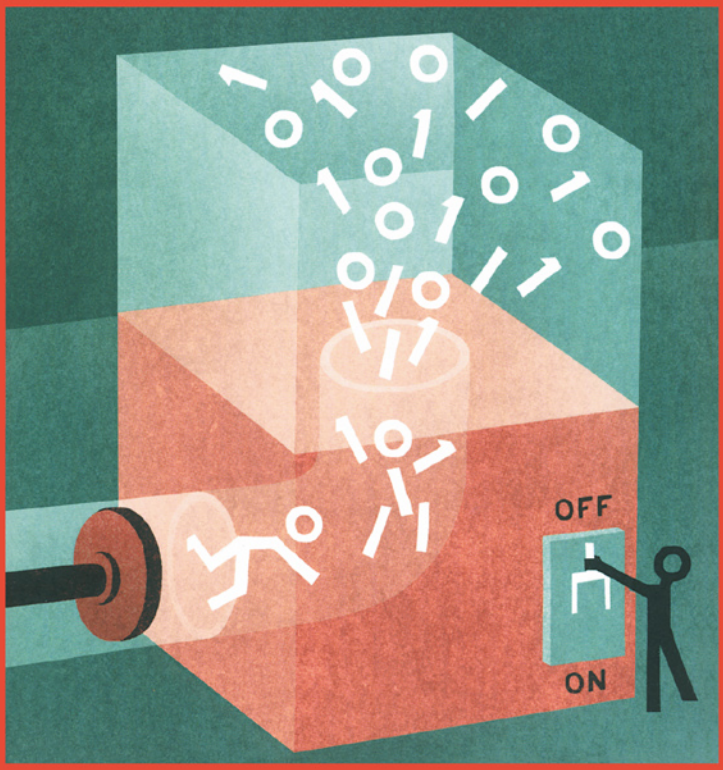
ECONOMICS LAB

AN INTENSIVE COURSE IN EXPERIMENTAL ECONOMICS



DANIEL FRIEDMAN AND
ALESSANDRA CASSAR
With contributions from Reinhard Selten and others

Economics Lab

The new field of experimental economics has come of age, as signaled by the 2002 Nobel Prize in Economics. Laboratory experiments with human subjects now provide crucial data in most fields of economics.

This textbook introduces the world of experimental economics. Contributors including Reinhard Selten and Axel Leijonhufvud add to a book that sketches the history of experimental economics before moving on to describe how to set up an economics experiment and to survey selected applications and the latest methods. This user-friendly book demonstrates how students can use the lessons to conduct original research.

With their freeflowing, discursive yet precise style Friedman and Cassar have created a book that will be essential to students of experimental economics across the world. On account of its authoritative content, *Economics Lab* will also find its way onto the bookshelves of leading researchers in all fields of economics.

Daniel Friedman is Professor of Economics at the University of California, Santa Cruz, USA.

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An intensive course in experimental economics

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With contributions from Reinhard Selten and others

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Steffen Huck's research is split between theory and experiments. His work on endogenous preferences and learning combines both. Topics he is currently working on range from mergers in Cournot markets to the role of trust in contractual relationships. Recently he has also been working on limited memory and imperfect recall. He obtained his PhD from Humboldt University in 1996. Before joining University College London in 2002 he spent two years at Royal Holloway and two years traveling, visiting Queen Mary, UCL, Texas A&M, and Harvard. Since 2001 he has been deputy scientific director of ESRC Centre for Economic Learning and Social Evolution (ELSE).

Axel Stig Bengt Leijonhufvud was born in Sweden. He came to the United States in 1960 to do graduate work and obtained his PhD from Northwestern University. He taught at the University of California at Los Angeles from 1964 to 1994 and served repeatedly as Chairman of the Economics Department. In 1991, he started the Center for Computable Economics at UCLA and remained its Director until 1997. In 1995, he was appointed Professor of Monetary Theory and Policy at the University of Trento, Italy. His research has focused on the limits to an economy's ability to coordinate activities as revealed by great depressions, high inflations, and (recently) transitions from socialist toward market economies.

Rosemarie Nagel's 1994 dissertation was in the area of experimental economics on reasoning and learning in games, supervised by Reinhard Selten, University of Bonn. She was a postdoctoral student of Al Roth in Pittsburgh before she joined the faculty of economics of the Universdad Pompeu Fabra in Barcelona in 1995. Her work on the beauty contest game has received attention not only in academic circles but also in several newspapers where readers were asked to participate in the game. Currently, Rosemarie works on economic behavior in games and auctions.

Reinhard Selten graduated in Mathematics from the University of Frankfurt in 1957, obtained his PhD in Mathematics in 1961 and his Habilitation in Economics in 1968. From 1969 to 1996, he taught at the universities of Berlin, Bielefeld, and Bonn. Professor Selten's major research interests are in Game Theory, Oligopoly Theory, and Experimental Economics. In 1994, he was awarded the Nobel Memorial Prize in Economics for his pioneering work in non-cooperative game theory.

Seven groups of students contributed chapters in the last part of the book.

Acknowledgments

The authors of any book incur large debts and we are no exception. The book originated in the extraordinary summer school program organized through the Computable and Experimental Economics Laboratory (CEEL) of the University of Trento. Additional funding was generously provided by the Latsis Foundation and Fondazione Cassa di Risparmio di Trento e Rovereto. We are grateful for the support of these worthy organizations.

Our greatest personal debt is to Axel Leijonhufvud. He is the guiding spirit and the practical organizer of the Trento summer school program. We constantly looked to Axel for guidance in putting together the Intensive Course in Experimental Economics. He pushed us to write the book and put us in touch with the editorial staff at Routledge. At every stage we were sustained by his enthusiasm, good sense, and vast knowledge of local restaurants.

Our guest lecturers were all indispensable, each in his or her own way. Reinhard Selten lent us his prestige as a Nobel laureate, and helped us attract students as well as other guest lecturers and sponsors. More directly, he devoted his lectures to new material of interest to a wide audience. Massimo Egidi, Rector of the University of Trento, also lent his considerable prestige and support, and shared his ongoing research. Steffen Huck and Rosemarie Nagel shared their deep knowledge in their fields and spent uncounted hours with students, helping them to sharpen their research ideas.

Morena Carli handled all local arrangements with extraordinary aplomb and, under the guidance of Director Luigi Mittone and Technical Assistant Marco Tecilla, we and our students drew on the impressive resources of the Computable and Experimental Economics Laboratory.

Our thanks go especially to all the summer school students. Their eagerness to put into practice what they were learning spurred us to develop the material we presented. We are proud to include their work in the third part of this volume.

We would like also to thank Routledge Economics Editor Robert Langham, who made our book proposal a reality; Editorial Assistant Terry Clague, whose unfailing patience kept us on track; and Vincent Antony and all the staff at Routledge who guided us rapidly through the production process. We are grateful to two anonymous reviewers for suggestions that helped us improve on the first draft.

Also contributing to the production of this book were senior colleagues who generously sent us vintage photographs: James Friedman, John Kagel, Martin Shubik, Charles Plott, and Vernon Smith. (Last minute technical glitches forced us to substitute a recent photo of Smith and to omit the Kagel-Battalio photo.)

Finally, our thanks go out especially to our families who gave us the space and support we needed to put the book together. Dan thanks Penny for everything, including her good nature and her good taste in prose. Alessandra thanks her mother for unlimited babysitting while we ran classes in Trento, and Rich for his support while we wrote the book back in Santa Cruz.

Part I

Introductions

An intensive course in experimental economics

Daniel Friedman

For two weeks, 18–29 June 2001, twenty economics graduate students from around the world gathered to learn how to run economics experiments. Despite the distraction of a stunning setting—a cliff-top hotel overlooking Trento and the Adige valley—the students made remarkable progress. Students sorted themselves into eight groups and on the last day, each group presented the results of an original pilot experiment. After returning home, many students continue to run laboratory experiments and to show others how to do it.

The structure of the summer school contributed to its success. Morning lectures began with an overview of the history and purposes of economics experiments, and then alternated between presentation of laboratory methods and surveys of applications. Methods lectures covered experimental control, emphasizing induced value theory; design, including the proper use of randomization and disposition of focus and nuisance variables; data analysis, including qualitative summaries as well as hypothesis tests; issues concerning human subjects and laboratory facilities; and project management. Applications topics included the mysterious efficiency of double auction markets; the successes and failures of institutional design, including spectrum auctions and California electricity markets; the successes and failures of game theory and learning theory in predicting bargaining behavior; and the promises and pitfalls of behavioral economics.

Afternoons usually featured guest lecturers. Distinguished guest lecturer and 1994 Nobel laureate Reinhard Selten lectured on his new theory of impulse balance equilibrium and laboratory applications, and also lectured on his recent theory of imitation equilibrium and applications to oligopoly. Guest lecturers Massimo Egidi, Steffen Huck, and Rosemarie Nagel surveyed laboratory discoveries in their fields: social learning, oligopoly, and coordination games. Program Director Axel Leijonhufvud lectured briefly on adaptive economic processes, and Peter Howitt gave a talk on themes for the next summer school that inspired one student project a year ahead of schedule!

Most important, the student groups met several times a day to hammer out a research question, design an experiment, and run a pilot session. The groups had scheduled afternoon meetings as well as impromptu meetings over meals, during coffee breaks, and late at night, in balconies, lobbies, and eventually in the CEEL facilities at the University of Trento. The groups worked with Teaching Assistant

Alessandra Cassar, and often consulted with the summer school director and guest lecturers. Our students' areas of applications went beyond what is covered in this book, to include two projects inspired by macroeconomic questions, and one in public good. Altogether, it was an intense learning experience for everyone!

This volume is intended to capture the essence of that summer school and to make it available to economists everywhere. We have written up most of the lectures, and edited the student project papers. We have tried not to homogenize everything as in a normal textbook, however. An intensive course works better when there is more than one voice, and we have tried to preserve the informal flavor of lobby discussions by sprinkling the text with comments in boxes.

Several monographs and textbooks on experimental economics appeared in the early and mid-1990s; we draw on and acknowledge these excellent books in subsequent chapters. The present volume makes four sorts of contributions:

- surveys of applications that have progressed rapidly in the last few years;
- streamlined and unified presentation of methods;
- original material by the distinguished guest lecturer and other contributors; and
- seven examples of early project development by our student groups.

This volume will serve as a helpful reference book for experimental economists, but it is primarily intended as a self-contained introduction to economists who want to develop a laboratory experiment but are not sure how. It can serve as a primary or secondary text in a formal course, or as the backbone of a do-it-yourself course.

1 The Trento Summer School

Adaptive economic dynamics

Axel Leijonhufvud

This Summer School in Experimental Economics is the second in a series. The first, on Computable Economics, was directed by "Vela" Velupillai. Next year, the third one, on Adaptive Economic Processes, will be run by Peter Howirt. And we hope to go on to Behavioral and Institutional Economics, for example. It may not be obvious what they have in common.

They are all part of our ongoing program in Adaptive Economic Dynamics—as we call it "for want of a better name." Although we—and some other colleagues—have made common cause in these efforts, the chances are that no two of us would explain what we are about in exactly the same way. What follows, therefore, is my own perspective on the matter.

The economic theory of recent decades has been built on the basis of the optimality of individual decisions and the equilibrium of markets. This "neoclassical" economics is often criticized, but it has many achievements to its credit. Indeed, it embodies most of what economists know and the tools of what they know how to do. If you are to become an economist you had better learn it!

Yet, neoclassical economics is the subject of constant criticisms from within and from without. But the notion that one might somehow abandon it, in favor of one or another alternative, founders on the enormity of the prospective cognitive loss. Those "schools" that have defined themselves largely in opposition to neoclassical economics have remained marginal.

We had better accept, therefore, that for now and for the foreseeable future, neoclassical economics is the core of our subject. Instead of looking for an alternative theory to replace it, we should try to imagine an economic theory that might transcend its limitations. Easier said than done! To get a start on it, it may help to compare how optimality and equilibrium are understood in modern theory with how they were understood in neoclassical economics many decades ago.

The architecture of modernity: choice, optimization, equilibrium

A brief summary of how a modern neoclassical model is built up may run as follows:

- *All* behavior is conceptualized as *choice.*
- Choice is formalized as constrained optimization.
- The solution to a choice-problem is *a plan*.