promote the cognitive functioning of their students. However, recent studies from highly selective school systems, for example Hong Kong (see Marsh, Kong, & Hau, 2000), suggest that differences in knowledge acquisition across school types are not a consequence of different learning environments, but can be explained entirely by

Tracked and Comprehensive System in German Secondary School

Two different approaches have been implemented in the German secondary school system: a tracked and a comprehensive system. The former allocates students completing grade 4 (in most *Länder*, grade 6 in two *Länder*) to three different types of school on the basis of previous achievement: *Hauptschule* is the academically least demanding track, *Realschule* an intermediate track, and *Gymnasium* the highest track. Education at the *Hauptschule* ends after grade 9 or 10, when its graduates enter the dual system, which combines general and vocational education in school with vocational training in companies. Students at the *Realschule* graduate after grade 10, and also enter the dual system, but usually aspire to more highly skilled occupations than *Hauptschule* graduates. Students at the *Gymnasium* graduate after grade 13 (or grade 12 in most of the East German *Länder*). A successful final examination at *Gymnasium* level (*Abitur*) is required for university admission, and some of the more attractive jobs in the dual system (e.g., bank clerk) also ask for this certificate.

The other system consists of the comprehensive school (*Gesamtschule*). Within this type of school, students are generally tracked from grade 7 onward, being allocated to classes according to their subject-specific achievement levels. However, this tracking system is usually only applied in major subjects like mathematics, German (as the mother tongue), English (as a foreign language), and sometimes physics (starting in grade 9). Students can gain the same qualifications as in the tracked system, leaving school at the corresponding grade levels.

Figure 2. Learning trajectories for mathematics according to type of secondary school.



individual achievement differences at the time of secondary school entry. Marsh et al. found that, after controlling for individual entry achievement, no additional effect of school-average ability on mathematics learning was observable. Similar findings were reported by Goldstein and colleagues for the English secondary system. In the BIJU study we tested whether these conclusions also hold for the German school system.

The BIJU project not only allows individual and institutional effects on learning to be disentangled, it also allows institutional effects in different subjects, that is, mathematics, biology, physics, English, and civics, to be investigated. Findings show that institutional effects are particularly apparent in core

subjects like English and mathematics, but that they are smaller in other subjects such as physics, biology, and civics. Figure 2 displays mathematics achievement trajectories for the different school types. The achievement scores in grade 7 are standardized with a mean of 100 and a standard deviation of 30. The largest mean difference (between *Gymnasium* and *Hauptschule*) is 42 points in grade 7, increasing to 87 points in grade 10, thus suggesting that the school-type variable is a very important predictor for learning rates in mathematics.

In order to disentangle the effects of prior individual achievement, school-average achievement, and type of secondary school on later achievement, multilevel analyses of the BIJU data

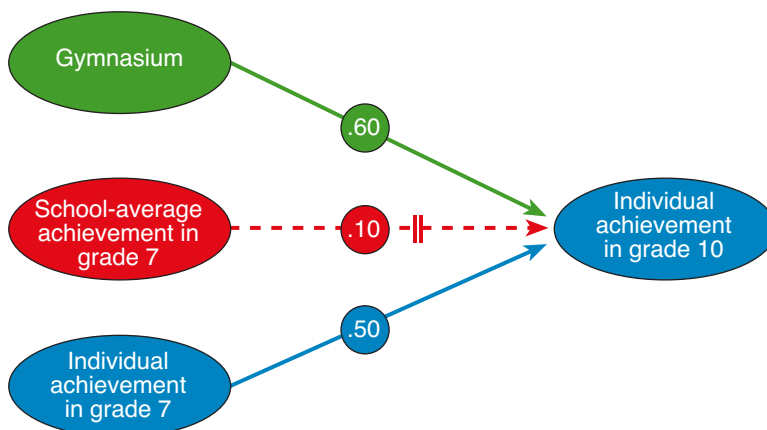
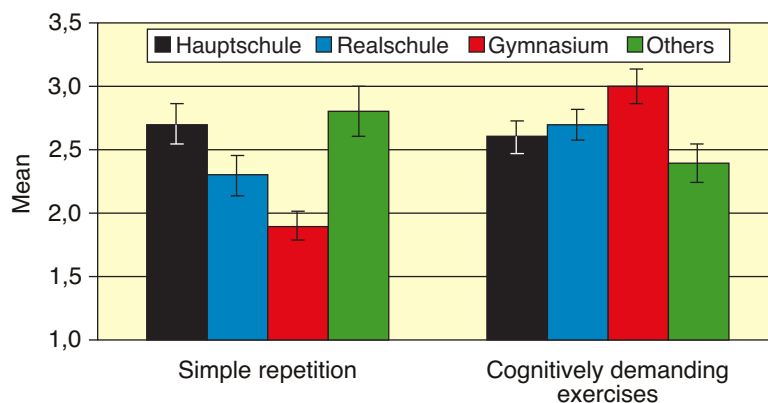


Figure 3. Effects of prior individual achievement, school-average achievement, and type of secondary school (1 = *Gymnasium* vs. 0 = others) on grade 10 mathematics achievement.

Figure 4. Quality of mathematics exercises according to type of secondary school (findings from TIMSS-Video).



were carried out. The findings of these analyses are presented in Figure 3 (note that there are usually large achievement differences between individual schools within one school type).

Obviously, the school type matters. That is, even after controlling for prior knowledge on the individual level and school-average achievement, **the type of secondary school has a substantial effect on later achievement.** Note that the effect of school type on achievement in grade 10 can be interpreted as an effect on *change* in achievement, because achievement in grade 7 is controlled. The nonsignificant effect of school-average achievement suggests that it is not the ability-grouping *per se*, but the learning climate of the *Gymnasium* that leads to higher learning rates. This assumption is supported by the findings of TIMSS-Video (see Research Area III), in which mathematics lessons in German schools were rated by experts on various instruction variables. Figure 4, showing the quality of exercises on two different dimensions, gives a good insight into why the *Gymnasium* is more effective at enhancing learning in mathematics. Relative to students' prior knowledge, the exercises used at the *Gymnasium* are cognitively more demanding than in other school types, thus helping students to learn in a more effective manner. These results thus provide empirical support for the as-

sumption that **different school types in Germany represent different learning environments**, in which the given opportunity structures have a substantial influence on the development of achievement. This effect is not restricted to curriculum-based tests, but also emerges from the psychometric intelligence tests administered in BIJU in grades 7 and 10. Here, longitudinal multilevel analyses show that the type of secondary school (1 = *Gymnasium* vs. 0 = others) has a substantial impact on **nonverbal intelligence** (standardized regression coefficient $\beta = .43$, $p < .001$), even after controlling for individual and class-average intelligence in grade 7. This last result is of paramount importance as it shows that the substantial effect of schools or school types on cognitive development reaches beyond the confines of curriculum-based knowledge. *Possible pedagogical implications of these findings include the provision of more favorable opportunity structures in schools other than the Gymnasium in order to optimize the cognitive development of the students in these schools.*

Opportunity Structures and the Formation of Academic Interests in Schools

Previous research on students' academic interests, particularly in science, has shown a dramatic decrease in mean interest over adolescence. Explanations for this phenomenon have usually referred to the predominantly scientific orientation of science instruction, which ignores the everyday experiences of students. Special instructional programs were, therefore, developed to encourage science teachers to build on student experiences, assuming that students will be more interested in and learn best from their own experiences. More psychologically-driven models, for example, the stage-environment-fit model proposed by Eccles and colleagues, suggest that the decline in interests could reflect a mismatch between individual needs in early adolescence and the opportunity structures typically provided by secondary schools. **Our theoretical approach to interest development** offers additional explanations for decreasing interests. Instead of stressing the negative role of class and school environments, our assumptions turn to individual developmental processes in adolescence.

Although traditional research on school effects on individual development has primarily focused on cognitive outcomes, especially language, mathematics, and science achievement, non-cognitive outcomes have also been investigated. These outcomes (e.g., self-esteem, academic self-concepts, and interests) are often seen as educational aims in themselves, and modern schools always strive to enhance students' development in these areas. Research on the development of academic interests, however, often suggests that schools are very ineffective in achieving non-cognitive goals in terms of increasing interests over time. In fact, previous research has shown a dramatic decrease in mean interest in adolescence, partic-

ularly in science. This development was replicated in the BIJU project. Figure 5 shows the development of interest in mathematics and physics during lower secondary school (from grade 7 to 10).

Interest values greater than 50 at grade 7 indicate positive interest, whereas values less than 50 indicate a lack of interest in the subject. There is a substantial decline for both girls and boys in both subjects suggesting that the developmental process is quite similar for both genders.

This general decline in academic interest, particularly in science and mathematics, has often been shown (for an overview see Baumert & Köller, 1998). One attempt to explain this trend assumes a mismatch between instruction-

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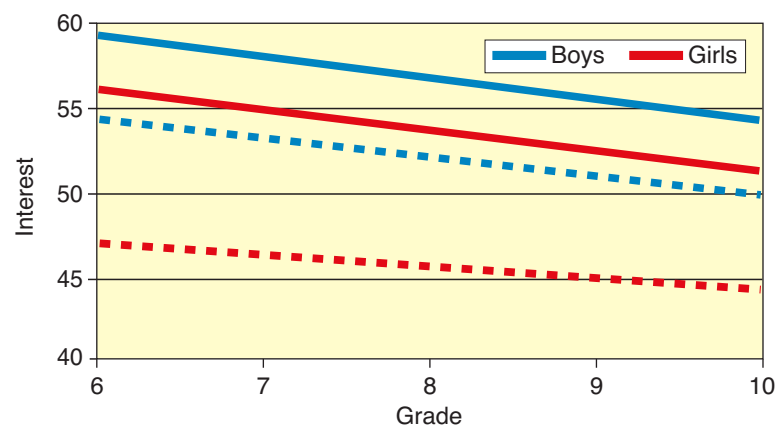


Figure 5. Development of academic interest in mathematics (bold lines) and physics (broken lines) in lower secondary schools.

al practice in classrooms and the general interests of adolescents. More specifically, it has been argued that teaching often fails to tie into students' everyday experiences. In fact, Schoenfeld (1988) shows that direct instruction in mathematics, which is usually regarded to be a quite successful approach, leads students to believe that mathematics has nothing to do with their everyday experiences and, as a consequence, they lose interest. Travers (1978) argues that *"the school is more likely to be a killer of interest than the developer."*

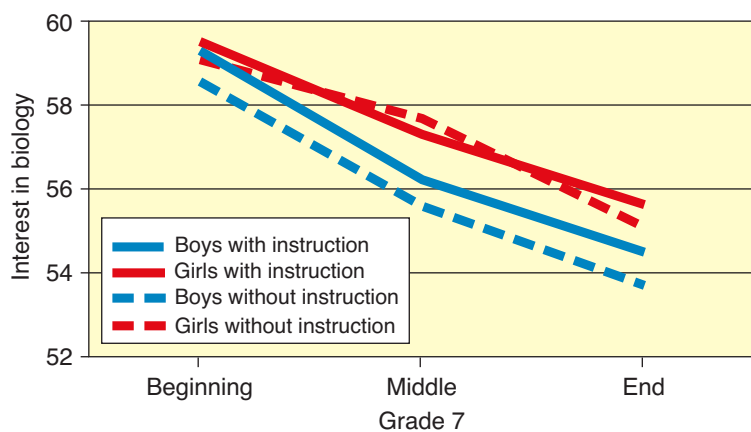
Viewing schools or traditional instruction as killers of academic interest suggests that no instruction would probably be a better way of promoting students' interests. The BIJU project allows for an analysis of the development of interest with instruction and without instruction. Following a resolution passed by the state government, no 7th graders in Mecklenburg-West Pomerania were taught **biology** during the 1991/1992 school year. This "natural experiment" allows us to compare changes in students' interest in biology under conditions in which biology was taught or not taught. Figure 6 presents the findings of this analysis. Here, the groups are additionally broken down according to gender. There is clearly no empirical evidence for any differences between the two instructional conditions. Only the time effect and the gen-

der effect were statistically significant, with girls displaying more interest in biology than boys. In sum, these findings do not support the frequent claims that lack of interest stems only from poor instruction.

An alternative explanation for the unfavorable interest trajectories observed during lower secondary school—and not only in the sciences—has been put forward by Eccles and colleagues. They point out that the field of experience outside of school broadens considerably during adolescence, providing competing opportunities for interest development. At the same time, the authors identify an institutionalized mismatch between the students' increasing desire for self-determination and the sometimes restrictive learning environments of schools. According to this view, the restrictive learning environments of lower secondary schools cause the typical decrease in interest over time.

A further explanation for the decline in academic interest during adolescence has been proposed by our research group (e.g., Köller, Schnabel, & Baumert, 1998), both supporting and expanding upon the argument made by Eccles and colleagues. Instead of stressing the role of curriculum and instruction, we turn to basic developmental processes occurring in adolescence. Following Deci and Ryan (1985), we start from the basic idea that students have an innate need to autonomously explore new fields of knowledge and action where they can develop a feeling of self-determination and experience competence and personal control. **In adolescence, students develop more realistic self-concepts of their own abilities** and become more and more aware of their **specific strengths and weaknesses** in various fields of knowledge and action. This **intraindividual comparison** is a central mechanism in

Figure 6. The development of interest in biology in classes with and without biology instruction.



the construction of personal identity and the development of personal interests. Coping with developmental tasks such as the transition from school to vocational education and the labor market exerts pressure on students to select and reinforce specific fields of interest, while giving up others. This **process of selection and optimization** technically results in decreasing mean values of interest across students during lower secondary grades. The logical consequence of this argument would be that a decrease in interest would not only be expected in mathematics and science, but in other key subjects such as German (as the mother tongue) and English (as a foreign language) as well. Empirical support for this assumption is presented in Figure 7 showing data from the BIJU project. As expected, the average interest in German and English decreased during grade 7.

In order to gather further empirical support for our assumption that interest development is affected by perceived competence in personally important domains, we investigated the relations between academic self-concepts and interest, hypothesizing that self-concepts would influence change in interest. Longitudinal structural equation modeling indeed provided evidence for the assumption that **self-concepts are important antecedents of academic interests**.

In order to investigate the role interest development plays in the processes of selection and optimization in specific academic fields, we explored the **relation between academic interest and course selection** in German upper secondary schools. At grade 11, German *Gymnasium* students have to choose advanced courses in two or three domains and basic courses in the remaining domains. Advanced courses usually comprise five to six lessons per week, whereas basic courses involve two to

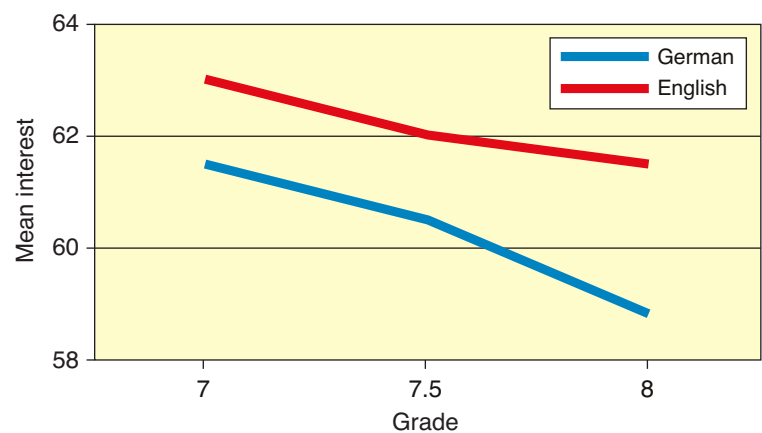


Figure 7. Development of academic interest in German (as the mother tongue) and English during grade 7; findings from the BIJU project.

three lessons per week. From our theoretical perspective, we predicted that students who later choose a basic course in mathematics would show decreasing interest in the subject during lower secondary school, while students later choosing an advanced course would show consistently high levels of interest.

The findings displayed in Figure 8 show that the one-third of the sample who opted for an advanced course in grade 11 indeed expressed high academic interest during lower secondary school. In contrast, the two-thirds of the students who opted for a basic course displayed a decrease in interest, resulting in a total decline for the whole sample. Therefore, the data portrayed in Figure 8 provide strong evidence for our assumption that the frequently reported decline in academic interest reflects a **process of differentiation** with students reinforcing specific fields of interest while giving up others and trying to optimize domains of high interest.

In our framework we propose that competing interests are not only to be expected in the academic field, but also between academic and nonacademic domains. Particularly in early adolescence, students have a strong tendency to prefer nonacademic contexts. At this time, children experience dramatic bio-

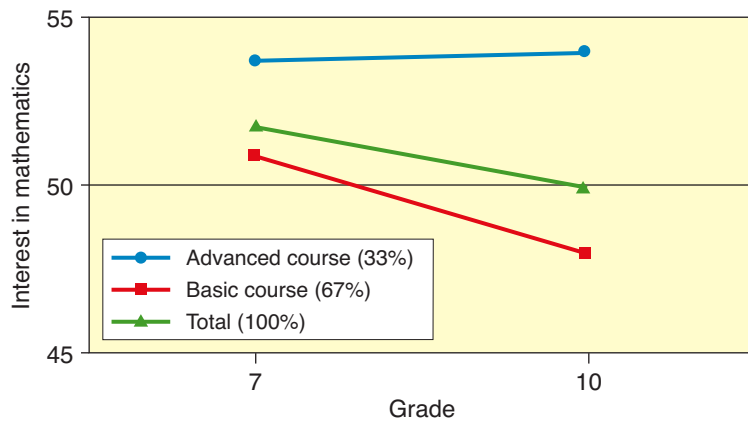


Figure 8. Development of interest in mathematics of students opting for an advanced or a basic mathematics course at grade 11.

logical and social changes associated with puberty. Peer groups become more and more important, while the parents' influence decreases and school often becomes a context which does not correspond to students' interests. Of particular interest are nonschool domains that compete with school in terms of attitudes, interests, and time investment. We thus hypothesized that the decline in academic interests during secondary school might also be a consequence of the increase in nonacademic interests and activities during adolescence. Contrary to expectations, however, none of the longitudinal analyses carried out so far have provided evidence for this hypothesis, thus indicating that the school context is less influenced by students' out-of-school experiences than suggested by prior re-

search. For German students at least, it seems that the academic world (school) and the nonacademic world (home, friends, clubs, teams, etc.) form two more or less independent domains that do not substantially influence one another. As a result, out-of-school variables and experiences have barely any impact on the development of academic interests.

Research Area II

Establishing a Monitoring System for Educational Performance: Foundational Studies

Despite the complex system of governance and federal cooperation which has been developed in the German educational system, Germany is one of the few industrial states which long had no national system of quality control to monitor the outcomes of educational processes and provide a framework for international comparison. With its participation in TIMSS, reliable data on the levels of performance of selected cohorts of students in mathematics and science have become available for the first time.

The Organization for Economic Co-operation and Development (OECD) uses the results of the TIMSS 7th- and 8th-grade assessment as performance indicators for the comparison of the educational systems in its member states. Data on mathematics and science performance are a regular feature of the OECD's annual publication "Education at a Glance" (OECD, 2000). The OECD has now launched its own program to monitor the outcomes of education systems in terms of student achievement, and to provide internationally comparable indicators for central domains of the edu-

cation system on a regular basis. All 16 of the German *Länder* are participating in this Programme for International Student Assessment (PISA), which builds on the experiences of TIMSS, but seeks to achieve qualitative improvement in many respects. A national consortium under the leadership of the Center for Educational Research is responsible for the national project management.

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The Third International Mathematics and Science Study (TIMSS)

The Third International Mathematics and Science Study (TIMSS) is the latest in a series of international comparative studies on mathematics and science teaching initiated by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS integrates the two domains in a single study, thus providing basic information on system performance in a core area of modern education in the 45 participating countries. The German research group consists of three partners: the Max Planck Institute for Human Development (MPIB), the Institute for Science Education at the University of Kiel (IPN), and the Humboldt University of Berlin (HUB). The national consortium is headed by the Max Planck Institute for Human Development.

The goal of TIMSS is to investigate achievement in mathematics and science from a cross-cultural perspective.

The international study is based on a cross-sectional sample of three age groups: (I) students from the two adjacent grades with the largest proportion of 9-year-olds, (II) students from the two adjacent grades with the largest proportion of 13-year-olds, and (III) students in the final grade of upper secondary school in the general and vocational education system. In Germany, age groups II and III were investigated. As an enhancement of the international design, the **TIMSS-Germany** design for age group II was longitudinal. Additionally, an international Videotape Study (TIMSS-Video) comparing mathematics instruction in Germany, Japan, and the United States has been interlinked with the panel study in Germany (see Fig. 1; see also Research Area III for a more detailed description of TIMSS-Video).

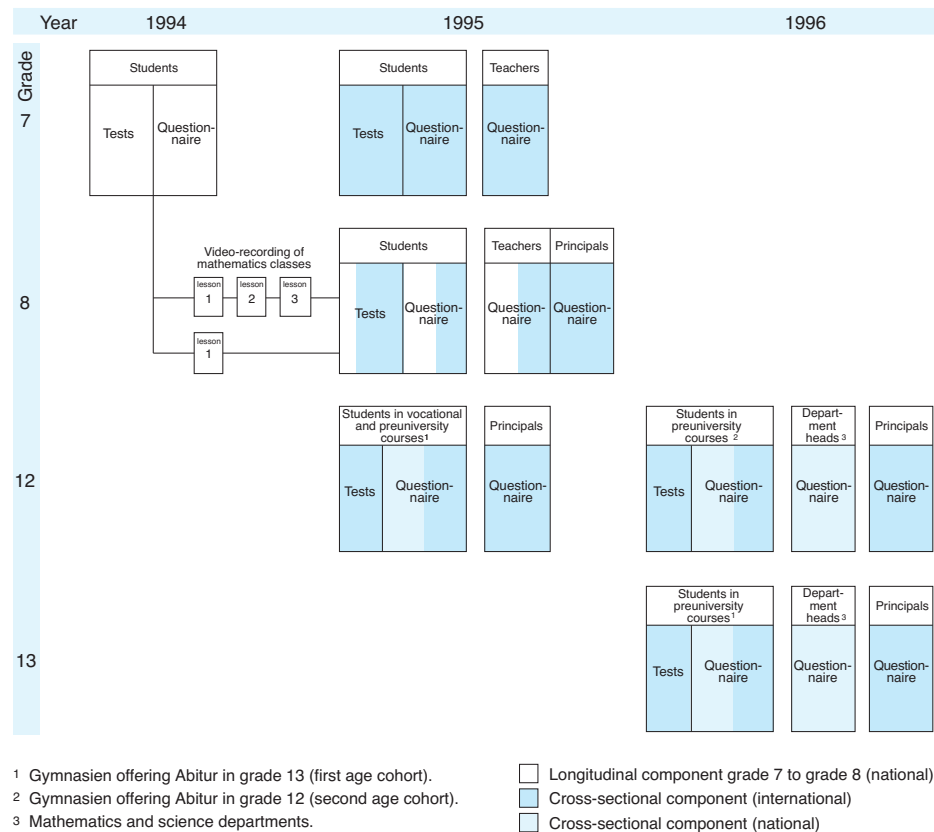


Figure 1. Design for TIMSS/II, TIMSS-Video, and TIMSS/III.

Research Questions

Since the publication of the reports on Population II, our investigations have focused on the analysis of Population III—the final grade of upper secondary education in vocational and preuniversity courses. The results of these analyses are presented in two recently published volumes.

The main foci of research were as follows:

- the structure and level of the mathematics and physics competencies acquired at school,
- epistemological beliefs about mathematics and physics,
- the relationship between motivation, learning strategies, and domain-specific knowledge,
- instructional strategies in mathematics and physics classrooms and the implications of these for the acquisition of domain-specific knowledge, and
- the relationship between course selection and domain-specific achievement, on the one hand, and career prospects and choice of university course, on the other.

Knowledge Structures in the Domain of Mathematical Literacy

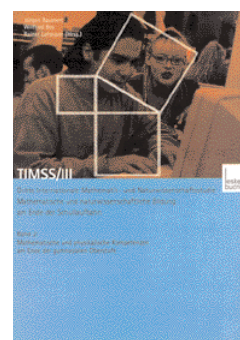
To analyze students' knowledge structures in a given domain such as mathematics, analysis has to go beyond the broad unidimensional achievement scores regularly established in educational measurement. Instead, students' understanding of the domain needs to be elaborated by means of qualitative categories derived from research on mathematics education and cognitive psychology. Therefore, test scores are anchored within the given content areas, and score levels are associated with cognitive demands mastered by students reaching the respective level. These *proficiency levels* also help to interpret research findings in a way that

is easily understood by teachers and educational researchers in the field.

Technically, proficiency levels can be described as critical thresholds in achievement, above which there is sufficient probability that students will provide the correct response to mathematics and science questions which call for particular knowledge or skills. Here, sufficient probability is defined as a 65% probability that the correct answer will be given. **Four proficiency levels** were defined for the domain of mathematical literacy, ranging from everyday reasoning to the application of basic mathematical routines, and on to mathematical modeling and argumentation. When the distribution of students across these proficiency levels is viewed in international comparison, qualitative differences in the structure of mathematical knowledge acquired become apparent. Table 1 illustrates the literacy profiles of school leavers in five European countries. For German mathematics instruction, the proficiency levels reveal an alarmingly high proportion of students who are unable to reliably apply basic mathematical routines—a necessary condition for successful transfer from school to vocational training. By the same token, the proportion of students who have attained the level of mathematical argumentation by the end of compulsory schooling is conspicuously low. The discrepancy between results in Germany and the Netherlands is striking. The finding that one third of the Dutch students in their final year of schooling do reach the highest level of mathematical literacy seems to provide convincing evidence for the success of **the realistic mathematics concept** developed by the Freudenthal Institute and implemented in the Netherlands.

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Table 1
Distribution of students across levels of mathematical proficiency at the end of full-time schooling (in %)

Proficiency level	Germany (TCI ¹ = 78)	France (TCI = 84)	Netherlands (TCI = 78)	Norway (TCI = 84)	Switzerland (TCI = 82)
Everyday reasoning	15.4	5.5	3.7	7.6	5.7
Application of basic routines	36.6	33.4	21.5	32.5	27.8
Modeling and mathematization	34.1	44.3	41.3	37.4	40.9
Mathematical argumentation	13.9	16.8	33.4	22.5	25.6
Total	100.0	100.0	100.0	100.0	100.0

¹ TIMSS Coverage Index: Percentage of the age cohort covered by the TIMSS sample.

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The Structure of Knowledge Acquired in Preuniversity Mathematics and Physics Courses: Strengths and Weaknesses of Students in Academic Tracks
Previous comparative educational research has shown that didactical traditions vary between countries. For example, the realistic mathematics approach implemented in the Netherlands as well as the problem-oriented approaches taken in the Scandinavian countries highlight the linking of mathematical concepts to authentic problem situations, while mathematics education in France and Japan stresses the systematic structure of mathematical concepts and inner-mathematical reasoning.

These observations lead to theoretical hypotheses on relative strengths and weaknesses of students from different countries. Within **TIMSS-Germany**, we tested these hypotheses by categorizing the cognitive demands of TIMSS test items and examining their differential functioning in international comparison.

The difficulty parameter describing each item's position on the proficiency scale was broken down into two components: (a) a component that covers the overall difficulty of the item on the international level and (b) a country-specific component indicating differential item functioning (DIF) between

countries. We made systematic use of such differential item functioning in pairwise comparisons of the countries participating in TIMSS. Furthermore, we are able to refer to the additional information provided by the proficiency scales, on the one hand, and expert ratings of the cognitive demands of the items, on the other. Statistical methods can be used to test which of these cognitive demands are related to the DIF parameters. The patterns of results indicate **systematic differences in the structure of knowledge acquired in the various countries**, and thus reveal the effects of the differing didactic traditions.

The German students' **mathematics performance at the preuniversity level** was not only generally weaker than that of many of their European counterparts, these weaknesses were particularly pronounced in the more advanced domains of mathematical reasoning (see Table 2). The relative weaknesses of the German upper secondary students lie in the domains of conceptual and procedural mathematical knowledge. The German students also underperformed in tasks requiring mathematical modeling, application, and problem solving, however. A certain strength of German mathematics instruction was found in the German stu-

Table 2
Relation between cognitive demands of advanced mathematics items and differential item functioning in various countries in comparison to Germany¹

Cognitive demands	Comparison country					All countries
	Austria	Switzerland	France	Sweden	USA	
Mathematical knowledge	-.22	-.31	-.28		-.32	-.38
Conceptual understanding	-.35			-.25	-.25	-.37
Algebra			-.29	-.36	-.34	-.28
Text comprehension			.35	-.23		
Modeling			.40	-.24		
Application				-.32		
Problem solving			.22	-.22		-.20
Visualization and using graphic material			.45	.25	.46	.32

¹ The values given are correlations between the cognitive demands (as rated by experts) and the differential item parameters across 66 TIMSS test items. Positive values indicate relative strengths of German students compared to students from the comparison country, while negative values indicate relative weaknesses. Only significant correlations ($p < 0.05$) are given.

dents' ability to visualize and use graphic material, but this was the only strength that could be identified. The pairwise international comparisons reveal some highly interesting variations in the country-specific cultures of pre-university mathematics. There is little deviation in the DIF parameters of the three German-speaking countries (Germany, Austria, and Switzerland). In other words, although the Swiss students far outperformed their peers in Germany and Austria, the didactic cultures of the three countries seem to be rather similar. These findings imply scope for optimization within one and the same didactic tradition.

The U.S. students' performance in the advanced mathematics test—though very low overall—was relatively high in tasks requiring conceptual and procedural knowledge. This indicates that high school lessons in Germany follow the same kind of lesson script that was also observed in the 7th and 8th grades, emphasizing the use of repetitive exercises and the rote learning of mathematical concepts (Baumert, Lehmann et al., 1997).

Students attending the mathematical and scientific track of the French *Lycée d'Enseignement Général* generally attain an extraordinarily high level of mathematics achievement. Their particular strengths lie in advanced mathematics and algebra skills. At the same time, the relations between the DIF parameters and the strategic demands of the tasks such as problem solving, restructuring, and spatial visualization show that—in comparison to their extremely high performance overall—French students are relatively weak in these areas. French instructional practice is obviously geared to the traditional approach of imparting systematic domain-specific knowledge.

As expected, the Swedish students' profile is complementary to that of their French peers. Compared to both German students and students in the other participating countries, the particular strengths of the Swedish students lie in the domains of application and problem solving, as well as in procedural knowledge and the qualitative understanding of mathematical concepts. This confirms that Swedish mathematics instruction

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indeed focuses more on problem solving and understanding than is the case in the other countries under investigation. Moreover, the level of competence achieved by the Swedish students was generally high.

The task shown in Figure 2 is a good illustration of differing knowledge profiles. The item, in which compulsory material from lower secondary education is embedded in an unfamiliar context, was administered to preuniversity students taking advanced courses in mathematics.

Country-specific profiles also emerge for the knowledge acquired in **preuniversity physics courses**. By in-

ternational comparison, the relative strengths of German upper secondary students lie in the formal, quantitative approach to physics. In contrast, German academic-track students have particular difficulty with tasks that require either a clear conceptual understanding or the overcoming of misconceptions (see Fig. 3). This finding shows that the results of intensive research into conceptual change have not been successfully transferred to instructional practice in Germany. This indicates a serious shortcoming in the implementation of research findings in in-service teacher training.

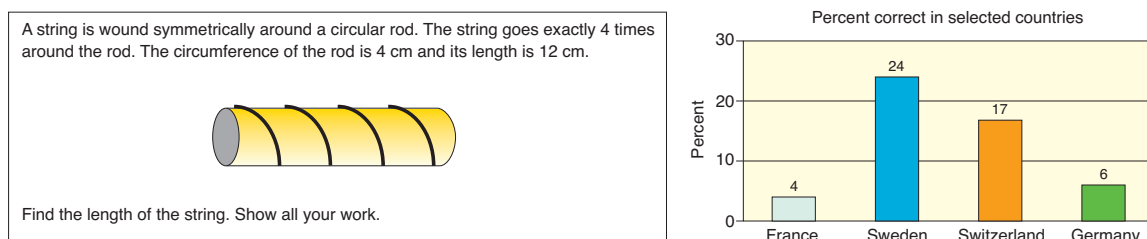


Figure 2. TIMSS item on problem solving in advanced mathematics.

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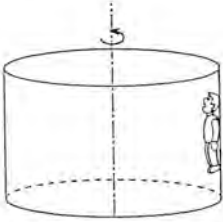
Epistemological Beliefs about Mathematics and Physics

The terms "epistemological beliefs" and "worldviews" cover all beliefs and subjective theories that individuals develop about knowledge and knowledge acquisition, either in general or in specific domains. The starting point for all research on epistemological beliefs is the assumption that these intuitive theories predetermine how the individual encounters and interacts with the discernible world. They impact on thought and reasoning, information processing, learning, motivation, and—ultimately—academic achievement. As a rule, analyses of epistemological beliefs take a developmental approach and assume an

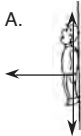

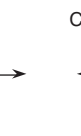
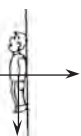
age-graded increase in the complexity of the worldviews. This process can either be fostered or obstructed by school instruction.

When epistemological beliefs are studied within the framework of research on mathematics and science education, the aim is not only to optimize the learning process. More importantly, **epistemological beliefs are perceived as an integral component of mathematical and scientific knowledge**. They provide implicit conceptual frameworks, indicating which questions can legitimately be posed in a specific domain, which methods can be used to solve them, and with what degree of certainty. The elaboration of students' intuitive

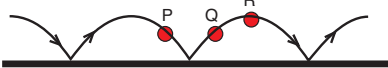
The figure below shows a special sort of amusement park ride. As the ride starts to rotate about its central vertical axis the floor drops slowly but the rider does not. The rider is pressed against the rough inside wall of the rotating cylinder and remains at rest with respect to the wall. The rider's feet are not in contact with the floor.



Which one of the following diagrams best represents the real forces acting on the rider?

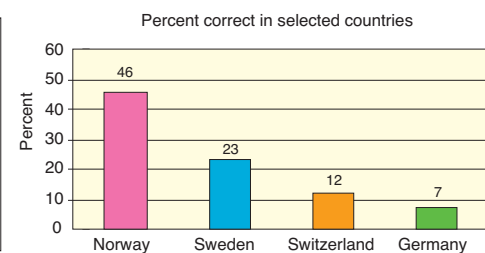
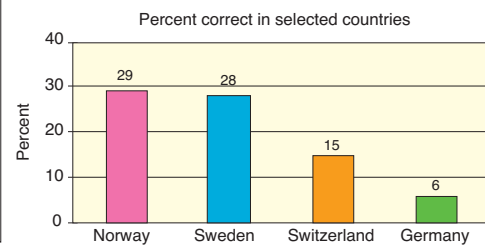
A.  B.  C.  D. 

The figure shows the trajectory of a ball bouncing on a floor, with negligible air resistance.



Draw arrows on the figure showing the direction of the acceleration of the ball at points P, Q, and R.

Figure 3. Two TIMSS items on misconceptions in advanced physics.



theories is therefore a goal in its own right in mathematics and science education, and epistemological beliefs are considered to be a core element of mathematical and scientific literacy. At the same time, typically occurring students' beliefs about mathematics and physics allow inferences to be drawn about the students' previous instruction in these domains (see Tables 3 and 4).

In **TIMSS-Germany**, epistemological beliefs about mathematics and physics were explored in a **supplementary national investigation**. The **key findings** can be summarized as follows: The mathematical worldview of upper secondary students in the academic track is typically a schematic and algorithmic perception of **mathematics** and mathematics instruction. A clear majority of respondents agreed with statements such as: "mathematics implies remem-

bering and applying definitions, formulas, mathematical facts, and procedures" or "doing mathematics means applying general rules and procedures to specific tasks." Accordingly, upper secondary students are not familiar with the constructivist approach to mathematics taken in the philosophy of science. This approach emphasizes the

Table 3
Students' beliefs about mathematics and learning mathematics

- Math problems have one, and only one, correct answer.
- There is only one approach to solving any given math problem—usually the method recently demonstrated by the teacher.
- Normal students can't expect to understand math; they have to learn methods off by heart and apply them mechanically.
- Students who have understood mathematical concepts and methods are able to solve any math problem in a matter of minutes.
- School math has little or nothing to do with the real world.
- Doing math is a solitary activity that individuals engage in on their own.
- Math is a formal system, and has nothing to do with intuition or creativity.

Table 4
Students' beliefs about science and learning science

- A logico-empiricist view of the world is predominant, according to which scientific theories are derived from observations and experiments.
- An adequate understanding of the relationship between models and reality is lacking. Models are viewed as a direct reflection of reality.
- Scientific knowledge is the result of human beings discovering objective, permanent natural laws (reification of discovery).
- In contrast to other forms of discovery, science knowledge entails a claim of absolute truth; the distinction between true and false is independent of theory and context.
- The notion that scientific discoveries are the result of interactive validation processes is lacking.
- The sciences represent the definitive way of understanding the world in modern societies.
- The sciences are the basis for modern technology and the engine driving progress.

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constructive and dynamic nature of mathematics, and the fact that mathematical innovation is dependent on creativity and imagination. Nevertheless, almost all *Gymnasium* students are aware of the importance of mathematics in the modern world. Rigid schematic perceptions, such as there only being one approach to solving any given mathematics problem—still a typical belief among 14-year-olds—are no longer found in preuniversity mathematics courses. In contrast to physics, Platonist perceptions play practically no role in the domain of mathematics.

A predominant worldview among academic-track students in upper secondary education can also be identified for the domain of **physics**. This perception couples the ontological belief that physics consists in the gradual discovery of a construction plan for the universe with the view that physics-related knowledge has system character. According to this view, the natural laws of physics are discovered by physicists on a step-by-step basis. The theories of physics systematize human experience, most of which is gained from experiments. In the international research literature, this basic perception is defined as a logico-empiricist view of science. An understanding of the constructive

nature of scientific theories is alien to this worldview.

As is also the case in mathematics, the societal relevance of physics is undisputed. The great majority of upper secondary students believe physics to be the driving force behind technological progress, its aim being to solve the practical problems encountered by humanity. However, there is a systematic difference in the physics-related worldviews of students enrolled in basic and advanced courses, the direction of which is worthy of note: The longer and more intense the students' involvement with physics in school, the more pronounced their empiricist beliefs about science, and the greater the claims of certainty that they associate with knowledge in physics. This finding clearly contradicts the normative expectations guiding physics education.

The development of epistemological beliefs about mathematics and physics during adolescence can be described as a process of differentiation. During adolescence, different aspects of beliefs, which are by no means always logically compatible, become more distinct from one another and thus more clearly defined. Where mathematics is concerned, a clear polarization of epistemological beliefs occurs over the course of this development—either in the direction of a static schema-oriented view or in that of a dynamic application-oriented position. Where physics is concerned, a similar differentiation of epistemological beliefs can be observed over the course of development. This has little effect on the empiricist view of the world that predominates in this domain, however. The main change here lies in the rejection of schematic perceptions of physics. Figure 4 shows the results of a latent class analysis for mathematics from a developmental perspective.

Epistemological beliefs are intuitive theories which represent an integral el-

ement of domain-specific knowledge and, at the same time, impact on motivation, learning processes, and ultimately academic achievement in the domain in question. In TIMSS, structural equation modeling was used to analyze the relationship between epistemological beliefs, on the one hand, and motivational orientations, use of learning strategies, and achievement in the given subject, on the other. It emerged that there was a high degree of comparability between the two subjects. The analyses of the **mathematical worldviews**—as shown in Figure 5—indicate that these beliefs **have direct or indirect**—that is, mediated by other factors—**effects on achievement in mathematics**. As expected, the effects of Platonist and **schematic perceptions** of mathematics are negative. The effect of schematic perceptions is mediated by interest in the subject and rehearsal strategies. Students who believe that mathematics consists merely in the application of particular algorithms to given tasks are less interested, more likely to use surface strategies when studying, and perform less well than their peers. As was also predicted, the other two dimensions of the mathematical worldview proved to have positive effects on achievement. Those students with a **constructivist perception** express great interest in mathematics and perform better than their peers.

Summary

In Germany, the TIMSS findings on the structure of knowledge in mathematics and physics synthesize with the students' modal epistemological beliefs to form a relatively homogeneous pattern and reflect a form of instruction which is fundamentally schematic and often

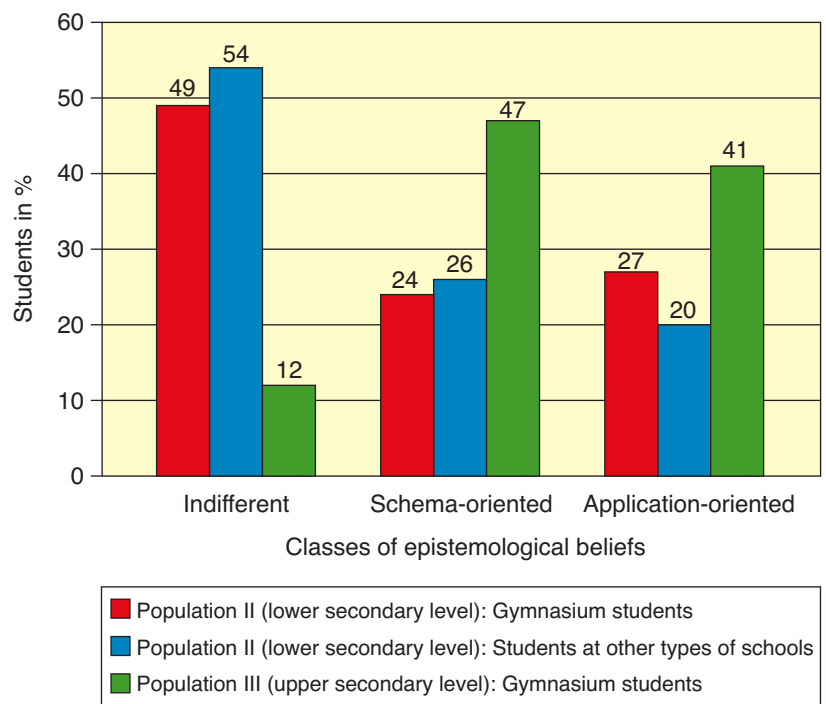


Figure 4. Students' epistemological beliefs about mathematics according to age cohort and school type (in %).

repetitive, involves relatively little variation, and does not have the primary aim of stimulating and fostering cognitive activity, intellectual autonomy, and self-regulated learning. This conclusion is confirmed by the TIMSS data on the structure and delivery of lessons (see below: *The Orchestration of Students' Learning Activities*). At the same time, the TIMSS results also reveal considerable variation in knowledge profiles according to the country, its didactic tradition, and the subject in question.

This convergence of results in the in-depth analyses conducted in Germany may well explain the far-reaching impact of the study. It seems fair to draw attention to the considerable political, practical, and scientific impact that TIMSS has had in this country. The findings have led to marked changes in the political agenda, inasmuch as the *Länder* have begun to establish a national monitoring system focusing on educational outcomes. From the practical

point of view, the federal and *Länder* governments have reacted with a well-equipped development program to improve instruction in individual schools and professionalize teaching in the domains of mathematics and sciences. From the scientific point of view, the findings of TIMSS and TIMSS-Video

have led to the **German Research Foundation (DFG)** funding a **new program** to further research on learning and instruction in mathematics and science, taking into account support systems existing both inside and outside of school.

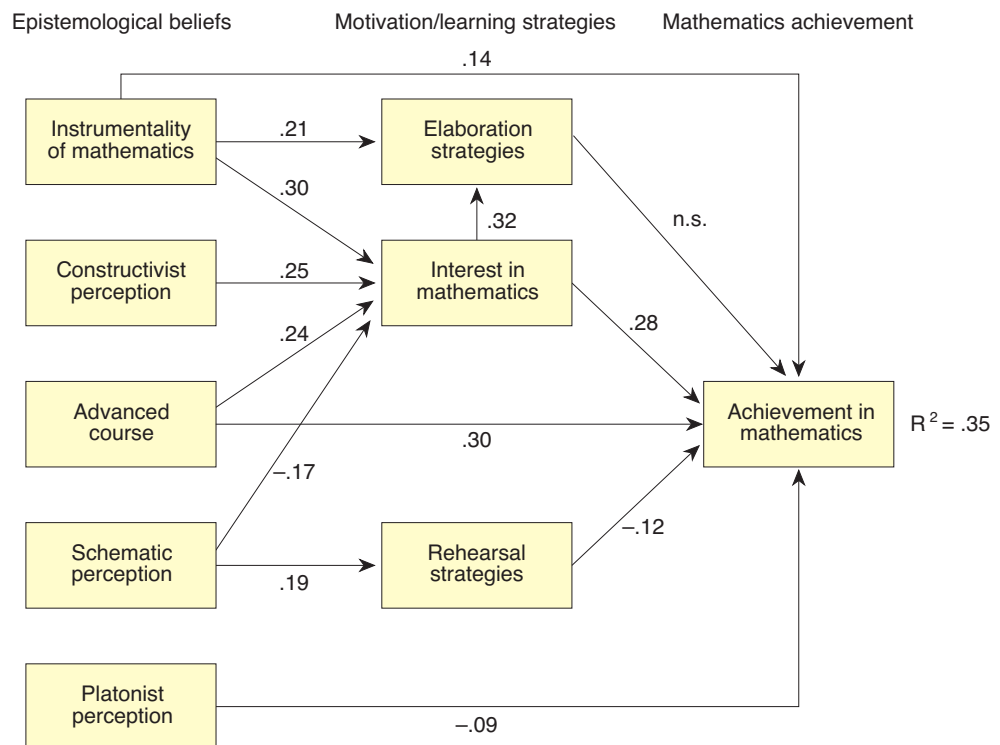


Figure 5. Epistemological beliefs, motivation, learning strategies, and performance in mathematics: Structural equation model.

Programme for International Student Assessment (OECD-PISA)

As projects like the Third International Mathematics and Science Study (TIMSS) have shown, large-scale assessments of student performance can provide valuable information for policy-makers, teacher trainers, and educators. The German ministers of education in the 16 German *Länder* have, therefore, resolved to monitor outcomes of schooling on a regular basis. The Programme for International Student Assessment (PISA) that was initiated by the member countries of the Organisation for Economic Cooperation and Development (OECD) provides an excellent basis for the establishment of such a monitoring system. This project assesses knowledge, skills, and competencies of 15-year-old students in reading, mathematics, and science, as well as in cross-curricular domains. Because the assessments take place on a regular basis, with updates every three years, the study presents a tool for monitoring changes in the performance of the participating countries' education systems and for gauging the effects of measures taken to improve

learning outcomes.

Another important feature of the PISA project is that it allows for national additions to the international design. This gives national committees the opportunity to address research questions that are of particular interest to them. The German PISA consortium has made extensive use of this opportunity and supplemented the program such that central research questions in education and educational psychology can be addressed. One main focus of these foundational studies is the explication of structures of knowledge and competencies in curricular and cross-curricular domains. In addition, an attempt is made to gauge the importance of individual-level and school-level factors, as well as curricular and didactical traditions affecting the development of these knowledge structures and competencies. Some of the national additions to the international PISA design and the research questions they aim at addressing are listed in Table 5.

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Table 5
National supplements to the international PISA design for analyses of knowledge structures and their determinants

Reading	Mathematics	Science	Cross-curricular competencies
<ul style="list-style-type: none"> Assessment of learning from texts as a component of reading literacy distinct from working with texts Assessment of proximal antecedents of text comprehension to identify possible points for intervention 	<ul style="list-style-type: none"> Fine-grained differentiation and description of competency classes Addition of broader range of items assessing aspects of mathematical literacy not covered by the international test Ratings of items based on a theory of cognitive demands Identification of effects of curricular and didactical traditions on knowledge structures 	<ul style="list-style-type: none"> More comprehensive assessment of understanding of scientific concepts to test the distinction between concept and process components of scientific literacy Identification and description of competency levels for the concept and the process dimensions 	<ul style="list-style-type: none"> Assessment of general problem-solving skills and validation of the construct Assessment of aspects of social competence and cooperative behavior Exploration of the role schools play in the development of CCCs

Analyses of Knowledge Structures

Reading literacy Each cycle of the international PISA program will focus on one of the three assessment domains. In the first cycle, this major domain is reading. The international framework for the assessment of reading literacy is largely based on a structural model developed by Kirsch and Mosenthal (1998), which strongly influenced both the U.S. National Assessment of Educational Progress (NAEP) and the OECD's International Adult Literacy Study (IALS). At a general level, this model distinguishes between a primarily text-based and a more knowledge-based aspect of reading comprehension. Whereas the former relies almost exclusively on information provided in the text, the latter also draws on prior knowledge. These two aspects are further broken down into five types of demands that readers encounter when working with texts, namely retrieving information, developing a broad understanding, and developing an interpretation, on the one hand (representing text-based comprehension), as well as reflecting on the content of the text and reflecting on the form of the text, on the other (representing more knowledge-based comprehension).

The international approach examines reading comprehension in the context of *working with texts*. In the test, students were allowed to refer back to the text while answering questions about it. This approach clearly captures an important aspect of reading literacy. Yet, reading literacy also encompasses the ability to generate mental representations of a text such that the information can be used at a later point in time, without having to consult the document again. This aspect, which can be described as *learning from texts*, was assessed in the national extension of the international PISA design. The na-

tional test is based on the psychological theory of text comprehension developed by Kintsch (1998) and van Dijk and Kintsch (1983). This theory differentiates three types of text representations: verbatim representations, which result from basic processing of a text's surface; propositional representations, which capture the meaning of texts; and situational representations, which integrate the information from the text with prior knowledge. By separating the reading or learning phase from the test phase, the national test assesses each of these representations. More specifically, students answered questions about a text they had read without being able to refer back to it.

According to Kintsch (1998), text comprehension encompasses text-driven construction processes and knowledge-driven integration processes. Idea units or propositions, on the one hand, and the reader's goals, on the other, lead to the retrieval and activation of associated elements (knowledge, experience) from long-term memory and the formation of an interrelated network. At the lowest level of comprehension, a person may be able to reproduce a text from memory without being able to use it for any other purpose; in that case, the information provided by the text remains inert knowledge. The most elaborated form of text processing, on the other hand, is the situational representation. Here, the contents of the text and the reader's current knowledge are interconnected and additional information stemming from inferences is incorporated, thus reflecting the deepest level of learning from the text. In generating situational representations, deliberate control becomes necessary when the textual information interferes with the knowledge base or when not enough knowledge is available for an orderly mental representation of the text to be constructed.

Large-scale assessment studies (e.g., IEA, NAEP) have recently begun to try to explain observed differences in text comprehension skills or reading literacy by reference to structural and individual features. Among other things, they examined the role of such factors as school characteristics, class size, and students' socio-economic background (SES). One of the main findings of these studies was that, compared to SES, school variables seem to have relatively little impact on text comprehension skills. However, the analyses did not take into account more proximal antecedents of reading comprehension that have been identified in the psychological literature on the processes operating during the construction of mental representations, on the one hand, and on individual predictors of comprehension and memory skills, on the other. Here, decoding skills, knowledge about language, domain-specific knowledge, basic cognitive capacities (working memory, mental ability), learning strategies, and metacognitive knowledge are described as major predictors of text comprehension. In addition, the construction of a coherent situational representation of a text may also depend on the reader's goals and motivation. The importance of motivational variables has repeatedly been shown in research on learning strategies.

Rather than concluding that schools do not make a difference, the national PISA consortium added an assessment of several proximal antecedents of text comprehension which could represent potential points of intervention, particularly in schools. The national additions include reading and learning strategies, thematic interest, and prior knowledge about the topic of each text. A reading speed test was also administered, allowing for the measurement of basic reading skills (decoding speed). Furthermore, students' knowledge of learning strate-

gies was assessed. That is, students were asked to rate a series of learning strategies in terms of how effective they would be for attaining a stated goal in six different scenarios, and their ratings were subsequently compared with corresponding judgments by experts.

As described above, the national design includes a second text comprehension test, differing from the international reading literacy test in several respects. Whereas the international assessment examines reading comprehension in the context of working with texts, the national test requires students to read each text within a limited period of time and to subsequently answer comprehension-based and knowledge-based questions from memory without being able to consult the text again. The extent to which students have developed a situational representation of the information provided is regarded as an indicator of learning from texts. On the basis of the different assumptions about text comprehension and literacy underlying the national and the international theoretical frameworks, we expect that different predictors will be identified for the aspects captured with the two tests. More specifically, the theoretical assumptions depicted in Figure 6 will be tested systematically by comparing structural equation models with varying constraints.

Based on the models by Kirsch and Mosenthal and van Dijk and Kintsch, we expect to find substantial effects of mental ability, decoding speed, knowledge about learning strategies, and interest, as well as of parents' socio-economic status (SES) on both aspects of text comprehension. Other predictors are expected to influence only one of the measures. For example, the theoretical assumptions suggest that prior knowledge and use of deep-level learning strategies (elaborations) will only

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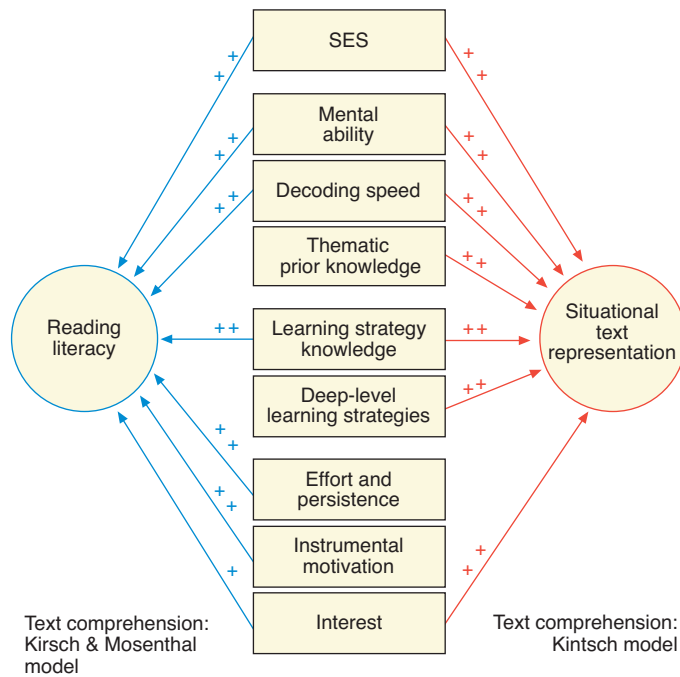


Figure 6. Theoretical assumptions about variables predicting the two facets of text comprehension.

have a positive effect on the development of situational text representations, whereas instrumental motivation and effort and persistence when studying should primarily be associated with higher levels of performance in the international reading literacy test.

Analyses of data from a field trial show that the international assessment (working with texts) and the national assessment (learning from texts) do, in fact, capture different aspects of reading literacy. A two-dimensional Rasch model was shown to represent the data better than a one-dimensional model. Owing to design restrictions in the field trial, however, we have not yet been able to test the complete model depicted in Figure 6 by considering both criterion variables simultaneously. Nevertheless, in line with our theoretical assumptions, partial models provided strong evidence to show that learning strategy knowledge and text-related prior knowledge have the highest predictive power, particularly where learning from texts is concerned. Most importantly, this conclusion holds even when SES is included as a predictor.

These findings suggest that metacognitive skills may present an appropriate point of intervention when it comes to fostering reading literacy in schools. To test this idea, an experimental training study has been designed. Based on the concept of reciprocal instruction, students will be trained in the use of metacognitive strategies, and the longer-term effects of this training program on text comprehension will be explored.

Mathematical literacy The international framework for the assessment of mathematical literacy is strongly influenced by the "realistic mathematics" approach introduced by Hans Freudenthal. This approach starts with the assumption that mathematical concepts and ideas have primarily been developed as tools for grasping and structuring phenomena of the physical, social, and mental world. In line with this assumption, the international PISA test consists mainly of items that require students to apply their knowledge and skills in authentic situations. Moreover, the composition of the test reflects the idea that problems involving modeling and application present the best indicators for mathematical understanding.

The "realistic mathematics" approach reflects current ideas on constructivist teaching and situated learning that are quite popular in didactics and educational research (see below: Research Area III). However, these conceptualizations leave unanswered such important questions about the nature and structure of mathematical competencies as the following:

(1) What is the relationship between modeling-and-application kinds of tasks, on the one hand, and inner-mathematical problem solving and technical skills, on the other? Do these competencies constitute different dimensions of mathematical literacy or do

they represent hierarchical levels of mathematical understanding that may be positioned on a singular latent dimension?

(2) Can different levels of mathematical modeling be distinguished?

To address these and other questions, the German PISA consortium has extended the international approach in terms of theory, design, and methodology:

(1) Further breaking down two of the three competency classes defined in the international framework, the national approach establishes a more fine-grained theory of mathematical competencies. More specifically, the model distinguishes the following competency classes: (1a) application of technical skills or recall of facts, (1b) modeling based on a single algorithm, (2a) single-step modeling that is primarily conceptual in nature, (2b) multi-step modeling that requires either the combination of several similar steps or knowledge from several mathematical domains, and (3) mathematical thinking, generalization, and insight.

(2) Based on mathematical and didactical conceptualizations as well as psychological approaches, a theoretical model of cognitive demands has been developed. Using this model, trained experts rated the cognitive demands of each item used in PISA.

(3) The test design was extended by adding a broader range of items. These items cover a wide variety of mathematical themes and a broad range of technical skills.

The structure of mathematical competence will be explored and compared across student groups and countries. Based on the theory of item demands and difficulty mentioned above, levels of proficiency will be described in detail for the dimensions and sub-dimensions identified in the structural analyses. In addition to providing further informa-

tion on structural aspects of the domain, these proficiency scales will allow for criterion-referenced interpretations of test scores. In order to gauge the effects of didactical and curricular traditions on structures of mathematical knowledge and skills, moreover, differential strengths and weaknesses across countries as well as regions and school types will be examined.

Taken together, the theoretical, empirical, and analytical power of the extended PISA mathematics study will provide important insights into the nature of mathematical literacy and into specific strengths and weaknesses in students' knowledge and skills. Such results represent valuable information for curriculum development, teacher training, and textbook writing.

Scientific literacy As is the case with mathematics, the first cycle of PISA assesses scientific literacy as a minor component. In line with the Anglo-Saxon notion of scientific literacy, as described in the *Benchmarks for Science Literacy* published by the American Association for the Advancement of Science, for example, the international PISA framework emphasizes process skills. The framework defines processes as "mental (and sometimes physical) actions used in conceiving, obtaining, interpreting, and using evidence or data to gain knowledge or understanding" (OECD, 1999, p. 61), and distinguishes five such processes: (1) recognizing scientifically investigable questions, (2) identifying evidence needed in a scientific investigation, (3) drawing or evaluating conclusions, (4) communicating valid conclusions, and (5) demonstrating understanding of scientific concepts. Although some scientific knowledge is needed for all five processes, only the fifth primarily focuses on this aspect of scientific literacy. In other words, understanding of scientific concepts is not

intended to be the main challenge in solving items designed to assess the first four of the processes covered in the international PISA test.

The national extension in science adds a more comprehensive assessment of conceptual understanding to the international design. This addition covers concepts from biology, physics, and chemistry. The data collected with both the international and national items will be used to test the distinction between concept and process components of scientific literacy. If, as expected, the distinction holds, competency levels will be determined and described for each of the two dimensions. Again, on the basis of such structural analyses, specific strengths and weaknesses of the students can be identified.

Cross-curricular competencies

PISA is the first international assessment study that goes beyond the measurement of knowledge and skills in curricular domains and attempts to capture so-called cross-curricular competencies (CCCs) that can be applied in a broad range of situations. This approach follows the central idea that the goals of formal education are not restricted to maximizing curriculum-based knowledge. In the first cycle of PISA, cognitive, metacognitive, and motivational prerequisites for self-regulated learning were assessed in most participating countries. The instrument for this part of the assessment was developed by PISA-Germany in collaboration with the OECD and the University of Groningen.

In Germany, a problem-solving component has been added to the design. Based on different psychological approaches to studying problem solving, both paper-and-pencil instruments and computer-based assessment procedures have been developed. A main goal of this part of the study is to determine the extent to which problem-solving

skills can be defined and measured at a domain-independent level and distinguished from general intelligence.

Analyses of the field-trial data identified two aspects of problem solving. The first was primarily picked up by the paper-and-pencil tasks, and reflects an abstract component that is closely related to general reasoning ability. Performance in the more complex, dynamic, and realistic computer-based tasks, on the other hand, seems to constitute a distinct factor. The data from the main study will be used to explore further the structure of the problem-solving construct and its relationship with other competencies and skills. Moreover, relationships between the CCCs, students' sociocultural background, and school-level variables will be analyzed to gauge the extent to which schools can promote the development of such general competencies.

Another national extension in the CCC domain aimed at assessing aspects of social competence. Particularly in the German debate about educational goals, social learning and social competencies play an important role. Protagonists of progressive education (*Reformpädagogik*) have placed special emphasis on social skills as paramount outcomes of schools. However, while it is relatively easy to capture academic achievement reliably and validly in large-scale assessments, the measurement of social behavior or social competencies in such studies poses more difficult problems. Most of the measures applied in previous research have been based on self-reports that tend to be affected by a tendency toward socially desirable responses. In addition to employing existing self-report scales measuring cognitive, emotional, and motivational antecedents of interpersonal behavior (e.g., perspective taking, social orientations), a group-task was, therefore, developed to assess cooperative behavior.

This task requires three students to work together on a problem and to pool the various pieces of information given to each group member in order to come up with a joint solution. Results from a validation study show that the joint solution represents a combination of the students' problem-solving abilities and aspects of social competence. The rela-

tionships between cognitive competencies, social skills, and cooperative problem solving will be further investigated with the data from the main study. Moreover, the assumption that cognitive and social outcomes of schooling show a positive rather than compensatory relationship will be tested.

Research Area III

Learning and Instruction: Cognitive Activation and Cognitive Tools

Three cornerstones of competence acquisition have to be integrated into research on learning and instruction: the tasks to be mastered, the students (who have to be engaged in meaningful learning activities), and the teachers (whose task it is to facilitate students' learning). Each cornerstone highlights different aspects of the learning process. Focusing on the tasks means asking what kinds of knowledge structures and more general cognitive preconditions have to be accessible in order for certain tasks to be mastered. Switching to the students' perspective leads to the question of how the learners' existing knowledge can be modified, extended, cross-linked, hierarchically ordered, or how new knowledge can be generated, in order to master the tasks. The teacher's role is to mediate between the tasks and the students. By selecting learning materials, giving appropriate feedback, and involving students in meaningful learning activities, teachers can support learners in closing the gap between prior knowledge and the knowledge needed to master the tasks in question.

Insightful Learning: A Challenge for Teachers as well as for Scientists

In comparison to the acquisition of facts, skills, and routines, insightful conceptual understanding—a central aim of science and mathematics instruction, in particular—is still a puzzle,

for teachers as well as for researchers. Nonetheless, scientific progress in modeling and explaining the emergence of insights and conceptual understanding is evident.

It is now widely accepted that new concepts and insights are not acquired through passive transmission of the ex-

pert's knowledge to the learner's mind, but rather that they are the result of the learner's active process of constructing increasingly complex and elaborated cognitive structures. Powerful learning environments stimulate students' cognitive activation, that is, students' mental involvement in the tasks to be mastered. In so doing, learners have to make use of, and are constrained by, the knowledge already available to them. Particularly for science and mathematics, it has been widely shown that **students** enter classrooms with intuitive concepts and belief systems which are partly based on universal conceptual primitives. These may have innate roots, but are also shaped by schooling. The negative consequences of ignoring this kind of prior knowledge have been demonstrated, particularly for physics education. Students often only adopt the knowledge taught at school at a superficial level, and therefore can only use it when faced with problems that have already been dealt with at school. Data from the TIMS advanced physics study show that overcoming certain misconceptions that are deeply rooted in everyday experience is the most difficult task of science education (see above *The Structure of Knowledge Acquired in Preuniversity Mathematics and Physics Courses*).

To effectively initiate and assist student learning, **teachers** need to take into account students' specific prior knowledge and understanding, and they need to design and organize lessons and classroom discourse in a way that closely attend to the curriculum as well as to the social construction of meaning in classrooms. Teachers can only do a good job if they know what makes certain tasks particularly difficult, on the one hand, and are aware of the way their students learn, on the other. For instance, they have to know what kinds of mistakes and obstacles typically oc-

cur during the learning process and whether students need special support to overcome these. In order to combine the task perspective and the student perspective, teachers need pedagogical content knowledge in the sense of Schulman (1987). This means that teachers have to know how particular topics, problems, or issues are organized, represented, and adapted to meet the diverse interests and abilities of learners and how they should be presented during instruction. Teachers' classroom behavior thus needs to be based on an understanding of how students learn in the respective academic domains.

In order to provide teachers with appropriate pedagogical content knowledge, research on learning and instruction has to focus on students' insightful learning. **Important questions to be addressed** include the following: What is the structure of the knowledge to be acquired? What prior knowledge does the learner have to build on? What particular tasks, explanations, and interactive discourse will assist students' construction of intelligent knowledge? Is the understanding of certain concepts subject to conscious or unconscious processes? At what stage of the learning process are feedback and direct instruction helpful? At what age can students make sense of certain forms of visual-spatial representation? What kind of practice do students need for the application of such tools in new content domains? Which tool is most appropriate for reasoning in a given content domain? What kinds of misconceptions can arise from using a tool that has not yet been fully understood?

Questions such as these are addressed in **quasi-experimental and experimental classroom studies** as well as in **training studies run in the laboratory**. Laboratory studies are a comparably cheap and particularly appropriate

method for researching certain aspects of students' learning. They allow factors of instructional input to be disentangled from factors related to teacher personality and the management and organization of classrooms and schools. Moreover, running studies with small groups in the laboratory allows for detailed video-based monitoring of learner activities, and leaves room for additional achievement measures to be gathered during the learning process. Although learning programs and training sessions developed for the laboratory can hardly be directly transferred to schools, they provide insights into particular effects of the presentation of information and learning materials that are of central importance for teacher education. We, therefore, consider them a very useful supplement to studies carried out in schools, particularly when linked to each other.

The Orchestration of Students' Learning Activities

Classroom instruction is not the only factor that determines the knowledge structures and epistemological beliefs acquired by students. It is, however, the factor that is most likely to be affected by the institutions of the education system and the professional activity of teachers. Recent findings emphasize that **classroom instruction**, rather than the school environment or management structures, has the **main impact on school effectiveness in terms of learning outcomes**. As such, the question of what actually determines good instructional practice is central to the success of formal education and the functionality of the education system. For this question to be addressed, pedagogical concepts of instructional quality need to be combined with the analysis of individual and collective processes of knowledge acquisition in specific domains.

From Educational Productivity to Cognitive Activation

In general, models of educational productivity (such as those devised by Walberg and colleagues), the quantity and quality of instruction are deemed to be productivity factors that cannot be compensated by other components, such as the home and classroom environment or individual abilities and motivation. There is a high level of consensus in the description of "instructional quality" in the international research community. **High quality instruction** is typically described by a set of basic properties that combine aspects of direct instruction with adaptivity and affective quality:

- good classroom management and effective responses to interruption,
- appropriate pacing and moderate speed of interactional exchange, allowing for a high level of student attentiveness and participation,
- clear and well-structured presentation of material and setting of tasks,
- adaptivity of task selection and feedback given by the teacher, based on his/her diagnostic understanding of the ability and learning progress of individual students, and
- affective quality of the teacher-student relations.

This concept describes the basic requirements of "instructional quality," the conditions which have to be met to allow for successful knowledge acquisition in the classroom. However, this concept of instructional quality is limited by that fact that (a) it does not show how teachers implement each of its elements in the structure and delivery of their lessons, (b) it has a distal relationship to the students' actual learning processes, and (c) it overlooks subject content, and thus, cannot adequately reflect the structure and quality of the knowledge acquired.

In the approach taken by the Center for Educational Research, the concept of instructional quality is extended by **adding specific didactic aspects** that (a) describe how basic elements of the productivity model are implemented in the setting of tasks and in instructional interaction processes, (b) have a more proximal relationship to the psychological processes of insightful learning, and

(c) take domain-specific criteria of knowledge acquisition into consideration. Linking up with the investigations of knowledge structures in mathematics and science described above, we ask the following question: How should instruction be shaped to allow students to gain a deep understanding of domain-specific concepts and develop adequate, nonschematic epistemological beliefs?

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www.mpib-berlin.mpg.de/TIMSS-Video/

Teaching for Understanding: Linking BIJU and TIMSS to Research on Learning and Instruction

TIMSS/III In the TIMS study on advanced mathematics and physics instruction at the end of compulsory schooling, students were asked to rate their instruction in each subject domain in terms of a given list of properties. It was possible to reduce these ratings to 4 or 5 scales (Baumert & Köller, 2000). In both domains, the first factor clearly represented understanding-oriented instruction. The three most important items were as follows: "Explaining the reasoning behind an idea," "describing and analyzing relations," and "working on tasks and problems with no immediate solution." The corresponding scales provide first indications of ways in which cognitive activation can be achieved in the classroom environment.

As shown in Figure 1, even in pre-university mathematics courses, under-

standing-oriented mathematics instruction is much less prevalent in everyday instructional practice than procedural drills (mostly solving equations) or a receptive instructional style, with the teacher demonstrating procedures and the students taking notes from the blackboard. It is even rarer for mathematics to be applied to everyday problems—a characteristic which is closely related to insightful learning. If these four instructional characteristics are placed in relation to the level of achievement in the course attended teaching for understanding emerges as a positive predictor and teacher demonstration as a negative predictor. This is a first indication that cognitively activating instruction is associated with higher levels of mathematics knowledge—be it that this type of instruction better fos-

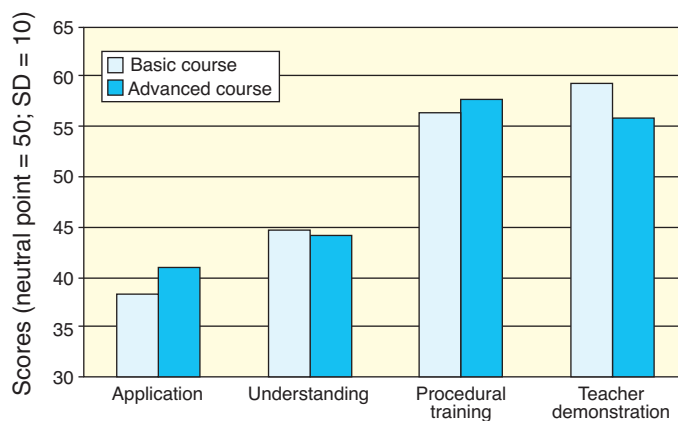


Figure 1. Instructional approaches in advanced mathematics courses as perceived by students.

ters student achievement or that it is more often practiced in high performing classes.

BIJU The cross-sectional design of the TIMS upper secondary study did not allow for a distinction to be made between the preconditions and the outcomes of lesson structure and delivery. This is possible within the longitudinal framework of the BIJU study, however. Gruehn (2000) used a multilevel approach to investigate the impact of instructional properties on performance gains in mathematics and science over the course of the 7th grade. Gruehn also surveyed the students' perception of their instruction, but here on a total of 21 scales. She was, thus, able to cover each of the above mentioned classical dimensions of instructional quality by several scales. Furthermore, two aspects of cognitively activating instruction were tapped in BIJU: First, "cognitively demanding exercises," that is, the use of tasks which restructure and contextualize subject content, thus, resulting in the reconstruction of knowledge; second, the "Socratic approach to mistakes." Gruehn (2000) was able to show that **cognitive activation has a positive effect on performance gains in both mathematics and physics**. A dominance of simple repetition tasks, in contrast, had a marked negative effect in all school types. When classes with cognitively activating instruction are identified and compared to classes in the same school type where instruction is more repetitive, the effects of cognitive activation on performance gains are striking (see Fig. 2).

TIMSS-Video The BIJU scales describing the instructional approach were also implemented in the TIMSS-Germany 8th-grade study (Baumert, Lehmann et al., 1997). Combining the data gathered by these scales with the

results of the **videotape study conducted in Germany, Japan, and the USA** (international coordination: James W. Stigler) allows a multi-perspective approach to be taken to the investigation of instructional quality. As part of an extension of this study at the Max Planck Institute for Human Development (Klieme, Knoll, & Schümer, 1999; Klieme & Bos, 2000), the scales from the student questionnaires were both presented to the teacher in question, and used as high-inference ratings by trained video viewers (Clausen, in press). On the basis of video analyses, it was possible to validate the "cognitive activation" construct and delimit it from other dimensions of instructional quality.

The 21 rating scale scores of the video viewers allow three superordinal dimensions of quality to be reconstructed: (a) effectiveness of classroom management, (b) individualization and positive climate of teacher-student relations, and (c) cognitive activation. The first two dimensions correspond with classical concepts of instructional quality. Interestingly, it emerged that instructional adaptivity and the affective quality of teacher-student relations

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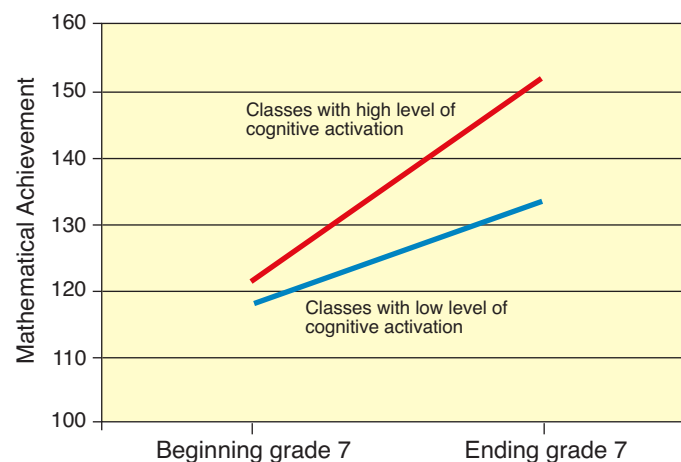


Figure 2. Achievement gain of *Gymnasium* students dependent on the level of cognitive activation (findings from BIJU, adapted from Gruehn, 2000). Metric defined across all school types with $m = 100$, $SD = 30$.

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were confounded. The additional didactic properties introduced by BIJU and TIMSS allow the third, more content-related dimension to be identified. **Performance gains** on the class level are predicted by the "cognitive activation" dimension, whereas **interest gains** are predicted by individualization and the quality of teacher-student relations.

In this extended model of instructional quality, classroom management is no longer the central component explaining performance gains. This does not imply that it is irrelevant, however. As shown in Figure 3, a high level of cognitive activation can only be achieved in a well-managed classroom. In other words, efficient classroom management is a necessary condition of good instruction, but not a sufficient one.

Based on discourse analyses of the videotapes by Schümer, it was shown that high levels of cognitive activation are associated with changes in the **verbal behavior patterns of teachers**: Teachers in cognitively activating classrooms make more content-related, but fewer discipline- and management-related statements; they pose more questions asking students to describe or explain something and fewer factual questions. From independent high-inference ratings of problem solving processes, we can infer that cognitive activation is associated with a new role for the teacher: Teachers

whose classes show higher levels of cognitive activation seem to act as mediators facilitating the students' own learning activities and argumentation, and not as providers of rules and facts.

Summary The various studies conducted within the framework of TIMSS/III, BIJU, and TIMSS-Video can be summarized as follows: In addition to the classic elements of good instruction—efficient classroom management, adaptivity of instruction, and quality of teacher-student relations—student surveys and video-based observations allow the identification of a further dimension of instructional quality, which can be termed **"cognitive activation."** This refers to teaching strategies, task settings, and patterns of interaction which allow students to **actively construct and cross-link knowledge**. Although—as assumed in educational productivity models—efficient classroom management is a necessary condition for instructional effectiveness in terms of learning outcomes, the level of cognitive activation, and hence the didactic quality of instruction, is of critical importance for performance gains. This forges a link between instructional quality research, psychological theories of insightful learning, and research on mathematics and science education.

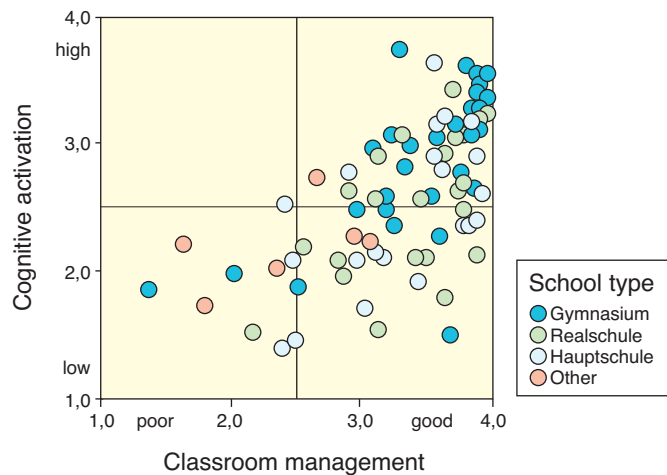


Figure 3. Relation between classroom management and cognitive activation (findings from TIMSS-Video).

Teacher Beliefs and the Orchestration of Learning Activities: From TIMSS-Video to the "Pythagoras" Project

As shown by studies such as TIMSS-Video, cognitive activation of students requires a certain type of teaching, where teachers act as facilitators for students' learning activities and guide them toward an in-depth understanding of the subject domain. This type of teaching behavior is dependent on the teacher having adequate understanding of his or her role, based on beliefs about the epistemological nature of the domain, learning, and instruction. With this in mind, the TIMSS teachers of lower secondary schools were asked to comment on the following statement: "Basic computational skills on the part of the teacher are sufficient for teaching primary school mathematics." The more strongly the teachers agreed with this statement and the more explicitly they thus reduced the teacher's role to the imparting of procedural skills, the lower the level of cognitive activation to be observed in the videos (cf. Fig. 4). In other words, a relationship could be identified between teacher beliefs and instructional quality in the sense of cognitive activation.

A new study, funded by the **German Research Foundation (DFG)** as part of its program on educational quality in

schools and carried out in the Center for Educational Research, links up with these findings from TIMSS-Video. The aim of the "Pythagoras" project, directed by Eckhard Klieme, is to investigate instructional quality and mathematical understanding in Germany and—in collaboration with the University of Zurich—in Switzerland. In the first stage of the project, mathematics teachers from the two countries will be surveyed about perceived instructional conditions, teacher beliefs, and instructional practice in two specific topics: algebraic word problems and the Pythagorean theorem.

Instructional practice on the Pythagorean theorem was surveyed with reference to the kind of mathematical tasks set. The teachers were asked to what extent certain types of tasks—procedural tasks, tasks requiring a qualitative understanding of mathematical concepts, proofs, inner-mathematical transfer tasks, and application tasks—were used in their lessons. On the basis of these data, the teachers participating in a pilot study in Germany could be grouped into two latent classes (cf. Fig. 5a): one group that used a higher total number of tasks, a broad-

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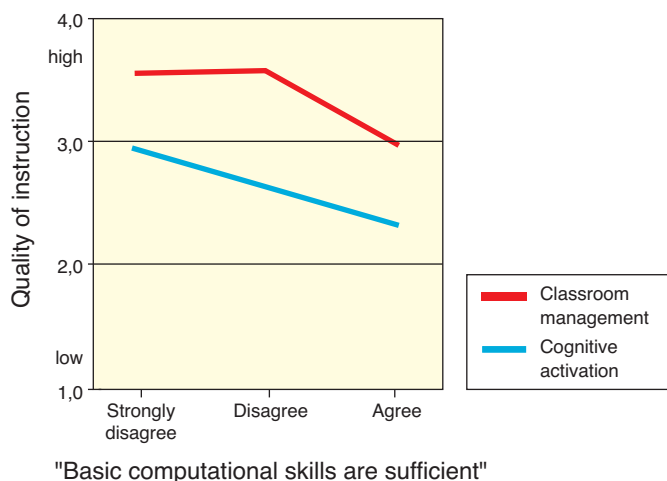


Figure 4. Instructional quality—rated by observers dependent on teacher's belief about the importance of basic computational skills for teaching at primary school (findings from TIMSS-Video).

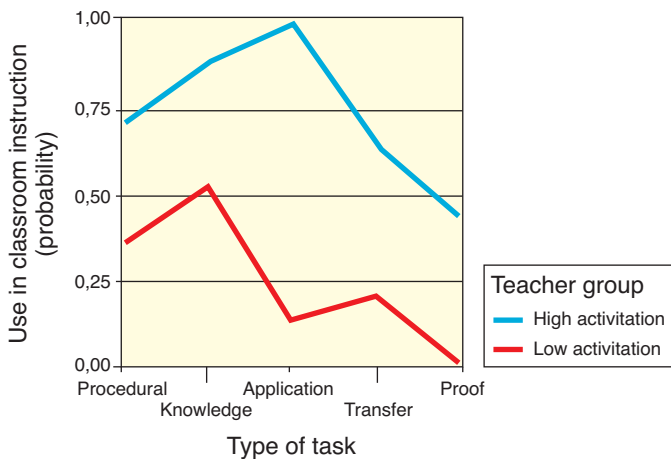


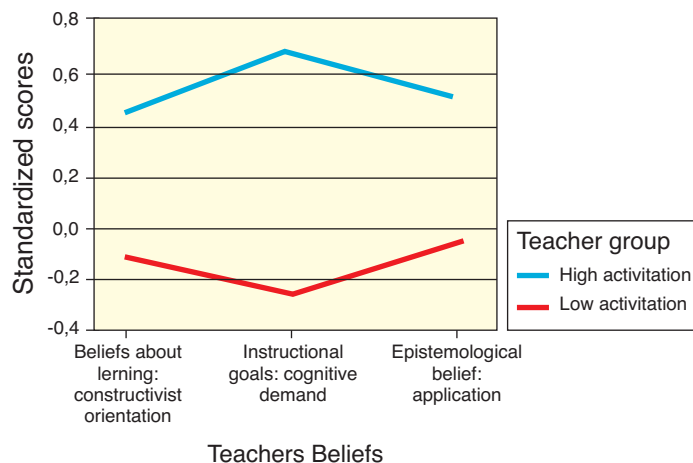
Figure 5a. Use at mathematical tasks in teaching the Pythagorean theorem by two groups of teachers.

er variation of task types, and emphasized application (high activation group), and a second group that limited its lessons to drilling routine knowledge and procedural skills (low activation group). When these two groups are compared in terms of their beliefs, considerable differences emerge (cf. Fig. 5b): Teachers with a cognitively activating instructional approach set themselves more demanding instructional goals. Their epistemological beliefs stress the application of mathematical models in real-world problem solving

and their beliefs about the learning processes (questionnaire developed by Fennema, Carpenter, & Loef and adapted by Staub & Stern) are in accordance with constructivist ideas of knowledge acquisition. This represents first empirical evidence confirming the existence of a **relationship between constructivist beliefs and instructional practice**. It is a telling result that cognitive activation was found to be associated with application-oriented instruction among the teachers surveyed. Although the German-Japanese comparison in TIMSS-Video revealed that inner-mathematical tasks are of particular value in cognitively activating instruction, German teachers are still unfamiliar with this approach (Klieme & Bos, 2000).

Within the framework of a longitudinal videotape study, the "Pythagoras" project will continue to explore the effects of teacher beliefs on instructional quality and student understanding, using methods including the quasi-experimental variation of instructional settings to provide for higher or lower levels of cognitive activation.

Figure 5b. Relation between instructional approach (high vs. low cognitive activation) and teacher beliefs.



Cognitive Activation by Means of Diagrammatic Tools

Knowledge dealt with in academic contexts is based on symbolic systems such as script, formal mathematical language, pictures, and diagrammatic representations. Symbols can be understood as *mental tools* that provide a basis for the construction of meaning in concepts, ideas, or plans. In order to successfully employ such tools, it is important to know which affordances and constraints different mental tools provide. For instance, both language and numbers provide affordances for constructing the concept of infinity, even though this concept has no direct relation to the perceivable world. Language allows prefixes such as "in-" to be added to words, thus reversing their meaning. Numbers provide the means for addition and allow quantities to be enlarged ad infinitum by adding a number to any given number. Following this line of argumentation, which is based on the core ideas of Vygotski, cognitive development and learning can be understood as a process of extending the use of mental tools. In this sense, symbols not only represent parts of the perceivable world, but themselves become objects of reasoning, thus allowing the construction of concepts which have no direct relation to the perceivable world. Within this framework, understanding can be conceptualized as the ability to use representations in a flexible manner.

While pictures, number systems, and written language have a long tradition of use in human culture, **visual-spatial tools such as graphs and diagrams** were only devised as tools for knowledge representation about two centuries ago. Since then, space has been used to represent nonspatial information, particularly in formal domains such as science and economics. Because computers have made the construction

and modification of graphs and diagrams so easy, the frequency with which individuals encounter such representations has increased markedly over the past decades. In view of this trend, cognitive science has put a great deal of effort into researching diagrammatic literacy. Beyond the function of depicting information, however, diagrams and graphs can also serve as **active reasoning tools**. Drawing diagrams may help to integrate complex information or provide a basis upon which inferences can be drawn. It has been demonstrated that experts in domains such as science, mathematics, and formal logic make extensive use of graphs and diagrams as reasoning tools. Apart from this rather small group of people, however, the active use of visual-spatial tools is not very common, neither inside nor outside of school.

With this in mind, the ENTERPRISE project (**Enhancing Knowledge Transfer and Efficient Reasoning by Practicing Representation In Science Education**) directed by Elsbeth Stern aims to explore the conditions under which graphs and diagrams can serve as tools for structuring learning environments, and thus foster conceptual understanding in science as well as other content areas.

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"One picture can be worth ten thousand words."

The Cognitive Potential of Graphs and Diagrams

The old adage that one picture can be worth ten thousand words has been confirmed by cognitive science research. Diagrams support a large number of perceptual inferences, which are extremely easy for humans to process. They group together all related information, thus making extensive searches for elements needed in a problem-solving inference superfluous. Indeed, visualization may lead to new insights into the formal structures of a problem. We will come back to this aspect when presenting a study which shows that elementary school children can already overcome misconceptions about proportional reasoning with the help of external representations.

Diagrammatic tools not only support the emergence of **conceptual knowledge**, they also offer efficient approaches to **solving formal problems**, for example, by comparing two slopes in a linear graph to infer information about different rates of change. Cross-tabulation can also be employed as a procedure allowing the effects of more than one variable to be disentangled.

It is widely accepted that diagrammatic representations also **foster analogical transfer**. Because the constraints to be considered when drawing graphs and diagrams are the same in different domains and content areas, learners using external representations may be able to identify previously imperceptible commonalities between domains. For instance, interpreting the slope of a graph as the rate of change requires the axes to be labeled in increasing units. Core concepts from different content domains, for example, price per unit, speed, density, reproduction rate, or concentration of acid can be represented by the slope of a linear graph. Such commonalities may bridge the gaps between different content ar-

reas (Stern, Aprea, & Ebner, in press). The first results of a **collaborative study** between the ENTERPRISE group and Reinhard Demuth, Institute for Science Education at the University of Kiel (IPN), indicate that graphs can be used as transfer tools. In four 10th-grade *Realschule* classrooms in the Kiel area, the concept of equilibrium was introduced as a new topic by means of a computer animation showing the varying relations of sharks and herrings in a marine ecosystem. In two of the classrooms, the animation was supplemented by line graphs demonstrating the regular fluctuations of the two species over time. Results revealed that all four classrooms improved their understanding of the equilibrium, but that only students in the classrooms using graphs were able to transfer their knowledge about the equilibrium to economics-related contents. This promising result supports **the core assumption of the ENTERPRISE project** that the competent use of graphs and diagrams is crucial for advanced reasoning and knowledge transfer in formal content areas such as science and economics.

Why Diagrammatic Tools are Particularly Appropriate for Stimulating Cognitive Activation in Classrooms

We assume that forms of external representation not only support individuals' cognitive functioning, but that they are particularly appropriate for classroom use. The major challenge for teachers is to orchestrate students' learning behavior by presenting problems and learning material which leave room for self-regulated activities. External representations are clearly one way of achieving this goal. From a socio-constructivist point of view, it can be postulated that external representations such as graphs will support high-quality discourse in the classroom as well as in small groups by offering stu-

dents an anchor for their reasoning processes.

Moreover, the **use of external representations** may be particularly appropriate for classrooms because the construction of graphs and diagrams leaves learners with various degrees of freedom. Depending on the learner's preferences, for example, diagrams can either be constructed in a sparse way, or they can be enriched with concrete pictures of the situation to be represented. In this respect, external representations allow **an element of freedom** and leave room for the introduction of the learner's own interests. As has been demonstrated in the BIJU study, this is otherwise quite rare. The use of diagrammatic tools may be particularly helpful in **coping with large interindividual differences in prior knowledge and general cognitive capabilities**. Each individual student can use and construct visual-spatial representations in the way that is most appropriate for his or her conceptual understanding of the given situation. Particularly if teachers offer a broad variety of diagrammatic tools, they can ensure that students are neither bored nor overtaxed.

Last but not least, the use of diagrammatic tools can also stimulate students' metacognitive activities, especially with respect to **self-monitoring**. Dealing with complex tasks requires particularly extensive planning and goal setting. Difficulties may occur because a learner does not know how to begin structuring the problem. In this case, familiarity with certain forms of external representation, such as the construction of concept maps, may help him or her to access an appropriate solution process. Moreover, by trying to map a certain concept or situation onto space, students may become aware of which particular aspects of the content area and the problem they do not yet understand. In this respect, the use of

external representations may relieve the teacher of close supervision, in that students can work independently in a meaningful way. The wider use of graphs and diagrams in classrooms may also improve students' metacognitive knowledge and learning strategies, which many studies—including TIMSS and PISA—have shown to be important.

Current Deficits in the Use of Graphs and Diagrams Inside and Outside School

Despite the value of graphs and diagrams as tools for knowledge structuring, reasoning, and problem solving, the competent use of such tools is not as widespread as would be desirable. Several studies conducted by the ENTERPRISE group have revealed that there is room for improvement in diagrammatic competencies, not only in students of all ages, but also in their teachers.

For instance, Elwin Savelsbergh developed a training program which used vector diagrams to support secondary school students' understanding of central concepts in mechanics, for example, pivots and levers. However, it emerged that the students could not take advantage of this training program because of their weaknesses in the sphere of graphical representation. A study on the graph-based reasoning of university students reading mathematics and economics (Stern, Aprea, & Ebner, in press) showed that such deficits are not rectified after leaving school. Participants in this study answered questions on a text dealing with the break-even point. Undoubtedly, the best way to infer the necessary information from the text was to construct hand-drawn graphs. Without an obvious hint, however, very few students did so.

A study with 5th-, 7th-, and 9th-grade students from Berlin *Gymnasium* schools showed that students even have difficulty in constructing qualitative di-

Key Reference

Stern, E., & Staub, F. (2000). Mathematik lernen und verstehen: Anforderungen an die Gestaltung des Mathematikunterrichts. In E. Inckermann, J. Kahlert, & A. Speck-Hamdan (Eds.), *Sich Lernen leisten. Grundschule vor den Herausforderungen der Wissenschaft* (pp. 90–100). Neuwied: Luchterhand.

agrams. Students were presented with short texts such as the following: "On the faraway planet of Urx, living beings are called pings. There are two kinds of pings—spotted pings and striped pings. There are also two kinds of spotted pings—laughing pings and crying pings. Among the striped pings, there are noisy ones and quiet ones. Tip is a crying ping." The best way to answer the subsequent inference question "Is Tip spotted or striped?" is by drawing a tree-diagram. However, even in 9th grade, only very few students took advantage of this form of representation although they had encountered it previously, both inside and outside of school. By varying the instruction in an experimental design, we tested whether students had diagrammatic methods at their disposal but were simply unable to access them. In fact, it emerged that students lack an understanding of the potential of diagrammatic representations. The large majority of students preferred propositional representations, although these were less appropriate for answering the questions posed at the end of the text. As shown by a **collaborative study with Zhu Liqi and Fang Ge from the Chinese Academy of Science**, however, the use of diagrams was quite natural for the majority of Beijing students of the same age. The superior performance of the Chinese students may be due to frequent practice of diagrams in mathematics lessons, as well as to indirect effects of their symbol-based writing system.

In sum, these findings suggest that *schools should provide more opportunities for students to practice graph- and diagram-based reasoning*. Teachers need to learn more about the potential of graphs and diagrams and to find ways of using them appropriately. German elementary school teachers currently lack training in ways of providing appropriate visualizations of arithmetical word

problems (Stern & Staub, 2000). Analyzing the use of representations in 8th-grade mathematics classrooms of the TIMSS-Video sample, Ilonca Hardy found that only 2.8% of introductory tasks were based on visual representations. Although representation tasks which demand a switch between symbolic systems are associated with high-quality instructional discourse, teachers rarely employ them as a basis for student activity.

Experimental Training Studies on Elementary School Students' Use of External Representations

In exploring the ways in which diagrammatic tools can best be implemented in science and mathematics instruction, the ENTERPRISE project concentrates mainly on elementary school children. Investigations of this age group provide valuable insights into human development, particularly because elementary school children's cognitive potential has long been underestimated. A widespread assumption is that students of this age group are "concrete" thinkers and this, in turn, has had a limiting effect on the design of elementary school science and mathematics curricula. This assumption has been fundamentally challenged by findings showing that elementary school children can have profound domain-specific expertise in several areas. There is good reason to assume that presenting elementary school children with more demanding learning material will better prepare them for the mathematics and science lessons in secondary schools. The extent to which elementary school children can already make use of graphs, diagrams, and other forms of external representation is investigated in experimental training studies.

Study I: How Linear Graphs can Help 4th Graders to Overcome Mathematical Misconceptions

In the left-hand pitcher there is a mixture of 5 glasses of orange juice and 9 glasses of lemon juice. In the right-hand pitcher there is a mixture of 8 glasses of orange juice and 12 glasses of lemon juice. Which mixture tastes more orangy or do both mixtures taste the same?

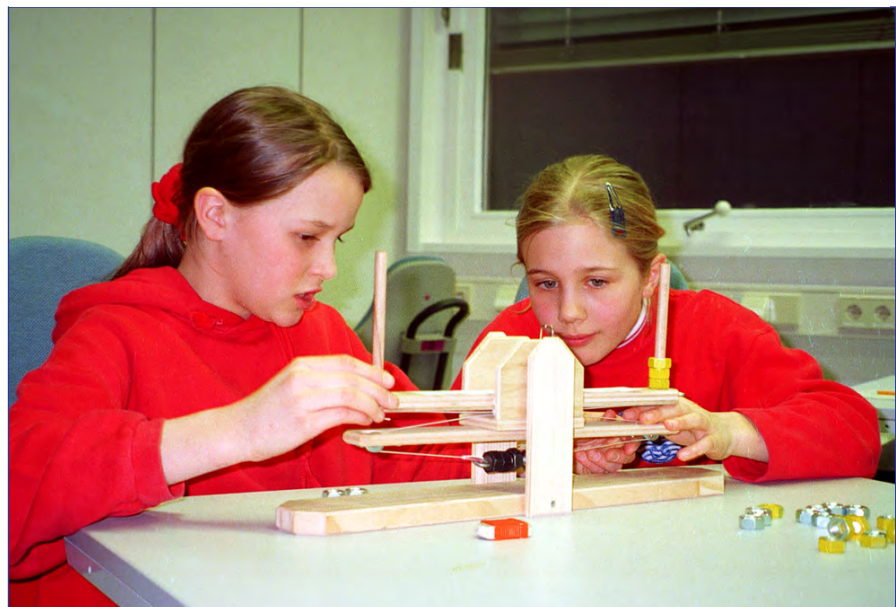
The majority of elementary school children, and even many adults, will erroneously answer that both mixtures taste "the same." The so-called additive misconception, according to which the difference between quantities rather than their ratio is considered, often prevails until students have acquired advanced competencies in using fractions and decimals.

A study with 67 4th graders (Koerber, 2000) revealed that additive misconceptions in proportional reasoning can be overcome with the help of external representations, as depicted in Figure 6. In order to fully exploit a representation and foster in-depth understanding of a quantitative concept, a meaningful integration of the symbolic understanding of the representation, on the one hand, and the quantitative understanding of the

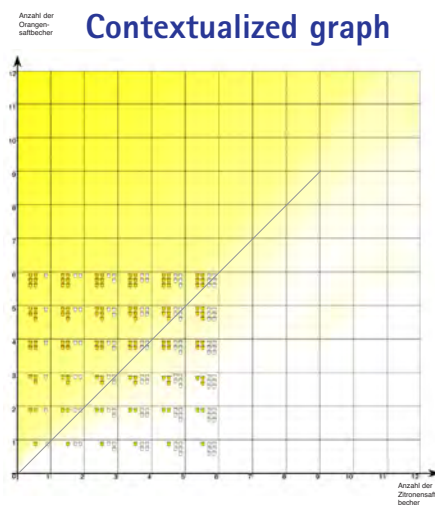
situation, on the other, has to be achieved. Different representations may meet these requirements in different ways, depending on their structural characteristics and the agents' prior experiences. One difference between forms of representation is their degree of intuitive interpretability. The functioning of the balance beam, for example, is understood comparatively easily by children. For instance, when children put different weights on each side of

Figure 6. The three forms of representation used in the training study.

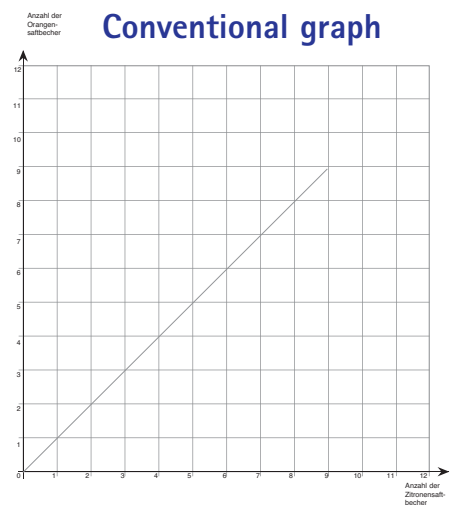
Balance beam



Contextualized graph



Conventional graph



Key Reference

Koerber, S. (2000). *Der Einfluss externer Repräsentationsformen auf proportionales Denken im Grundschulalter*. Doctoral dissertation, Technische Universität Berlin.

the beam, they intuitively interpret the side going downward as bearing more weight, owing to their experience with seesaws. Moreover, external representations may differ in their degree of abstraction with respect to the quantities involved (e.g., numbers on axes vs. weights which can be put on the balance beam, both representing quantities). With increasing abstraction, a definition of the relationship between the symbols used and the quantities represented becomes ever more important for interpretation.

The **balance beam** and the **Cartesian graph** both allow the representation of quantitative information on their levers or axes, respectively, and enable the integration of two quantities forming a **ratio** to be visualized. By taking a balance beam, where balance can be maintained by changing the arm length of a movable beam, two ratios can be compared and a conclusion drawn

about which mixture tastes more orangy, for example. The same conclusion can be drawn by comparing the slopes of two graphs in a Cartesian coordinate system representing the two mixtures. Such coordinate systems can be either designed in a purely numerical way (conventional graph), or they can be adapted to include elements of the context in question (contextualized graph). In the contextualized graph, the glasses of orange and lemon juice were depicted at the respective coordinates, and the background was colored with orange of increasing intensity moving from the x-axis (number of glasses of lemon juice) to the y-axis (number of glasses of orange juice). The inclusion of these two elements was intended to foster a meaningful relation between the unfamiliar representational format of graphs and the mixture context, thus facilitating the interpretation of the graph's properties (e.g., numbers at the

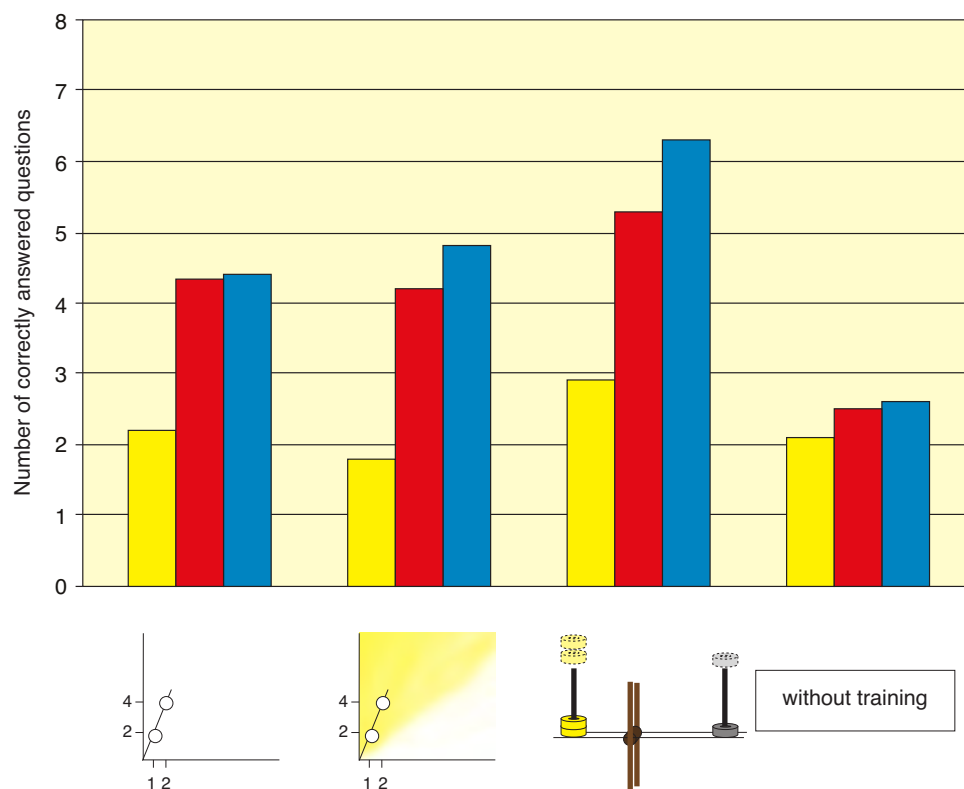


Figure 7. Mean performance of the three different training groups (abstract graph, contextualized graph, balance beam) and of a group, that did not receive any training on the proportional reasoning test (maximum score: 8 points) in the pretest (yellow column), posttest 1 (red column), and posttest 2 (blue column).

axes) and its principles (e.g., the steeper the slope, the more intense the orange taste).

The balance beam affords hands-on experience and thus the witnessing of cause-and-effect relationships. This helps children to interpret the balance beam intuitively without having been explicitly exposed to its rules. In contrast, any meaningful use of the Cartesian graph requires the knowledge and correct application of its rules (e.g., the steeper the slope, the faster or more intense the rate of change).

Tests were administered before the training (pretest), after the first half (posttest 1) and after the entire training (posttest 2). Figure 7 shows that performance in a proportional reasoning test increased under all three training conditions, but that **the group exposed to the balance beam gained the most from the training program**. Apart from this posttest evidence for the students' acquisition of proportional reasoning, student activity during the training process indicates that working with external representations leads to different degrees of insight into new mathematical concepts and different levels of conceptual change. In the balance beam condition, in particular, "eureka experiences" were observed when students used the balance to explain their reasoning. The posttest results of children who worked with the contextualized graph did not differ from those of children who worked with the conventional, rather abstract graph. The added contextualization apparently did not foster a meaningful connection between the symbols used and the proportional properties of the situation, thus resulting in proportional knowledge with a high level of situational specificity. This result qualifies the widely held view that embedding complex ideas and concepts within concrete contexts is particularly helpful for elementary school children.

In sum, results of this study are a promising indication that representations—once meaningfully related to the problem context—are not only beneficial for representing and communicating information about concepts that have already been acquired, but can be used as scaffolding tools for the **acquisition of new concepts, and thus aid conceptual change**. Combining the "natural" persuasiveness of the balance beam with the broad applicability of the abstract graph can be recommended as an instructional approach for elementary school.

Study 2: The Value of Self-Constructed Representations for Deeper Mathematical Understanding

Assuming that conceptual understanding is supported by transforming one representation into another, the tank system depicted in Figure 8 may be particularly suitable as a way of laying the foundations for an understanding of linear graphs (Hardy, in press). By pouring water into tanks using differently sized cups, both the y-intercept and the slope of a graph can be visualized. Although some elementary school children spontaneously see the connection between the tank system and the graph, an additional representation that mediates between the concrete and the abstract representational forms may be beneficial. In a study with 68 4th graders, Hardy found that a group who represented the tank quantities in tables before interpreting Cartesian graphs were more likely to show two-dimensional understanding of Cartesian graphs than a group who represented the tank quantities in self-constructed representations. Interestingly, the level of proportional understanding, as evidenced by the students' problem-solving activities with the tank system, was higher in the group with self-constructed representations. While tables represented the

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Hardy, I. (in press). Repräsentationsaktivitäten zur Förderung proportionalen und graphisch visuellen Verständnisses im Grundschulalter. In H. Petillon (Ed.), *Handbuch Grundschulforschung: Vol. 5. Individuelles und soziales Lernen—Kindperspektive und pädagogische Konzepte*. Leverkusen: Leske + Budrich.

two dimensions of number of pours and corresponding water level particularly well, thus enabling transfer to Cartesian graphs, self-constructed representations did more to further students' perceptions of mathematical relationships in the problem-solving situation.

Graphs, diagrams, tables, or other forms of external representation are culturally-developed tools which summarize the agreed-upon understanding of a mathematical community. However, they may vary in their initial degree of meaningfulness to novices. Such representations often need to be introduced by teachers, and only after a period of familiarization will students be able to use these tools in a self-determined manner for structuring their knowledge and reasoning. In contrast, self-constructed representations explicate an individual's mathematical understanding of a situation and, as such, are inherently meaningful to the constructor.

Self-constructed and predetermined visual representations may fulfill different purposes in students' development of proportional reasoning. This was explored in a study conducted by Ilonca Hardy with 27 12-year-old students who took part in a training session with either a predetermined form of representation or a self-constructed form. Effects of the one-hour training session were assessed by achievement gains in a proportional reasoning test closely related to the training domain, as well as by a transfer test involving a structurally dissimilar problem. In order to assess the students' ability to use visual representations in solving proportional problems, they were asked to visualize if they thought this would help their problem solving. Results showed that both groups achieved similar gains in performance after the intervention, but that the group using a predetermined form of representation was able to visualize

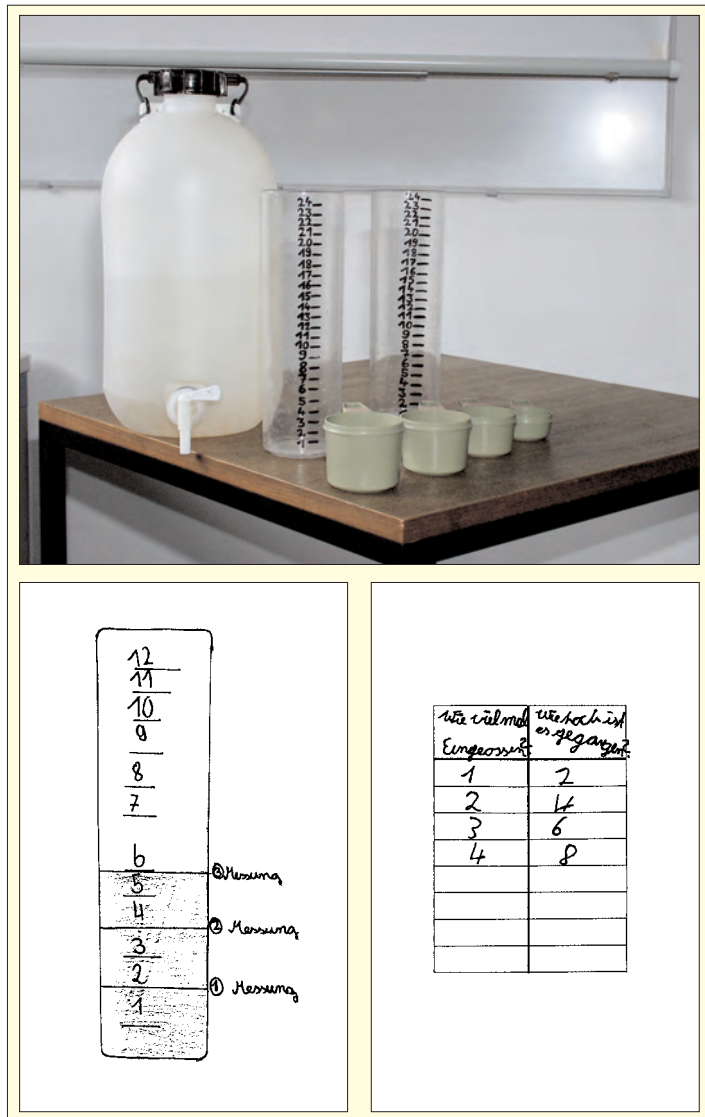


Figure 8. The tank system with differently sized cups (upper picture) and its transformation into a self-constructed representation (bottom left) and a table (bottom right).

their solutions significantly better than the group using self-constructed representations. In the transfer problem, however, the group using self-constructed representations outperformed the other group where both visualizing the problem structure and solving the problem were concerned. It seems that the process of devising a representation furthered students' perception of representations as flexible tools for problem solving, whereas instruction with a predetermined form of representation led

students to restrict the usefulness of the representation to the training domain. In further studies, we explore whether presenting students with pre-determined representations only *after* they have used self-constructed ones supports flexibility in dealing with representations.

Outlook on Further Research

The studies conducted thus far have shown that elementary school children are already able to map visual-spatial representations of quite demanding concepts and that this helps them to overcome misconceptions which can otherwise be quite persistent. In further experiments, we explore what kind of practice helps students best to use graphs and diagrams as tools for knowledge acquisition and transfer. Moreover, in a **collaborative project** funded by the German Science Foundation with Kornelia Möller, University of Münster, Ilonca Hardy and Elsbeth Stern are investigating how graphs can be implemented in an elementary school curriculum on "swimming and sinking."

These classroom studies are based on the assumption that graphs and diagrams can serve as instruments to structure learning environments, thus allowing a practicable mode of instruction based on constructivist views of learning.

Research Projects of the Director Emeritus

Experiential Learning and the Lifeworld of the School Since the mid-century criticism of the school had focused on problems of justice and functionality, the fairness of school organization to the different social classes and on acceptable relations of outcomes to input. However, until the nineties, the basic fit between the educational system and the manpower needs of the economic system was never called into question. However problematic their relationship, in a fairweather society with an expanding economy schools continued to prepare for "life" and to guarantee the social inclusion of their graduates.

Wolfgang Edelstein

In the last decade of the century the balanced relationship between school and life was being upset. An incipient imbalance in the relation between the school and the globalizing economy would lead to the potential exclusion of a sizeable segment of young people of school leaving age. Although a vast majority, especially of the better students, was not threatened, the relative shrinkage of opportunities was bound to affect the perspectives of everyone in some way or to some extent. Increased pressure not only derives from the stiffer competition for economic and social inclusion, but from the concomitant imperatives of compliance and submission to standards, the insistence on increased speed and compression of educational careers, and even from perceived threats of a departure from conventional pathways—both for individuals and schools.

Simultaneously with the onset of globalization-related risks and setbacks the unification of Germany produced a

set of problems more specifically felt in the Eastern provinces of the country. The unitary school system of the socialist GDR had been abolished, and a system akin to the threepronged Western system introduced; the job security of the graduates which had been part of an institutional patronage system linking schools to industries and workplaces dissolved, decreasing birth rates decimated the school population, and threatened school sites and teaching positions. And in the financially demanding reconstruction of the infrastructure in the Eastern provinces the needs of a renovated school system did not top the rank. In fact there is empirical evidence for alienation and disaffection of school in large portions of the population of secondary schools in the East. It is also quite clear that the alarming increase of right-wing extremism, xenophobia, cynicism and violence among secondary school students in East Germany largely occurs among those who are alienated by the school

and dissatisfied with their teachers.

In sum, the transformation of the economy and the needs generated by German unification have produced a fiscal crisis which, combined with the political goal of a lean state have deprived schools both in the old and the new federal states of essential funds, restricted the number of available teaching positions and thus the access of younger teachers to schools, a fact leading to diminishing expectations and decreasing professional aspirations as well as increasing burnout, as the average age of the teaching force increases. On the local level, this may result in growing numbers of cancelled lessons and extra-curricular projects—with the double-edged consequence of diminished discipline and increased achievement pressure. These problems, of course, vary across the states, hitting the poorest states like Berlin or Mecklenburg-West Pommern harder than the wealthier ones.

On the background of this picture of widespread dysfunction it appears reasonable to not only critically evaluate the outcomes of schooling and to initiate programs of curricular innovation, but to give special attention to social psychological processes in school—the quality of teacher/student interaction and of the school as a setting for life experience and moral growth in childhood and adolescence:

"Coalition of Self-Efficacious Schools" (Verbund Selbstwirksamer Schulen). In the aftermath of a conference on applications of A. Bandura's theory of self-efficacy sponsored by the Jacobs Foundation in 1994, R. Brockmeyer and W. Edelstein designed a project targeting teacher self-organization and students' enhanced wellbeing and achievement in secondary schools (ages 12–18). This was an attempt to respond

to the predicament of adolescents and schools as described above. The project was submitted to the Federal Commission on Educational Research and Planning (BLK), which after yearlong negotiations accepted to sponsor the project, and appropriate funds and teacher hours for project activities. Ten German states decided to participate, with one school each. For a period of three years, schools participating in the Coalition were to receive support for their self-designed self-efficacy projects. The support consisted in a half extra position for each school, federal money for central activities and foundation funding for the support for common development activities, conferences and teacher training endeavors, as well as school-based consultancies, training and evaluation activities. This model of mixed public and private appropriations was new and opened up a window of opportunities for support of individual programs not available to previous projects. No common treatment condition was designed for the participating schools. In line with the philosophy of self-efficacy as applied to organizational behavior the project was to rely maximally on the school's own proposals and preferences negotiated between teachers and the leadership of the institution. This decision made the evaluation of the project a much more complicated affair. While assessing overall effects of the intervention, each individual school had to be evaluated, at least in part, in terms of its own program.

The program was targeted on three sets of objectives: the students, the teachers, and the school. Student change was measured through a battery of self-efficacy scales relating to learning in various subjects, satisfaction with school, learning climate in the classroom, health, anxiety and control beliefs, and a variety of other variables. Teacher measures related to several

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Brockmeyer, R., & Edelstein, W. (Eds.). (1997). *Selbstwirksame Schulen. Wege pädagogischer Innovation*. Oberhausen: Verlag Karl Maria Laufen (168 p.).

burnout dimensions, professional involvement, collegial effectiveness, and individual professional efficacy, among others (Edelstein & Brockmeyer, 1997).

Change of the school as an organization was assessed by narrative accounts and day-to-day documentation of school events and decision making at various levels. An important dimension of the project was the establishment of a complementary network of schools to cooperate with each school in the Coalition, comparing and contrasting experience, and communicating through internet messages. The evaluation process is still under way, but major results show, on the average, slight progress in self-efficacy of teachers, lowered burnout scores, and, contrary to the overall trend in the corresponding population, arrested decrease in self-efficacy scores and interest in school for students with large within-school and between-school variations. On the average, scores rose significantly during the early phase of the project to remain stable or decrease somewhat in the later phase. The major effects were seen in the organizational progress of (most) schools, and important changes in attitudes towards school, school reform, and collegial cooperation among teachers.

The major weakness proved to be the following: Teachers were expected to enhance the growth of self-efficacy in students through changing their instructional strategies towards self-efficacy generating interactions and constructive individualizing feedback to students. This strategy, however, failed to produce effects as teachers rarely modified their didactic strategies and tactical moves with this goal in mind. Teachers need much more training, support, and cooperation to achieve goals involving changes in basic professional know-how and pedagogical attitude. For students to develop positive expect-

tations of success and motivation to invest effort in learning, as well as optimistic confidence in their competence to achieve, teachers need to be able to implement error friendly questioning strategies, inductive discourse, and evaluation methods that stress individual progress (e.g., portfolio methods). Quality of instruction and pedagogy consequently is the focus of the successor program "Quality in Schools and School Systems" (QuiSS) which the Federal Commission initiated to succeed the Coalition for the next five years. It has also influenced the preparation for yet another program sponsored by the Federal Commission provisionally named "Learning Democracy in Schools and Communities"—a program designed to fight the right-wing extremist youth culture to which adolescent dissatisfaction with school experience and with the lifeworld of the schools (Edelstein, 2000a, in press) appears to be a contributing factor.

It is a sign of success and of organizational self-efficacy that, when the project ended in 1999, the Coalition continued its activity even without external support, maintaining internal cooperation, conferences, and the external networks, now encompassing 60 schools. A grant has been ascertained to continue and to extend these activities for another three years, and new member schools are being recruited to join the Coalition.

Program "**Youth Take Responsibility**" (Jugend übernimmt Verantwortung) established through the Brandenburger Tor Foundation of the Berlin Bank Company.

Whereas the concept of the "self-efficacious school" targeted the social psychology of educational goals pursued to enhance student optimism and effort and to decrease teacher burnout through student-oriented instruction, communicative collegial interaction and

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co-constructive organizational process, the focus of the responsibility program is both more limited and more precise: The aim is to fuse the abstract characteristics of self-efficacy beliefs with the concrete experience of responsibility for cooperative action in a circumscribed project based in a school or community. Again, the basic idea is to counteract the sense of helplessness, heteronomy and alienation affecting many students in the secondary school (especially, but not only, low-achieving students) and to activate them through a sense of achievement with a self-chosen task undertaken in cooperation with others. A project in the program represents an experience of cooperation and democratic exercise of control in the context of collective goalsetting and decision making about a common task. It implies responsibility taken for action and responsibility shared with others. It also implies didactic and management shifts that teachers have to acquire (Edelstein, 1999f).

A first expert workshop on responsibility learning was held in May 2000 (Edelstein, 2000c). A conference on the learning of responsibility in various domains (schools, ecological projects, international youth programs, reeducation of adolescent delinquents) will take place in May 2001, and a summer school for teachers on responsibility learning in projects is in preparation for July 2001.

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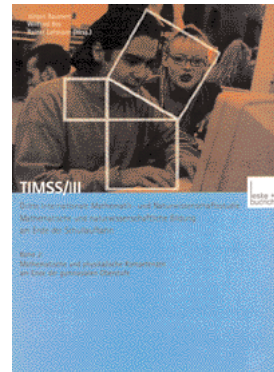
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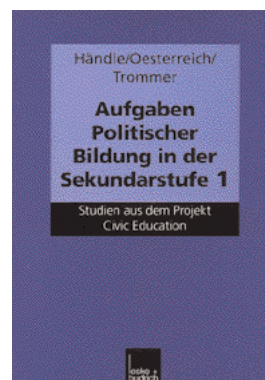


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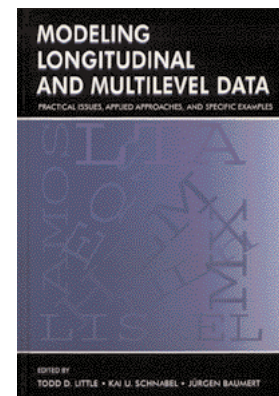
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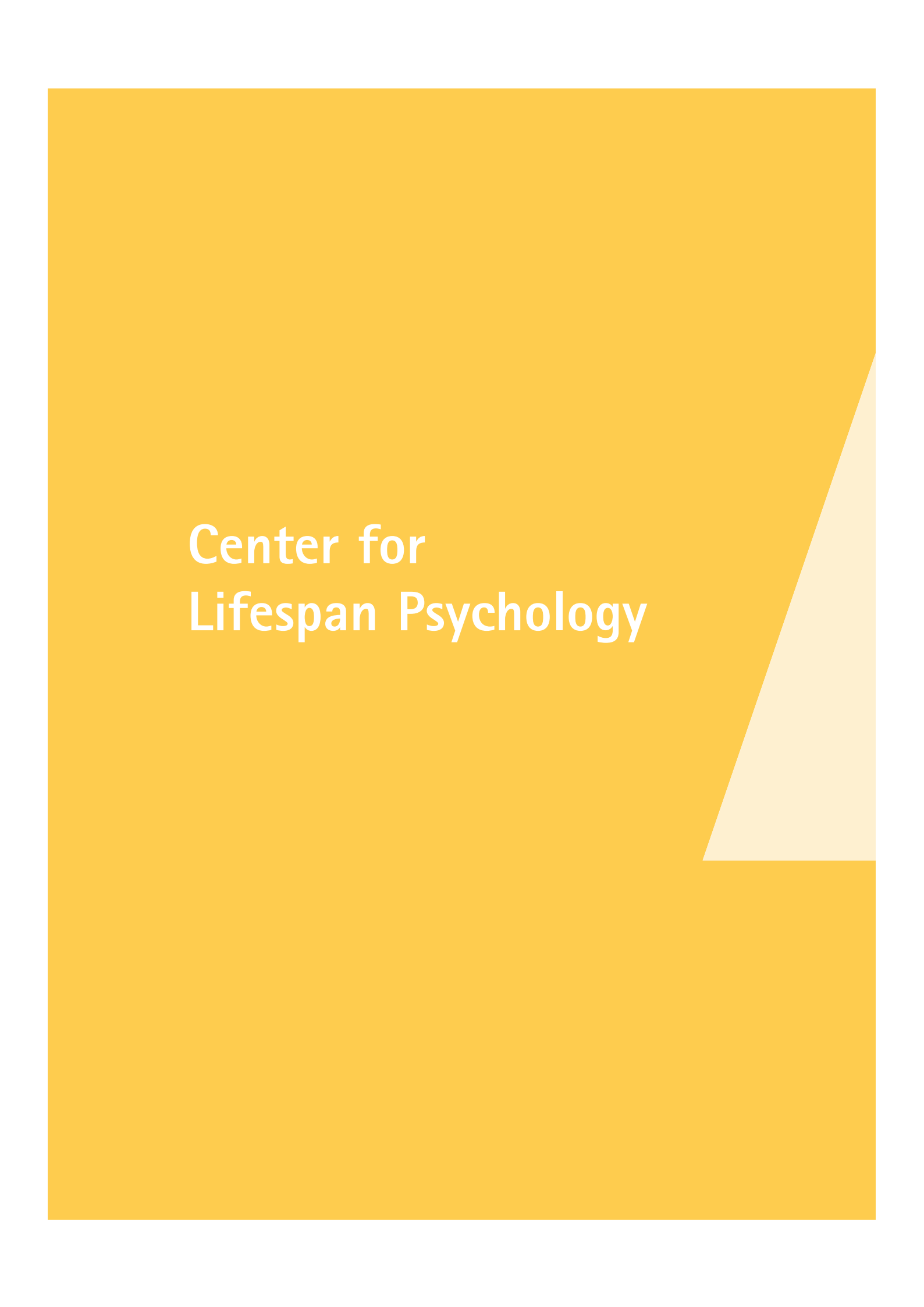
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**Center for
Lifespan Psychology**

Contents

Introductory Overview	123
Lifespan Psychology: Implications for Conceptions of Intelligence and Cognition	126
The Mastery of Life: Selection, Optimization, and Compensation (SOC)	131
Research Project 1 The Interplay of Sensorimotor and Cognitive Functioning	133
Research Project 2 Wisdom: The Integration of Mind and Virtue in Development	137
Research Project 3 Personal Goals in Lifespan Development	141
Research Project 4 Trends and Profiles of Psychological Aging	145
Research Project 5 Regulating Development by Controlling the Environment and the Self	153
Research Project 6 Parent-Adolescent Relationships: Family and Differential Perspectives	156
International Encyclopedia of the Social and Behavioral Sciences	159
Publications 1998–2000	161

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Introductory Overview

Conceptual Orientation The Center for Lifespan Psychology was created in 1981 when Paul B. Baltes was appointed director. Research and theory in the Center is conducted primarily from the perspectives of the field of developmental psychology. Its special focus is on the study of psychological change during adulthood and old age. The choice of these age periods is guided by the fact that the second half of life, while one of the major themes and issues of modernity and the aging of the population, is underresearched and offers unique opportunities for innovation, both in theory and practice. In fact, it seems fair to argue that the Center has been a major player in advancing the field of lifespan psychology.

What is developmental psychology, the field that is the disciplinary home of most researchers in the Center for Lifespan Psychology? The psychology of the ages of life, from childhood to old age and their interconnections, is the substantive scope of this field. To this end, developmental psychologists aspire to understand the behavioral, mental, social, motivational, and interpersonal characteristics and processes that constitute, accompany, and modify lifetime development. The major sources for the nature of lifespan development include the long-term consequences of bio-cultural evolution, the ongoing opportunity and inequality structures of society, the microenvironments, such as families within which individuals live, and, of course, the role of individual factors and processes, such as individual differences in learning histories, mental capacities, motivation, self-regulation, and strategies of life management.

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In general, developmental psychologists concern themselves primarily with the more proximal sources of individual behavior during the life span. However, to achieve a fuller understanding of individual development it is necessary for developmental psychologists to engage themselves in collaborative efforts with the biological and the social sciences. This is the special opportunity of the transdisciplinary concept of human development that guides work in the four centers of the Max Planck Institute for Human Development. In this vein, there has been considerable interaction of scientists in the Center for Lifespan Psychology with researchers in the other centers or from other institutions. A good example is the Berlin Aging Study in which medical researchers and behavioral and social scientists collaborate in the pursuit of knowledge about human aging in a changing society. During the recent decade, lifespan and life-course research have become a major focus of the Institute's research profile. This emerging focus has led to an increased cooperation between all Centers. The shared overall framework is the coordination of several lines of inquiry (psychological, sociological, educational) to understand the evolution and ontogeny of human behavior.

A sample of questions that developmental psychologists typically study are the following: How do nature and nurture interact in determining development, such as the emergence of the mind, how and why do such functions as intelligence and memory change with age, how and to what end do individuals acquire and maintain a sense of personal control, how do persons plan and manage their lives, what are the special bodies of knowledge and dispositions, such as life skills and wisdom that make for successful aging, how do aging individuals cope with illness or rapid technological change, how do parent-child

relationships change with time as children become adults and parents turn into seniors, or how do individuals maintain a sense of life satisfaction as they navigate the many transitions of life with their unique gains and losses?

These and similar questions are not only pursued regarding universal laws. On the contrary, developmental psychologists treat the human condition as co-constructed by biology and culture and, therefore, they are deeply committed to understanding individuality and the role of personal and nonnormative (idiosyncratic) choices in development. In this spirit, additional topics of great concern to developmental psychologists are questions of commonalities and differences in development and the ways by which individuals and their close partners can improve their own development as well as that of others.

What is special about the general research orientation that scientists in the Center for Lifespan Psychology display and use as mental scripts? The theoretical and methodological perspectives and research agenda of the Center are summarized below in **seven propositions**. These propositions reflect what may be considered the theoretical framework of lifespan psychology (Baltes, 1987, 1990, 1997; Baltes, Lindenberger, & Staudinger, 1998; Baltes & Singer, in press).

1. Human development is viewed as occurring *throughout the life span*, implying cumulative-continuous as well as innovative-discontinuous developmental processes and outcomes.

2. The process of human development from childhood into old age is considered to be an age-related change in *adaptive capacity*, in which there is a continuous interplay between growth (gains) and decline (losses).

3. Understanding psychological development requires theoretical models that are often identified as *contextual*,

interactive, or dialectical. For example, ontogenetic development occurs in the context of biosocial systems and biocultural change. Three macrostructural components are particularly relevant: (a) social change, (b) the system context provided by familial and/or generational transmission, and (c) the lifespan ecologies associated with settings, such as the family, school, work, leisure, health care, and retirement.

4. The *plasticity or basic potential* of development (i.e., its range and constraints) is a central focus of investigation. Of major concern are studies exploring the functional range within which individual developmental processes can be influenced. Objective and subjective knowledge about plasticity of development (in either a positive or a negative direction) is essential for the formulation of strategies aimed at the optimization of human development.

5. *Human activity and goal orientation* during lifetime development are other conceptual emphases that guide the Center's studies. Such an emphasis makes explicit the role that individuals play as producers of development—both their own as well as that of others.

6. Another conceptual orientation is the notion of *interactive minds*. This orientation, an orientation that has much in common with the field of cultural psychology, reflects the notion that the psychological nature of the social context of human development is essentially collective and involves internal as well as external mechanisms of social transactions and collaborations.

7. Understanding the nature of human development is facilitated by a perspective that attempts to link components of functioning into an integrated whole, that is, the individual. To this end, the search for general *models of successful development and aging* is a leitmotif of research in the Center. One such model currently under investigation postulates that selection, optimization, and compensation constitute the functional elements of the developmental process. It is argued that their dynamic coordination and orchestration results in successful development, that is, the maximization of gains and minimization of losses across the life span.

The following summary of the research programs of the Center are not comprehensive. They are samples and illustrate the lines of inquiry that Center scientists pursue in making a contribution to research and theory in lifespan psychology as well as its implications for social policy and the future of humankind.

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Lifespan Psychology: Implications for Conceptions of Intelligence and Cognition

Background Lifespan conceptions of intelligence provide a first general theoretical orientation to work in the Center. One domain of psychological functioning that has undergone major changes in theoretical orientation during the last decades is the psychology of intelligence. Research on lifespan intelligence was one of the contributory sources for this change. To illustrate, the psychometric tradition of intelligence testing pioneered, for instance by Stern and especially Binet close to 100 years ago is very much ingrained in people's everyday thinking of intelligence. In the minds of the general public, being smart and having a high IQ (Intelligence Quotient) is synonymous. In contrast, over the last couple of decades the climates of the scientific inquiry about intelligence have shifted from the IQ-based tradition—usually measured with respect to limited sets of abilities associated primarily with academic performance and work productivity—to more broadly-based inquiries about the **contextual and functional aspects of intelligence and its associated cognitive resources**. A new and productive marriage of the psychometric, cognitive-psychological, and ecological traditions is in the making.

Specifically, implicit in the psychometric approach is a focus of measuring, as opposed to understanding the causes, contexts, and functions of intelligence; and the view that intelligence reflects a collection of static abilities that characterizes a person, as opposed to a dynamic system of contextualized and adaptive cognitive functions that the individuals continue to acquire throughout their life course. One aspect of the Center's research program focusing on the theory and empirical investigations of lifespan intellectual development has contributed to this conceptu-

al shift by reconceptualizing intelligence with new insights into its nature as a system of contextualized and ontogenetically driven adaptive cognitive functions.

We pursued several lines of inquiry in our search for a dynamic view of intelligence that is both contextually and lifespan sensitive. Originally, our approach was guided by cognitive training research demonstrating more plasticity of the aging mind than is commonly assumed and subsequently by age comparative research on limits of functioning, that showed the existence of a

lifespan function of cognitive plasticity (Baltes, Lindenberger, & Staudinger, 1998). Meanwhile, we have broadened this approach by adding to it new theoretical orientations, if not new conceptions, that stem from efforts to further integrate cognitive experimental and contextual thinking with the psychometric traditions of intelligence testing.

A key characteristic defining intelligence and intelligent behavior is its adaptive value in novel situations. Lifespan contexts include continuity and change in contexts of adaptation. In old age, for instance, a larger and larger share of cognitive resources is invested into maintaining bodily functions, rather than "academic" pursuits. Seen from this perspective, intelligence is intrinsically related to a lifespan perspective of human development that considers development as a process within which individuals continue to adapt their bodies of factual and procedural knowledge to changes and transformations in biological, environmental, and cultural constraints that inevitably take place throughout their life course.

In this spirit, and by extending the Cattell-Horn theory of fluid-crystallized intelligence (Cattell, 1973), we have presented a new **dual-process model of intelligence** (Baltes, Staudinger, & Lindenberger, 1999) that highlights two distinct but interacting dimensions of intellectual functioning (see Fig. 1), the biologically (or neurophysiologically) driven cognitive mechanics (i.e., basic information processes in the sense of cognitive primitives) and the culture-based cognitive pragmatics of the mind (i.e., culture-based bodies of factual and procedural knowledge). The cognitive mechanics are basic information-processing primitives for memorizing and learning that people are capable of, and they are predominately preprogrammed by the neurophysiological architecture of the mind as it evolved during biologi-

cal evolution and unfolds under a minimum level of environmental support during individual ontogenesis. The speed, accuracy, and coordination of elementary information-processing mechanisms index cognitive mechanics. The primary substrate of cognitive pragmatics, on the other hand, is culture-based knowledge that is acquired through cultural learning and life experiences. Prototypical examples of cognitive pragmatics are being able to speak and understand the social implications of language and to solve practical daily problems involving formal-logical reasoning, to acquire the knowledge and skills related to professional expertise, or the kind of life skills that are necessary to navigate the modern world.

In the following, we describe **three general lines of our ongoing research** aimed at extending conventional models of intelligence from the perspective of lifespan psychology. The first line of research focuses on the relations between cognitive mechanics and pragmatics with biological and cultural factors and their differential lifespan trajectories. A second line of research is the investigation of resource management in sensorimotor functioning that has been motivated by our concept of the cognitive mechanics. The third line, the study of wisdom, is rooted in our research on the cognitive pragmatics.

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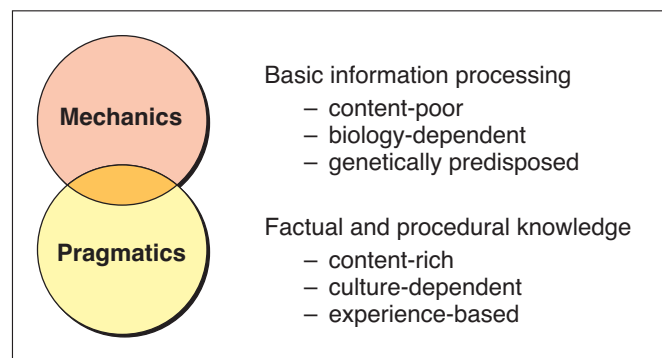


Figure 1. The dual-process model of lifespan intellectual development distinguishes between the cognitive mechanics and pragmatics of intellectual functioning (adapted from Baltes, Staudinger, & Lindenberger, 1999).

Sources of Age Differences in Cognitive Mechanics versus Pragmatics

To test the dual-process model of lifespan development of intelligence, thus far our research had directly examined the relations between these two aspects of intellectual functioning with biological and cultural factors and their differential lifespan trajectories. In our view, sensory and intellectual functions are closely related when cognitive primitives (mechanics) are operative in the task at hand. Congruent with this expectation our empirical findings (see Fig. 2) show that among old adults, basic sensory processing is much more highly correlated with the cognitive mechanics than with cognitive pragmatics. In contrast, socio-biographical predictors correlate more with cognitive pragmatics than with cognitive mechanics (Lindenberger & Baltes, 1997). The association between the more biology-based sensory-sensorimotor processes and cognitive mechanics is a robust phenomenon that generalizes to measures other than the average level of performance. Within persons, for instance, week-to-week fluctuations in old peo-

ple's sensorimotor performance also correlates highly with the cognitive mechanics. In this vein, old people who varied more in their walking performance from week to week showed worse episodic and spatial memory (Li, Aggen, Nesselrode, & Baltes, 2001).

Given that biology and culture co-contribute differentially to the mechanics and pragmatics of intelligence, investigations of how these two aspects of intellectual functioning develop, maintain, and decline throughout life could offer insights into the complex and co-constructive (Baltes & Singer, in press) interplay between the individual's biological and cultural "inheritances" in development. Combing our research on cognitive aging and concurrent work drawing data from a lifespan sample covering the first to the eighth decades of life, we found in line with our expectations differential lifespan trajectories for cognitive mechanics and pragmatics (see Fig. 3). As is true for research on the fluid-crystallized distinction, cognitive mechanics display an earlier growth pattern up to early adulthood. The growth of cognitive mechanics primarily driven by brain maturation can then be invested into the acquirement and refinement of culture-based cognitive pragmatics. However, because of their close ties to biology and genome-based determinants, continuous loss of cognitive mechanics starts early in adulthood. In contrast, the culture-based pragmatics, represented by the abilities of knowledge and language, have a later onset of decline and the decline is less pronounced (Li, Lindenberger, Prinz, Baltes, & the CoOP-MIND Research Team, 2000). However, in old age the role of biology-based cognitive mechanics in regulating the cognitive pragmatics increases (see also Fig. 2).

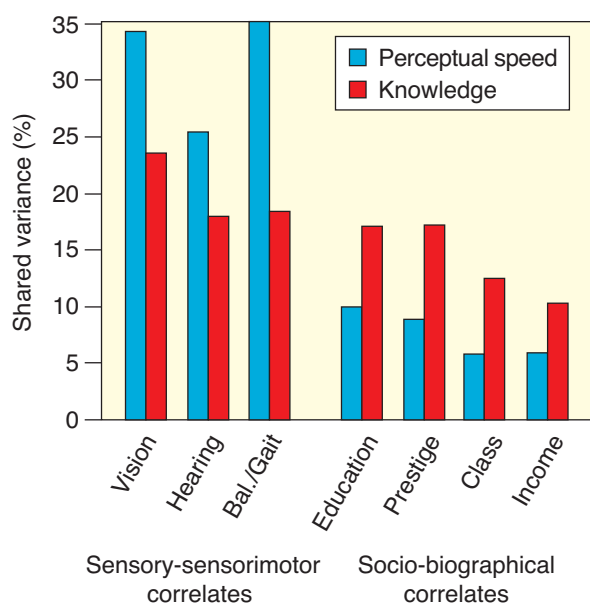


Figure 2. Differential correlational links of perceptual speed (a marker of the mechanics) and verbal knowledge (a marker of the pragmatics) to biological and socio-biographical indicators in old age (data from Lindenberger & Baltes, 1997).

Lifespan Differences in the Allocation of Cognitive Resources

The category of cognitive mechanics encompasses the efficiency of basic information processes and also includes the optimal allocation of cognitive resources. Flexible resource allocation is especially important whenever the individual is faced with multiple tasks or situational constraints. An example of these tasks or situational demands comprises basic sensorimotor functions like maintaining balance or walking while talking to a friend. Everyday life for the most part consists of such multitask situations. In the context of lifespan development, age brings with it different adaptive demands for individuals at different parts of their life course. Basic sensorimotor functions like postural stability and walking accuracy lose efficiency in later adulthood because of decreased muscular strength and reduced peripheral vision, as examples. As a corollary, we argue that such emerging deficits in the coordination of bodily functions require more and more cognitive resources. To illustrate: in our studies we systematically combined sensorimotor tasks of varying difficulties (i.e., walking with or without obstacles) with cognitively demanding

tasks (memorization) (Lindenberger, Marsiske, & Baltes, 2000; Li, Lindenberger, Freund, & Baltes, in press). Using dual-task and training research paradigms, the results suggest that older adults invest considerable cognitive resources to compensate for the decreased efficacy of their sensorimotor functions. At a larger scale, we assume that in later adulthood a considerable amount of the available cognitive resources is permanently captured by sensorimotor functions that are virtually automatized in younger adults. These cognitive resources in turn are no longer available for other cognitively demanding tasks (such as reading, writing, and conversing) or the acquisition of new skills. Because the conventional assessment of intelligence does not even touch interindividual differences in resource allocation capabilities, standard IQ assessment likely misses important dimensions of adaptive intelligent behavior. We aim at developing tasks and paradigms that reflect the contexts of the second half of life and permit the assessment of these characteristics.

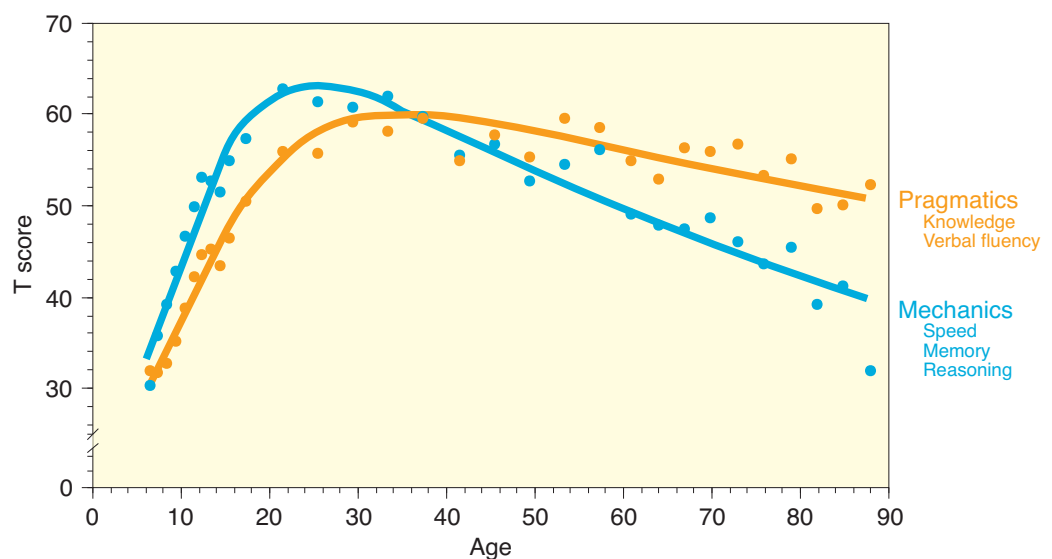
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Figure 3. Differential lifespan trajectories of cognitive mechanics and pragmatics. Plotted are means of 31 age groups (on average $n = 10$ per group). T scores are computed based on unit-weight composite of 9 and 6 variables for cognitive mechanics and pragmatics, respectively (data from Li, Lindenberger, Prinz, Baltes, & the CoOP-MIND Research Team, 2000).



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The Psychology of Wisdom

Our research on wisdom is the counterpart of the two other lines of research on cognitive mechanics and focuses primarily on the cognitive pragmatics. The original *raison d'être* for this work was the conclusion that wisdom might be a positive marker of aging; a marker that cannot be found empirically because it has not been included in the traditional tests of intelligence and personality. We have defined wisdom as "expert knowledge system in the fundamental pragmatics of life" (Baltes & Smith, 1990; Baltes & Staudinger, 1993; Staudinger & Baltes, 1996). The term "fundamental pragmatics of life" refers to important and difficult issues concerning life meaning and conduct including knowledge about life planning, review, and management.

However, wisdom expands conventional models of intelligence not only in that it involves general and specific knowledge about ill-defined life dilemmas having no clear-cut solutions. As we have discussed recently, two core features set wisdom apart from other more limited cognitive abilities: wisdom is holistic and integrative knowledge about the world of human affairs; and it involves an orientation toward the common good defined as individual *and* collective well-being (Baltes & Staudinger, 2000; Baltes, Glück, & Kunzmann, in press). Both core features signal that wisdom may have functions for successful lifespan development which are different from those abilities that typically are considered in conventional models of intelligence.

Furthermore, the concept of wisdom extends beyond "intellectual" subject matters to include notions of virtues versus vices. In this sense, wisdom can be seen as a body of knowledge, skills, and motives that functions as a metaheuristic to orchestrate human develop-

ment toward higher levels of functioning (Baltes & Staudinger, 2000). To be sure, memory, analytical, creative, social, and emotional skills are all important for living a good life as an individual, but they are not enough if the goal is a balance between individual well-being and social well-being. In our view, the special strength of wisdom is that it selects and orchestrates more specific abilities and bodies of knowledge toward **maximizing the individual and common good**. For instance, when guided by wisdom, individuals would consider only those goals and means as ways of self-development that do not violate the rights of others and, in addition, coproduce resources for others to develop. It is in this sense that we have considered wisdom as the **integration of mind and virtue**.

The Mastery of Life: Selection, Optimization, and Compensation (SOC)

A second general theoretical orientation of research in the Center for Lifespan Psychology is motivated by the question of how people develop successfully. To gain better understanding of factors contributing to successful development, that is, the simultaneous maximization of gains and minimization of losses, we attempt to specify the behavioral and cognitive strategies by which people, individually and collectively, master their lives. The focus of our theory is on the orchestration of selection, optimization, and compensation.

Throughout the entire life span, a person's (internal and external) resources are finite. There are, however, age-related changes in the availability and efficiency of resources. Starting out to be highly positive, the ratio of gains to losses in functional capacities and its consequences becomes less favorable with age. Thus, with increasing age, individuals have to allocate more and more of their resources into the maintenance of functioning and compensation of losses rather than into processes of growth (Heckhausen, 1999; Staudinger, Marsiske, & Baltes, 1995). According to the model of selection, optimization, and compensation (SOC) developed by Paul and Margret Baltes (1990; see also Baltes & Carstensen, 1996; Freund & Baltes, 2000; Marsiske, Lang, Baltes, & Baltes, 1995), successful development encompasses *selection* of functional domains on which to focus one's resources, *optimizing* developmental potential (maximization of gains), and *compensating* for losses, ensuring the maintenance of functioning (minimization of losses).

The SOC model constitutes a general

model of development defining universal processes of developmental regulation. These processes vary phenotypically depending on socio-historical and cultural context, domain of functioning, as well as on characteristics of the system or unit of interest (e.g., person, group, society). The meta-theory of SOC needs to be embedded in a specific theoretical framework for applying it to various domains of functioning (e.g., identity formation and maintenance, social relations, athletic performance) and to different levels of analysis (e.g., societal, group, or individual level).

On a macro-analytical level, it is possible to apply SOC-related perspectives to questions of societal functioning. How do the American, German, and Japanese cultures differ in goals, ways to optimize, and strategies of compensation? This would be one example for a macro-analytic, comparative study. An example of a micro-analytic level approach to the study of SOC would be the investigation of cognitive and motor performance in dual-task conditions and the way people of varying ages allocate resources differentially to memo-

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"Those who follow every path, never reach any destination."

ry and walking (Li, Lindenberger, Freund, & Baltes, in press).

(1) **Selection** Throughout the life span, biological, social, and individual opportunities and constraints specify a range of alternative domains of functioning. From this large number of options, individuals in collaboration with other forces, such as norms and parental expectations, select a subset on which to focus their resources. Selection of personal goals gives direction to development by focusing resources on specific life domains and by guiding behavior across situations and time. The function of selection is nicely illustrated by the saying "**Those who follow every path, never reach any destination.**" Selectivity can also be an adaptive response to losses in means threatening one's goals. This, in contrast to *elective selection*, we call *loss-based selection*. An example of loss-based selection is to concentrate on one's most important goals (e.g., enjoying to be with one's family) and giving up personally less important goals (e.g., cultural activities) when an illness constraints the level of energy one can spend on various activities.

(2) **Optimization** To achieve higher levels of functioning, goal-relevant means, that is, means that are conducive to goal attainment, need to be acquired, refined, coordinated, and applied in the selected goal domains. The acquisition and orchestration of such means for goal attainment we call optimization. An example of optimization is to practice scales when starting to learn the piano. By practicing scales, one can acquire flexibility in finger movements and stroke technique, both important skills for playing the piano. Of course, which means are best suited for achieving one's goals depends on the goal domain (e.g., sports, friendships), the social and cultural context providing opportunity structures making certain means

more accessible than others, and personal characteristics, such as age or gender. We need to recognize also that in most cases there are different pathways of optimization; consistent with the saying "**There are many ways to Rome.**"

(3) **Compensation** When encountering transient or permanent losses or decline in goal-relevant means threatening one's level of functioning, it is necessary to invest resources into counteracting the losses in order to maintain a given level of functioning. The process of activating or finding such alternative means we call compensation. For instance, when knee problems do not allow for going for walks any longer, using a wheelchair as a compensatory means of transportation can help to maintain one's routine of spending an hour in the park every day. As is true in the case of optimization, it depends on the domain of functioning, the social and cultural context, and personal characteristics which means are best suited for compensating transient or permanent losses in previously available means.

Research Project 1

The Interplay of Sensorimotor and Cognitive Functioning

This project has several conceptual foundations within the research framework of the Center for Lifespan Psychology. First, it speaks to the question of changing resource allocations across the life span and the use of selection, optimization, and compensation to master the changing demands and contexts of lifespan development. Second, it illustrates how intelligence—or cognitive resources in the broader sense—is constituted and applied to varying domains as life unfolds. Intelligence is not only a subject matter of logical reasoning or academic-cultural knowledge, it is also involved in such matters as the coordination of bodily movements. Third, the project is an outgrowth of the BASE finding that intelligence and sensorimotor functioning evince a higher and higher interdomain correlation as people reach old age. We attempt to understand this systemic connection and see it "in action."

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Let us begin with two backgrounds, one from everyday observations, the other from past research. Everyday observations suggest that older individuals invest much attention into the control of their motor behavior. For instance, when hiking in the mountains and facing an obstacle, such as a rock in the path, they stop talking and resume their conversations after the obstacle has been navigated. Younger people seem to show a lesser effect of this kind. This is an example of the role of both: lesser cognitive resources with aging and a greater need in advancing ages of cognitive resources for motor behavior.

Second, there is a long tradition of

research with dual-task paradigms. Numerous experimental studies have demonstrated that people find it hard to attend to more than one task at a time or to integrate sensory input from more than one source. It has also been shown that dual-task costs are often greater in old persons than in younger ones. At the same time, everyday life for the most part consists of settings in which multiple sensory inputs are relevant to behavior or in which concurrent tasks must be coordinated: examples are walking while trying to memorize a shopping list or maintaining one's balance on a bus while trying to read an advertisement on the other side of the

Key Reference

Li, K. Z. H., Lindenberger, U., Freund, A. M., & Baltes, P. B. (in press). Walking while memorizing: A SOC study of age-related differences in compensatory behavior under dual-task conditions. *Psychological Science*.

road. How is it possible for individuals to adapt to these multiple demands and their changes across situational contexts? Do individuals from different age groups differ in their efficiency at which they can cope with related performance constraints?

In line with these perspectives, in this project we investigate the efficiency of basic information processes and the allocation of cognitive resources in a lifespan developmental context. Related phenomena are referred to as aspects of cognitive mechanics in the literature. Examples for basic information processes are the perception of visual and auditory stimuli, their memorization, and their later retrieval from memory. In addition, this category includes sensory information processing in the service of motor functions like walking, maintaining an upright posture (balance), or the temporal coordination of movements. Our basic assumption is that all of these processes tax an indi-

vidual's pool of limited cognitive resources. In a way, they require "intelligence."

When more than one task or sensory input channel are relevant to the concurrent behavior, the cognitive system must allocate the available resources at any given time. In line with the theory of SOC (but also other theoretical accounts such as executive control), one possible strategy is to prioritize (select) one task over another or by carefully scheduling the processing of concurrent tasks. The focus of our investigations is on the **age-related developmental changes in resource allocation in multiple-task settings** (such as walking and thinking) that have a high degree of everyday validity. A vast literature exists on the simultaneous performance of multiple movements or the perceptual integration from different input channels. Thus, different from these earlier studies we are mainly interested in the interplay of sensorimotor functions and cognition in **settings that matter in everyday life**.

Individuals from different age groups differ with respect to the amount of cognitive resources that they have available for a given task. The relation between age and available processing resources takes a U-shape function. In young children the processing resources are still developing and growing. Older adulthood is characterized by decrements in available cognitive resources. Many cognitive tasks have been demonstrated to exert higher resource demands on older than on young adults. In the light of reduced capacity and increased task demands the necessity to optimize the allocation of available processing resources must be even higher in older than in young adults. Optimal resource allocation as a means to adapt overall performance is a critical marker of successful aging as described by the SOC theory (Baltes & Baltes, 1990;

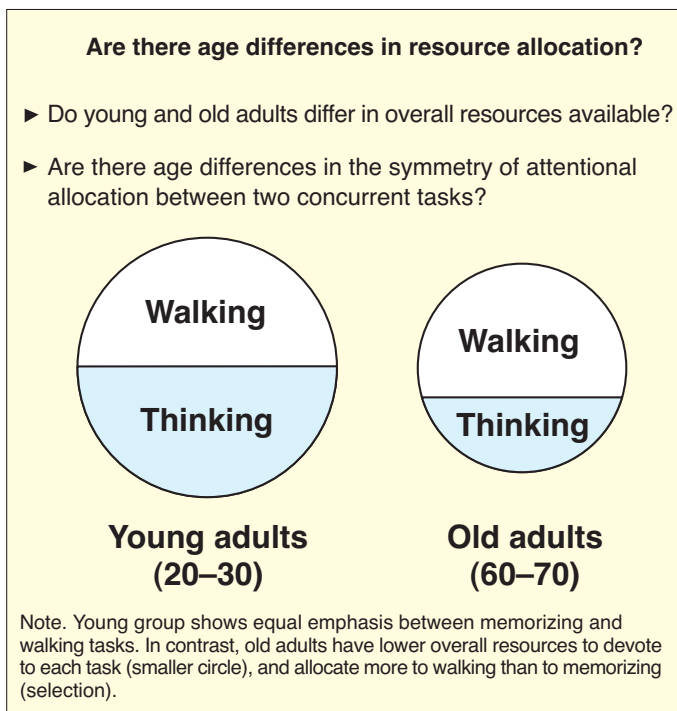


Figure 1. SOC: Overview of the central questions examined in the Dual-task Thinking & Walking Project.

Freund, Li, & Baltes, 1999). One central question in our project is whether individuals from different age groups differ only in terms of their available resources or whether the efficiency of resource allocation as such is subject to developmental changes (Fig. 1).

Current work on this topic includes the study of walking and the investigation of postural stability. To this end, we have developed during 2000 a **new laboratory**. This laboratory consists of two balance machines that permit dynamic posturography and a parcours that permits the assessment of walking accuracy. In both experimental settings participants either perform the sensorimotor task (walking or balancing) in isolation or in combination with cognitive tasks.

Completed work focuses on questions of walking and thinking. For instance, two studies demonstrate—as predicted—that **older adults** invest considerable cognitive resources presumably to **compensate** for the decreased efficiencies of their sensorimotor functions. Specifically, Lindenberger, Marsiske, and Baltes (2000) had participants of three age groups walk different tracks while memorizing word lists. They found (see Fig. 2) that speed and accuracy of walking were reduced when participants had to simultaneously walk and memorize. The size of this decrement, however, was considerably larger in older than in young adults. However, as shown in the right side of Figure 2, there were no age differences in dual-task costs for memory. In our interpretative posture, older adults selected walking efficiency over memory efficiency when their cognitive resources were challenged.

A subsequent study added to the design opportunities for

compensation. Specifically, Li, Lindenberger, Freund, and Baltes (in press) systematically combined sensorimotor tasks of varying difficulties (i.e., walking with or without obstacles) with a cognitively demanding task (memorization) (Fig. 3). In some testing conditions participants were given the option of using compensatory external aids (a handrail to optimize walking speed and accuracy and a button-box that delayed the presentation of auditory stimuli). While young adults optimized their memorization performances, older adults focused on the optimization of their walking by more frequent usage of the handrail.

Again, these results can be interpreted in the context of the SOC model as differences in overall resources as well as older adults' specific selection of attentional emphasis on walking over memorizing. These results highlight the differential ecological relevance of tasks for young and older adults and its effects on resource allocation: walking or maintaining balance is more critical for older than for young adults. Consequentially, **older adults prioritize sensorimotor over cognitive functioning**.

Ongoing studies in this project add a third sensorimotor component, namely

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Which suffers when doing both (walking and memorizing)?
Older adults show larger losses in memory
but not in walking



Figure 2. Suggested interpretation: When cognitive resources are tested at limits, older adults prioritize walking over memorizing (Lindenberger, Marsiske, & Baltes, 2000).



Figure 3. Dual-task performance: Memorizing while walking (research participants have the opportunity to compensate: either by using a hand-rail or a button to slow down the presentation rate of memory stimuli).

balance. Specifically, we use dynamic posturography for dual- or potentially triple-task experiments with similar questions. Dynamic posturography means that participants stand on a platform that can move (i.e., tilt) at different angular velocities (Fig. 4). The platform contains sensors that measure participants' stability (i.e., the distribution of their weights) at any given point in time. Our participants are individuals from different age groups (children, young, and older adults). In addition, we study groups that are assumed to have deficits in attentional control or resource allocation (Alzheimer's patients or children with AD-HD syndromes). In the long run, we are also interested in performing cognitive and motor training studies to explore the plasticity of the behavior systems involved. In this context we will also investigate resource allocation in young and older adults who have presumably optimized their sensorimotor functioning through long-term practice in balance-related forms of expertise.

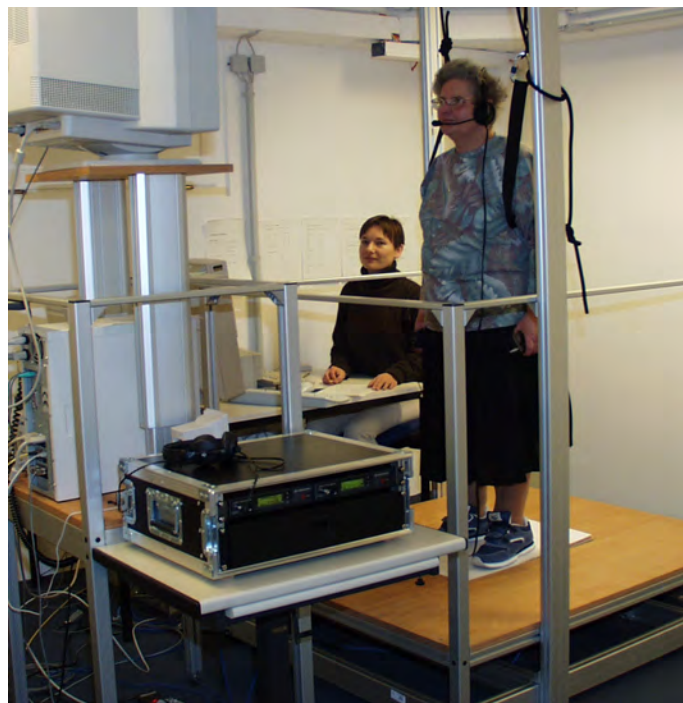


Figure 4. The new laboratory, which has been developed to examine dual-task performance includes apparatus to test dynamic posturography. One of our new studies investigates the capacity to memorize while keeping balance (memory stimuli are presented by ear phone).

Research Project 2

Wisdom: The Integration of Mind and Virtue in Development

Proceeding from the everyday meaning of wisdom as sound judgment and good advice concerning important but uncertain matters of life, we have defined wisdom as "expert knowledge system in the fundamental pragmatics of life" (Baltes & Smith, 1990; Baltes & Staudinger, 2000; Staudinger & Baltes, 1996). The term "fundamental pragmatics of life" refers to knowledge about significant aspects concerning the meaning and conduct of life, and includes knowledge about life planning (e.g., what life goals should we pursue and how?), life management (e.g., how can we deal with severe problems, such as suicide, violence, or family conflict?), and life interpretation (e.g., how can we make sense of our past, present, and anticipated experiences?). Wisdom involves general knowledge referring to those aspects of life meaning and conduct that are universal across cultural contexts and historical periods as well as more specific knowledge about the cultural, historical, and individual relativity of the human life course.

Although wisdom is not necessarily a property of individuals, but can also be found in written material, such as the bible or legal texts, most of our past research has focused on **wisdom-related knowledge** as expressed in a person's thoughts and judgments. To assess wisdom on the individual level, we present to participants short vignettes describing difficult life problems of fictitious people and ask them to think aloud about these problems. To illustrate, a problem concerning life management reads: "A 15-year-old girl wants to get

married right away. What could one/she consider and do?" A panel of trained raters evaluates our participants' responses with reference to five criteria that we believe indicate wisdom, namely, rich factual and procedural knowledge about the fundamental pragmatics of life, lifespan contextualism, value relativism or tolerance, and awareness and management of uncertainty. Two extreme responses to the wisdom task described above are depicted in Figure 1.

Past research in the wisdom project (for review see Baltes & Staudinger,

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Task: A 15-year-old girl wants to get married right away.
What could one/she consider and do?

Figure 1. Illustration of two extreme responses to a wisdom task.

Low wisdom score

A 15-year-old girl wants to get married? No, no way, marrying at age 15 would be utterly wrong. One has to tell the girl that marriage is not possible. (After further probing) It would be irresponsible to support such an idea. No, this is just a crazy idea.

High wisdom score

Well, on the surface, this seems like an easy problem. On average, marriage for 15-year-old girls is not a good thing. I guess many girls might think about it, however, when they fall in love for the first time. And, then, there are situations where the average case does not fit. Perhaps in this instance, special life circumstances are involved, such that the girl has a terminal illness. Or the girl has just lost her parents. And also, this girl may not be from this country. Perhaps she lives in another culture and historical period.

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2000) was concerned primarily with testing the validity and reliability of our psychological approach to the concept of wisdom, studying age-related changes, and exploring the antecedents and plasticity of wisdom-related knowledge. In this context, we were able to show that the activation of wisdom-related knowledge is facilitated by conditions of social discourse including the use of inner voices associated with inner dialogue (Staudinger & Baltes, 1996). Much of our work on age-related changes in wisdom was motivated by the idea that wisdom might be one of the very few gains associated with aging and, thus, may show improvement across the entire life span. What have we found? As seen in Figure 2, wisdom-related knowledge seems to increase during adolescence and young adulthood (Pasupathi, Staudinger, & Baltes, in press) and then remains stable, at least up to age 75. At first sight, the stability of wisdom across most of adulthood is at odds with the idea that wisdom is a positive aspect of aging. The finding is more in line with the notion of successful adulthood than a success story of old age. Given that basic cognitive functions lose efficiency relatively early in the life span, however,

maintenance of wisdom-related knowledge might be the best possible outcome that adulthood and old age can bring about.

Note also that our theoretical orientation never implied that wisdom-related knowledge is strictly tied to processes of age. Rather, we argued that a coalition of factors are involved, only some of which might be age-related (Baltes & Staudinger, 2000). Figure 3 presents the empirical associations of multiple person-related and environmental factors with wisdom-related knowledge in three samples of adults (see Fig. 3). The acquisition and optimization of wisdom-related knowledge seems to require a wide range of supportive conditions and processes related to an individual's personality, cognitive capacities, environment, and life history. Most certainly, wisdom-related knowledge is different from academic intelligence in that it integrates intellectual with emotional and motivational dimensions of knowledge about the meaning and conduct of life. Moreover, as we have demonstrated in research on the correlates of wisdom, wisdom as we define and measure it, carries a sizeable proportion of unique variance (Staudinger, Lopez, & Baltes, 1997). Even when

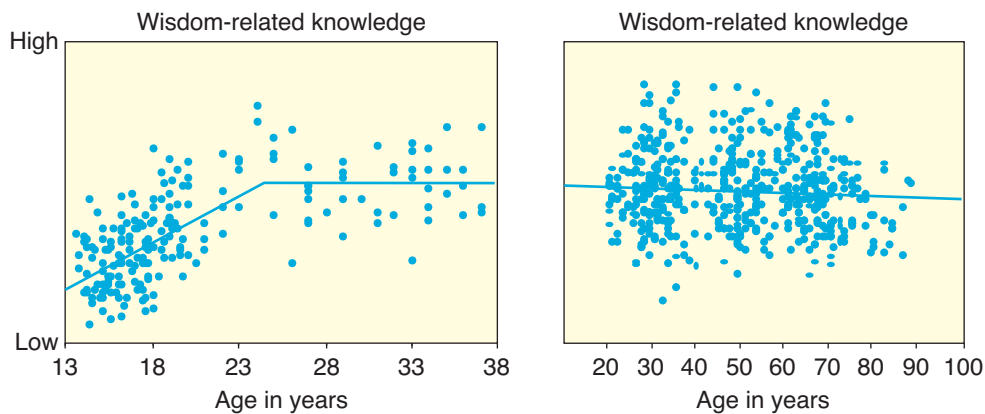


Figure 2. Cross-sectional age gradients and scatter plots for wisdom-related performance. The left panel show data from Pasupathi, Staudinger, and Baltes (in press) including outcomes of a spline analysis. The right panel summarizes results from several studies with adult samples (see also Baltes & Staudinger, 2000).

partialling out the covariations with over 30 measures of intelligence, personality, and cognitive style, two parallel tests of wisdom maintain a sizeable degree of uniqueness.

In our ongoing work, we have **two new research foci**. A first focus refers to the question whether it is useful to conceptualize wisdom as a **cognitive meta-heuristic**. Findings from our studies on the plasticity of wisdom have shown that wisdom-related performance can be enhanced relatively early by certain supportive conditions, such as the availability of social interaction, provision of inner voice dialogues, or certain memory strategies. This evidence led us to conclude that many people may have the bodies of knowledge that are required for thinking wisely available. However, they may not use these bodies of knowledge until the concept of wisdom is prompted, and one either explicitly or implicitly tries to think wisely. We are in the process of testing this hypothesis (Glück & Baltes, 1999) by having participants engage in wisdom-priming tasks including as one condition the instructional objective of "acting wisely." Support for our prediction that such tasks will lead to marked increases in wisdom-related performances, would confirm the notion that wisdom can act as a meta-heuristic that is conducive to activate those bodies of

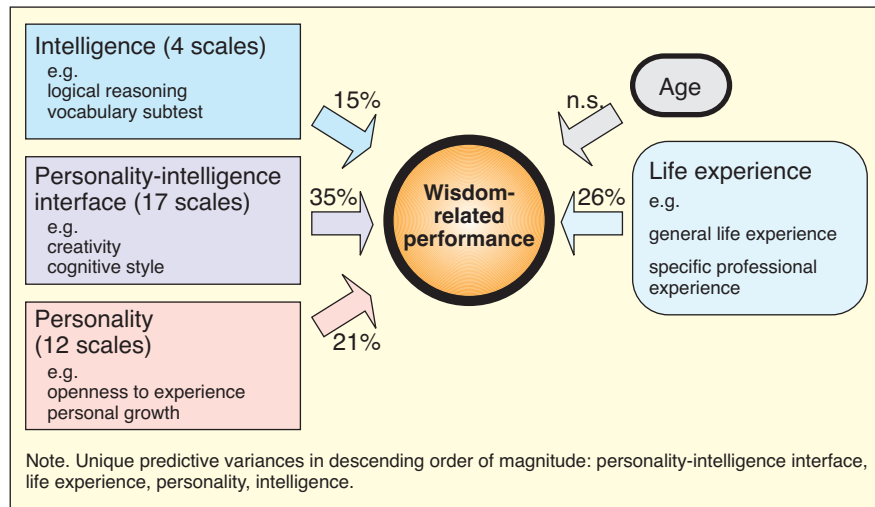
knowledge that are wisdom-prone.

In a second line of research, we are interested in expanding our conceptualization of wisdom as knowledge to also include motivational and emotional features. To date, our research program on wisdom has not considered explicitly the role of **emotional factors**, for instance in the acquisition of wisdom-related knowledge or the initiation of wisdom-salient dialogues. Stimulated by work on lay person's conceptions of wisdom, we plan to examine under which conditions people who have wisdom-related knowledge are also perceived as being wise or as desirable counselors in matters of the fundamental pragmatics of life. We are particularly interested in the social-emotional competencies that—in addition to wisdom-related knowledge—make a person appear to be wise and sought out as an advisor. In the tradition of explicit theories of wisdom, we will investigate under what conditions wisdom-related **knowledge** is reflected in people's **behavior** as they deal with uncertain life problems and interact with others. Emotional competence, as reflected by one's level of emotional reactivity, regulation, and reflection, most likely is one of the main factors that can either facilitate or hinder the translation of wisdom-related knowledge into our actions in everyday life (Kunzmann & Baltes, in press).

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Figure 3. Predictors of wisdom-related knowledge. Data are based on three studies with adolescent and adult samples. Not presented in this figure is our finding that intelligence plays a stronger role as predictor of wisdom-related knowledge in adolescence than in adulthood (Baltes & Staudinger, 2000).



In the long run, our goal is to move toward a more comprehensive conceptualization of wisdom that highlights its special strength, namely, the **integration of mind and virtue** as the optimum of human functioning (Baltes, Glück, & Kunzmann, in press). This work permits us also to spell out the relation-

ship between the theories of wisdom and the theory of selective optimization with compensation (SOC). In this context, we argue that, whereas wisdom defines the general range of acceptable means and goals, SOC offers the pragmatic techniques necessary to reach whatever goals are delineated.

The Center for Lifespan Psychology 2000

Left to right: (front row) Alexandra M. Freund, Albina Bondar, Judith Glück, Li Shu-Chen; (middle row) Ute Kunzmann, Kurt Kreppner, Jutta Heckhausen, Michaela Riediger, Jacqui Smith, Antje Stange, Paul B. Baltes; (back row) Tania Singer, Ralf Krampe, Susanne Ehrhorn, Regina Wolf, Julia Delius, Paolo Ghisletta, Florian Schmiedek, Michael Rapp.



Research Project 3

Personal Goals in Lifespan Development

The purpose of this project is the investigation of cognitive-motivational processes regulating human development across the life span. To investigate these issues, the meta-model of selection, optimization, and compensation (SOC) is adopted as a theoretical framework. In the SOC meta-model, **successful development**, defined as simultaneous maximization of gains and minimization of losses over time, results from an interplay of three processes: selection, optimization, and compensation (Baltes, 1997; Baltes & Baltes, 1990; Freund, Li, & Baltes, 1999; Marsiske, Lang, Baltes, & Baltes, 1995).

Scientific Investigators

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The project focuses on the action-theoretical study of SOC-related processes in the structure and function of personal goals (Freund & Baltes, 2000). In this line of inquiry, we assume that people actively shape their development through (1) the *selection* of personal goals, (2) the *optimization* of functioning in selected goal domains, and (3) the *compensation* of losses in goal relevant means.

We have investigated **the role of personal goals for life management** in several studies. For purposes of illustration and the use of varying methodology, we highlight **three different kinds of approaches**: (1) a self-report method, (2) a proverb method, and (3) process-oriented approaches.

(1) Self-report measure of SOC

One methodological line of inquiry focuses on what people report about their SOC-related behaviors. For this purpose, and together with the FU Berlin research group of the late Margret Baltes, we constructed a questionnaire (Baltes, Baltes, Freund, & Lang, 1999). In this

questionnaire, study participants are asked to indicate whether they engage in behaviors that we categorize as selection, optimization, and compensation or in alternative, that is, non-SOC behaviors. Such alternatives are, for instance, keeping one's options open rather than committing to a set of goals (selection), being content with results of first trials rather than trying to maximize one's performance (optimization), or waiting for solutions and betterment of a loss situation rather than engaging in compensatory behaviors. Table 1 lists sample items for each of the processes.

The psychometric properties of this questionnaire are highly satisfactory. One finding consistent with our lifespan framework is that it is during midlife, individuals express the strongest preference for SOC-related behaviors (see Fig. 1). Older adults report less engagement in the strategies of goal pursuit. We interpret this decline of self-reported optimization and compensation as being due to an age-associated limitation of resources that constrain the im-

plementation of goal-pursuit strategies. This is so because engaging in strategies of goal pursuit itself is effortful and requires more resources than might be available in old age. Future studies need to investigate the role of resources for the acquisition and implementation of goal-related life-management strategies more directly.

A second pattern of findings demonstrates substantial predictive validity of SOC involving a variety of life outcomes, even after controlling for a large number of alternative predictors. Table 2 summarizes some of these findings. Note that these results are based on samples varying in age and on different outcome criteria (Freund & Baltes, 1998, 2000; Wiese, Freund, & Baltes, 2000). People who report to engage in selection, optimization, and compensation of personal goals also report higher well-being (e.g., frequency of experiencing positive emotions, having a purpose in life, life satisfaction). Committing to personal goals, pursuing these goals and investing into their maintenance in the face of losses appears to contribute to positive subjective states across adulthood. Similarly, young adults who set clear priorities instead of

Table 1
Sample items for elective selection, loss-based selection, optimization, and compensation (Baltes, Baltes, Freund, & Lang, 1999). Items in right column indicate alternative (non-SOC) behaviors

<i>1a. Elective Selection</i>	
I always focus on the most important goal at a given time.	I am always working on several goals at once.
I have set my goals clearly and stick to them.	I often adapt my goals to small changes.
<i>1b. Loss-Based Selection</i>	
When I can't carry on as I used to, I direct my attention to my most important goal.	When I can't carry on as I used to, I direct my attention, like usual, to all my goals.
When something becomes increasingly difficult for me, I consider which goals I could achieve under the circumstances.	When something becomes increasingly difficult for me, I accept it.
<i>2. Optimization</i>	
I make every effort to achieve a given goal.	I prefer to wait for a while and see if things will work out by themselves.
When I want to get ahead, I take a successful person as a model.	When I want to get ahead, only I myself know the best way to do it.
<i>3. Compensation</i>	
When things don't go as well as they used to, I keep trying other ways until I can achieve the same result I used to.	When things don't go as well as they used to, I accept it.
When something in my life isn't working as well as it used to, I ask others for help or advice.	When something in my life isn't working as well as it used to, I decide what to do about it myself, without involving other people.

Middle-aged adults report more SOC-related behavior than younger and older adults. There is one exception: elective selection increases throughout adulthood

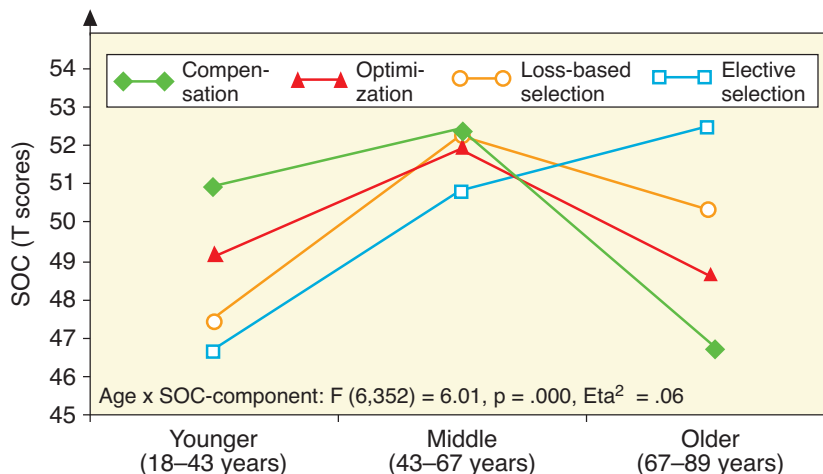


Figure 1. Life management strategies of SOC: Cross-sectional age differences in adulthood ($N = 181$) (Freund & Baltes, 2000).

pursuing work- and family/partnership-related goals at the same time report more goal progress, now and three years later.

(2) **Proverb method** To check on method artifacts and provide multi-method evidence, we explored evidence about goals and SOC-related behaviors gathered with a rather different methodology, namely the use of proverbs. We argued that if personal goals are important for development, there should also be some implicit folk knowledge about this fact. Proverbs can be considered as condensed forms of folk knowledge reflecting cultural knowledge about fundamental aspects of life. Often, proverbs are expected to give advice about how to manage one's life. Are there proverbs reflecting the importance of selecting, pursuing, and maintaining personal goals for life management?

The results were strongly supportive of our hypothesis. Using comprehensive collections of German proverbs as sources, we were able to identify a substantial number of proverbs reflecting the importance of personal goals in terms of selection, optimization, and compensation. This can be seen as evidence for cultural knowledge about the role of personal goals for managing one's life.

Moreover, individuals also make use of these proverbs. We presented individuals with life problems and asked them to identify proverbs that would match these situations. The proverbs they could select were either SOC-related or not. The contrasted proverbs did not differ in other characteristics, such as familiarity. In several studies, we found that adolescents, young, middle-aged, and old adults judged proverbs reflecting selection, optimization, and compensation to be more adaptive in the life-problem situations presented than alternative proverbs (see Fig. 2). Thus, folk knowledge about the role of personal goals is not only reflected in pro-

Table 2
Overview: SOC (self-report) predicts successful development (outcomes)

Outcome	SOC prediction (correlation)
Berlin Aging Study (72–102 yrs.; $N = 200$) (Freund & Baltes, 1998)	
Satisfaction with age	.33**
Positive emotions	.47**
Emotional loneliness	-.31**
Adulthood and Well-Being (14–89 yrs.; $N = 395$) (Freund & Baltes, 2000a)	
Positive emotions	.32**
Environmental mastery	.35**
Personal growth	.37**
Purpose in life	.44**
Work and Family in Young Adulthood (25–36 yrs.; $N = 206$) (Wiese, Freund, & Baltes, 2000)	
Overall well-being	.49**
Emotional balance	.37**
Self-esteem	.21**

** $p < .01$.

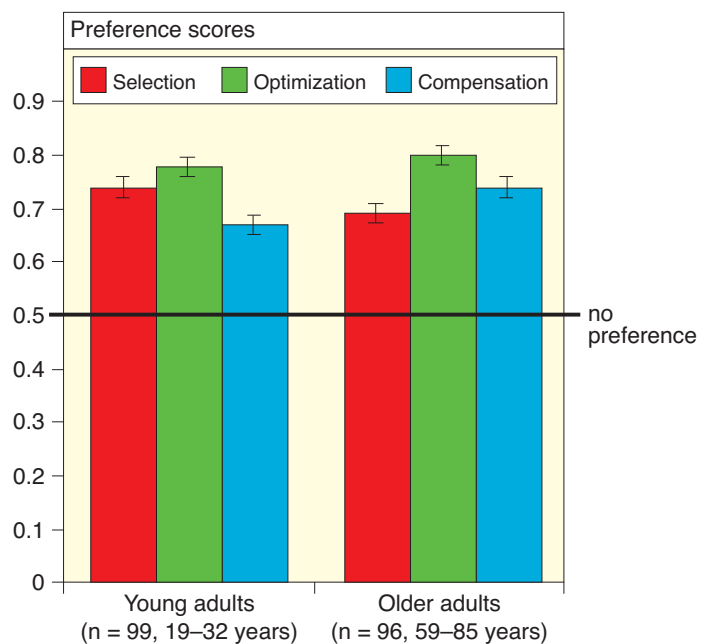


Figure 2. Young and old adults choose SOC-related proverbs more often as adaptive in dealing with life problems than alternative (non-SOC) but equally familiar and meaningful proverbs.

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verbs but also used by individuals when judging how to manage one's life in terms of proverbs.

(3) **Process-oriented studies** A third line of inquiry aimed at a closer measurement of behavioral indicators of selection of goals. In this set of studies, we investigate the mechanisms and functions of setting, pursuing, and maintaining personal goals. To give one example for this kind of work, we report findings from a study investigating the process of selection as setting goals and **building a goal hierarchy by prioritizing certain goals over others.**

The central question of this study was how young adults manage two of the central developmental tasks of their age, (a) establishing themselves in their work life and (b) founding a family (Wiese, 2000). As mentioned above, we found that those younger adults who prioritize goals reported higher general and domain-specific well-being. One of the processes that might contribute to such results is that prioritized goals lead attention to goal-relevant information, thereby enhancing knowledge useful for achieving the goal and also alerting a person to good opportunities to act upon a goal. Consistent with this assumption, we found that the prioritizing of goals also seems to influence information processing, such as faster recognition and a preference for goal-relevant information.

In a set of ongoing studies, we investigate **age-differential effects** of framing goals either in terms of optimization (i.e., achieving maximum gains) or compensation (i.e., counteracting a loss in goal-relevant means) on persistence. In these studies, we found that younger adults are more motivated and persistent when trying to achieve higher levels of performance than when trying to counteract a loss. Conversely, older adults show higher persistence when engaged in compensation of a loss than

when aiming at maximum performance (Freund, A. M. [2000]. *Processes of goal-selection and goal-pursuit in early and late adulthood*. Congress of the German Psychological Association, Jena, Germany). Further studies are planned to investigate the role of goal framing for persistence in personally important goals.

Taken together and when placed into the larger conceptual context of the SOC theory, this project highlights the importance of personal goals for individual development across the life span. Using different approaches to study how personal goals impact on developmental outcomes (well-being, goal-related performance), we consistently find that selection of goals, optimization of goal attainment, and compensation of losses in goal domains help to understand how individuals actively shape the direction and level of their development.

Research Project 4

Trends and Profiles of Psychological Aging

The opportunity for this project developed in the context of the Berlin Aging Study (Mayer & Baltes, 1996; Baltes & Mayer, 1999; Smith & Baltes, 1999b). Our efforts focus on understanding changes in psychological functioning in the last years of life (especially the Fourth Age; e.g., Baltes, 1997). Data collected within the Berlin Aging Study (BASE) clarified the health and social challenges faced by men and women between the ages of 70 to 100+ years. We obtained valuable information about age-related change in three aspects of psychological functioning involved in adaptation (cognitive ability, personality, and social relationships). BASE is one of the few studies to have a wide range of psychological test data from sufficient numbers of persons aged over 85 years as well as younger comparison groups to enable us to test hypotheses about change during old age and to examine the question whether very old age (the Fourth Age) represents a condition of life that is qualitatively different from young-old age (the Third Age). BASE findings complement and extend those reported by researchers from the MacArthur Successful Aging Network as well as other large studies of older adults in the USA, England, Sweden, and Canada.

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Psychological Aging from Age 70 to 100+: Central Findings

The psychology unit of BASE examined three basic domains of functioning: (a) intelligence and cognition, (b) self and personality, and (c) social relationships. In general, findings in BASE suggest that the amount, onset time, and rate of age-related change differs across psychological dimensions (Smith & Baltes, 1999b). **In the area of intelligence and cognitive functioning, negative age differences between 70 and 100+ years are substantial** (representing a 1.8 *SD* difference in performance level and 35% of the interindividual variance) and are associated with indicators of biological dete-

Overview of the Berlin Aging Study (BASE)

The multidisciplinary Berlin Aging Study (BASE), directed by Paul B. Baltes and Karl Ulrich Mayer, was initiated in 1989 under the sponsorship of the former West Berlin Academy of Sciences and Technology and its Committee on Age and Societal Development. Subsequently, and in connection with the re-establishment of the Prussian Academy, the study came under the auspices of the Berlin-Brandenburg Academy of Sciences.

As of 2000, the study involves five measurement occasions spaced over 10 years. In addition, subsamples have been recruited for intensive study (e.g., Singer, below). The distinguishing features of BASE include (1) a focus on the very old (70–100+ years), (2) a locally representative sample, stratified by age and sex, and (3) a broad-based interdisciplinarity (involving two research groups from the Free University of Berlin, Internal Medicine and Psychiatry, and two from this Institute, Sociology and Psychology). In addition to discipline-specific topics, four integrative theoretical orientations guide the study: (1) differential aging, (2) continuity versus discontinuity of aging, (3) range and limits of plasticity and reserve capacity, and (4) aging as a systemic phenomenon.

The initial focus of BASE (1990–1993) was to obtain an age by sex stratified heterogeneous sample of 70- to 100+-year-olds who completed a 14-session Intensive Protocol (involving detailed measures from the four disciplines). 516 men and women from the western districts of Berlin participated. Four longitudinal follow-ups of the survivors from this initial sample involving different amounts of assessment have been completed at approximately two-yearly intervals. A single-session multidisciplinary assessment was collected in 1993–1994 ($N = 361$), reduced versions of the Intensive Protocol (six sessions) were collected in the periods 1995–1996 ($N = 206$) and 1997–1998 ($N = 132$), and a repeat of parts of the Psychology Battery together with multidisciplinary outcome variables in 2000 (e.g., screening for dementia, assessment of well-being: $N = 90$). In addition, we also follow the mortality of the entire BASE sample.

The initial sample of 516 individuals formed the basis of the cross-sectional analyses reported in a German monograph first published in 1996 (Mayer & Baltes, 1996), in a featured section of *Psychology and Aging* (1997), and an English monograph published with Cambridge University Press (Baltes & Mayer, 1999). Key multidisciplinary findings about the challenges and constraints of old age are summarized on the next page. Special interests of the Psychology Unit of BASE include: issues of sample selectivity and representativeness, cognitive aging, subgroup profiles of psychological functioning, the Fourth Age, gender differences, mortality prediction, self-definition, well-being, and models of successful aging such as selective optimization with compensation.

Graduate Training Program (Graduiertenkolleg) in Psychiatry and Psychology of Aging jointly with the Freie Universität Berlin

Since 1998, the data bank of BASE offers the primary foundation for a DFG-funded graduate research training program (Graduiertenkolleg). The focus of this Kolleg is on the "Psychiatry and Psychology of Old Age."

Founded by the late Margret M. Baltes, the graduate training program is currently co-directed by psychiatrist Hanfried Helmchen and psychologist Paul B. Baltes. Other key psychologists involved are Ralf Schwarzer (Freie Universität Berlin) and Jacqui Smith. The total number of anticipated doctoral fellows is 25. In 2000, the program included 15 fellows.

roration (Lindenberger & Baltes, 1997; Lindenberger & Reischies, 1999). In contrast, age-related differences in personality, self-related beliefs, and social relationships are fewer and considerably smaller (approximately 0.5 SD ; Smith & Baltes, 1999b). Interindividual differences are substantial in all areas of functioning, reflecting the combined influences of biogenetic factors and life-history experiences. BASE findings also indicate that, among the oldest-old (over 85 years), a large number of individuals show decline or dysfunction in multiple areas of psychological functioning and that these losses contribute to decreased subjective well-being. This

latter finding is in line with the negative implications for very old age (the Fourth Age) derived from an overall metatheory about the incomplete architecture of ontogeny (Baltes, 1997).

Intellectual Functioning

Up to age 80, previous research has shown that performance on two broad categories of intellectual abilities, the fluid-like mechanics and crystallized pragmatics of intelligence, exhibit different patterns of maintenance and decline. The fluid mechanics, thought to reflect the neurophysiological architecture of the human brain, display instances of decline already in middle

www.base-berlin.mpg.de

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www.fu-berlin.de/age

Beliefs about Old Age: Key Multidisciplinary Findings from the Berlin Aging Study (BASE)*

1. The majority of older people are prescribed too many drugs—False

Although 92% of older adults take at least one drug, under-medication was found in 24% of cases. Quality and not quantity is clearly the main problem of medical treatment in old age.

2. Most older people have at least one illness—True

From a medical perspective, nearly all older persons can indeed be diagnosed as having at least one illness. However, life-threatening illnesses were observed only one third of cases.

3. Most older people report that their health is poor—False

29% of BASE participants rated their somatic health as good or very good, 38% as satisfactory, and only 33% as fair (19%) or poor (14%).

4. Older women live longer and therefore have fewer illnesses than men—False

Although women have a longer life expectancy, as a group their profile of illnesses is not really very different from that of men of the same age.

5. The majority of very old women need help to bathe or shower—True

60% of women aged 85+ reported needing assistance to bathe or shower compared to only 32% of men in this age group.

6. Most biochemical reference values do not change in old age—True

There were few significant age-related deviations from the reference ranges valid for younger adults on the broad range of biochemical analyses of blood parameters in BASE.

7. Depressive disorders become more frequent in old age—False

The prevalence of clinically diagnosed depression did not dif-

fer significantly across the BASE age groups.

8. Most persons aged 70+ have serious impairments in cognitive functioning—False

17% of older persons exhibit some form of pathological cognitive impairment and 14% are affected by dementia. However, there is a general decline in intellectual functioning.

9. About half of those aged 90+ exhibit dementia—True

The prevalence of dementia increases steeply with age. No cases were diagnosed in the 70- to 74-year-olds, but 43% of persons aged 90+ were affected by some level of dementia.

10. Most older people receive too many psychotropic drugs—False

Two thirds of older adults take psychotropic drugs. Overdosage was not detected. Undermedication was found in 36% of cases, and in a surprising 44% of persons with depression.

11. Everyday life for older adults consists mainly of passive activity and rest—False

Reconstruction of a typical day for BASE participants shows that on average only 19% of waking hours were spent resting. In the 70 to 84 age group it was only 12%.

12. Older people are preoccupied with death and dying—False

Of ten life domains, 70% of BASE participants reported that the well-being of family and relatives occupied their thoughts and actions to a large degree. Only 30% claimed to think a lot about death and dying.

13. Memory gets worse with age—True

Sizeable negative correlations were found between age and performance in memory tests.

14. Most older people are no longer able to learn new things—False

Despite memory decline, older people are capable of learning new things even into very old age.

15. A good education and challenging job are protective against age-related intellectual decline—False

The rate of intellectual decline (from 70 years onwards) for individuals with an above-average education, socially prestigious professions, and higher incomes is virtually equal to that of those with below-average resources.

16. Most older people believe that they can no longer control what happens in their life—False

70% of BASE participants stated that they felt in control of their lives.

17. Only very few older persons still have life goals—False

94% of BASE participants described scenarios for the future covering a broad range of life domains and goals.

18. Older adults live mainly in the past—False

40% of participants reported thinking mostly about the present, 30% about the past, and 25% about the future.

19. Most older people have a confidant with whom they can talk about difficult problems—False

Almost half of the BASE participants said that they had nobody with whom they could discuss personal problems.

20. In West Berlin many older adults are poor—False

Old age is not associated with large financial disadvantages. However, financial needs can rise disproportionately in very old age, e.g., when help is needed due to frailty and disability.

21. The number of social partners decreases with old age—True

70- to 74-year-olds named 12.7 persons for their social network, whereas those aged 95+ only nominated 6.6.

22. Most of those aged 95+ are institutionalized—False

37% of West Berliners aged 95+ live in a nursing home.

23. Children are the main caregivers of older persons who live in private households—False

Only 54% of those in need of assistance had children in Berlin. Of these, 8% received regular household assistance or nursing care from their children. Prime sources of regular care and assistance were spouses and professional community/ nursing services.

24. People who were more socially active in their youth participate more in social life in old age—True

There was a positive association between the former and current levels of social activities reported.

25. The poor are more ill in old age, the rich healthier—False

There were few differences in physical or mental health associated with social class or financial situation.

26. Women who were housewives are worse off in old age than women who were in paid employment—False

The duration of employment of the married and widowed BASE women was not related to household financial status in old age.

* Mayer, Baltes, Baltes, Borchelt, Delius, Helmchen, Linden, Smith, Staudinger, Steinhagen-Thiessen, & Wagner (1999).

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Singer, T. (2000). *Testing the limits of memory skill: An investigation of cognitive plasticity in very old age*. Doctoral dissertation, Freie Universität Berlin.

adulthood (30–50 years) and exhibit robust and more general decline in old age. In contrast, the crystallized pragmatics, understood as the culture- and knowledge-based software of the the mind, generally shows a relatively stable development pattern at least into the 60s and 70s.

Contrary to this differential pattern obtained for middle and young-old age, BASE findings regarding the age range from 70 to 100 suggest general rather than dimension-specific age trends in the mechanics and the pragmatics of intelligence (Lindenberger & Baltes, 1997; see Fig. 1). Intellectual function-

ing was assessed using a computerized battery of 14 subtests covering five abilities (perceptual speed, memory, reasoning, fluency, and knowledge). As indicated by the scatterplots in Figure 1, **individuals in old age continue to differ in their level of cognitive performance at all ages.**

There are several findings that are helpful in understanding the pervasive decline in intellectual efficacy obtained. All point to the relative increase in the role that biological-genetic factors play in advanced old age.

First, dissertation research by Tania Singer (2000) on a subsample of the oldest-old participating in BASE demonstrated that the quantity and quality of cognitive plasticity shows a sizeable loss in old age. Using a cognitive training paradigm and instruction in a memory technique (the Method of Loci), the 70- to 100-year-olds evinced little potential for *new learning*.

Second, Lindenberger and Baltes (1997) showed that **individual differences in advanced old age are closely connected with biological indicators of function, such as vision, hearing, and gait/balance.** They also showed that these factors become dominant in that category of the mind, that is crystallized pragmatics, where in adulthood socio-environmental and learning factors are the predominant explanatory conditions. In the same vein, the 70- to 100-year cross-sectional age gradients of intellectual abilities did not differ for persons above or below the mean on life-history variables, such as education, prestige, social class, or income.

While these findings await further testing with longitudinal data, their pattern is consistent with the lifespan architecture and the dual-process model of intelligence (i.e., fluid mechanics and crystallized pragmatics) outlined by Baltes (1997). When it comes to the "hardware-like" mechanics and the

Age-related and individual differences in intellectual functioning from 70 to 100+

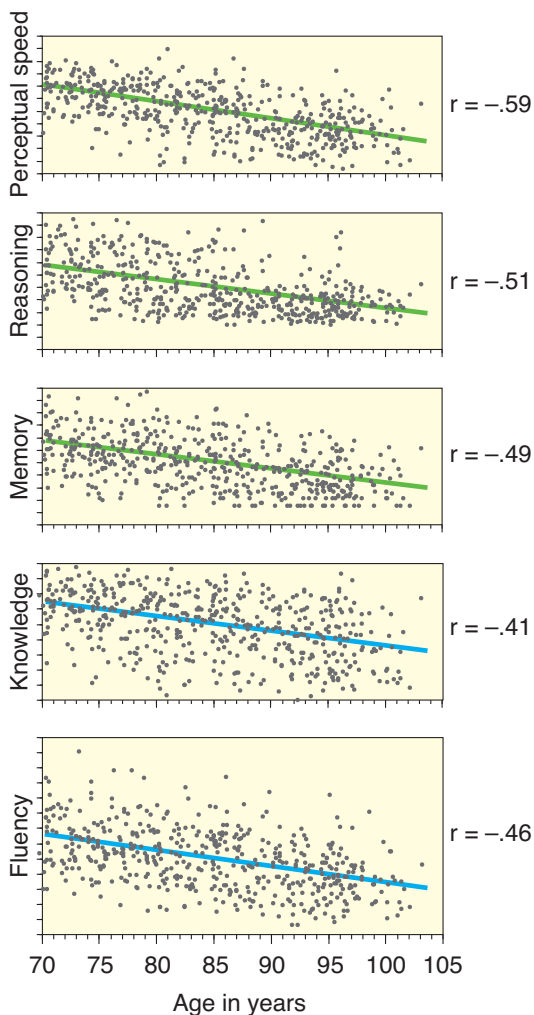


Figure 1. Negative cross-sectional age gradients (70–100+ years) for five intellectual abilities. Each ability is assessed by several subtests (Lindenberger & Baltes, 1997).

speedy and accurate functioning of basic mechanisms of information processing, old age takes its toll. Constraints and losses associated with the mechanics of intelligence are closely linked to biological and physical indicators of functioning. Conversely, whereas the lifelong contributions of life history and cultural factors to the pragmatics of intelligence continue to provide an advantage in terms of absolute level of functioning, they do not appear to protect against the rate of decline and loss of intellectual capacity. In old age, the compensatory role of culture and culture-based resources becomes less efficient.

Personality, Self, and Well-Being in Old Age

Stereotypes of old age suggest that **desirable personality characteristics decrease and less desirable ones increase in old age**. BASE data allowed us to examine this. Desirable characteristics were defined as those which researchers have found to positively influ-

ence the process of dealing with life problems: for example, an interest in being with others (extraversion), openness to new ideas and experiences (openness), frequent experience of positive emotions (positive affect), and a feeling of being in control of one's life (internal control). Psychologically less desirable characteristics are those which are known to signal elements of dysfunctionality, such as neuroticism, negative affect, and the belief that one's life is controlled by others (external control). Although the age correlations found in BASE for these dimensions were relatively small and mean differences amounted to less than 0.5 *SD*, the trends were nevertheless in line with the stereotypical expectations (Smith & Baltes, 1999b; see Fig. 2).

As a whole, these trends toward increased dysfunction could be interpreted as a type of chronic stress reaction. Such an interpretation would also be consistent with the architectural metatheory outlined by Baltes (1997). In advanced old age, individuals may be

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Age differences in personality characteristics

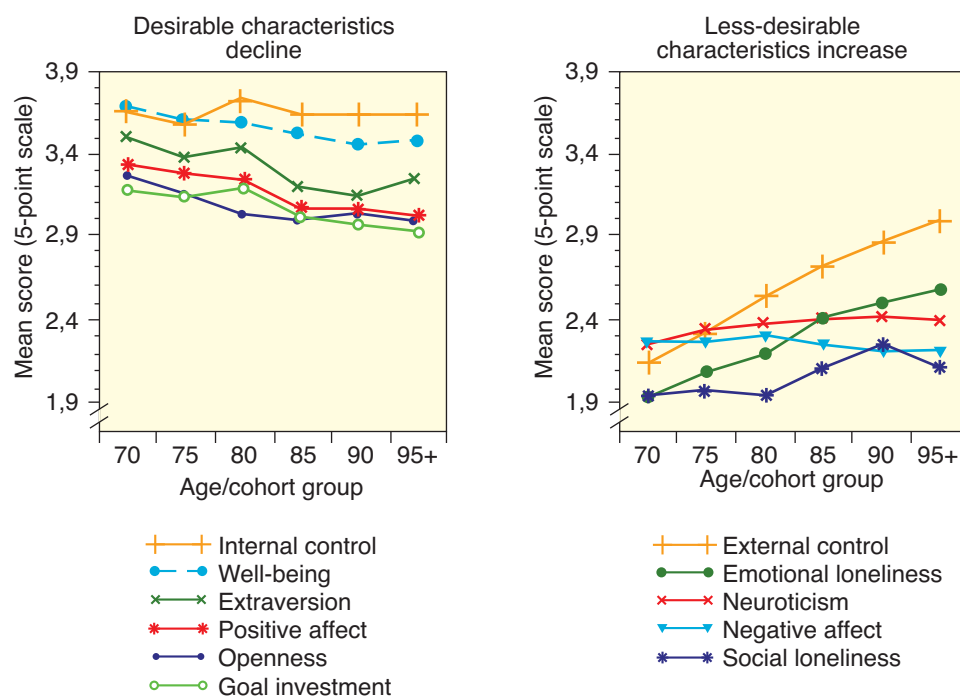


Figure 2. Cross-sectional age-gradients in desirable and less-desirable personality characteristics. Considered together, the small but negative age differences in desirable characteristic and the positive age differences in less-desirable characteristics suggest something like a chronic stress reaction in the self in old age. Such a picture supports these regarding generalized loss-related decline (Smith & Baltes, 1999b).

Gender differences in psychological functioning: 70 to 100+ years

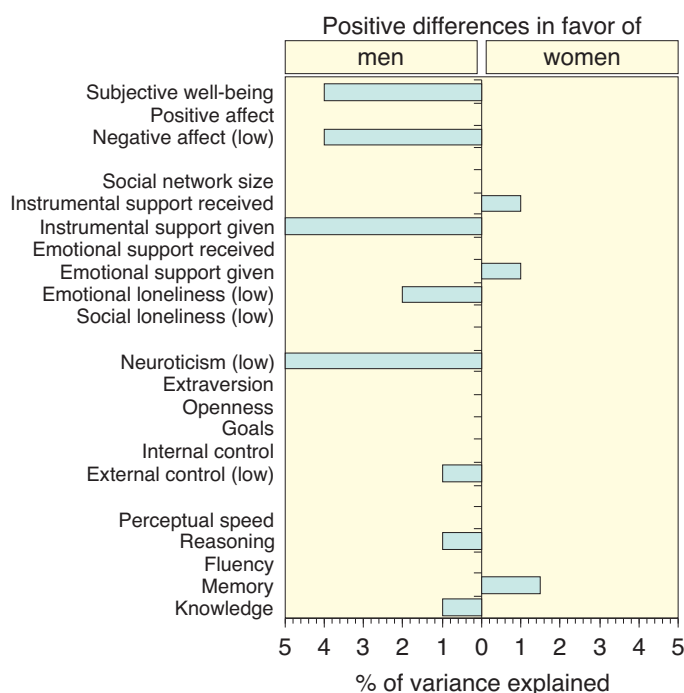


Figure 3. Older men and women in BASE differed on 11 of 21 psychological constructs examined (e.g., well-being, social support, neuroticism, and intellectual functioning). For 8 constructs differences favored men. The percent of individual difference variance explained by gender was small, but overall this pattern of findings together with the generally lower social status and greater disability levels of women suggests that life quality is lower for older women in very old age (Smith & Baltes, 1998; M. M. Baltes et al., 1999).

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Smith, J., & Freund, A. M. (in press). The dynamics of possible selves in old age. *Journals of Gerontology: Psychological Sciences*.

pushed to the limits of their adaptive psychological capacity (Staudinger et al., 1999). First longitudinal analyses of the BASE data support this conclusion.

Aspects of the self (e.g., self-definitions, future self-scenarios) are expected also to show differential and age-related change and to reflect the dynamic interaction between individuals and their environment. In BASE, we found small negative age differences in the content of self-definitions obtained using the “Who am I” task (Freund & Smith, 1999). Longitudinal analyses of hopes and fears about the future self revealed that this motivational system is intact in old age (Smith & Freund, in press). BASE participants focus more on achieving new aspects of hoped-for selves than on maintaining present

ones: 72% added new hopes about personal projects over a four-year period and 27% added highly elaborated possible self-images (i.e., ideas about the future self that were both positive and negative). The majority of possible selves were related to personal characteristics and health issues.

How about general well-being? Within the cross-sectional BASE sample, there was some indication that overall subjective well-being, expected future life satisfaction, and especially the experience of positive emotions including happiness may decrease from age 70 to 100 (Smith et al., 1999). Subsequent analyses of longitudinal data from the BASE sample have indicated that these small age-related correlations do represent age-related change and that older age in association with declining health predicts decreases in positive well-being (Kunzmann, Little, & Smith, 2000; Smith, Maier, & Borchelt, in press).

Gender Differences in Psychological Functioning in Old Age

Are there gender-related differences in psychological functioning in late life and do these reflect the life contexts and cumulative life histories of older men and women? In old age, gender as a variable carries differences in physical frailty and life conditions (e.g., education, marital status, income, types of illness) that likely have consequences for psychological functioning.

When we examined this question in the context of BASE, we indeed found significant differences between men and women: On 11 of 21 psychological constructs examined, the direction of the difference favored men (Smith & M. M. Baltes, 1998; see Fig. 3). In terms of level, these differences represented less than 0.5 *SD* and accounted for between 1% and 8% of the individual differences variance. In comparison, for the same set of variables, 0% to 14% of

the variance was age-related. The total picture, however, suggests that old age may be a less positive experience for older women than for older men.

Does Psychological Functioning Predict Mortality?

The psychological literature includes several proposals suggesting that in old age, **lower levels of psychological functioning are associated with imminent death.** Of course, illness and frailty are primary predictors of mortality in old age. However, it is also important to know if some dimensions of psychological functioning (i.e., behavior indicators) are unique predictors.

The explicit goal of our work in BASE has been to compare the predictive power of intellectual functioning, subjective well-being, personality characteristics, and social relationships in relation to mortality in very old age (Maier & Smith, 1999; see Fig. 4). Our analyses suggest that the prediction of mortality in old age may not just be specific to intellectual functioning, but rather extends to self-related evaluations of personal well-being. As a domain, intellectual functioning certainly provided the strongest and most robust set of predictors. Effects associated with predictors from the personality, self-related, and social domains appear to be more subtle. With one exception (dissatisfaction with aging), as shown in Figure 4, these predictors were only revealed as significant risks in analyses that did not first control for associations between age, SES, health, and mortality.

Subgroup Profiles: A Fourth Age?

The following analyses are generated by two lines of thinking. One reflects one of the theoretical orientations of BASE, namely a concern with systemic aspects of aging. The second is our interest in examining whether the theoretical proposition to distinguish between a

Psychological predictors of mortality in old age

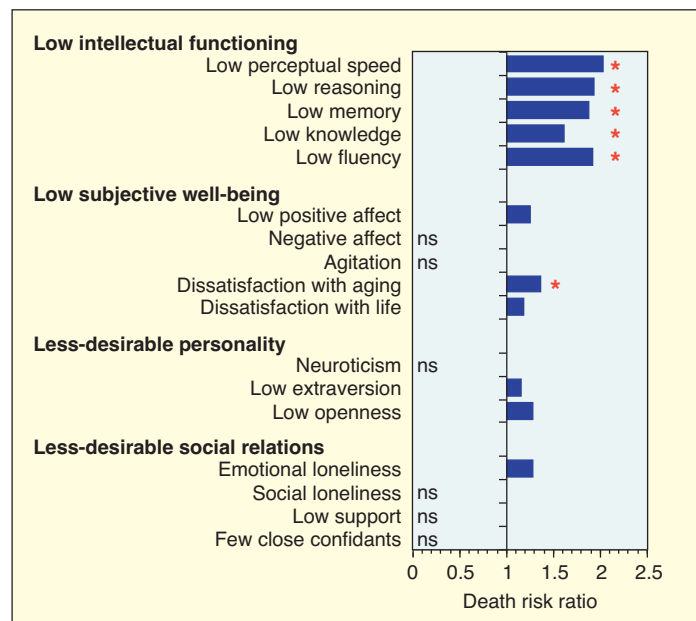


Figure 4. At the zero-order level, psychological constructs predicted increased risks of death in the BASE sample. For example, for every 1 *SD* decrease in perceptual speed, the risk of death was 2 times higher. 6 of the 11 predictors remained significant (indicated by *) after controlling for age, SES, and health (Cox regression) (Maier & Smith, 1999).

Third and a Fourth Age is empirically useful. Note in this context that this distinction while approximated by the distinction between 60- and 80-year-olds is not fixed. In general, for theoretical reasons (Baltes, 1997), we consider the point of discontinuity between young-old age and the oldest-old to be a moving target. The best approach may be to use the age at which 50% of the birth cohort have died. Currently, that would place the age point around 80 years.

One approach to examine systemic and **Third versus Fourth Age** effects is to consider a large number of indicators. In this vein, Smith and Baltes (1997; see also Baltes, 1997; Mayer et al., 1999; Smith & Baltes, 1998) used cluster analysis as an "unbiased" method to identify individuals who psychologically were more or less similar to each other based on their "profile" cluster membership. These profiles were derived from scores on 12 measures of intellectual, social, and self-related functioning. The cluster analysis illustrated that, even if such multivariable profile

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comparisons were considered, major age differences resulted. Of the 9 subgroups extracted, 4 reflected different patterns of desirable functioning (47% of the sample) and 5 less desirable functioning (53%; see Fig. 5).

Specifically, among the 70- to 84-year-olds in BASE, 70% were included in the high functional status (desirability) groups. Among individuals over 85 years, only 25% were in the desirable groups and 75% in the less desirable groups. The relative risk of membership in the less desirable profile groups was 2.5 times higher for the oldest-old than for the 70- to 84-year-olds. Women were more prevalent in the less functional profile groups. The relative risk for women was 1.25 compared to men. Whereas 53% of the men in BASE were members of desirable profile groups, only 41% of the women were. These risks remain if individuals with diagnoses of dementia were excluded from the analyses.

At the same time, and these findings speak to the continuing heterogeneity

of psychological aging, there was considerable overlap in age membership among the 9 subgroups. No subgroup was *exclusively* associated with one of the age/cohort groups in the BASE study design. Clearly, however, different proportions of each age group were represented in each of the profile subgroups (see Fig. 5).

These are dramatic age and gender differences in risk ratios. While longitudinal analyses need to be conducted to substantiate this pattern of results, the central outcome is unlikely to change. The oldest-old are at a much higher risk for dysfunctionality than the young-old. **Psychologically speaking, advanced old age appears to be a situation of great challenge and a period characterized by chronic stress.** Advanced old age, the Fourth Age, is a kind of testing-the-limits situation for psychological resilience.

Indeed, subsequent analyses have shown that there are considerable subgroup differences in the likelihood of survival over a six-year period after baseline assessment. Individuals in the desirable clusters lived significantly longer than individuals in the less desirable clusters. The odds of death significantly increased by a factor of 2.3 with membership in a less desirable profile group (Smith & Baltes, in prep.). A unique effect for cluster categorization remained after controls were added to the analysis for age, gender, physical health, and functional capacity. The survival differential based on cluster membership was seen for people aged 70 to 84 years as well as over 85 years. Among individuals over 85 years (where fewer than 50% survived longer than 6 years), the finding is highly significant: On average individuals over 85 years in the desirable clusters lived about 2 years longer than individuals in the less desirable clusters.

Age distribution in 9 profile subgroups ranked from 1 (high) to 9 (low) for desirability (functional status)

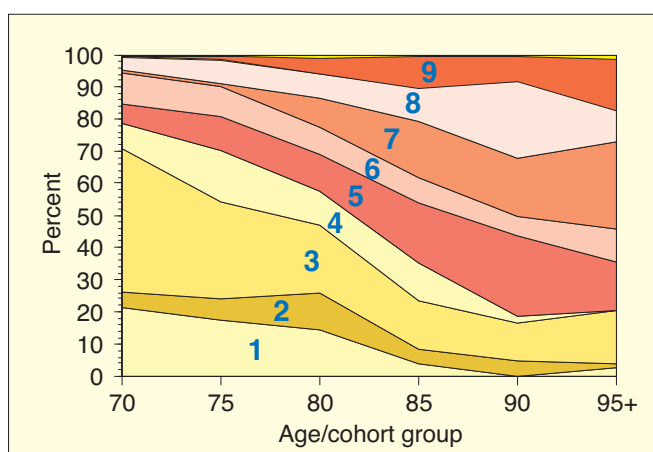


Figure 5. Cluster analysis of 12 psychological constructs suggested 9 subgroups in BASE characterized by different profiles of functioning that were ranked from 1 (high) to 9 (low) for desirability (functional status). The finding that 70% of people aged 70 to 84 belonged to subgroups with desirable profiles (1–4) compared with only 25% of the oldest-old, supported proposals that it is possible to distinguish a Third and a Fourth Age in terms of psychological functioning (Smith & Baltes, 1997).

Scientific Investigators

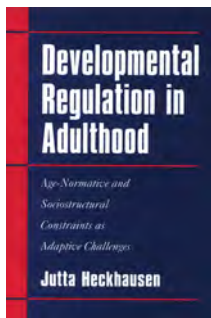
Jutta Heckhausen
(until 2000)

Carsten Wrosch
(postdoctoral fellow,
until 1999)

Regina Wolf
(predoctoral fellow)

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Research Project 5 Regulating Development by Controlling the Environment and the Self

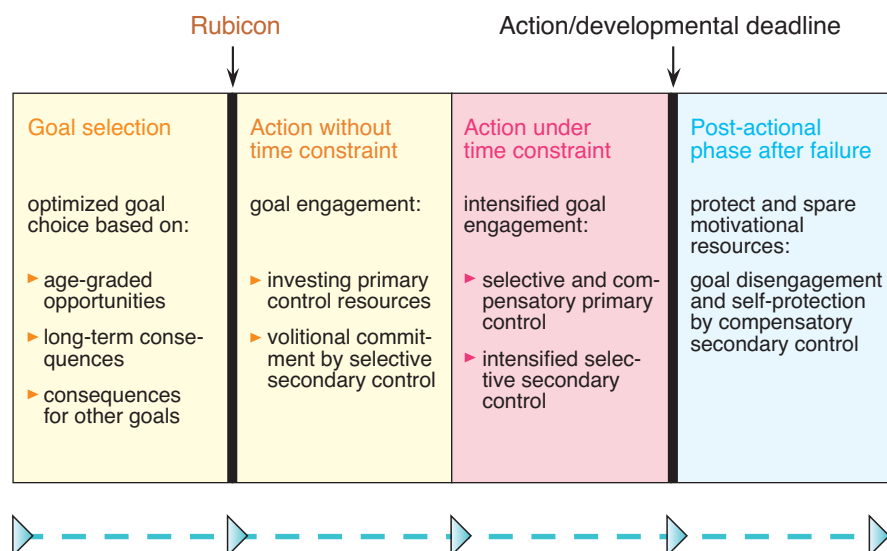
In general conceptual agreement with the theoretical orientation of viewing successful lifespan development as the result of processes of selection, optimization, and compensation, Jutta Heckhausen (in collaboration with Richard Schulz, University of Pittsburgh) elaborated a theory of successful development that took research and theory of the psychology of control as a starting point. In this vein, she argues that most individuals try to take charge of their development, and attempt to influence transitions and the course of change in their lives. The way they do this is by striving to control important events and changes in their immediate environment in the workplace, the family, and other important venues of everyday life. One important component in this striving for control is to control oneself, one's emotions, one's goals and motivations, one's hopefulness and energy to act.

These two aspects of control, controlling the environment and controlling the self, are the key elements of the lifespan theory of control (Heckhausen, 1999; Heckhausen & Schulz, 1993, 1995; Schulz & Heckhausen, 1996, 1997). This theory addresses basic motivational phenomena and their implications for development throughout the life span. The fundamental assumption is that individuals at different ages, and under different socio-economical and historical conditions need to master two fundamental challenges of developmental regulation: **selectivity and failure compensation**. Human development and behavior in general needs to be se-

lective with regard to the goals pursued. Moreover, such goal selections and the inevitable losses encountered throughout life and particularly in old age require mechanisms, which compensate for the negative effects of failure on motivational resources.

Both these basic challenges are mastered by the use of **two types of control strategies**. Primary control strategies address the external world and represent attempts to control effects in the environment. Secondary control strategies, by contrast, target the internal world of the individual and represent attempts to protect motivational resources and emotional balance (hope-

Figure 1. Action-phase model of developmental regulation.



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Wrosch, C., & Heckhausen, J. (1999). Control processes before and after passing a developmental deadline: Activation and deactivation of intimate relationship goals. *Journal of Personality and Social Psychology, 77*, 415–427.

fulness, positive self-regard). The life-span theory of control proposes that both types of control strategies ultimately serve the function to promote the long-term potential of primary control across the life span. The general research strategy in this project is the investigation of individuals' attempts to regulate their own development as a function of relevant constraints and challenges in the biological (including aging and health-related) and social (including sociostructural, cultural, historical) context.

We study **three kinds of control processes**, which serve to promote the engagement for a particular life goal (e.g., bearing a child, establishing a career): Selective primary (invest resources in primary goal attainment), compensatory primary (involving external assistance), and selective secondary (motivational focusing on selected goal striving). In contrast to the control processes of goal engagement, processes of compensatory secondary control help the individual to disengage from a goal (e.g., by finding disadvantages of the goal) that is or has become unattainable and protect the individual from the motivational-emotional costs of failure or losses (e.g., by attributing failure to

external factors).

In successful development, these **control strategies of goal engagement and of goal disengagement** are activated in accordance with the actual chances to attain goals. Thus, goal engagement is intensified when opportunities are favorable, and goal disengagement takes place when opportunities have vanished (e.g., "biological clock" for childbearing). In particular, we have studied developmental transitions, when the individuals undergoing these transitions knew in advance that their opportunities for reaching certain important goals in life (e.g., find a long-term partnership, bear a child) would become severely impoverished after passing a certain deadline. Such challenges for **appropriate timing** of goal engagement and disengagement are not uncommon in development, since we all are undergoing radical changes in physiology and in social roles across the life span.

Thus, transitions around **developmental deadlines** are highly active phases of developmental regulation. Developmental deadlines are characterized by age-graded changes in opportunity structures and require controlled shifts between a primarily primary control-

oriented mode of goal engagement to a mode of goal disengagement dominated by compensatory secondary control.

Four types of deadlines were addressed. First, we investigated the developmental deadline associated with **childbirth** for women in their thirties (Heckhausen, Fleeson, & Wrosch, in press). The findings suggest that women before compared to women after the deadline hold different mind-sets with regard to the topic of childbearing and upbringing. Pre-deadline women were more engaged with childbearing goals, and reported to use goal engagement control strategies. Post-deadline women were more focused on other goals (e.g., work, friends, self) and used more compensatory secondary control strategies to distance themselves from family-related goals. These motivational mind-sets can be empirically demonstrated not only at the level of explicit control strategies but also in terms of biased information processing.

A second study addressed another type of deadline-ridden developmental task, **partnership and separation** (Wrosch & Heckhausen, 1999). In this study, recently committed and separated individuals were compared at two age levels, early adulthood and late midlife. The contrasting opportunity and goal structures of the subjects in the different groups were found to be reflected in the preferred strategies of control in this domain (goal engagement vs. goal disengagement control strategies), and in differential incidental memory for positive versus negative aspects of partnerships. In addition, a 15-month longitudinal follow-up revealed that deadline-consistent compared to deadline-inconsistent control strategies predicted greater psychological well-being.

A study currently underway and funded by the German Research Foundation addresses adolescents' develop-

mental regulation during the **transition from school to vocational training**.

During the tenth grade of high school (German Realschule) applying for and attaining a position for an apprenticeship is an urgent task that typically should be completed before the adolescents' graduation from school. However, the economic crisis has rendered this transition into vocational training a highly challenging one, since many adolescents fail to find a position. Developmental regulation during this important life-course transition thus requires a skillful orchestration of primary control striving, goal adjustment in terms of aspirations for high status vocations, and self-protection to avoid motivational depletion.

Finally, in a collaborative study with Richard Schulz (University of Pittsburgh) the relationship between **depression and health-related engagement versus disengagement** was studied in older adults who faced either chronic or acute health stress. The findings showed that older adults who face chronic diseases reported reduced depression if they disengaged from health goals. In contrast, older adults confronted with acute health stress benefited from engagement in health goals. Based on this study, collaborative work is continued that addresses possible interventions to optimize motivation and control processes in depressed elderly to facilitate their mental health. (As of 2001, Jutta Heckhausen is full professor of psychology at the University of California, Irvine.)

Research Project 6

Parent-Adolescent Relationships: Family and Differential Perspectives

An important assumption underlying our research on successful development is that development is a dynamic process of both reacting to and proactively shaping one's environment as well as oneself. Relevant developmental environments involve both institutional structures (e.g., educational system, labor market) and specific social systems, such as the family. The importance of mutual adaptation and dynamic interaction is apparent in the family where not only the individual member (e.g., the adolescent) develops, but the other family members and the family system as a whole change in a coordinated manner.

The following project exemplifies this perspective in the context of parent-adolescent development. A total of 67 families with two or more children were studied longitudinally over three-and-a-half years in eight waves. Among other measures, interactions between parents and their children were videotaped (Kreppner, 1996, 2000).

We must begin to identify individuals, couples, and families, who are more likely than others to have difficulty in coping with transitional change.
(Cowan, 1991, p. 19)

Scientific Investigators

Kurt Kreppner

Manuela Ullrich
(predoctoral fellow, until 1999)

From Childhood to Adolescence in the Family

When children run through major developmental transitions, parents have to pay special attention to their offspring's physical and psychological changes.

New needs emerge and have to be satisfied, and new skills and competencies in the child may challenge the parental routines to handle everyday life. During these developmental transitions, the relationship between parents and the child has to be adapted to the child's new developmental level. The role of relationships between parents and the

child and, under a more holistic perspective, the role of the relational context of the entire family has become a major focus in developmental research for the analysis of differential developmental pathways. Such differences oftentimes were traced back to various social backgrounds, parental educational styles, personal history, or family structure, but it remained unclear, how a child is experiencing his or her proximal environment and the relational conditions inside the family. The mode

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and quality of communication inside the family by which the relationship between parents and children can be renegotiated during critical transition periods has become an important indicator for the essential condition that fosters or impedes the family's coping with stress associated with the child's development. Transition from childhood to adolescence is a unique period in an individual's life where major changes in both body and ego development occur.

One major goal of this **longitudinal study** was the exploration of differences in **communication patterns within the family**, as they occur in parent-child as well as in parent-parent or in sibling communications during the transition period. In order to explore divergent types of families and their ways to deal with children's developmental changes, various sources of information

were included in the study. One source consisted in adolescents' self-reports about relationship quality inside the family, such as everyday dependability and ambivalence, another included well-being and various aspects of self-esteem, and still another source encompassed concrete communication behavior between family members, including not only parent-child dyads but also parent-parent and sibling-sibling dyads. Naturalistic and semi-structured observations (on videotape) provided a rich record of the families' patterns of interaction and communication.

General trends of changes in communication patterns were found in parent-adolescent discussions over time. Communication formats indicating parental modes of talking to the child as a child like "teaching" or "giving attention" decreased during the three-

and-a-half year period, whereas frequencies for behaviors like "negotiation" or "exchange of statements" (signifying affirmation of one's own position) increased in both mothers' and fathers' communication modes (Kreppner, 2000; see Fig. 1).

The impact of parental socialization activities varies considerably among families and according to children's developmental stages. Adolescents' assessments of the quality of relationship with their parents and self-reports were used as a criterion to distinguish among

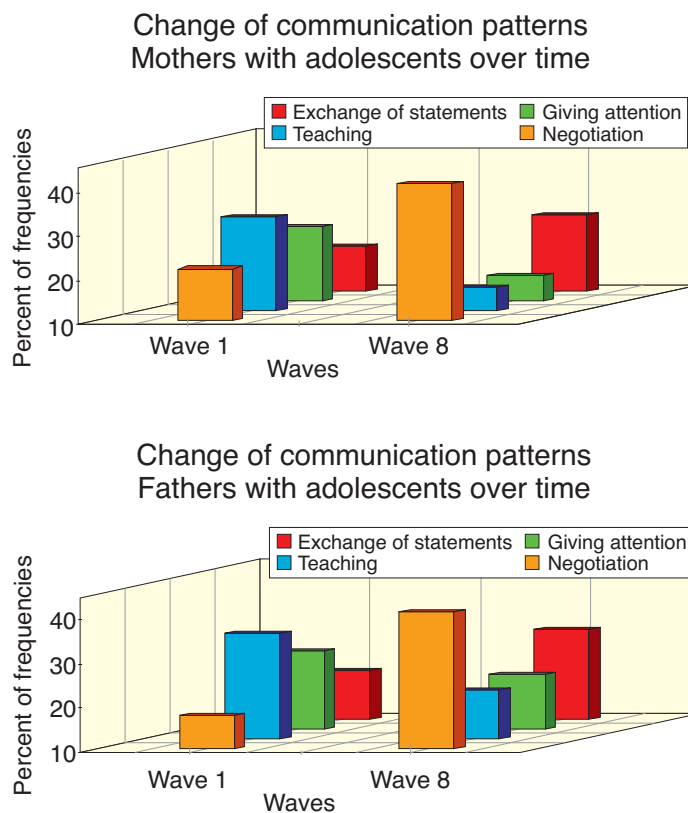


Figure 1. Changes of communication patterns between mothers and adolescents as well as between fathers and adolescents during the transition period from childhood to adolescence: General trends (Kreppner, 2000d).

different types of families. **Three groups of adolescents** were distinguished on the basis of having provided consistent responses over time on three relationship scales. These three groups described adolescents as showing "secure," "habitual," or "ambivalent" relationships with their parents over time. The most striking changes in family communication were found for groups in which adolescents had rated the quality of the relationship with the parents as being consistently "secure" or "ambivalent." For example, in the families of "secure" adolescents, fathers' integrative modes of communication, on the one hand, and the use of "statements" in discussions (exchange of different opinions without a common solution) changed considerably over time. The adolescents from the secure group, for their part, experienced this changes in a climate of emotional closeness. In contrast, in families of "ambivalent" adolescents, fathers did not show such time-specific variations in discussing different opinions, and adolescents did not experience a comparable degree of closeness during discussions with their fathers (Kreppner & Ullrich, 1998).

One interpretation of these findings is that fathers of secure adolescents very sensitively lead their children toward a more "adult" way of discussing controversial issues, they decrease step by step the more child-oriented mode of integrative communication and increase slowly the exchange of statements. In contrast, fathers of ambivalent adolescents do not show this age sensitive variation in their behavior (see Fig. 2).

Moreover, when adolescents from the secure and ambivalent group were compared, major differences were found in various aspects of self-esteem, pointing to a continuously higher level of self-esteem in adolescents from the secure group compared to adolescents

from the ambivalent group (Kreppner, 1996).

Another series of data analyses dealt with differences in communication patterns between mothers and adolescents in divorced and non-divorced families. Results indicate that negotiations between mothers and their children concerning the reorganization of an extant relationship end up more frequently in a more egalitarian and partner-oriented communication than this is the case in non-divorced families, where rule- and principle-oriented controversial communication between mother and adolescent prevail (Kreppner & Ullrich, 1999).

Finally, further data analyses centered on a comparison between parent-first child and parent-second child communication patterns pointing to a high degree of family consistency with re-

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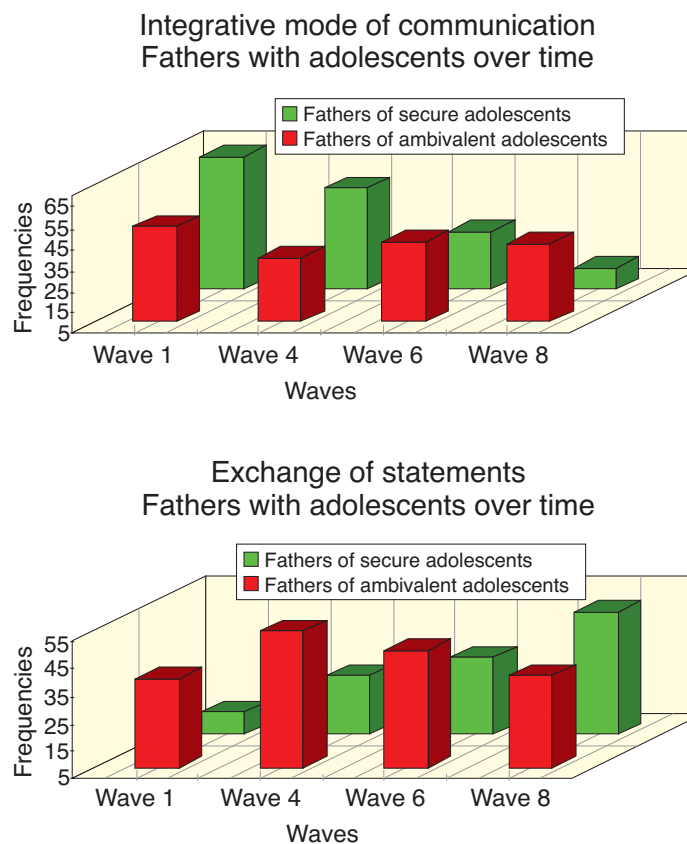


Figure 2. Comparison of development-sensitive with development-insensitive communication modes of fathers during their children's transition period: Trends for fathers of secure and ambivalent adolescents (Kreppner, 2000b).

gard to the creation of high or low closeness across all family relationships (Kreppner & Ullrich, 2000).

In sum, parent-child relationships undergo considerable changes during the passage from childhood to adulthood. Families do not only adapt their present repertoires of communication skills while dealing with transition problems, but also differ in their flexibility to produce new communication pat-

terns appropriate to meet their children's changing demands for more autonomy and adult formats of communication. Research centered on the detailed description of differential communication modes inside the family may slowly reveal the complexity of communication patterns which are typical of families that either successfully or unsuccessfully master developmental transitions during the life span.



International Encyclopedia of the Social and Behavioral Sciences

Together with Neil J. Smelser, director of the Center for Advanced Study in the Behavioral Sciences, Stanford, USA, Paul B. Baltes is the co-editor-in-chief of the new *International Encyclopedia of the Behavioral and Social Sciences*. It will be published by Elsevier Science Ltd. in Fall 2001 and will comprise 24 volumes. Julia Delius serves as Scientific Editorial Assistant. The major administrative tasks lie with the publisher.

Scientific Investigators

Paul B. Baltes
Julia Delius

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Smelser, N. J., & Baltes, P. B. (Eds.-in-chief). (in press). *International Encyclopedia of the Social and Behavioral Sciences*. Oxford, UK: Elsevier Science.

Work on this project began in 1997. Working closely with the two editors-in-chief, 51 section editors are responsible for a wide range of areas (from evolutionary sciences to the behavioral and social sciences to philosophy, see Table). Institute co-director Karl Ulrich Mayer is the responsible editor for the section on biographies.

More than 90% of the 4,000 anticipated entries have been submitted to the publisher. They are now either in review or in the production process. Review involved two stages: a first review by the responsible section editor, a sec-

ond and final review by the editors-in-chief, who are assisted by a team of experienced readers.

The authors come from more than 50 countries. About 79% are men, 21% women. Regarding continents, about 57% are North American (more than 2,000 are from the USA), 35% European (more than 400 are from Germany and the UK, respectively, and over 100 from France and the Netherlands), and 8% from the other regions of the world (e.g., more than 50 from Japan, 40 from Israel, and 25 from India).

International Encyclopedia of the Social and Behavioral Sciences: Basic Plan
Neil J. Smelser & Paul B. Baltes (Editors-in-Chief), Elsevier, 2001

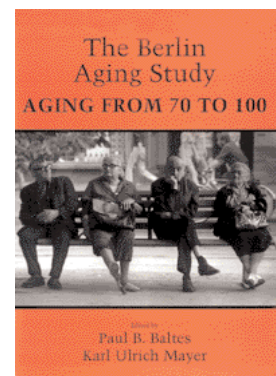
Sections, Section Editors, and Planned Number of Articles (January 2001)

History/Theory/Methodology		Disciplines		Intersecting Fields		Applications		
1.1	Institutions and Infrastructure D. L. Featherman, USA	36	3.1 Anthropology U. Hannerz, Sweden	195	1.5 Integrative Concepts and Issues R. Scott & R. M. Lerner, USA	35	3.12 Clinical and Applied Psychology T. Wilson, USA	150
1.2	History of the Social & Behavioral Sciences P. Wagner, Italy	91	3.2 Archaeology M. Conkey & P. Kirch, USA	51	4.1 Evolutionary Sciences W. Durham & M. W. Feldman, USA	67	5.1 Organizational and Management Studies A. Martinelli, Italy	88
1.3	Ethics of Research and Applications R. McC. Adams, USA, & J. Mittelstraß, Germany	45	3.3 Demography J. Hoem, Sweden	129	4.2 Genetics, Behavior, and Society M. W. Feldman, USA, & R. Wehner, Switzerland	57	5.2 Media and Commercial Applications M. Schudson, USA	86
1.4	Biographies K. U. Mayer, Germany	150	3.4 Economics O. Ashenfelter, USA	95	4.3 Behavioral and Cognitive Neuroscience R. F. Thompson & J. L. McClelland, USA	219	5.3 Urban Studies and Planning E. Birch, USA	80
2.1	Statistics S. Fienberg & J. B. Kadane, USA	134	3.5 Education F. E. Weinert, Germany	134	4.4 Psychiatry M. Sabshin, USA, & F. Holsboer, Germany	80	5.4 Public Policy K. Prewitt & I. Katznelson, USA	91
2.2	Mathematics and Computer Sciences A. A. J. Marley, Canada	139	3.6 Geography S. Hanson, USA	130	4.5 Health R. Schwarzer, Germany, & J. House, USA	148	5.5 Modern Cultural Concerns (Essays) R. A. Shweder, USA	55
2.3	Logic of Inquiry and Research Design T. Cook & C. Ragin, USA	86	3.7 History J. Kocka, Germany	156	4.6 Gender Studies P. England, USA	78		
4.10	Science and Technology Studies S. Jasanoff, USA	73	3.8 Law M. Galanter & L. Edelman, USA	165	4.7 Religious Studies D. Martin, UK	54		
			3.9 Linguistics B. Comrie, Germany	129	4.8 Expressive Forms W. Griswold, USA	33		
			3.10 Philosophy P. Pettit, Australia, & A. Honneth, Germany	102	4.9 Environmental/ Ecological Sciences B. L. Turner II, USA	75		
			3.11 Political Science N. W. Polsby, USA	192	4.11 Area and International Studies M. Byrne McDonnell & C. Calhoun, USA	137		
			3.13 Cognitive Psychology & Cognitive Science W. Kintsch, USA	182				
			3.14 Developmental, Social, Personality, & Motivational Psychology N. Eisenberg, USA	174				
			3.15 Sociology R. Boudon, France	204				

Note. Encyclopedia will be arranged alphabetically by titles of articles.

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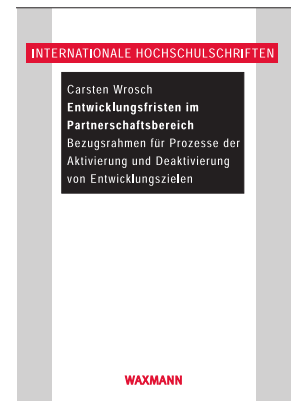
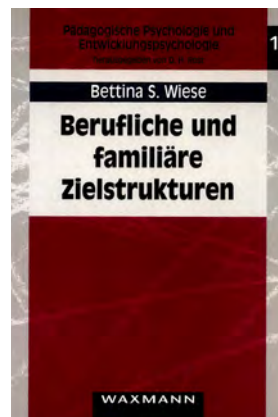
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**Center for
Sociology and the Study
of the Life Course**

Contents

Research Program and Research Projects	171
Education, Training, and Occupational Careers: Recent West German Experiences in an Historical and Cross-National Perspective	177
Education and Mismatch in the Labor Market	186
East German Life Courses during the Transformation of the Former GDR ...	191
Further Projects and Activities	198
Publications 1998–2000	201

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Research Program and Research Projects

Sociological Research at the Max Planck Institute for Human Development Sociology as a scientific discipline is interested in the formation of institutions and in the social behavior and actions of individuals embedded in institutions. Within the specific context of an interdisciplinary institute for human development, sociology can make two kinds of contributions. First, it examines the roles which the family, the educational and training system, the occupational structure, and the welfare state play in the development and life courses of individuals. Second, it examines the way in which specific life-course patterns express and affect the distribution of life chances.

We share substantive topics, theoretical perspectives, and methodological approaches with the other Centers of the Institute. With the Center for Educational Research we share an interest in the conditions of attainment in education and training. We are also interested in both the individual and social consequences of differential educational attainment. The longitudinal surveys of the two Centers overlap in the life phase occurring at the end of schooling

and early labor market experience. We are currently cooperating with the Center for Educational Research in the new version of the German Education Report. With the Center for Lifespan Psychology we share an interest in the full life course from birth to death, particularly the interplay between social environments and individual development. These common interests resulted in the joint Berlin Aging Study and joint research on psychological covariates of

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employment trajectories in East Germany during the unification process. With the Center for Adaptive Behavior and Cognition we share an interest in assumptions about rational behavior. Although our primary goal is to find and use appropriate individual-level assumptions in models of institutions, we also maintain an interest in the ways social structures shape and bound rationality.

Goals of the Research Program

The Center's research program is oriented toward answering **three sets of questions**:

(1) The first set of questions focuses on the relationships between the macrolevel structure of societies and patterns of the life course. In what manner and with which outcomes do institutions shape the patterns and distributions of individual life courses? We look at life courses as generated by social norms, by institutional configurations, and by opportunity structures, all of which vary across social groups as well as specific national and historical contexts. Life courses are a summary concept for the intertwined processes of residential migration, family history, education and training trajectories, employment, and occupational careers, as well as the temporal patterns of relationships to the social insurance systems. Therefore, with respect to institutions, we are primarily interested in schools and training institutions, the occupational structure and labor market, the family, and the welfare state. The relevant time dimension here is the historical time of socioeconomic change.

(2) The second set of questions focuses on the levels of individual and group action. How do individuals and families actively construct their lives? How do they experience their individual and collective life histories under the

given conditions of their own prior biography, their immediate family and work environments, and the generational contexts of their peer birth cohorts? Here we are primarily interested in the proximate influences of the mesolevel of informal groups, formal organizations, and local opportunity structures, as well as microlevel endogenous processes of the individual life course. The relevant time dimensions here are chronological age and the individual aging process, the duration of membership in families, households, and firms, as well as the time dimension of cohort and generational succession.

(3) The third set of questions focuses on feedback processes from the microlevel of individual action to the macrolevel of structural and institutional constraints. How do changes in life-course patterns shape distributional and aggregative features of social structure and institutional arrangements? What are the implications of such processes for social policies? Irrespective of how they arise, life-course patterns are powerful contexts for individual and group action. Life courses form the qualitative and quantitative basis for macrosocial change and for collective political decision-making. Accordingly, the empirical and descriptive social accounting of life-course patterns is an important research task.

We use **four perspectives** in investigating life courses. **First**, we see individual life courses as part and product of social and historical processes operating on different levels. Individual life courses are linked to the life courses of other persons (parents, partners, children, colleagues, and friends) and are embedded in the dynamics of small groups, especially the family. But life courses are also subject to the influences of social organization and the macroinstitutions of society, including

their development over time. **Second**, the life course is a multidimensional process. On the one hand, it unfolds in the different but mutually related life domains (e.g., family cycle and working life); on the other hand, it is dependent on intraindividual processes of organic and psychological development. **Third**, the life course is a self-referential process. The individual behaves and acts self-reflectively on the basis of past experiences and resources, making the life course to some extent an endogenous causal process. This is also partially true for the collective life history of birth cohorts. The past and initial conditions and characteristics of a cohort impact

both on their later collective life history (e.g., in the relationship between working lives and life in old age) and on the adjacent cohorts. The different age groups live together in the same time period, but they bring to the present their distinctive past histories. **Fourth**, through the manner in which persons shape their own life courses, they reproduce and transform the social structure. This can happen via "simple" processes of aggregation or in the form of institutional feedback.

Research Areas

The Center's research program is currently organized into the following areas:

Education, Training, and Employment

The transition between education, training, and employment is a major topic of investigation in the Center. This life phase is crucial for both intergenerational status allocation and the later life history. In reconstructing the collective transition experiences of successive cohorts, we gain empirical insights in the changing institutional linkages between the school and training systems, on the one hand, and between the labor market and the occupational structure, on the other. Moreover, we can examine controversial hypotheses about the lengthening and fragmentation of this transition period and about the increasing polarization of the opportunities for skill acquisition and early occupational careers. Other topics of research interest include the following: What are the consequences of educational expansion for working lives? Is there a crisis in the dual system of vocational training and how can this be accounted for? How widespread and serious are problems of mismatch between acquired and re-

quired skills in the labor market? Our guiding hypothesis in this research area is that despite massive distributional shifts and intense pressure for labor market flexibilization, the close linkage between education, training, and occupation persists.

Research Area 1

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Research Area 2 Life Courses in the Transformation of Former Socialist Societies

The opening of the Berlin Wall and the unification of Germany not only provided a major challenge for the social sciences to understand and guide this transition, it also provided unique opportunities for theory-guided research. On the one hand, the transformation allowed the functioning and nonviability of the former socialist society to be examined. On the other hand, it provided ample opportunities for the investigation of life courses under the impact of sudden dramatic institutional change. We have collected selected cohort/life-course data on both the German Democratic Republic and the transformation process. In addition, we

have intensified research cooperation with Polish social scientists for the purposes of comparative study. Our current investigations concentrate on the micromechanisms of individual adjustment, adaptation in the domains of family and work, the life-course consequences of institutional transfer from West to East Germany, and individual-level processes in the transformation of the system of social stratification and class. Our studies have revealed some rather surprising findings: Despite a rapid increase in labor market mobility and considerable breaks in individual careers, the pattern of social stratification has remained very stable.

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Research Area 3 Welfare State, Life Courses, and Social Inequalities

In this research area we focus on conceptual and empirical studies on the impact of various national institutional configurations on life-course outcomes. The macroinstitutions of the modern welfare state and the specific provisions and rules of the social insurance systems are among the major determining factors in the life course and in the distribution of life chances. The role of the welfare state may prove to be especially important in current societal adaptations to global competition and decreasing public finances. Microanalytic and cross-national studies are required to unravel the mechanisms and consequences of different welfare state

regimes and policies. Our guiding hypothesis for Germany holds that life courses are still relatively protected from pressures for flexibility, and that stability and continuity prevail.

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**Life-Course Research and Analysis:
Theory, Methods, and Synthesis**

This research area focuses on overarching topics and tasks: the provision of the empirical data base for our studies, methodological problems of measurement, analysis, and modeling, issues of general theory, and empirical work on the full set of cohort studies.

The Center's research program is empirically based on a series of six retrospective surveys. These surveys rely on population probability samples and were conducted from the early 1980s up to the present. They now comprise quantified life histories of 5,591 West German women and men (the cohorts born in 1919–21, 1929–31, 1939–41, 1949–51, 1954–56, and 1959–61) and 2,923 East German men and women (the cohorts born in 1929–31, 1939–41, 1951–53, 1959–61, and 1971). Moreover, fieldwork has been concluded and data editing is in progress for an additional 2,911 women and men born in West Germany in 1964 and 1971. Detailed life histories were also obtained for the 516 participants of the Berlin Aging Study, who were born between 1887 and 1922. All of these surveys are retrospective studies. We also carried out a panel study in 1996/97, re-interviewing our East German respondents from 1991/92. Data editing, the development and maintenance of the data banks, and data documentation form an important part of our ongoing research work. In the coming years our efforts will concentrate on establishing a more user-friendly data bank containing all of these cohort

studies and putting the data documentation into an electronic format.

The Research Center's own data sets are complemented with other German and non-German longitudinal studies, including the German Socio-Economic Panel (GSOEP), the Microcensus, the 1% sample of the Employment Register, the BIBB/IAB Employment Survey, and the British Household Panel Study. Our major methodological tools consist of dynamic models of discrete change in continuous time. Ongoing tasks include maintaining expertise and updating statistical software in this area, as well as improving practices of exploratory data analysis and representation.

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Current Research Projects and Research Associates of the Center for Sociology and the Study of the Life Course

Research Area 1 Education, Training, and Employment

Education, Training, and Occupation: Life Courses of the 1964 and 1971 Birth Cohorts in West Germany (MPI/IAB)—Cooperative Project with the German Institute for Labor Market Research

Michael Corsten, *Steffen Hillmert*, Karl Ulrich Mayer, Antje Mertens, Heike Trappe; Stefan Bender (IAB), Hans Dietrich (IAB)

• **Dissertation Project**
Patchwork or Career? Causes and Consequences of Multiple Educational Episodes

Marita Jacob

• **Dissertation Project**
The German Apprenticeship System in the 1990s and Its Effects on Individual Employment Chances

Holger Seibert

Education and Mismatch in the Labor Market

Felix Büchel

• **Dissertation Project**
School Performance, Occupational Choice, and Labor Market Outcomes

Matthias Pollmann-Schult

Children in the Family Division of Labor

Helga Zeiher

Research Area 2 East German Life Courses after Unification (LV-Ost)

Transformation of the East German Labor Market

Anne Goedicke

• **Dissertation Project**
Working Lives in Family Contexts

Anke Höhne

Transformation Processes in Poland and East Germany

Anne Goedicke, Bogdan Mach, Karl Ulrich Mayer

Bourgeois and Non-Bourgeois Intelligentsia in the German Democratic Republic: A Study of Biographical Upheaval

Erika M. Hoerning

Research Area 3 Welfare State, Life Courses, and Social Inequalities

Political Economy and the Life Course in Advanced Societies (POLIS)

Fran McGinnity, *Steffen Hillmert*, Karl Ulrich Mayer

• **Dissertation Project**
Leaving Home In Germany and Italy

Alessandra Rusconi

Education Report: Higher Education

Karl Ulrich Mayer

Higher Education in Germany and the US

Gero Lenhardt

Research Area 4 Life-Course Research and Analysis: Theory, Methods, and Synthesis

Post-War Social Development as a History of Cohorts

Karl Ulrich Mayer

International Encyclopedia for the Social and Behavioral Sciences (Section on Biographies)—Editorial Project

Karl Ulrich Mayer

• **Dissertation Project**
Psychology of Autobiographical Memory and the Reliability of Retrospective Measurements

Maïke Reimer

Projects Concluded in 1998–2001

Occupations as Socialization Processes Michael Corsten, DFG-Project

Changes of the Occupational Structure and Work Life Histories in East Germany Sylvia Zühlke, Dissertation Project

Organizational Contexts of Occupational Careers in East Germany after 1989 Anne Goedicke, Dissertation Project

Bridges and Traps: Labor Market Entry of Young East Germans under System Transformation Britta Matthes, Dissertation Project

The Integration of the West and East Berlin Police Force Fabien Jobard, Postdoctoral Project

Long-Term Trends in Social Mobility in Comparative Perspective Ineke Maas, HISMA-Project

Education, Training, and Transition into the Labor Market: Life Courses and Institutional Change in Britain and Germany Steffen Hillmert, Dissertation Project

Berlin Aging Study (BASE)—Sociology and Social Policy Ineke Maas, Karl Ulrich Mayer

Social Participation in Old Age Alexej Bukov, Dissertation Project

Social Inequality, Life Course, and Health at Advanced Ages Thomas Lampert, Dissertation Project

Support and Illness in Old Age Pascale Dorenlot, Postdoctoral Project

Education, Training, and Occupational Careers: Recent West German Experiences in an Historical and Cross-National Perspective

The research project *Education, Training, and Occupation: Life Courses of the 1964 and 1971 Birth Cohorts in West Germany* constitutes the latest part of the German Life History Study and focuses on the links between the West German education and employment systems during the 1980s and 1990s. Among the crucial factors shaping the life course during these two decades were educational expansion, occupational change, varying demand on the labor market, and demographic developments.

Including the new data (see text box below), our analyses can draw upon the life-course data of seven West German birth cohorts that enable us to describe the patterns of transition from general education to vocational or academic training and from training to employment. This is important because this transition process is central to inter-

generational status allocation and to the later life history observed in our data. In reconstructing the collective transition experiences of successive cohorts, we gain empirical access to the historical development of educational and occupational patterns in Germany from the 1930s onwards.

In 1998 and 1999, we added new data to the German Life History Study by interviewing a sample of 2,911 residents of West Germany born in 1964 and 1971. As a result, the work of the last two years has been mainly concerned with the process of thorough data checking and editing. We have also drawn up a conceptual framework taking up issues that have attracted much attention in public and academic debate (cf. Corsten & Hillmert, 2000). Compared to earlier stages of the German Life History Study, the project has a stronger focus on the details of vocational training and occupational careers. The research has been carried out in collaboration with the Institute of Employment Research (IAB) in Nuremberg.

Special methods for enhancing data quality have been introduced to the data collection. For example, computer-aided telephone interviewing was combined with instant consistency checking of major biographical information. The raw data then underwent detailed checking and a process of constantly monitored, rule-based correction; if necessary, respondents were re-interviewed by members of the research group. We intend to combine the close monitoring of this process with our methodological studies.

The future status of work and qualifications

Labor Market Entry—What Are Scenarios and What Are Facts?

In recent sociological discussions over the future status of work and qualifications a popular argument goes that full-time employment has lost its role as a dominant (and realistic) goal in society—standardized forms of employment no longer play a dominant role in individual life courses; careers have become highly individualized and increasingly independent of formal qualifications.

There is no consensus at all as to whether this reflects a fundamental increase in risks for individuals or whether it constitutes an increase in individual freedom. In any case, empirical accounts of these trends are rare to be found. While this also applies to macro-sociological analyses, it is particularly true of hypotheses referring to the micro-level.

In response to these contemporary debates on education and employment, we need to acknowledge empirical observations, such as massive distributional shifts, intense pressure for labor market liberalization, and, at the same time, continuing educational expansion even in the youngest cohort, that is, during the 1990s. However, our **guiding hypothesis** in this research area is that these recent developments do not necessarily contradict the persistence of a close link between education/training and occupational careers. On the contrary, our assumption is that institutionalized training forms, especially the dual system of vocational training, and educational qualifications are still the key structures in this transition process. This hypothesis is supported by empirical evidence from our earlier research.

Our collection of life-history studies represents a **unique source of information**, enabling us to shed more light on these issues. Major advantages include the ability to make long-term historical comparisons (covering almost all

of the 20th century), rich sequential data on various domains of life, and the great efforts that have been made to ensure their validity. Our basic assumption is that the concepts of the "institutionalization" and "social differentiation" of occupational careers can be investigated more closely from an historical perspective.

How Stable Have Major Institutions and Life Courses Been over the Past Decades?

In Germany, the majority of school-leavers pass through the vocational training system. Since the Second World War, this has increasingly become the standard path taken by young people. In his historical study on the development of the German system of vocational training, Konietzka (1999a) found strong evidence for the stability of both the institutional setting and the individual consequences of vocational training. He was able to show that there are still strong links between vocational training and the first job taken, as well as later career choices.

These linkages were reconstructed for five cohorts, including the younger ones born in 1954–56 and 1959–61. At least two significant results of this investigation deserve to be mentioned here. First, a lengthening of the transition phase from vocational training to the first occupational entries was found in the younger cohorts. This was balanced out by swifter upward mobility in the first phase of employment, however. Second, with respect to quality and content, 60% of those who completed vocational training subsequently worked in this occupational field, and those who stayed in the same occupation had a much better chance of stabilizing or improving their occupational status.

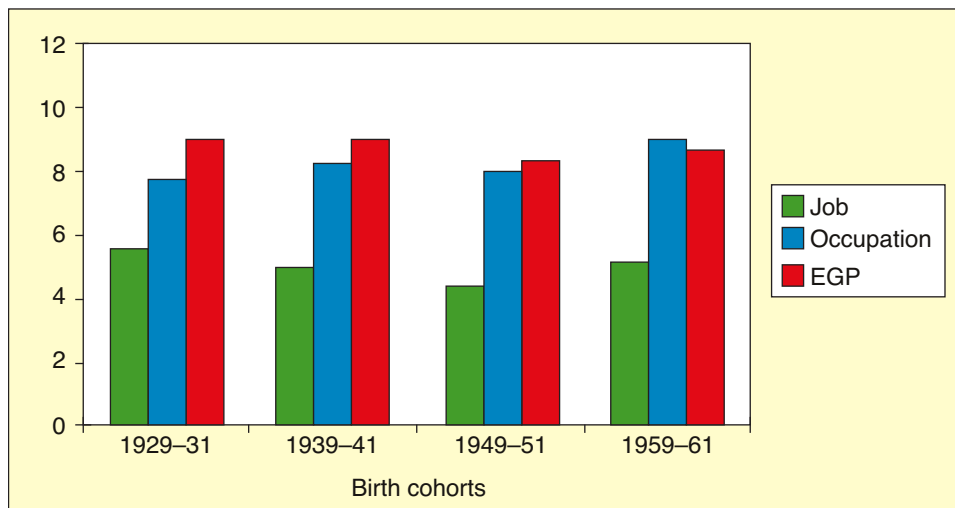
Vocational training has become a typical (if not crucial) element of the "normal career" in Germany, and the

proportion of those successfully completing their vocational training has increased across the birth cohorts under investigation—not least among women. At the same time, the proportion of those attaining qualifications in other educational forms in addition to vocational training has also increased. An interpretation of this somewhat paradoxical observation could be that vocational training is a necessary, but not always sufficient, qualification on the labor market. The first analyses with our new data suggest that these relationships have remained rather stable

during the 1980s and 1990s (cf. Hillmert, in press-c).

It is this very stability in the patterns of labor market integration (cf. also the figure below) that raises further questions about the ability of the German institutional system to adapt to rapid economic change. Is the dual system of vocational training able to provide trainees with the qualifications they need for the frequently changing demands of the workplace? In this sense, the need for life-long learning has been a major issue over the past few years.

Dimensions of early careers in Germany—median durations, by birth cohort



The figure shows the median durations with the first employer, in the first occupation (ISCO68), and in the first social class (EGP 11) on the basis of Kaplan-Meier estimates (years) for the first stable job. Both the absolute level of mobility and relative differences between the dimensions have remained relatively stable over time. The different stability of jobs and occupations means that employees often stay in the same occupation when changing employers, that is, that the human capital they have acquired can be transferred.

Is There (Still) a “Normal” Life Course?

While it is often disputed that full-time employment will persist as the core element of the individual occupational career, the structure of the social security system impacts directly on the connection between employment and retirement in the life course. Will full-time

employment continue to be the basic form of “social inclusion” in modern welfare states and, on a mesolevel, in modern organizations?

This project attempts to identify the extent to which the transitions from education to work still reflect the so-called “normal biography,” with a well-defined sequence of events and stages.

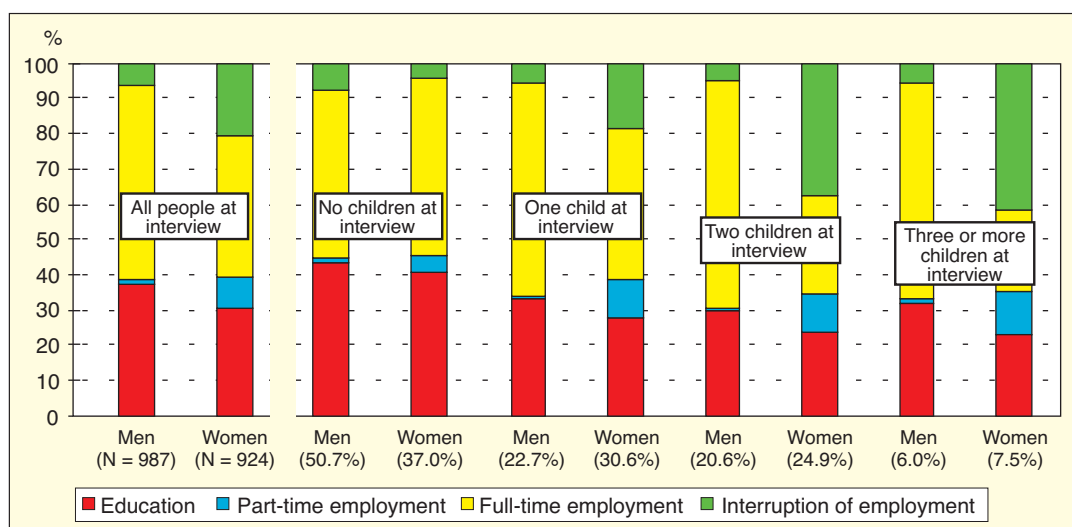
As shown by previous analyses of West German life-course data (Mayer, 2001a), the full-time career was typical of the male life-course model, whereas part-time work has been an alternative for women in all birth cohorts. Is the "feminization" of occupational career patterns an expectable trend for the beginning of the new century? Will we be able to observe a change in the male/female distribution of career models and occupational chances in life?

In order to answer these questions we need to consider and account for the social context of educational and working careers, looking, for example, at the impact of career decisions on family formation and the effects of changes in family composition on educational careers. Trappe and Rosenfeld (1998) have looked at the reproduction of social inequalities between men and women in life-course data gathered in East and West Germany. Looking at various birth

cohorts they have shown that male/female differences in income and social status can be attributed to different constellations of the family and that this is mediated by different institutional contexts. In recent works they have looked at occupational gender segregation in East and West Germany before and after unification.

Finally, educational expansion has produced "new" social groups, for example, new middle classes and new forms of upward mobility into the service sector. What have these changes implied for the structures of social inequality? Have the institutional mechanisms which led to inequality been weakened or enforced by educational expansion? These questions point to links with the issues addressed by the **Independent Research Group "Lack of Training: Employment and Life Chances of the Less Educated."**

Average duration of education, full- and part-time employment, and interruption of employment between the age of 15 and time of interview—FRG (birth cohorts 1954–56, 1959–61)



A dynamic view of social structures: "Life-time budgets" of men and women living in different family constellations (at time of interview).

How Do (Training) Institutions Function and How Do They Compare with Normative Standards?

Our ongoing research continues to pursue questions of institutional adaptation. In particular, we aim to evaluate recent institutional changes, individual consequences of the dual system of vocational training, and possible innovative forms of training and to assess the degree to which training institutions can support individual mobility as a means of adapting to structural occupational change.

When we endeavor to relate institutional structures to individual lives, we regard occupational careers not only in terms of qualifying young people for the labor market, but also from the perspective of learning and biographical development. Lifelong learning could be regarded as a temporal pattern of employment trajectories and careers. On the other hand, the acquisition and use of further qualifications in and after the initial phase of education and training is also an increasingly important aspect from a more cultural perspective. Solga and Trappe (2000) have discussed this new perspective with respect to the effects of the German dual vocational training system on the life course. Vocational training can be observed as a phase on three time axes: educational time, work time, and life time. On these levels, Solga and Trappe have identified ambivalent effects of changing educational patterns. The increasing variability of educational time and work time causes deviancies from the ideal model (in the dimensions of life and educational time) with serious consequences for young people's life planning and criteria of orientation. Nevertheless, the dual model of vocational training can still be regarded as providing an interval of "protected time" within the life course.

... and How Are Individuals Socialized within Them?

From this point of view it can be argued that the dual vocational training system serves as a specific institution of socialization. This aspect was further investigated in the project "Socialization Cultures in Occupational Education" (cf. Corsten, 2001).

Three different forms of training were distinguished: the dual system of occupational education in vocational schools and companies, exclusively school-based learning in training colleges, and forms of on-the-job training. The empirical focus was on occupational groups from the service sector. Cultures of socialization were analyzed in three dimensions: (1) qualification, defined in terms of different ways of mediating technical competencies, (2) discipline, defined in terms of different modes of mediation and normative orientations, and (3) the relationship between selection criteria and the support of trainees (and workers).

This project was funded by the German Research Foundation (DFG). The aim of the project was to describe how occupational fields of action which are institutionalized in certain forms of vocational training function in terms of socialization. In order to analyze the processes of occupational socialization in detail and from the trainees' biographical perspective, we chose an interpretative and ethnographic research design. We conducted expert interviews (including group discussions) with vocational teachers, leaders of occupational associations, and heads of company departments and working groups. We also conducted semi-structured biographical interviews with workers trained in five different occupations and held group discussions with classes of trainees.

We found that in each occupational group a specific socialization pattern was apparent in the process of selection/support, discipline, and mode of qualification. In the case of hairdressers, for example, we found a correlation between a selection process focusing on the expressive style of the applicant, a form of discipline based on traditional norm mediation, and a mode of qualification relying on pedagogically supplemented learning-by-doing. When look-

Conference

"The Future of Training and Work: Challenges for Vocational Training" (Jacobs Foundation Conference) November 2000

Organizers: Marlis Buchmann & Karl Ulrich Mayer, together with Michael Corsten

ing at the dimensions separately, East/West differences were shown to play an important role in the selection/support dimension of socialization experiences. On the discipline level, the specific characteristics of the health-care system were significant in the three groups of nurses, physiotherapists, and (to a lesser extent) beauticians. This was particularly apparent in the rigid performance and insistence on bureaucratic norms of teachers and instructors. Gender differences were found in the qualification dimension: Women often described difficulties in coping with discrepancies between theoretical and practical learning, whereas men gained more self-assurance from training situations in which they gained occupational responsibility as fully trained workers.

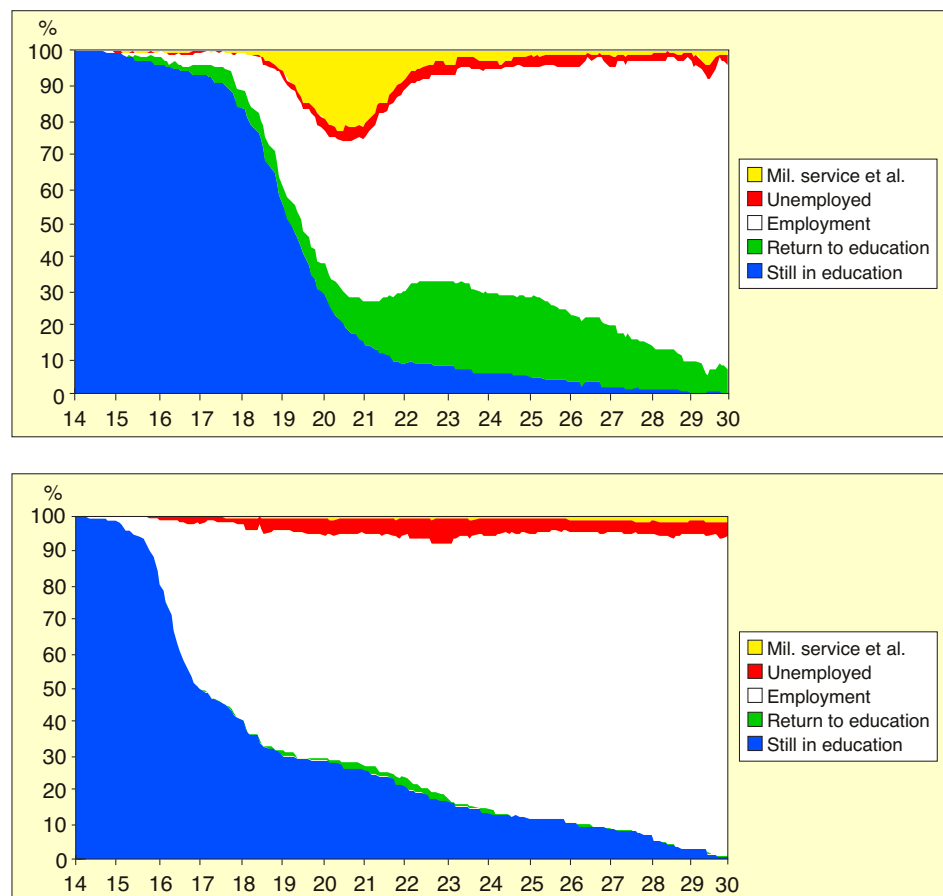
Are There Different "Political Economies of Life Courses"?

The political situation of post-war Germany is unique, and comparisons of the two parts of Germany have had a prominent position in the German Life History Study (Solga & Konietzka, 1999). We have now begun to look for further possible comparisons in order to extend our research into a broader international context. Here, we have benefited from discussions with the members of the *Political Economy and*

Life Courses in Advanced Societies research network.

One part of the life-course project has been a comparison of the systems of **education and training in the United Kingdom and West Germany**, and their consequences for individual life courses (cf. Hillmert, 2001). Using a general model that distinguishes between a horizontal, a vertical, and a temporal dimension of the process of integration into the labor market, we have shown that the two national systems of formal institutions represent different modes of coordination between the educational system and the labor market. Further pursuing these di-

Employment status of young men (aged 14–30) in Germany (above) and Britain (below): 1960 birth cohorts



The main international differences include the longer duration of full-time education in Germany (including "returns" after short interruptions as well as the impact of compulsory military service) and higher rates of youth unemployment in the United Kingdom.

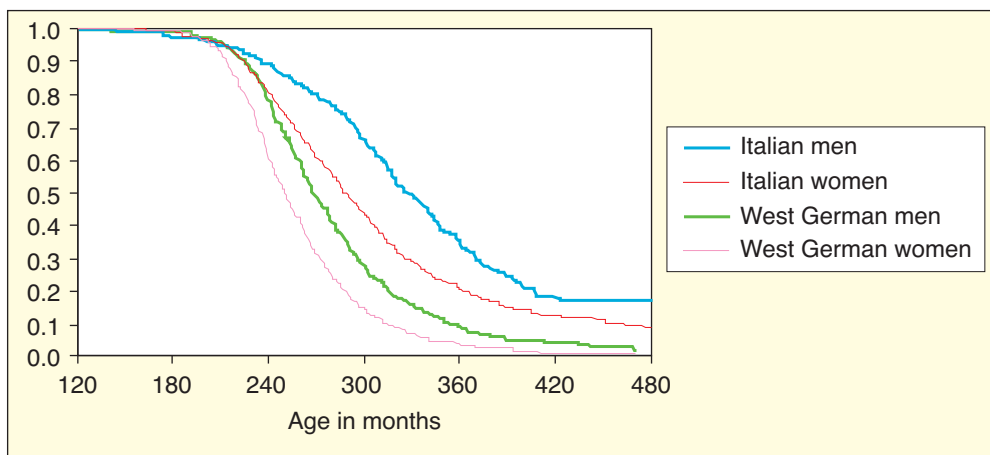
mensions in empirical terms, the main stages of research have been to describe the period of transition, to analyze the multidimensional stability of entry positions in early careers, and to assess the effects of formal qualifications on the quality of first jobs. The empirical results suggest that, in Britain, labor market entry is largely determined by the criteria of timing, the hierarchical grading of qualifications, and social status, whereas in Germany, occupational skills also play a major role. Historical re-

search has helped to explain why this is so. Rapid institutional changes, especially in the United Kingdom during the 1980s, have led to a much higher degree of labor market liberalization. In turn, this has undermined collective efforts to establish common standards for vocational training. Overall, the analyses provide evidence for institutional path dependencies and their links to individual life courses in the realm of education and training.

Mertens (1999) compared patterns of **job stability in West Germany with the United States and the United Kingdom**, where the literature reports some evidence of slightly decreasing job stability. Using cross-sectional data and calendar information from the German Socio-Economic Panel 1984-1997, a decline in job stability which cannot fully be explained by the business cycle was indeed identified. The median elapsed tenure of male workers has declined from around 10 years to 8.5 years; the probability of short-term employment seems to have increased relatively steadily for both males and females; and the risk of redundancy has continued to rise, despite the fact that the economy experienced a post-unification boom before the subsequent re-

cession. As "outsiders" are more likely to have difficulties finding stable jobs in rough times, separate analyses were carried out for those who had entered their jobs directly from unemployment or non-participation, and for workers who had entered the labor market having just completed their highest qualification. These groups were compared to the "insiders" who had switched from one job to another. While "insiders" were less likely to leave their new job, "outsiders" faced increasing risks of dismissal. It was also shown that the displacement of workers is likely to be the driving force behind this development.

Another "case study" within the life-course project has compared the process of **leaving home in Italy and Germany** (Rusconi, in press). Leaving



International and gender differences in the age at which children leave the parental home: "Survival curves" for Germany and Italy, indicating the proportion of those who have not yet left home.

home is considered to be an important event in the transition to adulthood, but in its interdependencies and consequences, it is also closely connected to educational and occupational "trajectories" and family decisions. The welfare states of Italy and Germany share common features: Although somewhat more accentuated in Italy, there is strong pressure in both countries for parents to remain financially responsible for their children, even when they enter young adulthood. In the first decades of the post-war period, the process of leaving home was rather similar in Italy and Germany. Now, however, the process has developed quite differently in the two countries. Young Italians seem to have adopted the strategy of living with their parents for a longer period of time and do not usually "leave the nest" until they get married. In contrast, young Germans become residentially independent at an earlier age and experience various forms of living arrangements. These developments suggest that explanations of international differences can only be found in a combination of macro- and microlevel analyses.

Can We Distinguish "Eras" of Dominant Life-Course Models? What Have Been the Long-Term Trends in Social Mobility?

In political economy, it is common to talk about different eras of economic development, work organization, and institutional regulation (the "Fordist" model probably being most prominent). The question arises whether this approach can be transferred to life-course research: Has there been an historical sequence of dominant life-course models and typical "life packages" of events that are expected to be achieved by a given time? The alternative would be that there has been only a very loose connection of rather continuous developments. In this respect, it will be par-

ticularly important to further link the life-history (cohort) information to data sources that reflect the macrosocial and macroeconomic situation in calendar time. From an international perspective, the question to be asked is whether other societies have developed in a similar way, or whether there has been variation and institutional path dependency in these developments.

Going back even further in history, another project has compared long-term trends in occupational and marital mobility in Western countries (Leeuwen et al., 1998). Against the background of relatively stable mobility patterns and small between-country differences after the Second World War, we ask whether trends were clearer and between-country differences larger during the 19th and early 20th centuries. International differences in general mobility rates and trends will be related to the timing and extent of industrialization, urbanization, educational expansion, and social policy. Differences in mobility chances within countries will be related to individual characteristics, such as occupation and literacy, and regional factors, like degree of urbanization and rates of geographical mobility. The main data sources for the project are church registers and censuses. Data sets on occupational mobility in 19th-century Sweden, Belgium, the Netherlands, France, England, Canada, and the United States have been collected and a network of mobility researchers from these countries (HISMA) has been created.

How Do We Ensure the Appropriate Analysis of Life Courses and How Do We Improve the Quality of Our Data?

The German Life History Study has always been associated with methodological advances, drawing especially on methods of event-history analysis. In the life-course analyses we have conducted over the past few years, we have

also made use of recent methodological innovations, for example, introducing Heckman-type econometric models that account for sample selection effects (cf. Engelhardt, 1999). Life history data essentially represent information about individual sequences of activity states, and various attempts have been made to use the full sequential information contained in the data. One possibility is Optimal-Matching Analysis (Halpin & Chan, 1998), which allows whole sequences of life courses—rather than single transitions—to be compared and classified. Another step will be to include techniques of multilevel modeling (Jacob, 2000) and simulation to our research.

As our latest wave of data collection (1964 and 1971 cohorts) was carried out in **collaboration with the** government-based **Institute of Employment Research (IAB)**, we have a unique opportunity to link two independent sources of information: the life-history

data from our survey and official (longitudinal) data from the *Beschäftigtenstatistik*, which is based on data from social security files. (The interviewees' consent is required for the information to be matched in each individual case.)

This linkage will allow us to investigate, for example, the effects of retrospective underestimation of mobility due to memory failure, drawing on a report that has reviewed the literature on this topic (Reimer, 2001). It will also allow us to conduct detailed investigations into the relationships between firm characteristics, firm dynamics, and individual working careers.

This will enable us to further promote the German Life History Study as a reliable source of information, especially for external researchers interested in dynamic analyses on the recent social structure of Germany, as well as those interested in the more historical and/or international context.

Open questions:
re-interviewing
respondents in the
latest part of the
German Life History
Study.



Education and Mismatch in the Labor Market

Productivity Losses Caused by Unemployment and Overeducation It is widely assumed that the human capital which a society accumulates in the form of education is a crucial location factor in the context of global economic competition. It should, however, be noted that the capital in question here is not the total volume of human capital produced by the education system, but the human capital invested "productively" in the economy. Because of the mass unemployment currently prevailing in Germany, substantial amounts of human capital are lying dormant, resulting in overall economic underachievement. "Superfluous" skills and qualifications—those for which there is no demand on the labor market—are not only temporarily sidelined, they are rapidly devalued owing to disuse and a lack of training opportunities.

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Büchel, F. (1998). *Zuviel gelernt? Ausbildungs-inadäquate Erwerbstätigkeit in Deutschland*. Bielefeld: W. Bertelsmann (288 p.).

Büchel, F., & Weißhuhn, G. (1997a). *Ausbildungsinadäquate Beschäftigung der Absolventen des Bildungssystems. Berichterstattung zu Struktur und Entwicklung unterwertiger Beschäftigung in West- und Ostdeutschland*. Berlin: Duncker & Humblot (Volkswirtschaftliche Schriften, 471) (128 p.).

One of the main aims of this project is to draw attention to the fact that the actual surplus of skills and qualifications produced by the education system considerably exceeds the surplus indicated in the unemployment statistics, even when hidden labor reserves are taken into account. The reason for this is that the unused and, therefore, unproductive skills of individuals who are obviously overqualified must also be taken into consideration. In Germany, similar to other industrialized economies, about one sixth of the employed population is considered to be overeducated. This calls the efficiency of the education system into question and raises the question of the resultant economic losses.

German research focusing explicitly on overeducation is still a rare commodity. Before the MPIB mismatch project

was initiated in 1998, Büchel prepared a monograph summarizing essential information on the subject of overeducation in Germany (Büchel, 1998). Büchel and Weißhuhn also authored a number of other monographs on behalf of the German Ministry of Education and Research (Büchel & Weißhuhn, 1997a, 1997b, 1997c).

The project is relevant to the research intentions of the Center of Sociology and the Study of the Life Course for two main reasons. First, the issue of overeducation involves several socioeconomic aspects which cannot be discussed from a purely economic perspective, but have far-reaching social implications. Second, most of the overeducation research carried out thus far has been cross-sectional. In the **mismatch project**, we are able to take advantage of the Center's extensive exper-

rience with longitudinal methodology to establish a longitudinal research perspective for the field of overeducation research. The project is of particular relevance to Research Area 1 ("Education, Training, and Employment") since all researchers in this area share an interest in identifying the factors which impede the transition from education to qualified employment, that is, to an occupation which fits in with the expectations of those who have acquired specific skills in the vocational training or university system.

What Did We Find out?

(1) Overeducation researchers have not yet reached a consensus on how best to measure skill mismatch. The lack of a standard approach means that traditional labor market researchers are very hesitant to accept this young discipline. Thus, the first phase of the project consisted in a broad analysis of measurement problems within the context of overeducation research. The typological similarity between unemployment and overeducation was also carved out by analyzing standard subjective measures in unemployment research, for example, the life satisfaction and political aptitude of unemployed, overeducated, and correctly allocated workers (Büchel, in press-b).

(2) One of the most popular explanations for the existence of overeducation is the career mobility theory developed by Sicherman and Galor. According to this theory, it may be rational for employees to accept an overeducated status at the beginning of their career path because wage losses are (over-) compensated by better promotion prospects. We found no empirical evidence to support this theory, however. When controlling for the starting level—which is crucial—the career paths of correctly allocated workers are significantly steeper than those of their

overeducated counterparts. This result is validated by the finding that overeducated workers seem to be systematically excluded from on-the-job training (Büchel & Mertens, 2000).

(3) A largely unexplored field in overeducation research is the motivation of firms to tolerate skill mismatches. The few existing studies conclude that overeducated workers are less productive than their correctly allocated counterparts as a consequence of frustration. These findings raise the question of why firms not only refrain from dismissing overeducated workers, but in fact hire them in large numbers. Our findings reveal that overeducated workers are less productive only when compared with correctly allocated workers with similar skills, that is, workers with the same educational level, but higher job requirement levels. This is not surprising, because the overeducated—by definition—work in jobs with lower skill requirements. When job requirement levels are kept constant, however—as is the case when personnel managers are charged with filling a specific vacancy—the reverse was found to be the case. Overqualified employees were healthier, more strongly work- and career-minded, more likely to participate in on-the-job training, and had longer periods of tenure with the same firm than their correctly allocated colleagues who—by definition—were less well-educated. No significant differences in job satisfaction were found. These findings are consistent with the established fact that overeducated workers receive wage premiums for their surplus schooling. The overall results make the hiring of overqualified applicants understandable and could explain the employers' motivation to accept persistent overeducation in the labor force (Büchel, in press-a).

(4) A major issue in German overeducation research is the question of whether overeducation patterns are

Key References (cont'd)

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(cont'd)

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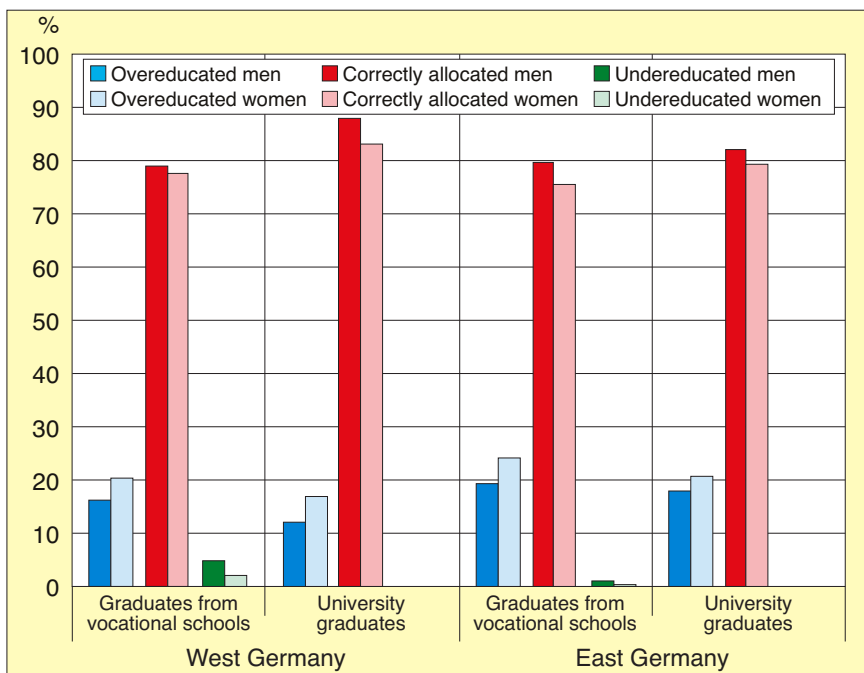
mainly determined by (inefficient) institutional characteristics of the education system, or whether some degree of skill mismatch is inevitable in highly differentiated labor markets (as anticipated by neoclassical theory in the case of "natural" unemployment). This question was addressed by conducting a comparative analysis of data gathered in Germany and the US. Together with co-authors from the US, we compared similarities and differences in the incidence and wage effects of over- and under-education in the US and West Germany. Two points in time were analyzed in the US, and it emerged that there were more similarities between the two countries than over time in the US. Bearing in mind the substantial differences in the structuring of the education system and the labor market in the two countries, this is a remarkable result (Daly, Büchel, & Duncan, 2000).

(5) In Germany, women are not only more likely than men to be unemployed, they are substantially more likely to be

overeducated. One of several competing explanations is that gender-specific differences in rates of overeducation are caused by spatial constraints on married women. According to the theory of differential overqualification developed by Frank (1978), married women living in rural areas run a higher risk of working in jobs for which they are overqualified. This is due to the problem of a dual job search being much more difficult to optimize than a single job search. In such a situation, husbands tend to follow the "Male Chauvinist Family Location Decision Rule" (Frank) and optimize their personal job search—possibly by inter-regional migration. Wives are "tied movers" or "tied stayers" (Mincer, 1978), and look for a job only under the condition their husbands already have found their optimal job—which determines their specific local labor market. Particularly in rural areas with small labor markets, this leads to a higher risk of mismatch between formal qualifications and job requirements. Only

McGoldrick and Robst (1996) and Battu, Seaman, and Sloane (2000) have previously tested this theory empirically, and their results led them to reject the theory. In contrast, our own findings are consistent with Frank's theory (Büchel, 2000b). However, at this stage of research we can only speculate about the factors that produce this unsatisfactory discrepancy in result patterns. There is an obvious need for further research.

Educational mismatch in the German labor market



Source: Own calculations from the German Socio-Economic Panel GSOEP (1998).

Further research perspectives

What Would We Like to Know?

(1) Spatial factors implying a higher risk of overeducation have, as yet, only been analyzed in the very specific context of married women (see above). We plan to analyze **the impact of local labor markets and regional mobility** on the risk of skill mismatch in a more general form. For this purpose, multilevel regression models (individual level, household level, and regional level) will be developed using data from the German Socio-Economic Panel (GSOEP). The data protection commissioner has already granted us special permission to use information on the GSOEP individuals' place of residence. This information can be matched with information about local labor market structures, local unemployment rates, branch structures, etc. The research will be conducted **in cooperation with Maarten van Ham** from the Faculty of Geographical Sciences at the **University of Utrecht**, the Netherlands.

(2) Overeducated status can be taken as evidence of a jobholder's flexibility. Flexibility and mobility are important mechanisms which enhance the efficiency of allocation on the labor market. In general, the level of flexibility and mobility displayed by German employees is considered to be below average. We intend to analyze flexibility and mobility on the labor market, looking for as many objective and subjective indicators as possible. This will enable us to consider skill mismatch in a broader context than is usually the case. Seen from the individual perspective, is mismatch primarily a voluntary or an involuntary outcome? Are there specific groups with atypically low flexibility and mobility? Can efficient policy measures to improve flexibility and mobility be identified? Special emphasis will be placed on **the graduate labor market**, and on a **German/US comparison** based on German data from the

GSOEP (1994–1998) and the 1991/92 BIBB/IAB Employment Survey, and US data from the Panel Study of Income Dynamics (PSID, 1993–1997) and the 1992 Highschool & Beyond Survey (HS&B). This project will be sponsored by the Federal Ministry of Education and Research, and the central results are expected to be included in the Ministry's annual *Report on Germany's Technological Capability*.

(3) In Germany, overeducation is much more widespread among **non-graduates** with vocational qualifications than among **graduates**. Neubäumer has developed a plausible theoretical framework to explain this kind of mismatch (Neubäumer, 1999). According to Neubäumer, branches that offer jobs with poor working conditions tend to train more apprentices than will be required as skilled workers. This strategy compensates for the above-average rates of anticipated dropout, resulting in a systematic overproduction of skills in specific occupations (ironically, mainly in those occupations with a low market applicability, such as hairdressing). Hence, those trained in these branches tend to have above-average rates of overeducation (and unemployment). The planned analyses will be performed **in cooperation with Renate Neubäumer** and will be based on data from the BIBB/IAB Employment Survey.

(4) Although the German school system is characterized by a strong and persistent trend toward higher education, most German school-leavers still enter into vocational training. It is thus a matter of interest to determine whether the **vocational training system** is able to adapt to the changed circumstances, that is, to continue to offer young people a form of training which will protect them from later unemployment or overeducation. The analyses will focus on long-term trends in the training-to-work transition in Germany

and will also be based on data from the BIBB/IAB Employment Survey.

(5) A general assumption underlying overeducation research is that overeducated workers are less "able" than correctly allocated workers with comparable formal qualifications. However, this assumption—which is consistent with a neoclassical view of labor markets—has never been explicitly proved. This could be due to the fact that ability-related information (beyond the school-leaving certificate held) is rare in micro-economic data sets, particularly in Germany. However, the German Life History Study (GLHS) which provides life-course data for West German cohorts born in

1964 and 1971 (collected by our Center in 1998), contains information on both the grades attained in apprenticeships and on any skill mismatch in the job performed at the date of interview.

These data will be used to analyze the **correlation between ability and overeducation**, measuring ability not by the type of qualification acquired, as is usually the case, but by the grades achieved within comparable types of qualification. Questions about school grades will be included in the GSOEP for the first time in the 2001 questionnaire. This information (expected to be available for public use in fall 2002) will be used to validate our results.

The Longitudinal Working Group Berlin and Brandenburg (LWBB) (Längsschnitt-Werkstatt Berlin-Brandenburg [LWBB])

The LWBB was founded in 1996 by an initiative of 17 young researchers working in the Berlin/Brandenburg area. These founding members included several researchers from our Center (Martin Diewald, Götz Rohwer, and Heike Solga). Two of the other founding members subsequently joined the Center (Felix Büchel from the Technical University of Berlin and Antje Mertens from Berlin's Humboldt University).

The main impulse behind this initiative was the unanimous opinion that longitudinal research needs to be promoted. The aim was to create a local network to facilitate data access and improve the transfer of technical and methodological know-how. In addition, the LWBB was set up to stimulate cooperation among its members, with a special accent being placed on interdisciplinarity. The founding members included sociologists, economists, and political scientists.

The LWBB is affiliated with the German Institute for Economic Research (DIW) in Berlin, the workplace of the initiative's *spiritus rector*, Jürgen Schupp. All expenses incurred in the work of the LWBB (over DM 200,000 in total) have been fully funded by the German Ministry of Education and Research.

One of the working group's main activities has been the establishment of a powerful server at the DIW, providing access to about 20 of the most important longitudinal data sets from Germany and abroad. Public access to these data is made easier than usual by providing support for users in terms of data-protection declarations and the technical assistance of a student worker. The data server at the DIW provides guest researchers with access to longitudinal studies including the European Community Household Panel (ECHP), the British Household Panel Study (BHPS), the Russian Longitudinal Monitoring Survey (RLMS), the Panel Study of Income Dynamics (PSID), and, of course, the German Socio-Economic Panel survey (GSOEP). Different data formats are available, and access and links to the Geocode information are included.

Other LWBB activities have included arranging a series of seminars on methodological issues, inviting distinguished lecturers to address the group (Prof. M. A. Ferber, Prof. J. A. Nelson, and others), holding workshops on specific datasets, and organizing or co-organizing the following **conferences**:

- Labor market statistics between reality and fiction (September 1997, Berlin)
- Longitudinal data in social stratification monitoring (March 1998, Berlin)
- The polarization of occupational and life chances—Is Germany establishing an underclass? (October 1998, Berlin)
- Recent trends and methods of social stratification research (April 1999, Potsdam)
- Low pay—low qualification? Opportunities and risks of a low pay sector in Germany (May 2000, Berlin)

The following **publications** have resulted from these conferences:

Schupp, J., Büchel, F., Diewald, M., & Habich, R. (Eds.). (1998). *Arbeitsmarktstatistik zwischen Realität und Fiktion* (Labor market statistics between reality and fiction), Berlin: edition sigma (Series "Sozialstruktur und Sozialberichterstattung" of WZB Berlin) (240 p.).

Büchel, F., Diewald, M., Krause, P., Mertens, A., & Solga, H. (Eds.). (2000). *Zwischen drinnen und draußen. Arbeitsmarktchancen und soziale Ausgrenzung in Deutschland* (Labor market prospects and social exclusion in Germany), Leverkusen: Leske + Budrich (236 p.).

All papers presented at the "Low pay—low qualification?" conference are available on a CD jointly released by our Center and the DIW.

The members of the LWBB are currently engaged in intense discussion on the future of the initiative. The main question is whether to apply for additional funding and for which specific purposes.

East German Life Courses during the Transformation of the Former GDR

Despite considerable research to document and describe the political, social, and economic changes that have taken place in East Germany since 1989, accounts of these transition processes are still characterized by a weak understanding of their dynamics, long-term causes, and lasting consequences. The unique expertise of the Center for Sociology and the Study of the Life Course enables the societal transformation of East Germany to be placed in an historical and cross-national perspective, thus allowing theoretical generalizations to be drawn. Drawing on a series of quantitative life-course studies, as well as qualitative accounts of institution (re-)building, we are able to systematically investigate the new, post-1989 society in East Germany and to compare it to the past society.

In the first half of the 1990s, our research on East Germany (primarily within the project **"Life Courses and Historical Change in the German Democratic Republic"**) focused on a reconstruction of GDR society and its social history. Based on these results, a follow-up project **"East German Life Courses after the Transformation"** (in progress since 1995) was designed to investigate the process of transformation in East Germany and the associated process of German unification. This project involves studying the life courses of different birth cohorts as "mirrors" of social change, while bearing in mind the inner dynamics of individual trajectories.

One of our research questions is how the system of social inequality has changed in East Germany since 1989. Have old social positions disappeared,

perhaps as a result of their state-socialist specificity? Have new social positions emerged, possibly as a result of the market character of the "destination" society? Assuming that a change in social positions has occurred, which mechanisms were operating and how were people matched to the new positions? How did individuals and families in East Germany cope with institutional and organizational change on the labor market and in society in general? Since societal transformation in East Germany was accompanied by a massive transfer of institutions from West to East Germany, a baseline hypothesis is that similarities and differences between institutions in the GDR (the society of "departure") and institutions in West Germany (the society of "destination") are of great consequence for individuals' success or failure after 1989.

A first phase of the project "Life Courses and Historical Change in the German Democratic Republic" was completed in the summer of 2000. Research here concentrated on restructuring processes in the *labor market*, one of the main domains of social stratification and social inequality. We explored the shaping of employment histories by institutions and organizations, and endogenous causalities of individual careers, with special emphasis on time-dependencies. Patterns and causal conditions of individual employment histories in post-1989 East Germany have been analyzed in two doctoral theses and one habilitation thesis. A doc-

toral thesis on the labor market entry of young East Germans is in preparation. In addition to these studies, research findings have been presented in a series of publications. Furthermore, important results were discussed with external scholars at a **conference** that we organized in **November 1999** on the occasion of the tenth anniversary of the fall of the Berlin Wall. Since studies restricted to East German data continually raise questions about the extent and specificity of change, we relate our analyses on East German societal transformation to the pre-1989 GDR, to West Germany, and to Poland as an example of another post-socialist society.

Conference
"The Incomplete
Unification: Social
Inequalities and
Occupational
Trajectories in
East Germany"
November 1999

Organizers:
Karl Ulrich Mayer,
Martin Diewald, &
Heike Solga

The East German Life History Study

The main empirical basis for our life-course analyses of East Germans is a data set that combines a panel survey with an event-history design. In 1991/92, a total of 2,331 East German men and women from four birth cohorts were interviewed about their whole life history. These interviews were conducted as part of the project "Life Courses and Historical Change in the Former GDR." In 1996/97, we succeeded in re-interviewing 1,394 of these participants by applying a combined CATI and CAPI strategy. The participants were again asked to give complete employment and family histories for the period since December 1989. These longitudinal data are suitable for use with methods of event-history analysis. Compared to earlier life-course studies, more detailed information was collected about organizational contexts of occupational careers within firms and subjective dimensions of developmental regulation, such as control beliefs, perceived primary and secondary control, and self-esteem. The latter information was combined with the first measurement of a postal follow-up survey carried out in 1993, thus allowing investigation of the interplay between life courses and individual development. A non-response study produced an additional 200 cases for the initial four birth cohorts. A new birth cohort was added in 1996/97, namely 610 men and women who were born in 1971. The special focus here was on the investigation of processes of labor market entry and family formation under the conditions of system transformation. The field work for the three data samples (panel study, non-response study, and 1971 birth cohort) was carried out in 1996/97, and since then a considerable amount of effort has been put into editing, completing, and documenting these complex data sets.

New Patterns of Social Inequality: The East German Labor Market since 1989

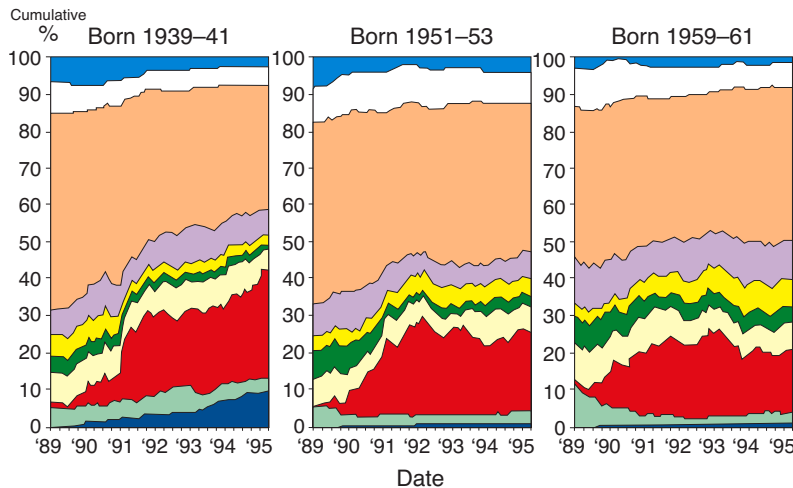
In the 1990s, the East German labor market was characterized by a mixture of upheaval and continuity with the old system. Economic transformation and the transfer of institutions from West to East Germany led to the rapid establishment of high and seemingly permanent unemployment. Job mobility increased, but most changes of job or employer did not result in enhanced career prospects or promotions. On the contrary, the tendency toward higher

rates of job mobility in East Germany was mainly a result of individual attempts to avoid unemployment after firm closures or downsizing. The proportion of external job shifts (i.e., shifts between firms) grew, while the proportion of internal shifts declined (Diewald, 2000b). Older cohorts, in particular, were forced to become mobile at a point in life at which they would normally have entered stable careers within firm-internal labor markets. Individual job mobility did not only rise in comparison to the former GDR—it was also much higher than in West Ger-

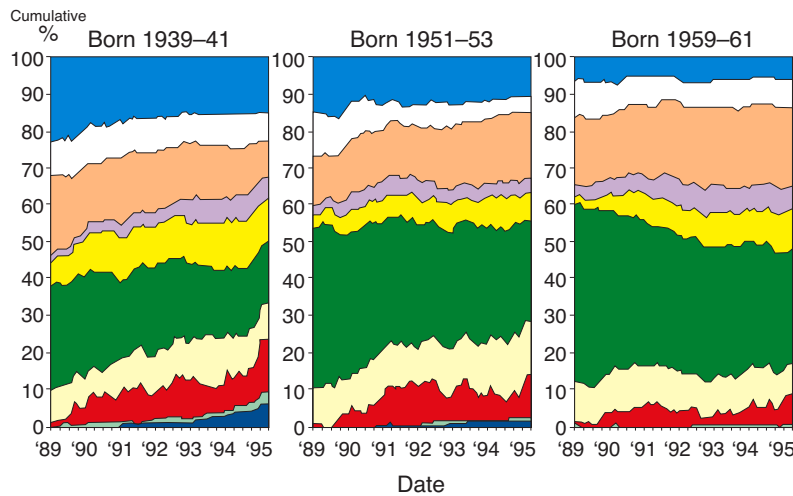
many or even Poland. Rather surprisingly, the devaluation of biographical assets, breaks in occupational careers, and the risk of unemployment were much more prevalent in East Germany than in post-socialist Poland. However, the higher instability in occupational careers was compensated for by much higher wages and unemployment benefits than in Poland (see Diewald, 2000b; Mach & Solga, 1997; Diewald, Mach, & Solga, 2000).

Despite widespread discontinuity in East Germans' occupational careers, the pattern of social inequality was not completely changed. Institutional similarities between the GDR and West Germany, on the one hand, and the transfer of institutions from West to East after 1989, on the other, resulted in continuities in social status over the course of the transformation (see Mayer, 2001c). Such similarities are of special interest to us with respect to **job-shift patterns**

Life time budget: %-distributions of occupational position (incl. nonemployment statuses) between December 1989 and March 1996—East German women



Life time budget: %-distributions of occupational position (incl. nonemployment statuses) between December 1989 and March 1996—East German men

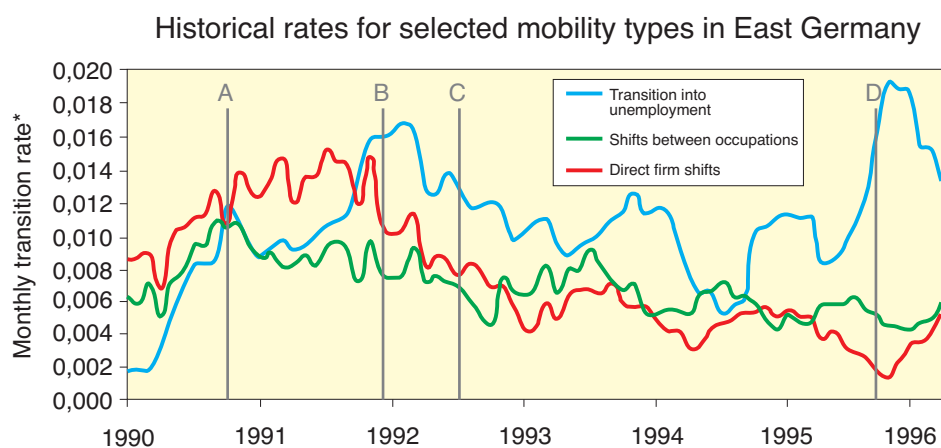


and the system of **occupational training and certification**. The determinants of job-shift rates suggest that before 1989 work-life mobility in both countries was governed in a similar way by labor-force experience and educational credentials (Solga & Konietzka, 1999), although East Germany was less segmented by gender, social class, and the industrial sector, and was instead characterized by a stronger tendency toward internal job shifts. It emerged that mechanisms operating in both East and West Germany prior to 1989, such as the German form of "occupationalized credentialism" and internal labor markets, did not lose their efficacy after the Berlin Wall came down. Yet because of the interplay with the opportunity structure, these similarities resulted in different outcomes in East and West Germany. Such findings contribute to the theoretical understanding of the regime-specific embedding of "general" institutions (Solga & Diewald, 2001).

Notable differences were observed in the **opportunity structures of different social groups**. It comes as no surprise that groups, such as women, less-

qualified workers, and older employees, suffer from displacement, but the mechanisms of their exclusion are often subtle and blurred by labor market segmentation. The theoretical framework of life-course research predicts differences between birth cohorts, and our research indeed reveals remarkable differences in the post-unification labor market opportunities of different birth cohorts. Older individuals (born around 1930) were excluded from the labor market by early retirement. Of those who entered the labor market before 1989 and who were not hit by early retirement, men and women born around 1940 were most vulnerable to the risks of the changing labor market and experienced significantly more "losses" than other cohorts.

Historical time turned out to be a central factor in the distribution of labor market opportunities after 1989. In addition to the major breaks that occurred around 1989, the transformation process can be divided into historical periods characterized by different opportunity structures and mechanisms of allocating persons to jobs and other social positions. For a number of reasons, the first two years of the transformation were much more open to "irregular" occupational shifts and external job shifts than the years after 1992. After 1992, the competition for jobs again began to increase, and the chances of disadvantaged groups declined further (see Solga, Diewald, & Goedicke, 2000).



* Monthly transition rate = number of events occurring in a given month divided by the number of persons at risk.

- A – Unification, October 3, 1990;
- B – End of short-time work schedule;
- C – End of first period "window of opportunity";
- D – End of "bad-weather allowance" for construction workers.

The Processing of Occupational Change: Occupational Shifts and Training

Occupational qualifications continue to represent a major allocation mechanism in the East German labor market. However, East Germans have had to adapt to rapid shifts in the occupational structure and new demands for qualifications. In her doctoral thesis, Sylvia Zühlke analyzed the consequences of occupational change—that is, changes in job requirements and responsibilities (a qualitative dimension) and shifts in demand for certain qualifications (a quantitative dimension)—for individual occupational careers. She investigated processes of individual occupational re-orientation between 1989 and 1996 in two professional groups: clerks and manual workers. Occupational shifts were differentiated into further qualifications and professional reorientations, and these were explored as individual (time-dependent) responses to experiences of unemployment. Furthermore, occupational shifts were analyzed in an institutional context, with reference to two settings: training provided by firms and government training schemes. The results show that the two professional groups displayed very different patterns of adaptation to the new labor market conditions. These patterns appear to be dependent on the transferability of human capital and on continuities in individual employment histories (see Zühlke, 2000).

Professions as Frames in Times of Biographical Upheaval: Bourgeois and Non-Bourgeois Intelligentsia in the GDR and after 1990

The socialist intelligentsia, or the educated class, appeared with the foundation of the GDR in 1949 and was dissolved along with the state in 1990. The original intention was for the ranks of the intelligentsia to be open to social

groups hitherto unconcerned with education (workers and peasantry). But since the children of this first generation of graduates demanded the same level of education as their parents, GDR society shifted increasingly toward stratum-specific differentiation and a re-production of societal structures. Case studies of the "socialist intelligentsia" conducted by Erika Hoerning examine the role of the profession in biographical (re-)orientation. The professional and life histories (narratives) of 31 women and men born between 1929 and 1938 (the generation that rebuilt Germany after the Second World War) and between 1950 and 1960 were recorded on repeated occasions, allowing us to describe the social character of the educated class (the new socialist intelligentsia) and the professional cultures of the former GDR, as well as the life courses of both bourgeois and non-bourgeois members of the intelligentsia. It was then possible to observe the re-orientation process retrospectively by examining the transition to "new" social, cultural, and political structures, and obtaining information about how retrospective assessments change over the course of time and life. The study shows that success (or failure) in coping with the transformation process is not only a function of the individual biographical capital, but is highly dependent on the historical development of the institutions (professions) to which individuals belong. The institutional and biographical transfer to/integration into the "new" Federal Republic is being explored in case studies on a number of professional groups: medical, law, media, and science professionals, university professors, managers in industry and science, the clergy. These case studies will be discussed within the framework of current theoretical debates on professions in a **book in progress: "Intelligenz, Experten, Professionen."**

Institutions as Bridges and Traps: The Labor Market Entry of Young East Germans

A central question in the dissertation currently being prepared by Britta Matthes is how the institutions of the educational system, the system of occupational education, and the labor market overlap and connect with one another. Matthes examines the early employment careers of young East Germans under system transformation—more specifically, the process of labor market entry of those who were born in the former GDR in 1971 and, thus, experienced the fall of the Wall at the age of 18. She addresses the question of whether the specific institutional settings during system transformation have led to a more open or closed situation with respect to the impact of the social background, the reversibility of life events, occupational selection, and stigmatization. A major theoretical contribution of this study consists in the link between intergenerational and intragenerational patterns of social selection. Decisions about the level of education that were made within families in the GDR are seen as structuring training and employment opportunities after 1989. However, individual assets acquired in the GDR were devaluated by the change of regime, even if they did affect early employment careers. The training experiences and first jobs of the 1971 birth cohort are compared to those of the 1959/61 East German birth cohort, and, thus, embedded into an historical context.

Organizational Contexts of Employment Careers: Firm Development and Personnel Strategies after 1989

Formal organizations such as firms play an important role in mediating between institutions and the individual life course. The doctoral thesis prepared by Anne Goedicke studied the nexus be-

tween the restructuring of the East German industrial landscape and the individual employment trajectories of East German employees after 1989. Two organizational characteristics were assumed to be of particular importance with regard to exits from and entries into firms: the renewal of the firm population in East Germany after 1989 (including the founding, downsizing, closing, and restructuring of enterprises) and the orientation of personnel strategies toward internal or external labor markets. Different conceptions of organizations (in particular as job systems and as purposeful agents) were combined to trace the impact of these factors on individual employment histories. The study linked individual mobility to shifts in employers' demand for labor and demonstrated that individuals' employment histories have been strongly influenced by the fate of industries and single companies in East Germany. Mechanisms of discrimination against women, less-educated workers, and older employees could be attributed more specifically to selection processes at firm entry and/or exit, and it was shown that these groups of people suffered from different types of disadvantages. Time dependencies in the employment system could be attributed to organizational change (see Goedicke, 2000).

The Usefulness of Resources Acquired in the GDR before 1989

Any societal transformation challenges "normal" expectations of cumulative causal contingencies of the individual life course. Our collection of East German employment histories shows that many former "investments" (e.g., in education, firm commitments, work experience) have been devaluated, while former barriers to occupational success (e.g., "lack" of political loyalty) have disappeared. Yet continuities in occupa-

tional behavior and success can also be observed. The question thus arises of where and under which circumstances continuity as opposed to "interruption" can be found in the life courses of individuals. It is crucial for the interplay between individual characteristics (e.g., functional skills, self-esteem, etc.) and structural opportunities (e.g., job vacancies, gender segregation, age discrimination, etc.) to be considered from a **developmental perspective**. Three dimensions are especially important: first, a before-after dimension—the "legacy" of life in the GDR was not simply destroyed by the abolition of its political, economic, and social institutions, but is incorporated into individual life courses which reflect a variety of selection and adaptation processes in different phases of GDR history; second, a dimension of individual-institution interdependence, emphasizing that the interplay between personal and situational characteristics might vary between segments of the la-

bor market; third, a time dimension, meaning that the transformation is not just a single "event," but a process divided into different developmental phases. In his habilitation thesis, Martin Diewald looked at contingencies of East German life courses before and after 1989. He conceptualized the link between structural and individual perspectives via processes of selection and adaptation in different historical and institutional contexts (see Diewald, 2000b).

While occupational qualifications and firm tenure acquired in the GDR emerged to be very important for employment stability after 1989, a surprising and somewhat perplexing empirical result is that GDR residents who showed initiative in their job seeking had a professional orientation and experience of firm and job mobility and were generally no better off in the labor market after 1989 (see Diewald, 1999c; Diewald, Goedicke, & Solga, 2000).

Research Perspectives

Over the coming years, life-course research at the Center for Sociology and the Study of the Life Course will continue to systematically examine patterns of social stratification under conditions of rapid social change. **Three types of research** will be central to our work:

- (1) comparative analyses of East and West Germany (including the labor market entry of East and West Germans born in 1971) as well as comparisons between East Germany and other post-socialist and non-post-socialist countries;
- (2) further investigation of the nexus between different institutions and organizations shaping employment trajectories under conditions of rapid social change (e.g., the nexus between firms and occupations, or that between households and labor markets);
- (3) longitudinal analyses that, from a life-course perspective, explore long-term developments within careers through different societal settings, thus exploiting the unique potential of our data on the GDR.

Ten years after the collapse of the Berlin Wall, transformation research is slowly dissolving as a separate topic of empirical inquiry. It has to be replaced by a pan-German and international comparative perspective, as well as by a deeper theoretical understanding of the long-term causes and consequences of system change.

Further Projects and Activities

The Berlin Aging Study (BASE)—Sociology and Social Policy

The Sociology and Social Policy Unit of the Berlin Aging Study formally concluded its main research activities with the joint publication of **the English version of the BASE monography** (Baltes & Mayer, 1999). The unit contributed to 11 of the 18 chapters of the book, not least in the area of interdisciplinary studies such as:

- Baltes, M. M., **Maas, I.**, Wilms, H.-U., Borchelt, M., & **Little, T. D.** Everyday competence in old and very old age: Theoretical considerations and empirical findings (pp. 384–402).
- Linden, M., Horgas, A. L., **Gilberg, R.**, & Steinhagen-Thiessen, E. The utilization of medical and nursing care in old age (pp. 430–474).
- **Maas, I.**, Borchelt, M., & **Mayer, K. U.** Generational experiences of old people in Berlin (pp. 83–110).
- **Marsiske, M.**, **Delius, J.**, **Maas, I.**, **Lindenberger, U.**, Scherer, H., & Tesch-Römer, C. Sensory systems in old age (pp. 360–383).
- **Staudinger, U. M.**, **Freund, A. M.**, Linden, M., & **Maas, I.** Self, personality, and life regulation: Facets of psychological resilience in old age (pp. 302–328).

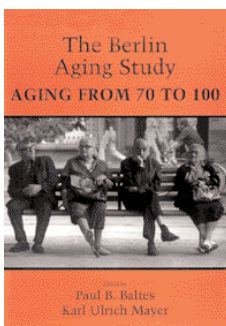
- **Wagner, M.**, Schütze, Y., & **Lang, F. R.** Social relationships in old age (pp. 282–301).

Three dissertation theses have been completed:

- **Bukov, A.** (2001). *Social participation in old age*. Free University of Berlin.
- **Gilberg, R.** (2000). *Hilfe- und Pflegebedürftigkeit im höheren Alter. Eine Analyse des Bedarfs und der Inanspruchnahme von Hilfeleistungen*. Berlin: Max-Planck-Institut für Bildungsforschung (Studien und Berichte, 68) (293 p.).
- **Lampert, T.** (2001). *Social inequalities, life course and health in older age*. Berlin: Free University of Berlin.

Moreover, the project's longitudinal data on the relationships between mortality, on the one hand, and socioeconomic inequalities and social support, on the other, have been analyzed as part of a postdoctoral research project by Pascale Dorenlot, who joined the Institute in the framework of the **MPG-CNRS cooperation program** in connection with the Centre Marc Bloch in Berlin.

Baltes, P. B., & Mayer, K. U. (Eds.). (1999). *The Berlin Aging Study. Aging from 70 to 100*. New York: Cambridge University Press (552 p.).



The Unification of the Berlin Police Force: An Example of Institution Rebuilding after 1989

Another MPG-CNRS postdoctoral fellow, Fabien Jobard, has worked on a case study examining the process of integration of the West and East Berlin police forces in the years following unification (see Jobard, 2000). At the end of 1989, two coexisting police forces were charged with protecting one public order in the administratively divided city of Berlin. In October 1990, the

West Berlin Police force took over its counterpart in the East of the city. From then on, police officers in the former GDR had to implement laws and regulations with which they were not familiar. Several aspects of institution building were observed, including the efforts of the East German police chiefs to shape new administrative languages and programs, the East German officers'

resistance to the loss of public legitimacy and of their institution, and various attempts made by the West Berlin police force to gain control over the process of unification of the two forces and deal with the new agenda. These observations help to explain the non-mobilization that occurred both in the

ranks of the West Berlin police force, where many rank-and-file-officers simply refused to collaborate with their "colleagues" from the East, and in the ranks of the East Berlin police force, where deep and sudden uncertainty was felt, as well as individual and collective stigmatization.

Children in the Family Division of Labor

Only recently have sociologists begun to analyze the kind of intergenerational relationships that are actually practiced in real family life. The division of domestic labor between children and adults in the family is an important topic in this context (Hengst & Zeiher, 2000a; Zeiher, 2000a, in press-b). The dominating social pattern of childhood as a period of development and learning has increased the care dependency of today's children. If children do not participate in domestic work serving common needs and reciprocal care, the question may arise of whether this might dissolve the links between children and adults and result in further separation of the generations. On the other hand, recent changes in the roles of the mother and the housewife and

trends toward more maternal participation in the labor market may challenge these patterns. Case studies of ten-year-old children have been conducted, with each child being followed through the entire sequence of his or her activities on seven days. Analysis starts with the investigation of transitions from one activity to the next in order to reconstruct every decision in its situation-specific and biographical contexts. The results of these decision analyses form the basis of subsequent analysis on the specificity of intergenerational processes in each family. Comparisons are made in order to outline differences and similarities in individual childhoods, and to reveal general characteristics of social childhood which are apparent in the daily life of particular individuals.

Higher Education: A Comparative Study of Germany and the United States

The system of higher education has also attracted increased public attention over recent years, with reform proposals often alluding to the situation in the USA. This is the background to our comparative analysis of higher education in Germany and the United States (*Higher Education and Professionalism*). The study focuses on the institutional structures and their links to modernization in the two countries (see Lenhardt & Spear, 2000). The theoretical point of departure is provided by Parsons' theory of professionalization and Weber's the-

ory of the "expert culture." Both are theories of social development, institutional rationalization, and socialization. It emerges that Parsons' professionalization theory is congruent in all three of these respects with Humboldt's concept of the modern research university, which is still a prominent feature in contemporary debate. Common denominators include the concepts of individualism as an institutional characteristic of the democratic society, academic freedom in higher education, and the culture of professionalism. It is general-

ly assumed that the systems of higher education in Germany and the USA are increasingly giving institutional expression to the normative concept of citizenship. Yet, the German system seems to be doing so only with some delay. The German system still bears traces of the anti-individualist "expert culture" dating back to feudal absolutism. In this

project, the progress of individualism is reconstructed with regard to the relationship between higher education, the state and the civil society, the rationalization of the internal structure of universities, the distinction between "pure" and "applied" science, and the social role of students.

Higher Education in Germany: Institutional Development, Personnel Structure and Careers, and Labor Markets

Higher education in Germany has also been the focus of a number of further research activities of both basic and applied concern. Karl Ulrich Mayer joined the editors and authors of the new *Bildungsbericht*, contributing a major chapter on the structure and recent developments of the tertiary sector. This undertaking builds on his intensive committee work as chair and

member of the *Wissenschaftsrat* committees on Higher Education and the Labor Market (1999) and Personnel Structures and Qualification Processes (2001), and as co-chair of the Committee for the Development of Higher Education in Saxony (2000/2001). A by-product of this kind of "fieldwork" has been a smaller study on "Science as Vocation or Career?" (Mayer, in press-a).

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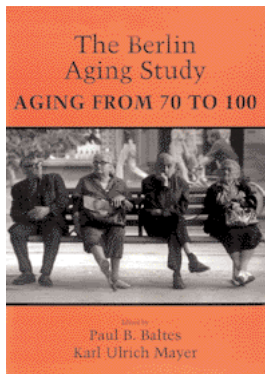


Left to right: Marita Jacob, Maïke Reimer, Holger Seibert, Steffen Hillmert, Karl Ulrich Mayer, Michael Corsten, Erika M. Hoerning, Felix Büchel, Helga Zeiher, Matthias Pollmann-Schult, Anne Goedicke, Britta Matthes, Alessandra Rusconi; not pictured: Antje Mertens, Heike Trappe, Gero Lenhardt.

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Independent Research Group

Lack of Training:
Employment and Life Chances
of the Less Educated

Contents

Why do We Need to Know More about the Less Educated?	211
Research Program	212
Research Activities and Results	215
Publications	219

Duration: January 2000–December 2004

Head of Research Group: Heike Solga

Doctoral Candidates: Justin Powell
Sandra Wagner

Why do We Need to Know More about the Less Educated?

Despite their group's relatively small size—at about 15% of all present-day school-leavers, or between 80,000 and 100,000 youth, depending on the birth cohort—"less-educated" persons represent a significant object of both German policy and public debate. They face extremely high unemployment risk. They constitute half of all long-term unemployed persons in Germany. Their higher vulnerability is usually attributed to the following: (1) the number of jobs for less-educated workers has decreased and will continue to decrease, and (2) due to the current job shortage, less-educated persons are forced out of the labor market because they lose in the job competition with better-qualified persons. The underlying cause of their higher unemployment risk seems to be their lack of qualifications, making the acquisition of vocational qualifications seem a fitting solution to the problem. Germany spends billions on so-called "training offensives" at both the federal and *Länder* levels to increase the number of training positions so that as many young people as possible can benefit from opportunities for training. But no one really knows whether this money is well-spent. It is not yet known whether these efforts will succeed in (1) reasonably decreasing the number of youth who hold no formal vocational certificate, and (2) actually improving their subsequent employment chances if they do complete such special training programs.

In fact, our research agenda emphasizes an explanation other than displacement. The "selection" hypothesis locates inequality of opportunities earlier in the life course—the result of selection processes in educational systems—and does not simply state that at labor market entry higher-educated persons outperform the less educated. Our perspective is historical, institutional, and comparative, as we examine changes in composition of the group of less-educated persons over time, in shifting institutional contexts, and in different regions and countries.

Research Program

The main reason for uncertainty as to the success of Germany's "training offensives" is that present-day policy mainly focuses on the question of what is to be done about less-educated youth once their lack of qualifications has become reality, reducing the problem solely to the qualification dimension. The research group will go beyond this perspective by addressing three main research questions:

(1) We explore why there are still less-educated young persons at all and who constitutes this group today.

(2) We re-introduce the sociological explanation that selection on the basis of formal qualifications is not a natural law, but the result of social action. Thus, we investigate the educational experiences and labor market opportunities of less-educated persons from an historical and institutional perspective and explore whether lack of training is a general or an historically defined, dynamic educational deficit in labor markets.

(3) We investigate whether less-educated Germans are socially excluded, and if so, whether their disadvantaged labor market situation is in fact the cause of their social exclusion.

Two dissertation projects begun in January 2000 address the first two research questions. To answer the question of why there are still less-educated youth after an extraordinary educational expansion and who they are from a sociological perspective, the dissertations investigate why particular socio-structural groups are over-represented among the ranks of less-educated youth. If innate ability differences alone were the cause of the variance in educational outcomes, we should find equal proportions of less-educated youth in

all social strata, but we do not. Thus, the sociological question to be addressed first is: *Which societal factors produce this group?* The two dissertations investigate the segregating German education system as a "producer" of differently-certified groups, the different school types as a form of institutionalized inequality in learning and socialization environments, and the significance of family background and disability labeling for individual careers in the German school and vocational training system. **Sandra Wagner's** dissertation, *Family background and school careers of less-educated youth in (Western) Germany*, focuses on historical changes in the composition of the less-educated group in terms of social background and ethnicity, and the effects of changes in the German education system on their resources for socialization and ability development over the past 50 years. **Justin Powell's** dissertation, *Does school integration matter? Comparing educational attainments of youth with physical disabilities in Germany and the United States*, attempts to offer new insights into the social mechanisms and schooling structures responsible for defining and labeling "failures" in educational systems, about how educational institutions themselves contribute to

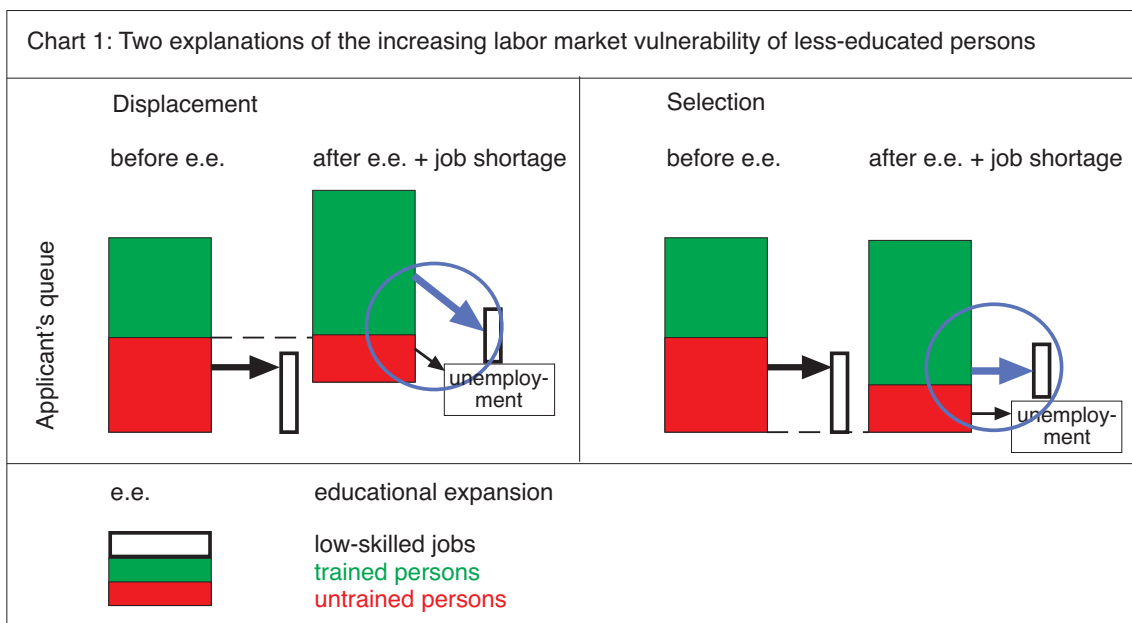
such definitions, and why certain groups (here youth with disabilities) bear far higher risks of educational disadvantage. In both countries, these youth make up a large proportion of those who do not attain the minimum degree usually required for further training. By investigating this particularly disadvantaged group, we may more clearly discover selection processes and discrimination based on so-called ascriptive characteristics, such as disability.

The third question is addressed by Heike Solga's research. Less-educated persons' labor market participation since 1950 will be examined. Entry into the labor market, career paths, and opportunities to gain qualifications later in life will be analyzed for different cohorts. The central complementary theses are:

(1) **Superfluosity hypothesis** In general, employment opportunities are determined by the qualification structure of the labor force (supply side) and the quality and quantity of the available jobs (demand side). Thus, lack of training does not in itself result in less-educated persons' marginalization in the

labor market. The functional irrelevance or superfluosity of less-educated persons is produced by an oversupply of qualified labor and/or a decline in labor demand.

(2) **Selection hypothesis** In sociological research, one explanation for the disadvantaged labor market position of less-educated persons is that more highly qualified persons displace less qualified persons. This project presents another, less established explanation, namely "selection." It is reasonable to assume that the persons who escaped from the "camp of the less educated" over the last decades were not a random sample of the population. The remaining individuals are most probably a "negative" selection in terms of learning and cognitive competencies. Their increasing labor market vulnerability would still result from increased job competition, but the disadvantages caused thereby would be analyzed more as a consequence of this "creaming-out" process and less as a sign of mere displacement (see chart 1). Moreover, since those who remain untrained are not randomly distributed within the social



Since May 2000 we have cooperated with the Department of Special Education, University of Cologne: Sociological research evaluating the model project "Job-coaching for school under-achievers" (funded by the Krupp Foundation and the state government of North Rhine-Westphalia).

stratification system, this hypothesis must and does include an explanation of how this lack of ability and skill is socially produced and constructed. In contrast to the displacement argument, it locates inequality of opportunities earlier in the life course—as selection processes in the educational system—and does not simplistically state that more highly educated persons outperform the less educated at labor market entry.

With respect to living conditions of less-educated persons, the project explores the extent to which discernible differences in lifestyle can be attributed either to their "less-educated status" or to their labor market exclusion. The former would be correct if we find differences to higher-educated groups for all cohorts; the latter if differences are only found for less-educated persons in cohorts with poor employment chances. The **two competing hypotheses** are:

(1) Less-educated persons *generally* display different patterns in these domains of life compared to persons who have completed a vocational training program, even when they are in stable employment. If this is correct, any differences identified could generally be attributed to these individuals' less-educated status. This certainly does not imply that the less educated can or should be personally blamed for their fate. Instead, it would indicate the fact of their general disadvantage and their restricted access to the life options enjoyed by those with qualifications.

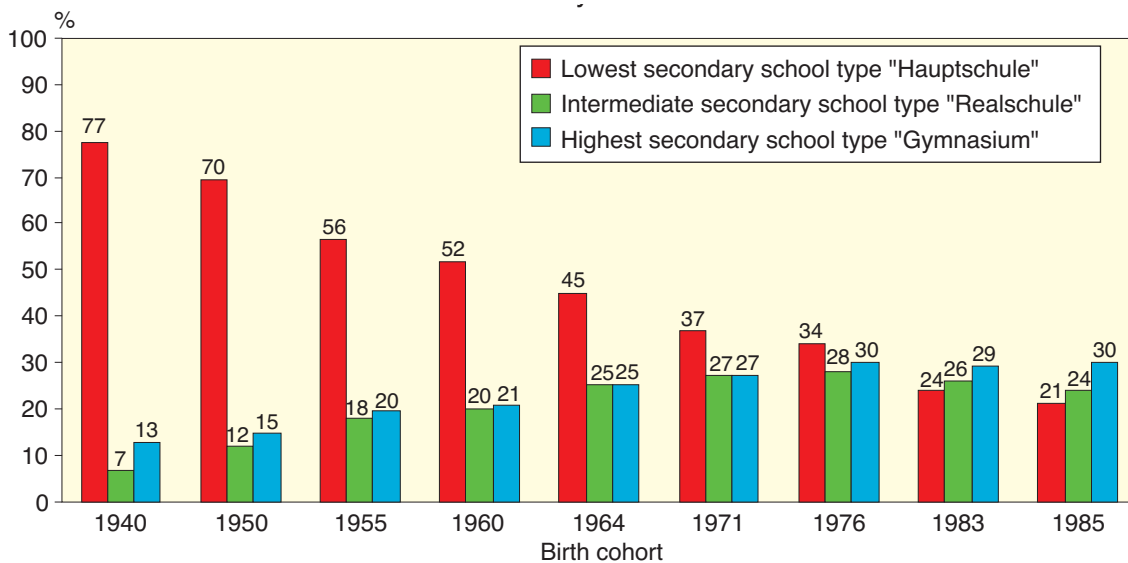
(2) Such differences *only* exist when less-educated persons are especially disadvantaged in the labor market, that is, in times of low demand for labor. The real reason for their disadvantaged living conditions, then, would not be their less-educated status in itself, but the instability of their employment status and their growing marginalization in the labor market due to long-term unemployment and/or changes in their group composition (see selection hypothesis).

The answers to our three research questions may lessen the uncertainties mentioned above. From a scientific perspective, this research focused on the less educated contributes to the specification of education's significance in society and in labor markets, and the interrelations between employment opportunities and other domains of life.

Research Activities and Results

The research group's work started with an **inaugural conference** entitled "Low-paid = low-skilled? Opportunities and Risks of a Low-Wage Sector in Germany" (in collaboration with the Network on Longitudinal Research Berlin-Brandenburg [LWBB] at the German Institute for Economic Research [DIW]). Held at the Max Planck Institute for Human Development, Berlin, on May 11–12, 2000. The conference was successful in stimulating interdisciplinary discussions between economists, sociologists, and political scientists from Germany and abroad. Conference contributions have been published on a **CD-ROM** and are also available via internet. The main result drawn from the conference contributions with respect to the research group's focus was that *an increase in the number of low-wage jobs would most probably not improve the employment opportunities of the less educated*. On the contrary, this increase might even result in a growing number of young people without formal qualifications. It might have negative effects on firms' willingness to provide training opportunities, because cheap labor without the time and task restrictions of training requirements would be available in the German labor market and on young people's motivation to accept apprenticeship when the risk of remaining low-paid after completion of training would be high (cf. conference paper presented by Heike Solga, "Consequences of a low-wage sector on the training system in Germany").





Cohorts before 1983: only West Germans.

Cohort from 1983: West and East Germans.

The difference to 100 percent = special schools for "disabled" youth, comprehensive schools, Waldorf and private schools.

Source: Official statistics.

Figure 1. School attendance of 13-year-old West Germans.

Further research results of the first year are:

Educational expansion has led to a social homogenization of the lowest secondary school track in Germany (Hauptschule), which negatively impacts the school environment of children attending this school type. Analyses on "A side effect of educational expansion: The increased social homogeneity of the Hauptschule" (by Heike Solga and Sandra Wagner, 2001) have shown that today, children attending the Hauptschule are doubly disadvantaged. Decreases in the number of children attending the Hauptschule (see Fig. 1) have not only been a quantitative process, but have also led to qualitative changes in the school environment. Increasingly, children attending the Hauptschule come from deprived families; their parents over-proportionally work as unskilled workers; and more than those in other school types,

they have experienced negative life events during childhood. They are not only faced with fewer resources for educational attainment by virtue of their own family background, but their peers also come mainly from less-advantaged families. Thus, they have lost compensatory resources in their school environment, which they had in the past when the Hauptschule was the standard school type and attended by the majority of youth.

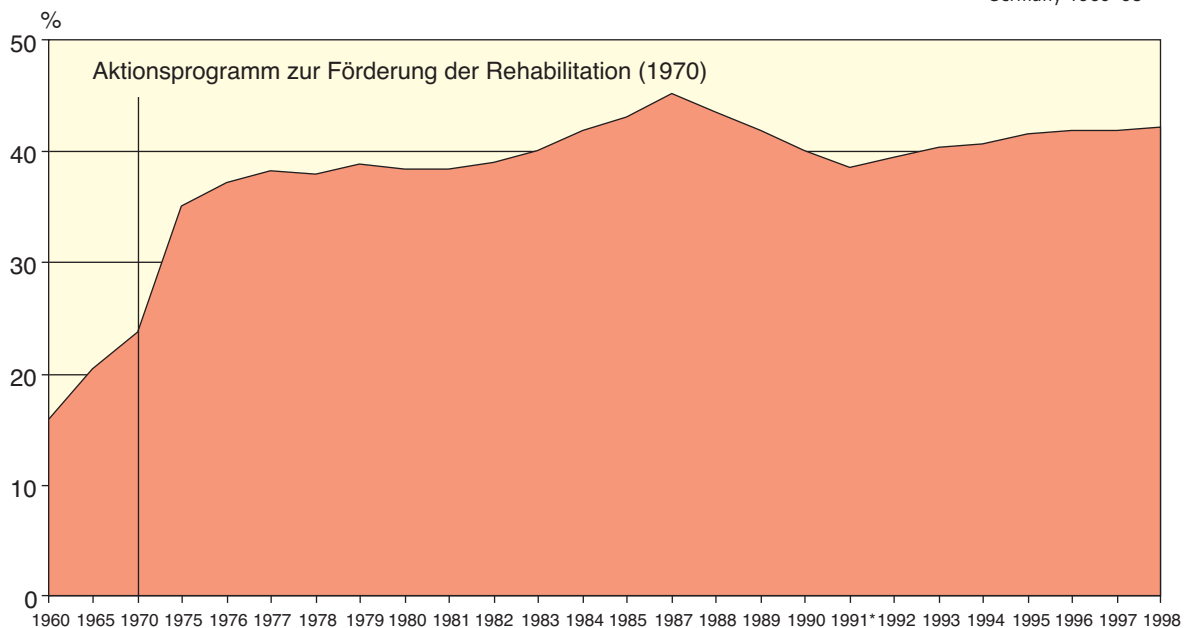
Similar anti-discrimination protections and calls for social integration in Germany and the U.S. have not led to similar levels and types of school integration for children with disabilities. Research presented by Justin Powell, "Disability discrimination and equality in Germany and the United States: Changing legal conceptions and social realities," at the 30th Biennial Meeting of the German Sociological Association, Cologne, September 2000,

showed that while Germany and the U.S. both protect the civil rights of citizens with disabilities, their educational systems differ in levels of integration and inclusion and access to certification. **In Germany**, the rapid growth of special schools during the post-war educational expansion and their stability since hinders these individuals' educational attainment. Only a fraction of Germany's *Sonderschulen* offer higher education or even middle-level certification. In 1998, youth with disabilities who attended *Sonderschulen* constituted over 40% of all school-leavers who did not receive even the lowest certificate, the *Hauptschulabschluss* (see Fig. 2). In the same year, less than 10% graduated with an intermediate certificate (*Realschulabschluss*) and only 0.4% of these school-leavers attained a certificate needed for university study. Given the declining value of the lowest-level certificates, students labeled disabled face reduced opportunities in further education and employment. **In the United States**, rising levels of integration of youth with disabilities (over

40% spent about 80% of their school days mainstreamed in regular classrooms in 1996 compared with around 30% in the late 1980s) have been accompanied by higher rates of high school graduation and steadily increasing college and university participation rates, but Americans with disabilities still face extremely poor labor market opportunities as do Germans with disabilities.

"Creaming-out" effect and educational disadvantages of persons with less-advantaged family backgrounds contribute to explain the increasing vulnerability of less-educated persons in labor markets. In the paper "Displacement or selection? Two explanations for the increasing vulnerability of less-educated persons" (Independent Research Group Working Paper 2/2000), Heike Solga reintroduced the selection argument to explain the increasing vulnerability of less-educated persons over the course of educational expansion. In sociology and economics, the dominant explanation of this vulnerability has been the displacement hypothesis,

Figure 2. Percentage of school-leavers without formal school certificate (without "Hauptschulabschluss") from special schools (*Sonderschulen*), West Germany 1960-98*



Source: Federal Bureau of Statistics, Fachserie 11, Reihe 1, several years. * Figures as of 1991 include all German states.

namely, that the less qualified are displaced by higher qualified persons. Our analyses have shown that instead of such displacement, the higher (negative) selectivity of this group is an essential cause of their poorer employment opportunities today. By analyzing the chances of less-educated persons to enter into skilled jobs and how these chances have changed as the less-educated group has become smaller, the paper shows that those who constitute the less-educated group today have always had the poorest employment opportunities. Due to the outflow of persons with relatively higher ability and advantageous social background characteristics into higher educational groups over the course of educational expansion, these lessened opportunities become increasingly visible. The analyses show that—especially for men—the social selectivity of less-educated persons has increased over the cohorts. Due to this selectivity, certificates have increasingly replaced personal, ascriptive characteristics in job competition. Whereas in the older cohorts, employers had to observe several personal characteristics alongside the indicator of “vocational certificate” in order to choose the relatively best applicants, after educational expansion they put “trust” in the single indicator of certification, because more than ever before it simultaneously indicates the less-advantaged social background characteristics of the untrained and, with them, the relatively disadvantaged environment of ability development in families and schools. This finding must be strengthened through an investigation of the relationship between the creaming-out process and other labor market outcomes—such as unemployment, upward mobility, and opportunities of acquiring formal qualification later in life.

One could argue that it does not matter whether one calls it “selection” or “displacement,” the result of the increased job competition is the same: ultimately, less-educated persons have poorer employment opportunities today than in the past. Both hypotheses would “agree” that today the new quality of less-educated persons’ vulnerability is that they are those who are legitimately defined as being economically obsolete. However, whereas the displacement hypothesis explains the exclusion of the less educated by the newly emergent (at labor market entry) displacement phenomenon, the selection hypothesis defines labor market disadvantage as solely a new feature and higher visibility of the *continuing* social disadvantages that less-educated persons suffer. Whereas “displacement” occurs at a particular moment in time at the micro level, after educational investments already have been made, the selection hypothesis locates inequality of opportunities earlier in the life course—as a continuous selection process in educational systems—and does not simply state that at labor market entry higher-educated persons outperform or out-qualify less-educated persons. In doing so, it emphasizes the idea that it is not an individual’s failure, but the social environment that produces and is responsible for his or her lower achievement, through disadvantages accumulated in schooling and socialization.

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Publications by Heike Solga that originated from her previous work within the Center for Sociology and the Study of the Life Course can be found there.



Left to right: Heike Solga, Justin Powell, Sandra Wagner.



Service Units

Contents

Library and Research Information	223
Information Processing Center	226
Publications 1998–2000	228

Scientific Staff (1998–2000)

Library and Research Information: Lydia Lange, Diann Rusch-Feja

Information Processing Center: Peter Grund, Jürgen Hess

Library and Research Information

Overview The Library and Research Information Unit of the Max Planck Institute for Human Development is a service unit for the research activities in the Institute. To this end, the Unit supplies printed and electronic media as well as information which is necessary to meet the needs of internationally oriented basic research in various fields of the social and behavioral sciences. This media and information offering is built up and maintained according to the research profile of the Institute. Currently, the collection includes approximately 185,000 volumes and approximately 630 current periodicals.

Media and information for the collection in the Library and Research Information Unit are processed according to library and information science standards, placed into the active collection as rapidly as possible and provided with ease of access. Scientific literature and information are acquired immediately upon request by the researchers, if the requested material is not already present in the Library collection. In addition to the Online Public Access Catalog (OPAC), we offer direct access to a wide variety of relevant databases, filtered and value-added information from external sources including web-based resources which are relevant to the research projects. A comprehensive intranet with the service offerings is continuously monitored and expanded according to the needs of the

researchers. Institute publications and research results are indexed comprehensively in the online Library catalog which is available via a Z 39.50 interface.

The staff of the Library and Research Information continue to actively support users with personal reference consultancy, regular introductions to the Library services, training courses in using various databases, relevant Internet resources, and electronic journals, citation frequency analyses, etc.

Electronic Library

The last years have been dominated by the increasing digitalization of the Library services and resources. The following gives just a cursory overview of these developments:

The Web-server for the online Library catalog using Allegro-C was expanded through the integration of the Z 39.50 protocol. The Library database is thus now available via the Z 39.50 interface for other information retrieval and database programs. This is especially useful for those researchers in the Institute who use EndNote as a bibliographic administration program for their most-frequently cited literature, and who now have direct access and downloading facilities from the Library catalog into their individual EndNote system. This alleviates incorrect citation of titles and tedious individual input.

In the Intranet and Internet of the Library and Research Information Unit, various lists of publications are generated on demand directly from the Library database thus representing the most current state of new publications. This includes, for instance, the new acquisitions list of the Library, list of periodical holdings, publications of an individual researcher or a specific project. Such lists can be structured in various formats and sorted according to individually chosen criteria. In this way, the newest Institute publications are always

available on the project Web pages without extra update procedures to recreate the HTML pages.

Cooperating with three of the Research Centers of the Institute, the Library and Research Information Unit has begun archiving and making a selection of electronic full texts of the Institute publications publicly accessible in various formats (HTML, PDF, etc.) and with direct links from the Library catalog. Since January 2000, this has evolved into a "Preprint/Archive Server" which contains over 80 full text Institute publications. Towards the end of the year, procedures were created to augment these electronic documents with Dublin Core Metadata in accordance with the Open Archives Initiative specifications. This "Preprint/Archive Server" will continue to be developed, making additional electronic texts available with supplementary metadata on the Institute Web site.

Since February 2000, Institute staff members searching a title in the online Library catalog can determine the circulation status of a work and, if on loan, who is currently using it.

Since August 2000, a Z 39.50 Gateway has been integrated into the Library offerings which enables a simultaneous search in the most important article databases, as well as other important library online catalogs (including the Library of Congress).

The offering of electronic full texts within the context of the Max Planck Society wide library cooperation and *Grundversorgung* through the Advisory Council for Information Provision (*Beratender Ausschuss für Informationsversorgung [BI]*) was expanded through consortial agreements with Elsevier Science Direct, Springer LINK, Kluwer, Academic Press and Science. Institute researchers in Max Planck Institute for Human Development now have full text access to articles in a total of

2,364 electronic journals. In the context of the Max Planck Society Task Force for Information Provision, a study on the use and acceptance of electronic journals by researchers in the entire Max Planck Society was conducted and evaluated under the direction of Diann Rusch-Feja and in cooperation with Uta Siebeky, librarian of the Fritz Haber Institute.

The Library catalog is accessed on the average of 14,000 times monthly. The publication lists of the Institute and the Clearinghouse are used approximately 700 times monthly.

Databases

Similarly, the number of subject-oriented bibliographic databases available through the Library has also increased. Various databases are no longer held as CD-ROM databases on the Institute network, but are available via the WorldWideWeb at the GWDG (Society for Scientific Data Processing). Various bibliographic databases are also expanding their service to offer clickable links to full texts, such as Web of Science, an additional service through the consorital agreements of the Max Planck Society available to all Society libraries.

Librarian Trainees and Internships

During the period covered, the Library and Research Information participated as the practicum library for students in the Master's degree program in Library Science at the Humboldt University, the post-graduate Training Program for Academic Librarians in Scientific Libraries at the Humboldt University, the Librarian Certification Program (Diplom) at the Archive, Library and Documentation Department of the Potsdam University of Applied Sciences (Fachhochschule), and for an intern and former Fulbright student entering an ALA-accredited graduate library school program in the United States. In addition, one thesis focused on impact of the transition from print to electronic journals on the workflow procedures and services of the Library and Research Information: Letzner, V. (2000). *Das zunehmende Angebot elektronischer Zeitschriften in wissenschaftlichen Spezialbibliotheken. Auswirkungen auf die Arbeitsvorgänge*. Humboldt-Universität zu Berlin.

The Final Report summary in German is available on the Task Force for Information Provision web site <http://w3.rz-berlin.mpg.de/infoprojekt/evalkurz.html> and an English-language presentation of the results has been published (see Rusch-Feja & Siebeky, 1999a, 1999b).



Information Processing Center

The *Information Processing Center* supports the projects and other service units at the Institute through its central facilities.

The **central cluster configuration** provides compute servers for the decentralized workstations. The cluster strategy is based on the client-server concept, including six ALPHA servers (AXP), all running Compaq (former DEC) OpenVMS.

Software that is supported includes: SAS, SPSS, BMDP, HLM, EQS, SIR-DBMS, LISREL.

New servers are installed with Windows NT or Windows 2000 for dedicated purposes: internet/intranet servers, software server, etc. Three NT-cluster systems with big RAID storage installations provide the capacity for the central data management. Several powerful NT-terminal servers establish a CITRIX server farm. They allow the user to run programs (SPSS, SAS, MAT-Lab, etc.) on the server CPUs from their own workstations (Windows or Apple PC). "Server-based computing" helps to overcome the constraints of the different workstations concerning CPU power and local storage.

The **decentralized personal computing capacity** comprises about 240 Intel PCs and 150 Apple computers. Apple computers are running MacOS, Intel PCs are operating on Microsoft's Windows NT 4.0 or Windows 2000. A central backup service is provided for all data on cluster disks. A wide array of software is available for the desktop systems.

To provide the necessary security, a Cisco-PIX firewall system was installed which allows the failure of certain modules without a complete breakdown. Central virus scanner software—continu-

ously updated via the internet—monitor all Intel and Apple workstations to avoid data loss caused by viruses.

The Local Area Network (LAN) integration of all desktop computers provides access to central resources and cluster capacity. In 1998 the traditional standard- and thin-wire Ethernet was substituted by a new network based on fiber optic cable. Now the desktop systems are directly connected with a maximum speed of 10 Mbit/s.

The Institute's connectivity to **Wide Area Networks** (internet etc.) is provided via the Research Network (WIN) of German Telekom and the German Research Network Association (Deutsches Forschungsnetz [DFN]). The Max Planck Society is a DFN member. The Institute is sharing a Berlin node (155 Mbit/s) for all Max Planck Institutes managed by the Fritz Haber Institute of the Max Planck Society. Late in the year 2000 the GIGA-WIN (1 Gbit/s) was installed allowing the Institute to increase the use of high-speed connectivity.



The Center's services include

- operating, optimizing, and developing the devices of the central cluster and network equipment;
- mending and updating OpenVMS and Windows NT operating systems;
- centralized printing capacity, including high-speed and color printers;
- LAN integration of desktop computers and the continuous enhancement of LAN facilities;
- national and international connectivity (Wide Area Network);
- internet services: Email, WWW, NEWS, FTP, and Telnet;
- maintenance and webmaster tasks of the Institute's internet and intranet servers.

Complementing departmental services are

- user support and trouble-shooting for Intel PCs and Apple computers;
- coordination and technical support for desktop computers and software;
- software acquisition.

The Center provides

- general design and coordination of the Institute's information technology equipment;
- the documentation of data concerning the existing computer and network equipment;
- an overview of market developments;
- advice for the Institute's boards and departments;
- the promotion of new concepts for state-of-the-art computer equipment.

Publications 1998–2000

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Appendix





Contents

1. Research Colloquia 1998–2000	233
2. Visiting Scientists 1998–2000	237
3. Other Professional Activities 1998–2000	239
4. Academic Degrees 1998–2000	243
5. Scientific and Professional Staff 1998–2000	245

1. Research Colloquia 1998–2000

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|-------------|--|-------------|--|
| January 14 | Martin Abraham , Universität Leipzig:
With a little help from my spouse:
Mitarbeit der Ehepartner von beruflich
Selbstständigen. | June 19 | Willard Zangwill , University of
Chicago:
Heuristics in electronic commerce
firms—Bounded rationality or total irra-
tionality. |
| January 17 | Robert N. Proctor , Pennsylvania State
University:
The Nazi war on tobacco and the war
on tobacco today. | June 23 | Peter Gerjets , Universität des Saar-
landes:
Knowledge acquisition in combinatorics
with example-based hypertext-environ-
ments: Experimental studies and in-
structional implications. |
| January 18 | Peter Borkenau , Universität Halle-
Wittenberg:
Genetische und Umwelteinflüsse auf
Persönlichkeitsmerkmale. | June 23 | Jens Alber , Universität Konstanz:
Produzieren kontinentaleuropäische
Wohlfahrtsstaaten typische Beschäfti-
gungsprobleme? |
| January 24 | Robin M. Hogarth , University of
Chicago:
Educating intuition. | June 27 | Gisela Labouvie-Vief , Wayne State
University:
Affect dampening and affect complexi-
ty in the life span. |
| January 25 | Ralf T. Krampe , Universität Potsdam:
Constraints and adaptations in move-
ment timing: The role of expertise and
aging. | July 3 | Maya Bar-Hillel , University of
Jerusalem:
Where did 1850 happen first, in Europe
or America: A cognitive look at a his-
torical bias. |
| February 25 | Stephen P. Jenkins , University of
Essex:
Re-employment probabilities for Span-
ish men: What role does the Unemploy-
ment benefit system play? | August 30 | Kurt Danziger , Royal Society of
Canada:
Searching for the concept of memory:
A historical journey. |
| March 3 | David Soskice , Wissenschaftszentrum
Berlin:
Patterns of innovations in the US and
Germany: Explaining increasing diver-
gence. | November 7 | Alan D. Baddeley , University of Bristol:
Working memory: What's new? |
| April 10 | Londa Schiebinger , Pennsylvania State
University:
Has feminism changed science? | November 14 | Robert J. Sternberg , Yale University:
Successful intelligence. |
| April 17 | Bernd Wollring , Universität Gesamt-
hochschule Kassel:
Qualitative empirical investigations
concerning primary school children's
concepts of probability. | November 27 | Zhou Xialoin , University of Peking:
Reading processes and developmental
dyslexia in Chinese. |
| April 18 | Thomas D. Cook , Northwestern Univer-
sity:
A theory of generalization of causal
connections. | December 1 | Hartmut Esser , Universität Mannheim:
Das Framing der Ehe und das Risiko zur
Scheidung. |
| May 17 | Joyce Moore , University of Iowa:
Understanding the relationship between
representations and their quantitative
referents: A study in the domain of sta-
tistics. | | |
| May 19 | Paul Rozin , University of Pennsylvania:
The psychology of food choice. | | |
| May 23 | Endel Tulving , University of Toronto:
What is episodic memory? | | |
| May 24 | Susan Goldman , Vanderbilt University:
Learning from text in a mulitmedia age. | | |
| May 30 | Robert W. Levenson , University of Cal-
ifornia, Berkeley:
Emotion and age: From the inside out. | | |
| June 15 | Hans Bertram , Humboldt-Universität
zu Berlin:
Familie, Ökonomie und Fürsorge. | | |

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| January 8 | Friedrich Buttler , Ministerium für
Wissenschaft, Forschung und Kultur,
Potsdam:
Anreizkompatibilität und Hochschul-
organisation. |
| January 19 | Michael Tomasello , Max-Planck-Insti-
tut für evolutionäre Anthropologie,
Leipzig:
The human adaption for culture. |
| January 22 | Hans-Jürgen Andreß , Universität Biele-
feld:
Armutrisiko Scheidung. |
| January 26 | Dirk Vorberg , Technische Universität
Braunschweig:
Priming-Effekte durch unbewusste und
bewusste Reize. |

January 29	Wolfgang Zapf , Wissenschaftszentrum, Berlin: Sozialberichterstattung und Wohlfahrtsmessung: Rückblick und Ausblick.	June 4	Heiner Ganßmann , Freie Universität Berlin: Wohlfahrtsstaaten und Arbeitslosigkeit – Schweden, Dänemark, die Niederlande und die Bundesrepublik im Vergleich.
February 1	David Over , University of Sunderland: Uncertain conditionals and the reliability of inference.	June 8	Elizabeth Maylor , University of Warwick: Prospective memory across the lifespan.
February 10	Dietrich Albert , Universität Graz: Die Wissensraumtheorie: Grundlagen und Anwendungen.	June 11	James Shanteau , Kansas State University: Decision making by experts: Psychological explorations of expertise.
February 12	Wout Ultee , University of Nijmegen: The Jews in the Netherlands 1936–1945. Addressing questions on societal cohesion by analyzing life courses in time of crisis.	June 18	Martin Kohli & Harald Kühnemund , Freie Universität Berlin: Der Alterssurvey: Konzeption und Ertrag eines neuen Beobachtungsinstruments.
February 16	Stephan Dutke , Freie Universität Berlin: Multiple Repräsentationen beim Textverstehen: Zur Replizierbarkeit des Crossover-Effekts.	July 2	M. Rainer Lepsius , Universität Heidelberg: Willensbildung und Entscheidungsfindung in der Europäischen Union.
February 19	Jaap Dronkers , University of Amsterdam: Sind auch in Deutschland nicht öffentliche Schulen effektiver als öffentliche Schulen?	July 5	Augusto Blasi , University of Massachusetts, Boston: The moral ambiguity of moral emotions.
February 26	Helmut Seitz , Europa-Universität Viadrina, Frankfurt/Oder: Determinanten und Finanzierung der Sozialhilfeausgaben.	July 6	Lynn Hasher , Duke University: Aging and inhibitory control.
March 3	Peter Reimann , Universität Heidelberg: Erwerb prozeduralen Wissens aus Lösungsbeispielen.	July 7	Jianxin Zhang , University of Peking: Differentiating between general and specific trust: Evidence from mainland China and Hong Kong.
March 23	John Gabrieli , Stanford University: Age-associated changes in memory: A cognitive neuroscience perspective.	July 9	Peter Ayton , City University, London: Sunk costs: Are wasps and mice more rational than behavioral scientists?
April 13	Richard Nisbett , University of Michigan: Culture and systems of thought: Holistic vs. analytic cognition.	September 8	Jacquelynne Eccles , University of Michigan, Ann Arbor: Activities, identity and adolescent development.
April 23	Viktor Steiner , ZEW Mannheim: Evaluation von staatlich geförderter Fortbildung und Umschulung.	September 17	Denise Cummins , California State University: How the social environment shaped the evolution of mind.
April 26	Leslie Smith , Lancaster University: Necessity in social reasoning.	September 27	Nils-Eric Sahlin , Lund University: Epistemic risk.
April 27	Hannelore Weber , Universität Greifswald: Die soziale und persönliche Konstruktion angemessener Bewältigung.	September 28	David Rubin , Duke University: A new method for the study of autobiographical memory.
April 28	Barbara Tversky , Stanford University: Cognitive origins of graphic displays.	October 1	Daniel Guhr , The Boston Consulting Group: Wissensmanagement im Wirtschaftsalltag: Warum weniger oft mehr ist.
May 4	Richard M. Lerner , Boston College: Adolescents and their communities: Applied developmental science and the promotion of positive youth development.	October 5	Annette Karmiloff-Smith , Institute of Child Health, London: What can genetic disorders tell us about normal cognitive development?
May 11	James McClelland , Carnegie Mellon University: Complementary learning systems: Insights from the successes and failures of connectionist models of learning and memory.	October 7	Michael Frese , Universität Gießen & University of Amsterdam: Action errors: The work and organizational psychology perspective.
May 25	Lola L. Lopes & Gregg C. Oden , Iowa University: Attention and aspiration in risk choice: Putting it all together.	October 15	Stavros Stavrou , CEDEFOP, Thessaloniki: Die Förderung des Unternehmertums und die potentielle Rolle der beruflichen Bildung.

October 18	Denis Hilton , Université de Toulouse II: Causal induction and causal explanation.	November 19	Michael Burda , Humboldt-Universität zu Berlin: Blue Laws—Eine theoretische und empirische Untersuchung der Ladenschlussgesetzgebung in den Vereinigten Staaten.
October 26	Wolfgang Schneider , Universität Würzburg: Gedächtnisentwicklung im Kindes- und Jugendalter: Klassische Positionen und neuere Trends.	November 30	Norbert Schwarz , University of Michigan: Cognition, aging, and self-reports.
November 5	Aviana Bulgarelli , ISFOL, Rom: Program evaluation and training policies: Approach, methodology and results.	December 1	Beate Sodian , Universität Würzburg: Theory of mind beyond age four—Understanding the nature of (scientific) knowledge.
November 8	Alexander Wearing , University of Melbourne: Person and task characteristics in multiple person dynamic decision making.	December 7	Richard Shweder , Chicago: Why cultural psychology, not cross-cultural psychology?
November 16	Ed Diener , University of Illinois: Measurement and findings of subjective well-being.	December 8	Ulrich Schiefele , Universität Bielefeld: Motivation und Handlungskontrolle als Bedingungen der Leistungsgüte und -menge im Studium.
November 17	Ellen Bialystok , York University, Toronto/Ontario: Bilingualism and cognition: Searching for interactions in development.		

1998

January 7	Heinrich Mintrop , University of Maryland: Die Reform des pädagogischen Kernbereichs von Schule in vergleichender Perspektive.	March 16	David H. Jonassen , Pennsylvania State University: Representing what we know and learn: Mindtools as an academic toolkit.
January 17	Friedrich Pfeiffer , Zentrum für Europäische Wirtschaftsforschung, Mannheim: Die Veraltung von Ausbildungswissen. Eine Analyse des dualen Ausbildungssystems.	March 18	Robert F. Boruch , University of Pennsylvania: Connections between large scale surveys and controlled experiments in educational and other social research.
January 30	John C. Dencker , Harvard University: Who is laid off and why? An analysis of workforce reductions in a large U.S. firm, 1967–1993.	May 6	Norbert Bischof , Universität München: What is specifically human?
February 3	Marcus Hasselhorn , Universität Göttingen: Wird die dysphasische Sprachentwicklungsstörung durch Dysfunktion im phonologischen Arbeitsgedächtnis verursacht?	May 6	Joachim Brunstein , Universität Potsdam: Motivationale Effekte der Bindung an ein Studienziel: Reaktionen auf Mißerfolge und selbstdefinierende Ideale.
February 16	Christoph Klauer , Universität Bonn: On the interaction of logical validity and belief in syllogistic reasoning.	May 11	Antje Mertens , Humboldt-Universität zu Berlin: Arbeitsplatzverlust und Lohnentwicklung—Eine empirische Analyse für Westdeutschland.
February 17	Barbara Krahe , Universität Potsdam: Sexuelle Aggression zwischen Jugendlichen: Prävalenz und Prädiktoren.	May 11	Ryan Tweney , Bowling Green State University: Cognition and scientific thinking: Levels of analysis for a cognitive science of science.
March 9	Reinhard Selten , Universität Bonn: Learning direction theory and the winner's curse.	May 18	Friedhart Klux , Humboldt-Universität zu Berlin: Zur Evolution intelligenzintensiver Module des Denkens.
March 10	Robert Boyd , University of California: Population structure and equilibrium selection in evolutionary games.	May 19	Axel Franzen , Universität Bern: Persönliches Umweltverhalten zwischen kollektivem Nutzen und individuellem Interesse.
March 13	Richard Breen , European University Institute, Florence: Risk and recommendation: Towards a		

- May 19 **Winfried Hacker**, Technische Universität Dresden:
Prospektives Gedächtnis—Bedingungen des Ausführens zurückgestellter Handlungen.
- May 20 **Peter Drewek**, Freie Universität Berlin:
Internationalisierungsprozesse zu Beginn des 20. Jahrhunderts—Erziehungssystem, akademische Mobilität und Erziehungswissenschaft im deutsch-amerikanischen Vergleich.
- June 2 **Daniel M. Wegner**, University of Virginia:
How to think, feel, or say precisely the most inappropriate thing for any occasion: Ironic processes of mental control.
- June 3 **Hans Spada**, Universität Freiburg:
Spontaneous, schematic, and coherent judgments in environmental risk evaluation: Model and data.
- June 9 **Geert Hofstede**, University of Maastricht:
Entrepreneurship in Europe.
- June 25 **Shelley E. Taylor**, University of California, Los Angeles:
Harnessing the imagination.
- July 6 **Elisabetta Ruspini**, Mannheimer Zentrum für Europäische Sozialforschung:
Lone mothers and dynamics of poverty in Europe.
- July 22 **David Uttal**, Northwestern University, Illinois:
Seeing the big picture: Map use and the development of spatial cognition.
- August 5 **Herbert W. Marsh**, University of Western Sydney Macarthur:
Academic self-concepts and achievement: An overview.
- August 10 **Judy De Loache**, University of Illinois:
Becoming symbol minded: Young children's understanding and use of symbols.
- August 12 **Herbert W. Marsh**, University of Western Sydney Macarthur:
Student evaluations of university teaching effectiveness.
- September 9 **Susan Stodolsky**, University of Chicago:
Why are some teachers willing to change their classroom practice? A comparison of secondary mathematics and English teachers.
- October 6 **John A. Bargh**, New York University:
Automaticity of everyday life.
- October 30 **Peter Sloane**, University of Aberdeen:
On gender wage differentials.
- November 4 **Gavriel Salomon**, Haifa University:
New media: The cultivation of useful skills vs. the "butterfly effect."
- November 13 **Siv Gustafsson**, University of Amsterdam:
Optimal age of giving birth: Sweden, Germany, Britain and the Netherlands.
- November 17 **Willard W. Hartup**, University of Minnesota:
Risk and protective factors in peer relations in human development.
- November 20 **Manfred Tessaring**, CEDEFOP, Thessaloniki:
Qualifikationsungleichgewichte in Europa.
- November 27 **Jonathan Gershuny**, University of Essex:
Using life course data to establish social position.
- December 1 **Wolfgang Schnotz**, Universität Landau:
Mentale Repräsentation beim Wissenserwerb mit Texten, Bildern und Diagrammen.
- December 1 **Klaus Fiedler**, Universität Heidelberg:
Emotionseinflüsse auf Kognition und Verhalten: Die Rolle von Assimilation und Akkommodation.
- December 4 **Gerhard Kleinhenz**, Institut für Arbeitsmarkt- und Berufsforschung der Bundesanstalt für Arbeit, Nürnberg:
Ist hohe Beschäftigung noch ein realisierbares Ziel der Wirtschafts- und Arbeitsmarktpolitik? IAB-AGENDER für Mehrbeschäftigung.
- December 7 **Orlando M. Lourenco**, University of Lisbon:
The psychology of my discontent: A critical view on present psychology.
- December 9 **Hans N. Weiler**, Europa-Universität Viadrina, Frankfurt/Oder:
Hochschulfinanzierung, Hochschulstrukturen, Hochschulreform: Feststellungen und Vermutungen zu einer vergleichenden Fragestellung.
- December 11 **Ivan Szelenyi**, University of California, Los Angeles:
Changing social structure during market transition: The case of central Europe.
- December 18 **Wolfgang Schluchter**, Max-Weber-Kolleg, Universität Erfurt:
Handlungstheorien nach Max Weber.

2. Visiting Scientists 1998–2000

2000

July 1999–January 2000	Thomas A. DiPrete Duke University	June	Seisoh Sukemune Mukogawa Women's University, Nishonomiya, Japan
January–June	John Nesselroade University of Virginia	October 1999–July 2000	Andreas Ortmann Bowdoin College
October 1999–February 2000	Batbold Enkhtuvshin Mongolian Academy of Sciences	September–December	Szymon Wichary Jagiellonian University, Cracow
February–April	K. Warner Schaie Sherry L. Willis Pennsylvania State University	November 1999–October 2000	Katariina Salmela-Aro University of Helsinki
September 1999–March 2000	Chin-fen Chang Academia Sinica, Taiwan	October–November	Erich Ramseier Amt für Bildungsforschung, Bern
October 1999–March 2000	Johannes Huinink Universität Rostock	October–November	Ödön Vanscó University of Budapest, Hungary
April–August	Thomas Cook Northwestern University	November	Marilyn Binkley National Institute on Postsec- ondary Education Libraries and Lifelong Learning, Washington, DC
May	Robert Levenson Berkeley University	since October 1999	Tilmann Habermas Freie Universität Berlin
May–June	Janet Aisbett Greg Gibbon Newcastle University, Australia		
June	Gisela Labouvie-Vief Wayne State University		

1999

November 1998–February 1999	Jaap Dronkers University of Amsterdam	June 1998–July 1999	Tomas Korpi University of Stockholm
March	Laurel Bornholt University of Sidney	July	Tenko Raykov Fordham University
April	Richard Nisbett University of Michigan	July	Valentina McInerney University of Western Sydney
April–August	Heinz-Martin Süß Universität Mannheim	July	Ge Fang Academia Sinica, Peking
April–September	Susana Garcia Diez Consejo Superior de Investiga- ciones Cientificas	July	Fuxi Fang Academia Sinica, Peking
May	Richard Lerner Boston College	July–August	Peter Ayton City University, London
May	Michael Marsiske Wayne State University	August–September	Jacquelynn Eccles University of Michigan
May	Ann Horgas Wayne State University	September	Denise Cummins University of California, Davis
May–August	Derek Isaacowitz University of Pennsylvania	September–October	Hannah Brückner Columbia University

September–December	William Fleeson Wake Forest University	November	Miguel Oliveira Universidade de Coimbra
September–December	David Rubin Duke University	November	Norbert Schwarz University of Michigan
October	Fritz Staub Universität Zürich	November	Edward Diener University of Illinois
October 1998–September 1999	Elio Tuci National Research Council, Rome	November	Brett Laursen University of Florida

1998

January	Heinrich Mintrop University of Maryland	August	Herbert W. Marsh University of Western Sydney Macarthur
February	Jean Czerlinski University of Chicago	September 1996–August 1998	Bogdan Mach Polish Academy of Sciences
February	Geoffrey Miller College University London	September–November	Friedrich Douglas University of West Florida
February	William C. Wimsatt University of Chicago	September–December	Anita Liberalesso Neri State University Campinas, Brazil
February–March	Glenn Carroll University of California, Berkeley		
February–April	X. T. Wang University of South Dakota		
March	Robert F. Boruch University of Pennsylvania		
March	David H. Jonassen Pennsylvania State University		
April–December	Jeremy Straughn University of Chicago		
May	Kathryn Laskey George Mason University		
July	Elisabetta Ruspini MZES Mannheim		
July–August	David Uttal Northwestern University, Illinois		
July–September	Mihai Gheorgiu Maison des Sciences de l'Homme, Paris		
July–October	Tenko Raykov University of Melbourne		



3. Other Professional Activities 1998–2000

- Paul B. Baltes**
- Academia Europaea (Founding Member; Election Committee, Section on Psychology and Behavioral Sciences).
 - Berlin-Brandenburgische Akademie der Wissenschaften (Founding Member; Member of Executive Committee).
 - Freiburger Stiftung, Berlin (Member of Kuratorium).
 - US National Academy of Science, Future Research in Cognitive Aging (Member of Committee).
 - International Encyclopedia of the Social and Behavioral Sciences (Coeditor-in-Chief with Neil Smelser).
 - Jacobs Foundation (Member of Board of Trustees).
 - Social Science Research Council, USA (Chair of Board of Directors and Member of Executive Committee).
 - Deutsche Akademie der Naturforscher Leopoldina (Vice-President).
 - DaimlerChrysler Berlin Leadership Seminar (Chair of Steering Committee for Seminar 2001 and Member of Advisory Board).
- Jürgen Baumert**
- Deutsche Forschungsgemeinschaft (Member of Senate and Main Committee; Member of Committee on Research Perspectives).
 - Review Committee Pedagogics and Education (RCPE), Utrecht (Member).
 - Academia Europaea (Member).
 - Programm "Steigerung der Effizienz des mathematisch-naturwissenschaftlichen Unterrichts" (Chair of Board of Scientific Advisers).
 - Deutsches Institut für Internationale Pädagogische Forschung (Member of Board of Scientific Advisers).
 - Zentrum für Schulforschung und Fragen der Lehrerbildung der Martin-Luther-Universität Halle-Wittenberg (Member of Board of Scientific Advisers).
 - Zeitschrift für Erziehungswissenschaft (Coeditor).
 - Zeitschrift für Unterrichtswissenschaft (Coeditor).
 - International Journal of Educational Research (Editorial Board).
 - Zeitschrift für Pädagogische Psychologie (Member of Board of Scientific Advisers).
 - Zeitschrift Psychologie in Erziehung und Unterricht (Member of Board of Scientific Advisers).
 - Schweizerische Zeitschrift für Bildungswissenschaften (Member of Board of Scientific Advisers).
 - Journal für Mathematik-Didaktik (JDM) (Member of Scientific Advisory Committee).
 - Waxmann Verlag, Reihe Pädagogische Psychologie und Entwicklungspsychologie, Münster (Member of Board of Scientific Advisers).
 - School Effectiveness and School Improvement (Member of Board of Scientific Advisers).
 - Organizing Committee, 9th European Conference of the European Association for Research on Learning and Instruction (EARLI).
- Felix Büchel**
- Economics of Education Review (Member of Editorial Board).
 - Verein für Socialpolitik, Sozialpolitischer Ausschuss (Member).
 - Verein für Socialpolitik, Bildungsökonomischer Ausschuss (Member).
 - Arbeitskreis Berlin-Brandenburgischer Wirtschaftswissenschaftler (Active).
 - Längsschnittwerkstatt Berlin-Brandenburg LWBB (Founding Member).
 - Project "New Indicators for Vocational Education and Training" (VOTEC), conducted by the European Commission (DG XXII), EUROSTAT, and CEDEFOP (German representative at the Board of Scientific Advisers).
 - Swiss Household Panel SHP (Member of Scientific Advisory Board).
- Michael Corsten**
- Deutsche Gesellschaft für Soziologie, Working Group "Methoden der qualitativen Sozialforschung" (Co-Speaker).
- Wolfgang Edelstein**
- Max-Planck-Gesellschaft (Co-Chair of Commission on "Responsible Conduct in Science").
 - Ministerium für Bildung, Jugend und Sport des Landes Brandenburg (Chair of Board of Scientific Advisers for the new school subject Life Skills – Ethics – Religion).
 - Commission for the preparation of a model program "Learning Democracy in School and Community" to be implemented under the auspices of the Joint Commission of the Federal Government and the State Ministries of Education (BLK) (Member).

- BLK-Programm "Qualitätsverbesserung in Schulen und Schulsystemen" (Member of Board of Scientific Advisers).
 - Stiftung "Brandenburger Tor" der Bankgesellschaft Berlin (Member of Board of Scientific Advisers).
 - Centre Marc Bloch—Centre Franco-Allemand de Recherches en Sciences Sociales (Member of Board of Scientific Advisers).
 - Institut für angewandte Familien-, Kindheits- und Jugendforschung e.V., Potsdam (Member of Board of Scientific Advisers).
 - Interdisziplinäres Zentrum für Gerechtigkeitsforschung an der Universität Potsdam (Member of Board).
 - Suhrkamp Verlag, Reihe Beiträge zur Soziogenese der Handlungsfähigkeit (Editor).
 - Social Justice Research, New York (Editorial Board).
- Gerd Gigerenzer**
- Berlin-Brandenburgische Akademie der Wissenschaften (Member).
 - Theory and Psychology (Coeditor).
 - Cognition (Editorial Board).
 - Journal of Behavioral Decision Making (Editorial Board).
 - Humboldt Research Awards Committee (Member of Selection Committee).
 - Latsis Awards on Communications Sciences (Member of Selection Committee).
 - Evolution and Human Behavior (Editorial Board).
 - Max-Planck-Institut zur Erforschung von Wirtschaftssystemen (Member of Search Committee).
- Christa Händle**
- Deutsche Gesellschaft für Politische Bildung, Sektion Politische Bildung (Member of Board).
 - Förderprogramm "Demokratisches Handeln" (Member of Advisory Board).
 - Landesverband der Gemeinnützigen Gesellschaft Gesamtschulen (Member of Board).
- Jutta Heckhausen**
- Gerontology (Editorial Board).
 - North American Journal of Psychology (Editorial Board).
- Jürgen Hess**
- Newsletter "Specialist Group Computer Sciences and Development" of the Gesellschaft für Informatik (Editorial Board).
 - Union "Öffentliche Dienste, Transport und Verkehr" (Member of Executive Board of the Department for Science and Research, Berlin).
- Erika M. Hoerning**
- International Sociological Association (Research Committee 38, Biography and Society, Member of Board).
 - International Yearbook of Oral History and Life Stories (Coeditor).
 - Oral History Association, USA (Corresponding Member).
 - BIOS, Zeitschrift für Biographieforschung und Oral History (Coeditor).
 - Konzil der Deutschen Gesellschaft für Soziologie (Member).
- Ulrich Hoffrage**
- Memory, Special Issue "Hindsight Bias" (Coeditor).
- Fabien Jobard**
- Centre Marc Bloch—Centre Franco-Allemand de Recherches en Sciences Sociales, Berlin (Associate Researcher).
 - Centre d'études sociologiques du droit et des institutions pénales, Paris (Associate Researcher).
 - Max-Planck-Institut für ausländisches und internationales Strafrecht: Research project on police cooperation in Europe (Member).
- Monika Keller**
- Jean Piaget Society for the Development of Knowledge (Member of Board of Directors).
 - Zeitschrift für Ethik und Sozialwissenschaften (Editorial Board).
- Eckhard Klieme**
- Deutsche Forschungsgemeinschaft, Research Program "School Quality" (Group of Initiators).
 - OECD, Center for Educational Research and Information, Network for Student Outcome Indicators (Expert Group).
 - Program of International Student Assessment (PISA) (Member of the German National Scientific Consortium).
 - National Center of Education Statistics, Washington, DC (Scientific Adviser for the International Adult Literacy and Life Skills Study).

- Olaf Köller**
- Zeitschrift für Pädagogische Psychologie (Member of Board of Scientific Advisers).
 - Lesson Lab, University of California, Los Angeles (Adviser for the TIMSS-Repeat-Video Study)
- Lothar Krappmann**
- Bundesministerium für Familie, Senioren, Frauen und Jugend (Board of Scientific Advisers for Family Issues).
 - Universität Konstanz, Forschungsschwerpunkt "Familie und Gesellschaft" (Board of Scientific Advisers).
 - Empirische Pädagogik (Board of Advisers).
 - Zeitschrift für Familienforschung (Board of Advisers).
 - Neue Sammlung (Coeditor).
 - Haus der Politischen Bildung e.V., Berlin (Chairperson).
 - Lucius & Lucius (früher: Enke Verlag), Reihe "Der Mensch als soziales und personales Wesen" (Coeditor).
 - Newsletter of the International Society for the Study of Behavioural Development (Coeditor).
 - Sachverständigenkommission für den 10. Kinder- und Jugendbericht (Chairperson).
- Kurt Kreppner**
- From Past to Future. Clark Papers on the History of Psychology (Editorial Board).
 - Psicologia: Teoria e Pesquisa (Psychology: Theory and Research, Brazil) (Editorial Board).
- Gero Lenhardt**
- Educação & Sociedade (Editorial Board).
- Laura Martignon**
- Swedish Council for the Development of Science (Member).
 - Deutsche Gesellschaft für Didaktik der Mathematik, Arbeitskreis Stochastik (Adviser).
 - International School for Advanced Studies, Neuroscience Section, Trieste (Member of Board of Advisers).
 - Stochastik in der Schule (Editorial Board).
 - Matemática Universitária (Associate Editor).
- Karl Ulrich Mayer**
- Berlin-Brandenburgische Akademie der Wissenschaften (Member of Constitutional Council; Committee on "Young Academy").
 - Deutsche Akademie der Naturforscher Leopoldina (Senator, Founding Member of Section on Economics and Empirical Social Sciences).
 - Deutsche Gesellschaft für Soziologie (Member of Board).
 - Freudenberg Stiftung (Member of Working Group Youth in Education-Employment).
 - German-American Frontiers of the Behavioral and Social Sciences Symposium (GAFOSS) of the German-American Academic Council (GAAC) (Coordinator for Germany).
 - Kommission der Bundesregierung zur Verbesserung der informationellen Infrastruktur zwischen Wissenschaft und Statistik (Member).
 - Max-Planck-Institut für Demographie (Chair of Founding Committee; Member of Board of Scientific Advisers).
 - Max-Planck-Institut zur Erforschung von Wirtschaftssystemen (Member of Search Committee).
 - Max-Planck-Institut für Gesellschaftsforschung (Chair of Search Committee).
 - Sächsische Hochschulentwicklungskommission (Vice-chair).
 - University of Oxford (Member of Board of Electors for a new sociology professorship).
 - Wissenschaftsrat (1993-1999; Chairperson of the Scientific Committee 1996-1999; Member: Presidential Committee Future Science System, Personnel Structure in Higher Education; Chairperson of the following Working Groups: Evaluation Committee on Research on the Deutsches Jugendinstitut, Higher Education and Labor Market).
 - Max-Planck-Institut für ausländisches und internationales Privatrecht (Member of Search Committee).
 - Kölner Zeitschrift für Soziologie und Sozialpsychologie (Coeditor).
 - Berliner Journal für Soziologie (Editorial Board).
 - European Academy of Sociology (Member).
 - Yale University, Center of Comparative Research (Member of Advisory Board).
 - Cornell University, Center for the Study of Inequality (Member of Advisory Board).
- Justin Powell**
- National Science Foundation, Review Committee for the Science Resources Studies Division "Women, Minorities, and Persons with Disabilities in Science and Engineering" (Member).

- Diann Rusch-Feja**
- International Federation of Library Associations and Institutions (Secretary/Treasurer, Section of Information Technology; Secretary, Coordinating Board of Division 6, Library Management and Technology).
 - Special Librarians Association, GLOBAL 2000 (Program Committee).
 - BMB+F (Advisory Committee; "Untersuchung zur Nutzung elektronischer Fachinformation, -publikation und -kommunikation in der Hochschulausbildung").
 - Global-Info Consortium (Member).
 - Dublin Core Metadata Initiative (Advisory Committee; Usage Committee).
 - Arbeitsgemeinschaft Spezialbibliotheken (Advisory Committee).
 - Open Archives Initiative (Steering Committee).
 - International University Bremen (Library Consultant; Information Resources Center).
 - Deutscher Bibliotheksverband (Advisory Committee; Regionalverband Berlin-Brandenburg).
 - Information and Communications Commission of the German Learned Societies (IuK-Kommission) (DGfE-Delegate); Working Group "E-Journals" (Co-Speaker); "Metadata and Classification" (Member).
 - Gesellschaft Information Bildung e.V. (Co-Chair).
 - World Conference on Continuing Professional Education in the Information Professions 2002 (Co-Chair; Program Committee).
- Jacqui Smith**
- The Journals of Gerontology: Psychological Sciences (Editorial Board).
 - Research Group on Psychological Gerontology, Medical School, Freie Universität Berlin (Interim Chair).
 - XVth Biennial Meetings of the International Society for the Study of Behavioural Development (ISSBD) (Program Committee).
 - XVIth Biennial Meetings of the International Society for the Study of Behavioural Development (ISSBD) (Program Committee).
 - International Society for the Study of Behavioural Development (ISSBD) (Member of the Executive Committee).
 - Graduiertenkolleg "Psychiatry and Psychology of Aging" (Steering Committee).
 - 15. Tagung der Fachgruppe Entwicklungspsychologie (Program Committee).
- Heike Solga**
- "Die Junge Akademie" an der Berlin-Brandenburgischen Akademie der Wissenschaften und der Deutschen Akademie der Naturforscher Leopoldina (Member).
 - German-American Frontiers of the Behavioral and Social Sciences Symposium (GAFOSS) of the German-American Academic Council (GAAC) (Member of the Organizing Committee).
 - GSOEP 2000 International Conference (Program Committee).
 - Max-Planck-Gesellschaft (Arbitrator).
 - Max-Planck-Gesellschaft (Senator).
- Elsbeth Stern**
- Landesprüfungsamt Berlin (External Member of Board of Examiners for Psychology).
 - Deutsche Gesellschaft für Psychologie (Board of Governors of the Subject Section "Pädagogische Psychologie").
- Peter M. Todd**
- Animal Cognition, Springer Verlag (Associate Editor).
 - Adaptive Behavior, MIT Press (Associate Editor).
- Heike Trappe**
- Arbeitsgemeinschaft sozialwissenschaftlicher Institute (Institute's Representative).
 - European Sociological Review (Expert).
- Helga Zeiher**
- Deutsche Gesellschaft für Soziologie, Sektion "Soziologie der Kindheit" (Chair).
 - International Sociological Association, Research Committee "Sociology of Childhood" (Member of Board).
 - Zeitschrift für Soziologie der Erziehung und Sozialisation (Coeditor).
 - COST (Coopération européenne dans le domaine de la recherche scientifique et technique)—Action 19 Children's Welfare (Member of Management Committee).

4. Academic Degrees 1998–2000

Habilitations

Büchel, F. (1998). Unterwertige Erwerbstätigkeit in Deutschland. Technische Universität Berlin.

Diewald, M. (2000). Entwertungen, Umwertungen, Aufwertungen. Ostdeutsche Erwerbsverläufe zwischen Kontinuität und Wandel. Freie Universität Berlin.

Grundmann, M. (1998). Norm und Konstruktion. Sozialisationstheoretische Überlegungen und Analysen zum Bildungserwerbsprozess. Humboldt-Universität zu Berlin.

Händle, C. (2000). Lehrerinnen in System und Lebenswelt. Erkundungen ihrer doppelten Sozialisation. Universität Oldenburg.

Hoffrage, U. (2001). Urteilen und Entscheiden. Freie Universität Berlin.

Klieme, E. (2000). Förderung mathematisch-naturwissenschaftlicher und fächerübergreifender Kompetenzen. Freie Universität Berlin.

Lindenberger, U. (1998). Intellektuelle Entwicklung über die Lebensspanne: Überblick und Brennpunkte der Forschung. Kurzmonographie im Rahmen des Habilitationsverfahrens. Freie Universität Berlin.

Martignon, L. (1998). Probabilistic inference in brain, mind and machine. Universität Ulm.

Smith, J. (1999). Differential psychological aging: Towards clarifying a longstanding concept. Freie Universität Berlin.

Uhlendorff, H. (2000). Erziehung im sozialen Umfeld. Eine empirische Untersuchung über Erziehung zwischen elterlicher Kontrolle und Freiräumen für Kinder in Abhängigkeit vom persönlich gestalteten und gesamtgesellschaftlichen Umfeld von Familien. Universität Potsdam.

Doctoral Dissertations

Alfeld-Liro, C. (1999). Gender, achievement, motivation, and mental health among adolescents in the 1990s. University of Michigan, Ann Arbor.

Artelt, C. (1999). Voraussetzungen und Effekte strategischen Lernens bei Schülern—Inhaltliche und methodische Aspekte. Universität Potsdam.

Barrett, H. C. (1999). Human cognitive adaptations to predators and prey. University of California, Santa Barbara.

Böhmig-Krumhaar, S. (1998). Die Entwicklung einer wissenschaftlich-aktiveren Gedächtnisstrategie im Bereich der Pragmatik des Geistes am Beispiel des Weisheitskriteriums "Wert-Relativismus". Freie Universität Berlin.

Börner, K. (2000). Family dynamics following parental loss: A comparison of mother- and father-headed families. Freie Universität Berlin.

Chase, V. M. (1999). Where to look to find out why: Rational information search in causal hypothesis testing. University of Chicago.

Clausen, M. (2000). Wahrnehmung von Unterricht. Übereinstimmung, Konstruktvalidität und Kriteriumsvalidität in der Forschung zur Unterrichtsqualität. Freie Universität Berlin.

Dencker, J. C. (1998). Workforce reductions and intra-organizational mobility response: An analysis of promotion and turnover in a large US firm, 1967–1993. Harvard University.

Engelhardt, H. (1998). Zur Dynamik von Ehescheidungen. Universität Bern.

Goedicke, A. (2000). Beschäftigungsfolgen betrieblichen Wandels. Eine Studie zu Betriebswechsell und Arbeitslosigkeit in Ostdeutschland. Freie Universität Berlin.

Gruehn, S. (1998). Unterricht und schulisches Lernen. Schüler als Quellen der Unterrichtsbeschreibung. Freie Universität Berlin.

Hardy, I. (1998). The contribution of contextual variables to conversation in a foreign language. University of Iowa.

Hillmert, S. (1999). Ausbildung und Übergang in den Arbeitsmarkt. Lebensverläufe in Großbritannien und der Bundesrepublik Deutschland im Kohortenvergleich. Freie Universität Berlin.

Hosenfeld, I. (2000). Subjektive Theorien von Schülern über die Ursachen von Schulerfolg und der Zusammenhang zur Leistungsentwicklung. Freie Universität Berlin.

Kray, J. (1998). Adult age differences in task switching: Components, generalizability and modifiability. Freie Universität Berlin.

Koerber, S. (2000). Der Einfluss externer Repräsentationsformen auf proportionales Denken im Grundschulalter. Technische Universität Berlin.

Kunzmann, U. (1998). Being and feeling in control: Two sources of older people's emotional well-being. Freie Universität Berlin.

Lages, M. (1998). Bias in visual discrimination and detection. University of Oxford, UK.

Marsh, B. (2000). Making the best choice: Judgement and decision making under conditions of risk and uncertainty. University of Oxford, UK.

Mertens, A. (1998). Labor mobility and wage dynamics: An empirical analysis for Germany in comparison with the United States. Humboldt-Universität zu Berlin.

Noble, J. (1999). The evolution of animal communication systems: Questions of function examined through simulation. University of Sussex, UK.

Offenberger, P. (1999). Konfliktbewältigung und Freundschaft in der mittleren Kindheit. Universität Potsdam.

Savelsbergh, E. R. (1998). Improving mental representations in physics problem-solving. University of Twente.

Singer, T. (2000). Testing-the-Limits in einer mnemonischen Fähigkeit. Eine Studie zur kognitiven Plastizität im hohen Alter. Freie Universität Berlin.

Stanat, P. (1998). Voicing unpopular views: Effects of majority similarity on public expressions of minority positions. University of Massachusetts.

Ullrich, M. (1998). Differentielle Kommunikationsformen in Familien und ihre Bedeutung für die Entwicklung Jugendlicher. Freie Universität Berlin.

Wiese, B. (1999). Prioritätensetzung im jungen Erwachsenenalter. Zur Dynamik beruflicher und partnerschaftlich-familiärer Zielstrukturen. Freie Universität Berlin.

Zornemann, P. (1998). Hilfe und Unterstützung im Kinderalltag. Eine qualitative Untersuchung von Interaktionen unter Gleichaltrigen anhand von videografierten Beobachtungen in einer Grundschulklasse. Freie Universität Berlin.

Zühlke, S. (1999). Beschäftigungsabbau ohne Perspektive? Zur Verarbeitung berufsstruktureller Wandlungsprozesse durch berufliche Mobilität. Freie Universität Berlin.

Master's and Diploma Theses

Abdel-Karim, A. (2000). Zum Akzelerationsphänomen der psychometrischen Intelligenz: Eine Längsschnittstudie. Freie Universität Berlin.

Bromba, M. (1999). Sozialer Wandel und Kontrollüberzeugungen: Eine empirische Untersuchung mit der Lebensverlaufsstudie Ost. Freie Universität Berlin.

Ebner, N. (2000). Physical activity and aging: Associations between physical activity, subjective health, functional health, and control beliefs in late life. Freie Universität Berlin.

Fichtner, C. (1999). Persönlicher Umgang mit gesellschaftlichen Veränderungen. Verarbeitung des Wendeinflusses auf die sozialen Beziehungen der Aufbaugeneration der DDR. Technische Universität Berlin.

Gerstorff, D. (2000). Transcending the rubicon: Psychological predictors of longevity in centenarians. Freie Universität Berlin.

Härtel, A. (1999). Evaluation arbeitsmarktpolitischer Instrumente in bezug auf Wiedereingliederungschancen und Kontrollüberzeugungen: Eine empirische Untersuchung der Studie "Ostdeutsche Lebensverläufe im Transformationsprozeß." Universität Leipzig.

Höhne, A. (2000). Berufsstruktur und Bildungsexpansion, Kontinuität und Wandel im Berufseinstieg von

Frauen der Geburtsjahrgänge 1939–41 und 1959–61 in Westdeutschland. Humboldt-Universität zu Berlin.

Hönig, G. (1998). Zukunftsdenken und Lernmotivation. Technische Universität Berlin.

Hoppmann, C. (2000). Berliner Frauen der 20er Jahre: Lebensentwürfe mit und ohne Kinder und Lebensstil im Alter. Freie Universität Berlin.

Klemmert, H. (1998). Die Entwicklung des mathematischen und verbalen Selbstkonzepts. Technische Universität Berlin.

Kolbe, S. (1998). Beziehung und Moral im kulturellen Kontext (Master thesis). Humboldt-Universität zu Berlin.

Malti, T. (1998). Moralische Gefühle, Begründungen und Sozialverhalten in der Kindheit: Ein integrativer Ansatz. Freie Universität Berlin.

Müller-Heydenreich, A. (1999). Wohlbefinden im hohen Lebensalter: In Abhängigkeit von unterstützenden und stimulierenden Beziehungen zu Verwandten und Nichtverwandten. Freie Universität Berlin.

Plaßmeier, N. (1998). Beliebtheit und personenbezogene Merkmale: Sekundäranalyse des Zusammenhangs bei Schülern der Sekundarstufe I. Universität Münster.

Sauer, B. (2000). Die Fähigkeit zur Selbstreflexion und Wohlbefinden im Alter. Freie Universität Berlin.

Schäfer, S. (2000). Age differences in the regulation of action sequences. Freie Universität Berlin.

Schindler, I. (2000). Die Optimierung der Zielauswahl und ihre Auswirkung auf die Zielbindung (Commitment). Humboldt-Universität zu Berlin.

Stange, A. (2000). Untersuchung des Forced-Choice-Antwort-Formates des Fragebogens zur Erfassung von Selektion, Optimierung und Kompensation. Freie Universität Berlin.

Thebis, F. (2000). Die Entwicklung fremdenfeindlicher bzw. integrationsbereiter Einstellungen bei Jugendlichen. Eine Sekundäranalyse anhand der Daten des BIJU-Projekts am Max-Planck-Institut für Bildungsforschung. Freie Universität Berlin.

Art exhibition by secondary school students in the Institute's entrance hall.



5. Scientific and Professional Staff 1998–2000

Artelt, Cordula (Dr. phil. in Psychology, 1999, Universität Potsdam): Research in learning (learning strategies and metacognition); cognitive, emotional, and motivational development.

Baltes, Paul B. (Dr. phil. in Psychology, 1967, Universität des Saarlandes; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Psychology, Freie Universität Berlin): Lifespan human development: evolution and ontogenesis; aging of the mind (intelligence, memory, personality, wisdom); theory of successful development; science policy: interdisciplinarity, history, and internationality.

Baumert, Jürgen (State Examination for Teachers, 1968, Hamburg; Dr. phil., 1968, Universität Tübingen; habil. in Educational Sciences, 1982, Freie Universität Berlin; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Educational Sciences, Freie Universität Berlin and Humboldt-Universität zu Berlin): Research in teaching and learning; cultural comparisons, large-scale assessment, cognitive and motivational development in adolescence.

Baumgarten, Jürgen (Dr. phil. in German Language and Literature, 1973, Freie Universität Berlin; Head of the Editorial and Publications Unit): Prehistory of the Middle East; Intellectual and cultural history of Central and Eastern Europe.

Büchel, Felix (Dr. rer.pol. in Political Science, 1991, Freie Universität Berlin; habil. in Economics, 1998, Technische Universität Berlin): Economics of education; labor market research; social policy research.

Corsten, Michael (Dr. phil. in Sociology, 1991, Universität Marburg; habil. in Sociology, 1997, Freie Universität Berlin): Interpretive sociology; cultural research on institutions, organizations, and professions; studies on biographies, generational discourse, and youth cultures.

Davis, Jennifer N. (PhD in Psychology, 1996, McMaster University): Parental investment decisions and parent-offspring conflict in humans and other animals; evolutionary explanations of decision-making; the use of socially transmitted information in decision-making, especially in food choice; use of the environment to make decisions for one; the evolution of human family systems.

Delius, Julia (Dr. med. in Medicine, 1993, Universität Frankfurt a.M.): Editorial responsibilities including the International Encyclopedia of the Social and Behavioral Sciences; interdisciplinary gerontology; Berlin Aging Study coordination and website design.

Diewald, Martin (Dr. phil. in Sociology, 1991, Technische Universität Berlin; habil. in Sociology, 2000, Freie Universität Berlin): Social stratification and labor market; transformation of former socialist countries, especially GDR; life course and individual development; in-

formal networks; family and social inequality (now at the Universität Duisburg).

Engelhardt, Henriette (Dr. rer.soc. in Sociology, 1998, Universität Bern): Methods of empirical social research; sociology of family; social inequality; social demography.

Freund, Alexandra M. (Dr. phil. in Psychology, 1994, Freie Universität Berlin): Processes of developmental regulation; motivation across the life span; development of self-regulated cognitions over the life span.

Gigerenzer, Gerd (Dr. phil. in Psychology, 1977, Universität München; habil. in Psychology, 1982, Universität München; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Psychology, Freie Universität Berlin): Models of bounded rationality; social intelligence; ecological rationality; heuristics of scientific discovery; philosophy, history, and methodology of social sciences.

Goedicke, Anne (Dipl.-Soz., 1996, Humboldt-Universität zu Berlin): Social stratification and formal organizations; transformation of former socialist countries; life course; social mobility; labor market, firms, and occupations.

Goldstein, Daniel G. (PhD in Psychology, 1997, University of Chicago): Fast and frugal models of cognition, satisficing (how organisms make accurate and robust inferences, given constraints of limited time, knowledge, and computational might); behavioral economics (especially presenting information to make "risk aversion" disappear); scientific discovery.

Grund, Peter (Dipl.-Inform., 1981, Technische Universität Berlin; Member of the Information Processing Center scientific staff): Statistical software and data base management systems; data protection.

Gürtler, Christine (Dipl.-Psych., 1999, Universität Würzburg): Socio-cognitive development; social processes among children; familial relationships.

Händle, Christa (First and Second State Examination for Teachers, 1961, 1965; Dr. phil. in Sociology, 1977, Universität Bremen; habil. in Educational Sciences, 2000, Universität Oldenburg): The culture of educational institutions; the double socialization of teachers; transformation of the education system in the new federal states.

Hardy, Ilonca (PhD in Educational Psychology, 1998, University of Iowa): Learning environments incorporating the social character of cognition (emphasis: collaborative learning); the role of language in problem solving; effects and uses of external representations.

Hartung, Dirk (Dr. rer.pol. in Sociology, 1973, Universität Bremen): Educational training and employment; Chairman of the Gesamtbetriebsrat of the Max Planck

Society (on leave from the Center for Sociology and the Study of the Life Course).

Heckhausen, Jutta (PhD in Psychology, 1984, University of Strathclyde, Glasgow; habil. in Psychology, 1996, Freie Universität Berlin): Lifespan developmental psychology; motivational psychology of human development; primary and secondary control and their evolutionary origin; developmental regulation across the life span.

Hertwig, Ralph (Dr. rer.soc. in Psychology, 1995, Universität Konstanz): Models of cognitive processes in hindsight bias and the reiteration effect; risk perception and decision-making in the domain of crime perception; ecological rationality; methodology (i.e., comparison of the methodological approaches in psychology and experimental economics).

Hess, Jürgen (Dr. phil. in Sociology, 1982, Freie Universität Berlin; Head of the Information Processing Center): Service management in research institutions; information technology in the social sciences; computer-assisted qualitative social research; higher education in sub-Saharan Africa; application of information technology and methods of empirical social research at universities in sub-Saharan Africa.

Hillmert, Steffen (Dipl.-Soz., 1996, Universität Bamberg; Dr. phil. in Sociology, 2000, Freie Universität Berlin): Life courses and institutional change; comparative studies; education, training, and transitions into the labor market; occupational careers; research methods.

Hoerning, Erika M. (Dr. rer.pol. in Sociology, 1977, Freie Universität Berlin; habil. in Sociology of Education, 1994, Universität Bremen): Biographical and life course research; qualitative methods; historical generations and social change; professions, intelligentsia, and intellectuals.

Hoffrage, Ulrich (Dr. phil. in Psychology, 1995, Universität Salzburg): Risk communication, in particular, Bayesian inference and the impact of external representations of information; models of cognitive processes underlying choices and probability judgments; analytical study of simple heuristics; models of cognitive processes in hindsight bias and the reiteration effect, and the co-occurrence of both effects.

Hutchinson, Christopher (PhD in Biology, 1990, University of York): Behavioral ecology; spatial optimization problems in biology and the social sciences, and the performance of simple rules of thumb; daily routines, with a particular interest in the dawn chorus of birds; what simple cues and rules might be used by organisms to predict weather; diverse aspects of snail and slug biology; theoretical morphology; skylarks (*alauda arvensis*): singing behavior; extra-pair paternity; morphology.

Keller, Monika (Dr. phil. in Psychology, 1974, Universität Heidelberg; habil. in Psychology, 1994, Freie Universität Berlin): Social perspective taking; domains and moral development; social and moral reasoning; decision-making and moral feelings in cross-cultural con-

text; contracts and the role of emotions in cheating detection.

Klieme, Eckhard (Dipl.-Math., 1978, Universität Bonn; Dipl.-Psych., 1981, Universität Bonn; Dr. phil. in Psychology, 1988, Universität Bonn; habil. in Educational Sciences, 2000, Freie Universität Berlin): Research on teaching and learning; problem solving in mathematics and science; cross-curricular competencies; large-scale assessment and evaluation.

Köhler, Helmut (Dr. phil. in Educational Economics, 1975, Technische Universität Berlin): Statistical analysis of educational development; social background and educational careers; national and international education indicators; research on school statistics of the GDR.

Köller, Olaf (Dipl.-Psych., 1991, Universität Kiel; Dr. phil. in Psychology, 1997, Universität Kiel): Empirical methods of social research; research in teaching and learning; motivational psychology.

Körner, Nina (Second State Examination in Law, 1973, Hamburg; Head Administrator of the Institute).

Krampe, Ralf T. (Dr. phil. in Psychology, 1992, Freie Universität Berlin): Expertise movement timing and coordination; cognitive aging; practice and motivation.

Krappmann, Lothar (Dr. phil. in Sociology, 1969, Freie Universität Berlin; Honorary Professor of Educational Sciences, Freie Universität Berlin): Socialization theory; social and moral development of children in middle childhood; children's peer interactions, relationships, and groups; links between family and peer relationships; day-care institutions; observational research methodology.

Kreppner, Kurt (Dr. phil. in Psychology, 1969, Technische Universität Darmstadt; habil. in Psychology, 1996, Freie Universität Berlin): Families as developing systems; family communication during infancy and adolescence; methodological issues in the study of human interaction; history of developmental psychology.

Kunzmann, Ute (Dr. phil. in Psychology, 1998, Freie Universität Berlin): Successful lifespan development; wisdom; emotion competence; personal values.

Lange, Lydia (Dr. phil. in Social Psychology, 1966, Universität Jena; Dr. sc. phil. [habil.] in Methods of Empirical Social Research, 1986, Humboldt-Universität zu Berlin; Member of the Library and Research Documentation Unit scientific staff): Bibliometrics; history of psychology.

Lenhardt, Gero (Dr. rer.soc. in Sociology, 1974, Universität Konstanz; habil. in Sociology, 1983, Universität Frankfurt a.M.): Sociology of education, work, and development; sociology of higher education; sociology of minority groups.

Li, Shu-Chen (PhD in Psychology, 1994, University of Oklahoma): Lifespan cognitive development and aging; computational models of child cognitive development and aging; intraindividual variability in behavior and

cognition; theoretical studies of computational complexity.

Lindenberger, Ulman (Dr. phil. in Psychology, 1990, Freie Universität Berlin; habil. in Psychology, 1998, Freie Universität Berlin): Measurement, development, and structure of intelligence over the life span; the role of executive function in learning and development; methodological and theoretical issues in cognitive development.

Maas, Ineke (Dr. in Sociology, 1990, University of Utrecht): Social mobility; social participation in old age; cultural participation.

Martignon, Laura (Dr. rer.nat. in Mathematics, 1978, Universität Tübingen; habil. in Neuroinformatics, 1998, Universität Ulm): Simple heuristics vs. complex decision machines; analysis of lexicographic algorithms for comparison, estimation, and categorization tasks; detection and measurement of higher-order correlations in non-linear environments; Bayesian strategies for statistical inference and machine learning, compared to fast and frugal algorithms for human adaptive behavior; model search in the Bayesian framework; the didactics of Bayesian reasoning based on adequate information formats; stochastics and probability in general.

Mayer, Karl Ulrich (Dr. rer.soc., 1973, Universität Konstanz; habil. in Sociology, 1977, Universität Mannheim; Fellow of the Max Planck Society; Co-director of the Institute; Professor of Sociology, Freie Universität Berlin): Social stratification and mobility; comparative analysis of social structure; sociology of the life course; occupational structures and labor market processes.

Mertens, Antje (Dr. rer.pol. in Economics, 1998, Humboldt-Universität zu Berlin): Labor economics; micro econometrics.

Müller-Brettel, Marianne (Dipl.-Psych., 1971, Freie Universität Berlin; Dr. phil. in Psychology, 1995, Freie Universität Berlin): Scientometrics; history of psychology.

Neher, Karl M. (Dr. phil. in Psychology, 1996, Freie Universität Berlin): Geronto-psychiatry; diagnosis of dementia; cognitive development across the life span.

Oesterreich, Detlef (Dipl.-Psych., 1968, Freie Universität Berlin; Dr. phil. in Psychology, 1975, Freie Universität Berlin): Theory of authoritarianism, authoritarianism and political consciousness; civic education of adolescents.

Rusch-Feja, Diann (PhD in German Literature, 1986; MLS in Library and Information Science, 1981, State University of New York at Buffalo; Head of the Library and Research Documentation Unit): Scientific information systems and information management; electronic information systems and networked information resources; digital libraries, indexing, classification, and metadata; education in library and information-oriented professions.

Schnabel, Kai (Dipl.-Psych., 1989, Universität Marburg; Dr. phil. in Psychology, 1996, Freie Universität Berlin): Developmental and educational psychology: motivational and achievement development in adolescents in the context of schooling; pathways to adulthood after high school; political socialization in late adolescence and beyond; methodology: multivariate statistical approaches in empirical research in the behavioral sciences.

Schrenk, J. K. (Dipl.-Psych., 2000, Westfälische Wilhelms Universität Münster): Socio-cognitive development, social processes among children, processes in relationships.

Schümer, Gundel (First and Second State Examination for Teachers, 1962, Stuttgart; 1970 Tübingen; Dr. phil. in Educational Sciences, 1977, Universität Hamburg): School systems and instruction; theories of instruction and methods of instructional research; comparative research on schools and instruction; the language of the classroom.

Schwippert, Knut (First State Examination in Electronics and Economy, 1993, Universität Hamburg; Dr. phil. in Educational Sciences, 1998, Humboldt-Universität zu Berlin): Large-scale assessment; effective schools; missing data.

Singer, Tania (Dr. phil. in Psychology, 2000, Freie Universität Berlin): Lifespan psychology; cognition and aging; longitudinal research.

Smith, Jacqui (PhD in Psychology, 1984, Macquarie University, Sydney; habil. in Psychology, 1999, Freie Universität Berlin): Potentials and risks for development and successful aging; application of intelligence and life knowledge; profiles of psychological functioning in the old and oldest-old; psychological predictors of longevity.

Solga, Heike (Dr. phil. in Sociology, 1994, Freie Universität Berlin; Head of the Independent Research Group: Lack of Training: Employment and Life Chances of the Less Educated): Social stratification; social mobility; life course; labor market research.

Stanat, Petra (Dipl.-Psych., 1992, Freie Universität Berlin; PhD in Psychology, 1998, University of Massachusetts at Amherst): Large-scale assessment; social competence; group processes.

Staudinger, Ursula M. (Dr. phil. in Psychology, 1988, Freie Universität Berlin; habil. in Psychology, 1997, Freie Universität Berlin): Lifespan development of the integration of cognition, emotion, and motivation; mechanics and pragmatics of self and personality; interactive minds as paradigm for the study of cognition and cognitive development; life as unit for psychological investigation.

Stern, Elsbeth (Dipl.-Psych., 1982, Universität Hamburg; Dr. phil. in Psychology, 1986, Universität Hamburg; habil. in Psychology, 1994, Universität München; Univ.-Prof., 1994, Universität Leipzig): Cognitive development; intelligence and knowledge; research in teaching and learning.

Thußbas, Claudia (Dipl.-Psych., 1994, Technische Universität Berlin; Dr. phil. in Psychology, 1999, Technische Universität Berlin): Cognitive and educational psychology; analogical transfer, learning, and teaching in mathematics; cognitive development; media psychology.

Todd, Peter M. (PhD in Psychology, 1992, Stanford University): Evolution of behavior (computer simulations of populations of simple organisms adapting to different environmental structures, both physical and social); simple heuristics for sequential search (including mate choice), categorization (including intention-from-motion), and multi-step processes (including parental investment); psychological selection; rhythmic and time-based behavior (including music, sequence learning/production, and evolution of song); connectionist models of cognition.

Trappe, Heike (Dr. phil. in Sociology, 1994, Freie Universität Berlin): Gender stratification; labor market research; comparative research on gender and welfare state.

Trommer, Luitgard (Dipl.-Kfm. Applied Economics, 1966, Universität München): Civic education; youth integration into the labor market; statistical evaluation and analysis, including that of foreign workers in Germany and women's employment.

Vitouch, Oliver (Dr. rer.nat. in Psychology, 1999, Universität Wien): Robustness (and related properties) of fast and frugal heuristics (vs. optimization/maximization models); methodological and epistemological issues in psychology (e.g., replicability and cross-validation of findings, problems of NHST, research and publication norms); methods and issues in cognitive neuroscience (functional brain imaging); problems of consciousness; cognitive psychology of music (expertise and skill acquisition, absolute pitch, musical imagery, cognitive effects of film music).

Zeiger, Helga (Dr. phil. in Sociology, 1973, Freie Universität Berlin): Sociology of childhood; shaping daily life; intergenerational relationships.

Emeritus Members of the Max Planck Society

Edding, Friedrich (Dr. phil. in History, 1934, Universität Kiel; Dr. rer.pol. h.c. in Economics, 1981, Freie Universität Berlin; until 1977 Director of the Institute; Emeritus Professor of Educational Economics, Technische Universität Berlin): Economics of the educational system; vocational training; adult education; relations between institutionalized and informal learning.

Edelstein, Wolfgang (Dr. phil. in Medieval Studies, 1962, Universität Heidelberg; Fellow of the Max Planck Society; until 1997 Co-director of the Institute; Honorary Doctoral Degree of Social Science, University of Iceland; Honorary Professor of Educational Science, Freie Universität Berlin; Honorary Professor of Educational Science, Universität Potsdam): Development and

socialization; social-cognitive and moral development; developmental and structural aspects of curriculum and instruction; developmental and school related conditions of successful learning; conditions of successful school transformation.

Roeder, Peter M. (Dr. phil., 1960, Universität Marburg; habil. in Educational Sciences, 1966, Universität Marburg; Fellow of the Max Planck Society; until 1995 Co-director of the Institute; Special Professor of Educational Sciences, Freie Universität Berlin): Educational sciences; school research; history of educational science.

Postdoctoral Research Fellows

Alfeld-Liro, Corinne (PhD in Education and Psychology, 1999, University of Michigan, Ann Arbor): School-to-work transition; adolescent identity development; transition to adulthood; social equity and opportunity in secondary and post-secondary schools.

Barrett, H. Clark (PhD in Anthropology, 1999, University of California, Santa Barbara): Human cognitive evolution; domain-specific cognition; predator-prey coevolution; South American hunter-horticulturalist societies (Shuar, Achuar, Shiwiar); folk psychology and folk biology; human cognitive development; cognitive neuroscience; biological anthropology; evolutionary psychology.

Bluck, Susan (PhD in Psychology, 1997, University of California, Irvine): Social cognition in adulthood: the relation of autobiographical memory to the self; functions of autobiographical memory across developmental life phases; reminiscence.

Bullock, Seth (PhD in Artificial Intelligence, 1997, University of Sussex): Evolutionary simulation modeling; methodological issues raised by evolutionary simulation modeling; genetic algorithms; artificial neural networks; economic and evolutionary game theory; (co)evolution of natural signaling systems; the handicap principle; sexual selection.

Dorenlot, Pascale (Doctorate in Social Psychology, Ecole des Hautes Etudes en Sciences Sociales, Paris): Identity construction in multicultural contexts; bilingualism; national identities, European identity; multifactorial analysis (physical, psychological, and social factors) of language learning, illness, aging processes.

Dencker, John C. (PhD in Sociology, 1998, Harvard University): Labor markets; corporate restructuring; social mobility; stratification.

Fiddick, Laurence (PhD in Psychology, 1998, University of California, Santa Barbara): Deontic reasoning; moral reasoning; logical reasoning and the history of logic; folk-biology and its role in people's understanding of evolutionary theory; folk-psychology/sociology and its role in deontic and moral reasoning; cultural psychology; the role of emotions in cognitive processes.

Ghisletta, Paolo (PhD in Psychology, 1999, University of Virginia): Psychometric measurement; structural equation modeling in longitudinal research; cognitive and sensory aging.

Glück, Judith (PhD in Psychology, 1999, Universität Wien): Statistical methods in psychology (classification methods for longitudinal data; item-response models); wisdom (wisdom as a metaheuristic; assessment of wisdom); individual differences in cognitive strategies.

Jobard, Fabien (Dr. phil. in Political Science, 1998, Institut d'études politiques de Paris): Police use of force; European policies in the field of drugs and drug dependency; democratic transitions through law enforcement force.

Kurz, Elke M. (PhD in Psychology, 1997, Bowling Green State University, Ohio): Scientific practice and expertise from a historical-cognitive perspective; the history of the differential calculus; the history of linear regression models; history of psychology; Egon Brunswik's methodological challenges to psychological experimentation (Schloebmann grant).

Lages, Martin (Dr. phil. in Psychology, 1997, Universität Heidelberg; Dr. phil. in Experimental Psychology, 1998, University of Oxford): Individual choice behavior: bounded rationality and intransitivity; selected topics from applied mathematics, graph theory, and logic; psychophysics of vision: adaptive cognitive mechanisms in discrimination and detection tasks.

Li, Karen Z. H. (PhD in Psychology, 1996, University of Toronto): Aging and cognition; executive control; inhibitory processes.

Liqi, Zhu (PhD in Developmental Psychology, 1998, Chinese Academy of Sciences, Peking).

Marsh, Barnaby (Dr. phil. in Behavioral Ecology, 2000, University of Oxford; Juliana Cuyler Matthews Research Fellow, New College, Oxford): Decision making under risk and uncertainty; evolutionary psychology; comparative decision making in humans and animals; behavioral ecology; domain-specific reasoning; experimental economics; applied decision theory; research methodologies and the philosophy of science.

Noble, Jason (Dr. phil. in Computer Science and Artificial Intelligence, 1998, University of Sussex): Aggressive signals and threat displays; communication given conflicting or congruent interests; methodological issues in the use of evolutionary simulations; sexual signaling and the handicap principle; simple mechanisms in animate vision; simple mechanisms in social learning.

Pasupathi, Monisha (PhD in Psychology, 1997, Stanford University): Cognitive performances in interpersonal contexts; particularly: development of wisdom-related knowledge across the life span and storytelling across the life span.

Rode, Catrin (Dipl.-Psych., 1992, Universität Konstanz; Dr. phil. in Psychology, 1996, Universität Münster): Cognition; decision-making; domain-specific reasoning.

Savelsbergh, Elwin R. (Msc. in Physics, 1993, University of Utrecht; PhD in Psychology, 1998, University of Twente): Development of expertises; learning physics; graphical presentation; mental models.

Takezawa, Masanori (MA in Social Psychology, 1997, Hokkaido University): Distributive justice; social cooperation; social intelligence; social exchange theory, game theory, and evolutionary game theory in general.

Wrosch, Carsten (Dr. phil. in Psychology, 1997, Freie Universität Berlin): Developmental regulation across the life span; developmental deadlines; primary and secondary control.

Yang, Lixia (PhD in Psychology, 1999, Institute of Psychology, Chinese Academy of Sciences, Peking): Cognitive and sensorimotor functions and aging; working memory; wisdom.

Predocctoral Research Fellows

Bondar, Albina (Dipl.-Psych., 1999, Freie Universität Berlin): Balance and cognition: Resource allocation and dual-task costs in young and old adults.

Bukov, Aleksej (Dipl.-Soz., 1991, Lomonossov University Moscow; Dipl.-Soz., 1994, Institut für Höhere Studien, Wien): Participation in social activities; distribution and usage of individual resources in old age.

Chase, Valerie M. (PhD candidate, Psychology, University of Chicago): Ecological sensitivity to base rates in causal hypothesis testing; conceptions of rationality; content effects in mathematical reasoning.

Clausen, Marten (Dipl.-Psych., 1996, Universität Kiel; Dr. phil. in Psychology, 2000, Freie Universität Berlin): Quality of instruction; classroom observation; educational productivity.

Daniels, Zoe (Dipl.-Psych., 1998, Universität Hamburg): Research in teaching and learning; motivational development during adolescence.

Demmrich, Anke (Dipl.-Psych., 1999, Universität Potsdam): Research in instruction and learning; cooperative learning; working memory.

Dhami, Mandeep K. (PhD candidate, Psychology, City University, London): Evaluating the relative descriptive validity and prescriptive utility of regression and fast and frugal models of legal judgment; developing the methods of judgment analysis through considering issues of systems level analysis and representative design.

Dudey, Thomas (Dipl. in Economics, 1998, Universität Bonn): Game theory; experimental economics; bounded rationality; sequential search.

Ehrhorn, Susanne (Dipl.-Psych., 1999, Technische Universität Braunschweig): Social relationships and loneliness in old age.

Fanselow, Carola (Dipl.-Psych., 2000, Universität Potsdam): Decision strategies; process-tracing methods in decision making; hindsight bias.

Felbrich, Anja (Dipl.-Psych., 2000, Universität Potsdam): Research in teaching and learning; development of graphing competencies.

Graßhof, Matthias (Dipl.-Psych., 1999, Technische Universität Berlin): Political socialization; international and comparative educational research; action-control beliefs.

Hosenfeld, Ingmar (Dipl.-Psych., 1996, Universität Kiel; Dr. phil. in Psychology, 2000, Freie Universität Berlin): Students' beliefs about the causes of success in school; IRT; gender differences.

Jacob, Marita (Dipl.-Soz., 2000, Universität Gießen): Education and training in Germany in the 1990s; rational choice theory and educational inequality; research methods.

Knoll, Steffen (Dipl. in Educational Science, 1989, PH Köthen): Research on teaching and learning; international comparative studies.

Koerber, Susanne (First State Examination for Teachers, 1993; Dipl.-Psych., 1997, Universität Würzburg): Theory of mind; social cognition; symbolic representations of spatial, temporal, and quantitative relations.

Krauss, Stefan (First State Examination in Mathematics and Physics, 1995, Universität Erlangen-Nürnberg): Probabilistic reasoning, especially Bayesian diagnostics and judgments (physicians and judges); Monty Hall dilemma; didactics of mathematics.

Kunter, Mareike (Dipl.-Psych., 1999, Julius-Maximilians-Universität Würzburg): Research in instruction and learning; social skills; teamwork and cooperative learning.

Lampert, Thomas (Dipl.-Soz., 1996, Freie Universität Berlin): Social inequality in morbidity, disability, and mortality in later life.

Lüdtke, Oliver (Dipl.-Psych., 2000, Freie Universität Berlin): Five-factor model of personality.

Matthes, Britta (Dipl.-Soz., 1995, Universität Leipzig): Labor market entry of young East Germans during system transformation.

Pollmann-Schult, Matthias (Dipl.-Soz., 2000, Freie Universität Berlin): Parental background, school performance, and labor market outcomes.

Powell, Justin (MA, 1999, Humboldt-Universität zu Berlin; BA, 1992, Swarthmore College): Social stratification; sociology of education; sociology of science; educational attainment and labor market participation of youth with disabilities in Germany and the United States.

Rapp, Michael (Medical Examination, 1997, Humboldt-Universität zu Berlin, Campus Virchow): Cognitive development in old and very old age, especially the connection between sensory and cognitive performance in old age; selective optimization with compensation in old and very old age; behavioral signs and symptoms in dementia.

Reimer, Maïke (Dipl.-Psych., 2000, Freie Universität Berlin): Quality of retrospective survey data; cognitive techniques in life history data assessment.

Riediger, Michaela (Dipl.-Psych., 1997, Humboldt-Universität zu Berlin): Developmental regulation in late adulthood; selection and pursuit of life goals and strivings; lifespan developmental psychology.

Rieskamp, Jörg (Dipl.-Psych., 1998, Technische Universität Berlin): Experimental evidence for simple decision strategies; research on methodological approaches for identifying judgment and decision strategies; research interest on experimental economics, especially on models of bounded rationality for bargaining games.

Rusconi, Alessandra (Dipl.-Pol., 1997, Università degli studi di Firenze): Demographic transformation in East Germany; German-Italian comparison in the life courses of young adults.

Schmiedek, Florian (Dipl.-Psych., 2000, Universität Mannheim): Cognitive development in old age: Models of psychometric intelligence and intraindividual variability in cognitive functioning; multivariate methods and measurement theory: Structural equation modeling and item-response theory.

Schuster, Peter (Dipl.-Psych., 1994, Freie Universität Berlin): Social and moral development in childhood and adolescence; educational application.

Seibert, Holger (MA in Sociology, 2000, Universität Rostock): Education, training, and labor market entry; unemployment in early adulthood.

Stange, Antje (Dipl.-Psych., 2000, Freie Universität Berlin): Wisdom; adaptive lifespan development: Selective optimization with compensation; test construction and validation: SOC questionnaire.

Trautwein, Ulrich (Dipl.-Psych., 1999, Universität Göttingen): Effects of homework assignments on academic achievement; determinants of academic choices and educational careers.

Wagner, Sandra (Dipl.-Soz., 1997, Humboldt-Universität zu Berlin): Social stratification; sociology of education.

cation; social origin and family background of less-educated persons in Germany.

Watermann, Rainer (Dipl.-Päd., 1996, Universität Münster): International and comparative educational research; quantitative methods of social research; political socialization; social gerontology.

Wirth, Joachim (Dipl.-Psych., 1998, Technische Universität Berlin): Research in teaching and learning; analogical problem solving; cognitive modeling.

Wolf, Regina (Dipl.-Psych., 2000, Technische Universität Berlin): Control strategies in the life span; coping with finiteness; managing the transition from school to work.

Zühlke, Sylvia (Dipl.-Pol., 1994, Freie Universität Berlin): Occupational qualifications and occupational careers in East Germany.

Associate Research Scientists

(in projects funded from outside the Institute and in other cooperative forms of research)

Bos, Wilfried (Dipl.-Päd., 1985, Universität Münster; Dr. phil. in Educational Sciences, 1988, Universität Münster; habil. in Comparative Educational Sciences, 1995, Universität Hamburg; Professor of Education, Universität Hamburg): Methods of empirical educational research; cross-cultural research on education and instruction (Universität Hamburg).

Gruehn, Sabine (Dipl.-Päd., 1993, Freie Universität Berlin; Dr. phil. in Educational Sciences, 1998, Freie Universität Berlin): Research in teaching and learning;

cross-cultural comparison (Humboldt-Universität zu Berlin).

Kurzenhäuser, Stephanie (Dipl.-Psych., 1999, Universität Heidelberg): Communication of uncertainty and risk in medicine, especially Bayesian inference; the impact of external representations on probabilistic reasoning; perception of risk and social norms in the domain of crime and aggression; political psychology, especially information processing in voting decisions (Deutsche Forschungsgemeinschaft).