IELab

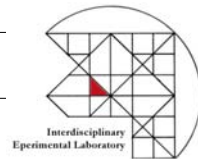# Welcome to the Interdisciplinary Experimental Lab

Official Opening
April 26th, 2004

Who: IU Schools, Departments and Centers Involved

➢ COAS Departments: Anthropology, Economics, Geography, Political Science, Psychology

➢ SLIS: InfoVis Lab

➢ Center for the Study of Institutions, Population, and Environmental Change and the Workshop in Political Theory and Policy Analysis

How: National Science Foundation Major Research Infrastructure Grant
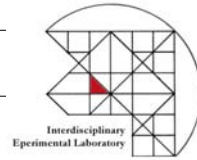
➢ Provided $847,875 external funds for five years – to purchase computers, server & software, employ a full-time programmer

➢ IU invested $115,000 to remodel the space in Woodburn plus investments in furniture, eventual life-cycle replacement of computers, and extensive cost-share.

➢ Fantastic colleagues who are willing to invest heavily in an interdisciplinary and inter-unit facility and activities.


When: Grant Awarded August 15, 2002 thru August 15, 2007
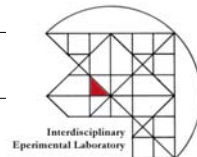
➢ Academic Year 2002-2003 spent in detailed planning of laboratory

➢ Construction began Summer of 2003 and completed in the Fall

➢ Equipment installed in November & December of 2003

➢ First experiments conducted in January of 2004

➢ First class taught in Spring of 2004!

**Focus: Research on the Leading Edge Questions in
Participating Discipline**
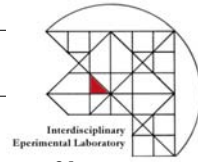
➢ The hardware and software setup allows to run experiment with up to 29
simultaneous subjects AND teaching that cannot be done anywhere else on
campus – or at most major universities

➢ Unique capabilities to explore spatial dynamics

➢ Puts IU "on the map" (so to speak)

Advantages of the Interdisciplinary Experimental Lab
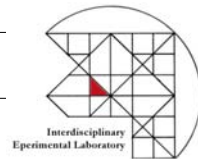
➢ Intra-departmental collaborations provides useful intuitions for studies of spatial
decision making.

➢ For quantitative examination, many participants should be run.

➢ Large screen enable the presentation of complex spatial environments.

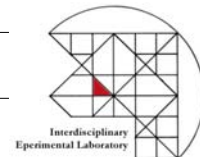➢ What does experimental research look like in the social sciences.

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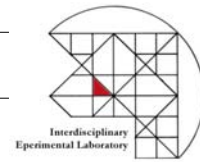
Experiments
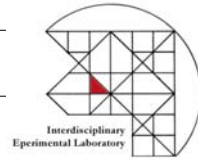## Micro Decision Environments

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Experimental Setting

COMPONENTS:

➤ Institution: Rules & Messages

➤ Environment: Subjects, Endowments, Induced Values

➤ Behavior: Choices and Interactions
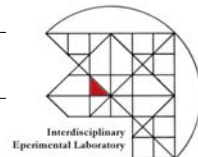
Experimental Settings

Long History of Decision Making Experiments in the Behavioral Sciences
and in Particular at Indiana University. Contexts Include:

➤ Markets

➤ Voting Mechanisms

➤ Social Dilemmas

➤ Individual Choice

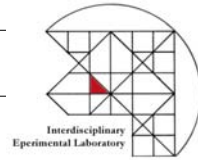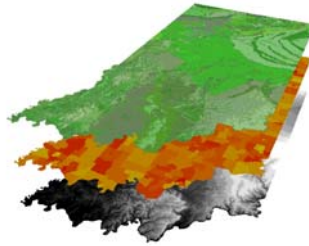*IELab Open House 2004.04-26*

Current IEL Experiments

➤ resource allocation decisions in stochastic settings

➤ commitment mechanisms in public goods provision environments

➤ allocation processes in environments with spatial heterogeneity over production
suitability and/or externalities in use within and across spatial territories

➤ experiments in judgment and decision making that involve choices between
alternatives organized in spatial patterns, in particular examining the effect of
psychological factors that effect risk taking.
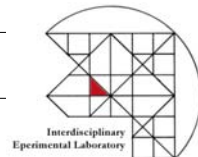
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Spatial Relationships

Spatial representation and Geographic Information Systems provide a framework for integrating data and phenomena from disparate sources
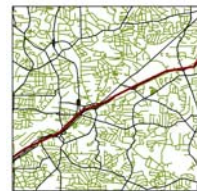

Ecosystem Function

- ➤ Human behavior has an impact on the spatial distribution of resources
- ➤ The spatial distribution of social and biophysical phenomena affects human behavior
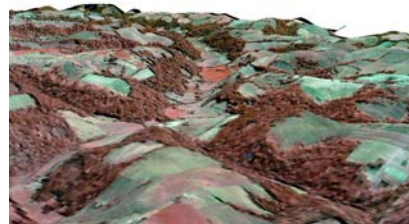- ➤ The spatial pattern of systems defines their behavior and function

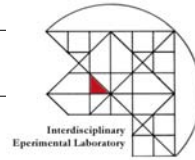Downtown Atlanta   Suburban Atlanta


Monroe County Landcover

Spatial Decision-Making

➢ It is important to understand how human behavior and actions affect the spatial structure of human modified systems
  - How is human behavior affected by the spatial distribution of resources and vice versa?
➢ Previous experimental research has explored decision-making from a non-spatial perspective
➢ The Inter-disciplinary Experimental Lab is designed to extend this previous research to the spatial aspects of decision-making

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A Spatial Experimental Design
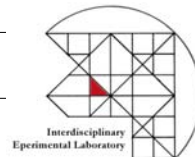
➢ Objective

What are the spatial implications of the variability in human decision-making in an abstract framework

Goal ultimately to take experiment into the field with real landowners

➢ Basic structure

9 players, 25 cells each (5x5)

Subject decision: Place cells in either use B or G resource

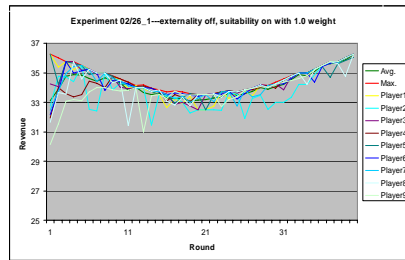Prices of B and G change through experiment, 40 total decision-making rounds
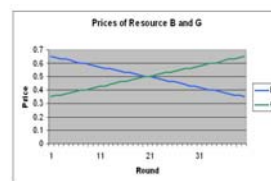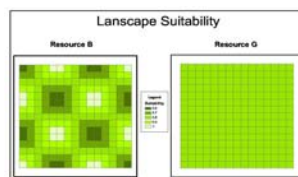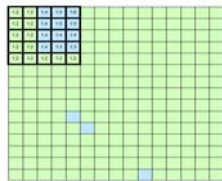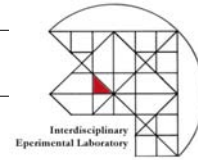

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Matching Experiments to Simulations

Simulation Results Animation

Experimental Results Animation

Optimal allocation by round

Prices of Resource B and G

BLUE   MIX   GREEN

Experiment 02/26_1---externality off, suitability on with 1.0 weight
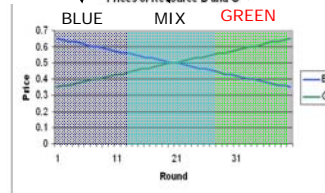
- ➢ Some subjects more successful than others at seeking optimal revenue or highest potential payoff
- ➢ High initial variability in revenues with most subjects approaching optimum towards end of experiment
- ➢ Some subjects relatively stable % of optimum, others highly variable

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Examination of choices in a multi- cell environment

Recently, there is an interest in studies of decision making where payoff are learned through experience.
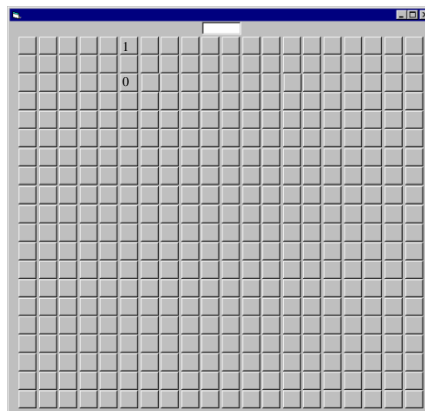
e.g., choose any button that you want…. You have 200 button clicks

An examination of the spatial dimension

An examination of the spatial dimension allows the examination of:

➢ Direction learning

➢ Function learning

➢ The relationship between an individual alternative in a group and a set of alternatives
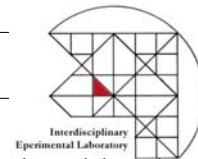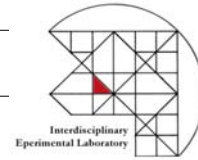

An Experiment

Green side: Lose 200 Cents (probability of 0.005) Blue side: Lose 8 Cents (probability of 0.005)
Lose 1 cent (probability of 0.995) Lose 2 cents (probability of 0.995)
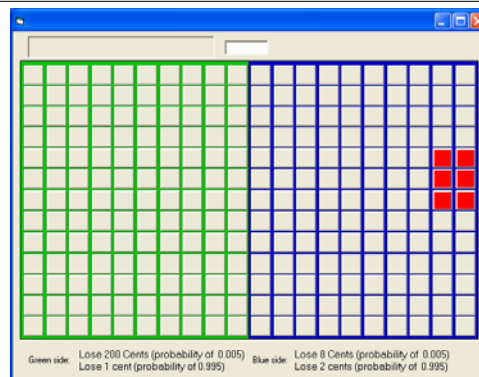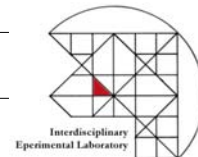
➢ The performer starts in "Blueland" and can move only to adjacent cells. Upon each choice, there is a payoff.
➢ "Greenland" has more positive payoff most of the time but a rare probability of a very bad outcome.
➢ So the decision is how much time to spend in green-land in repeated trials.

An Experiment

A random green button in lost 1

Control				
Forgone-130				
Forgone-1				

Green side: Lose 200 Cents (probability of 0.005)
Lose 1 cent (probability of 0.995)

Blue side: Lose 8 Cents (probability of 0.005)
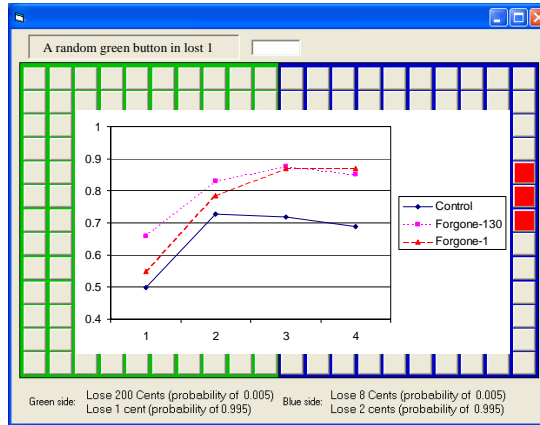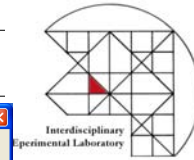Lose 2 cents (probability of 0.995)

➢ In one condition a person gets information from <u>one cell in</u> Greenland (knows how much that cell lost in the previous trial). Would that make a difference?

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Information Visualization Laboratory at SLIS, IUB

IV LAB
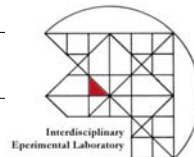
Analysis and Visualization of
➢ User Activity Patterns over Time and Space
➢ Structure and Dynamics of Scientific Fields
➢ Scholarly Information Diffusion
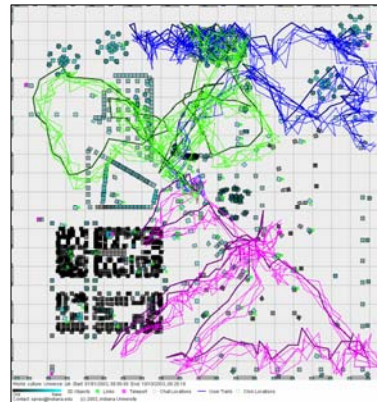
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Social Diffusion Patterns

Temporal-spatial distribution of Conference attendees

➢ Conference worlds are represented by square, perspective maps, each labeled by its name.

➢ Worlds accessed at the beginning of the conference are placed at the bottom, worlds accessed later toward the top.

➢ Next to each world is a circular snapshot of the virtual venue. Short descriptions of the main sessions are added as text.

➢ Major jumps between worlds are visualized by transparent lines. The thickness of each line corresponds to the number of traveling users. Color coding was used to denote the chronological paths of the conference sessions.

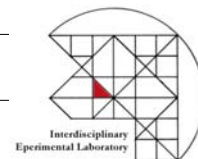*IELab Open House 2004.04-26*
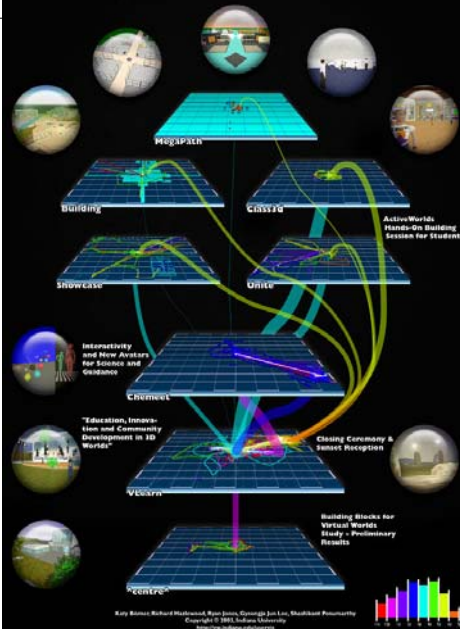
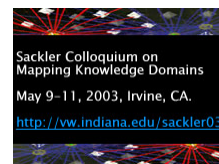## Knowledge Domain Visualizations

Can help answer questions such as:

➢ What are the major research areas, experts, institutions, regions, nations, grants, publications, journals in xx research?

➢ Which areas are most insular?

➢ What are the main connections for each area?

➢ What is the relative speed of areas?

➢ Which areas are the most dynamic/static?

➢ What new research areas are evolving?

➢ Impact of xx research on other fields?

➢ How does funding influence the number and quality of publications?

Börner, K., C. Chen and K. Boyack (2003). Visualizing Knowledge Domains. Annual Review of Information Science & Technology. B. Cronin. Medford, NJ, Information Today, Inc./American Society for Information Science and Technology. **37:** *179-255.*
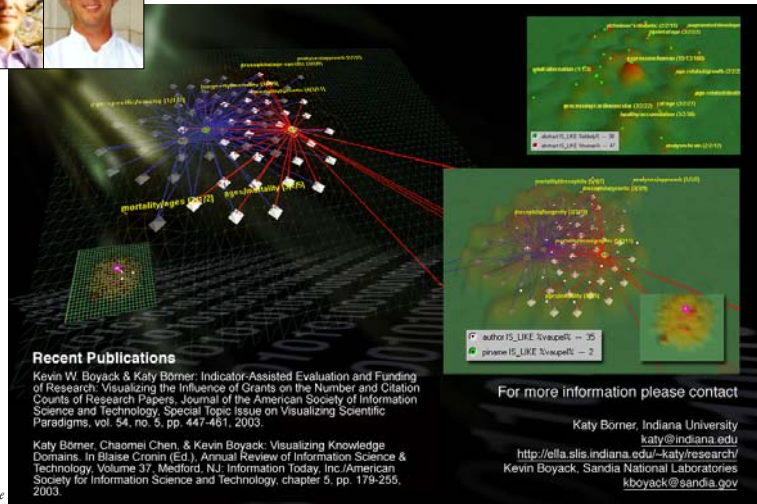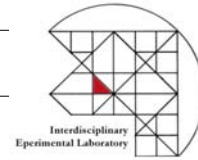
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Visualizing Knowledge Domains

For more information please contact

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Topic Bursts in PNAS

Co-word space of the top 50 highly frequent and bursty words used in the top 10% most highly cited PNAS publications in 1982-2001.

Ketan Mane & Katy Börner: Topics and Topic Bursts in PNAS. Accepted for publication in Proceedings of the National Academy of Sciences of the United States of America.

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Color Code
82 - 85
86 - 89
90 - 93
94 - 97
98 - 01

circle size ~ burst weight
cicle color ~ burst onset
ring color ~ year of max word count
years of 2nd and 3rd burst are given in color
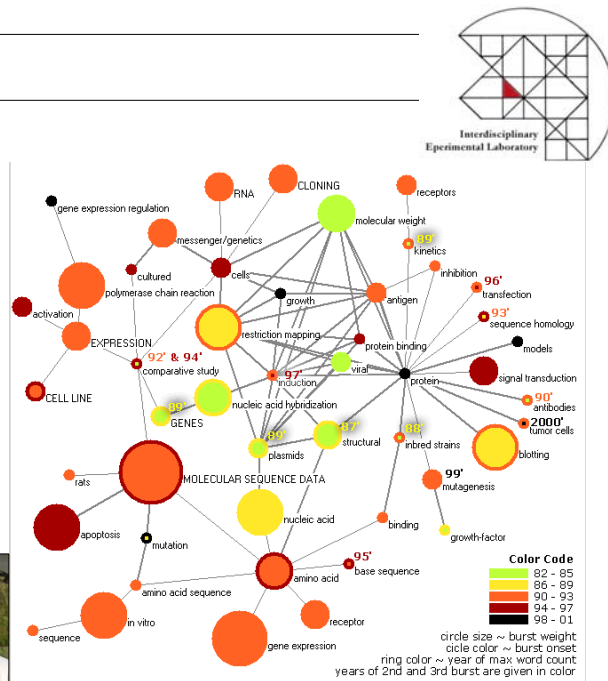
Information Diffusion Patterns
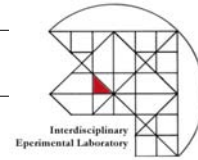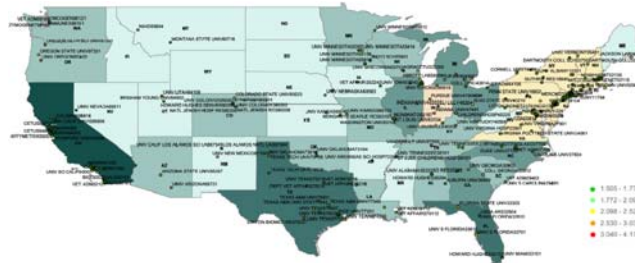
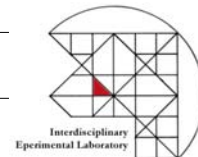Top 500 most highly cited U.S. institutions.

Each institution is assumed to produce and consume information.

Does Internet lead to more global citation patterns, i.e., more citation links between papers produced at geographically distant research institutions?
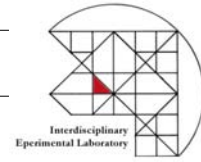
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Pending Proposals Utilizing the IEL Resources

➢ Collaborative Research: Program in Human and Environmental Dynamics", NSF proposal (Elinor Ostrom, Krister Andersson, Marco Janssen, Harini Nagendra, James Walker, January 05 - December 09, $1,896,025, Pending)

➢ Combining Artificial and Human Agents in GIS-based Spatial Resource Use Experiments", NSF Proposal (Jerry Busemeyer, Tom Evans, Hugh Kelley, January 05 - December 06, $185,871, pending)

➢ The Dynamics of Rules in Commons Dilemmas", NSF Proposal (Marco Janssen, Robert Goldstone, Filippo Menczer, Elinor Ostrom, January 05 - December 08, $744,038, pending)

➢ Development of Spatially Explicit Experiments for Studying Coordination and Dilemma Problems: Linking Local Level Decisions to Macro Level Outcomes", NSF Proposal (Tom Evans, Hugh Kelley, September 04 - August 06, $157,428, pending)

➢ Modeling the Diffusion of Scholarly Knowledge. Human and Social Dynamics NSF proposal (Katy Börner, Jan 05 - Dec 07, $266,360, pending).

➢ Center for Network Dynamics: Supporting Research and Education on Social, Biomedical, and Physical Networks. Special State Research Funding Proposal. (Debora Shaw, Katy Börner, Javed Mostafa, 2003-2004, $528,700, pending)

➢ NetWorkBench: A Large-Scale Network Analysis, Modeling and Visualization Toolkit for Biomedical, Social Science and Physics Research. NSF SEIII proposal (Katy Börner, Albert-Laszlo Barabasi, Santiago Schnell, Craig A Stewart & Alessandro Vespignani, Sept 04 - Aug 07, $964,017, pending)

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Thanks for Coming

Please Join Us in the Traditional Ribbon Cutting and Refreshments …

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