Experimental and quasi-experimental methods for political sciences

BIASES IN INFORMATION PROCESSING. EVIDENCE FROM THE LABORATORY AND THE FIELD

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. I

OUTLINE

a) Experimental purposes and methods

b) Experiments in political science

c) A critique of verbal self-report

d) Gaze direction and dual system

e) Noisy and redundant information

f) Anomalies in financial markets

g) Conclusions

Abstract. The seminar aims to give an introduction to the experimental approach in political sciences. Inspired by experimental psychology on the one hand, and experimental economics, on the other hand, experimental research has gained in popularity in politics during the last decennium. I will introduce experimental research and its logics with some examples that will be discussed extensively in class. The seminar includes a dicussion on the use of incentiv

References

Druckman J.N., D.P. Green, J.H. Kuklinski and A. Lupia (2006) "The growth and development of experimental research in political sciences", *American Political Science Review*, 100, 627-635.

Morton R.B. and K.C. Williams (2010) *Experimental Political Science and the Study of Causality. From Nature to the Lab*, Cambridge University Press, New York, Chapter 1.

Friedman, D. and A. Cassar (2004) *Economics Lab. An intensive course in experimental economics*, Routledge, London and New York,

Innocenti, A., A. Rufa and J. Semmoloni (2010) *Overconfident behavior in informational cascades: An eye-tracking study*, Journal of Neuroscience, Psychology, and Economics, Vol. 3, n. 2, pp. 74-82

Innocenti, A., P. Malpenga, L. Menconi and A. Santoni (2011) *Intra-Day Anomalies in the Relationship between U.S. Futures and European Stock Indexes*, Journal of Index Investing, Vol. 1, n. 4, pp. 40-52.

Innocenti, A., T. Nannicini and R. Ricciuti (2013) *The Importance of Betting Early*, IGIER WP, Università Bocconi, Milano, n. 502.

LABSI LAPS EXPERIMENTAL LABORATORY

EXPERIMENTS

PROS

"Would it not be better to leave laboratory experiments to psychologists who are trained to run them properly? Nobody doubts that we have a great deal to learn from psychologists about laboratory technique and learning theory, but recent history would nevertheless suggest that the answer is a resounding *no*. Our comparative advantage as economists is that we not only understand the formal statements of economic theory, but we are also sensitive to the economic environments and institutions within which the assumptions from which such statements are deduced are likely to be valid. Just as chemists know not to mix reagents in dirty test tubes, so we know that there is no point in testing economic propositions in circumstances to which they should not reasonably be expected to apply."

(Binmore 1999)

"Once models, as opposed to economies, became the focus of research the simplicity of an experiment and perhaps even the absence of features of more complicated economies became an asset. The experiment should be judged by the lessons it teaches about theory and not by its similarity with what nature might happen to have created."

(Plott 1991)

CONS

The laboratory is not a socially neutral context, but is itself an institution with its own formal or informal, explicit or tacit, rules

Human agency takes place within a socio-economic world that is structured in the sense that it consists of internally-related positions and systems

Experimentation in economics is likely to be of limited value, save for situations – such as auctions – that exist in conditions of relative isolation and are characterized by low internal complexity

(Siakantaris 2000)

➢ experimental situations often project a game-like atmosphere in which a 'subject' may see himself as 'matching wits' against the experimenter

➢ experimental subjects are cast in roles and they can act in accordance with his (mis)perceptions of these roles

➢ experiments have too short horizons (real world lasts many years and many trials)

➢ human beings are capable to control their behavior through the implementation of abstract rules

(Cross 1994)

DATA SOURCES

	Happenstance (uncontrolled conditions - ongoing processes)	Experimental (controlled conditions - deliberately created)
HOW? WHERE?		
Field (naturally occurring environment)	Election polls National Accounts	Income Maintenance Experiments Field Experiments
Laboratory (artificial environment)	Casual Processes in the Lab Discovery of Penicillin	Choice Experiments Auctions Simulation Laboratory Asset Markets

EXPERIMENTAL ECONOMICS
LABORATORY   +   EXPERIMENTS
(artificial environment)   +   (controlled *ad hoc* conditions)

PURPOSES OF EXPERIMENTS (WHY?)

1) Test of Behavioral Hypotheses.
   by constructing a laboratory environment that satisfies as many of the **structural** assumptions of a particular theory, it is possible to verify its **behavioral** implications

2) Theory Stress Tests
   to examine the **sensitivity** of a theory to violations of obviously **unrealistic** assumptions

3) Searching for Empirical Regularities
   heuristic experiments to **discover** and document stylized facts

(Davis-Holt 1994)

a) Speaking to Theorists

b) Searching for Facts

c) Whispering in the Ears of Princes

(Roth 1986)

EXPERIMENTAL METHODOLOGY (HOW?)

1. PROCEDURAL REGULARITY

to permit replications that the researcher and observers would accept as being valid

- instructions
- subject pool and methods of recruiting subjects
- experimental physical environment
- computerized or manual

2. MOTIVATION

Induced-value theory: use of a reward medium allows to induce pre-specified characteristics in experimental subjects and to make subjects' innate characteristics largely irrelevant

- monotonicity: subjects prefer more reward medium to less and not become satiated

- salience: rewards are explicitly and unambiguously connected to the decisions made

- dominance: changes in subjects' utility from the experiment come mainly from the reward medium and other subjective costs or benefits are rendered negligible by comparison, i.e. others' reward

3. UNBIASEDNESS

Experiments should be conducted in a manner that does not lead participants to perceive any particular behavioral pattern as being correct or expected, unless explicit suggestion is a treatment variable - double blind setting

4. CALIBRATION

The design has to pre-specify and to cleanly separate the experimental predictions of alternative theories.

5. DESIGN PARALLELISM

Results established in the lab hold in other, especially non-lab, real-world situations where similar ceteris paribus conditions hold

"While laboratory processes are simple in comparison to naturally occurring processes, they are real processes in the sense that real people participate for real and substantial profits and follow real rules in doing so. It is precisely because they are real they are interesting" (Plott 1982)

PROFESSIONAL SUBJECTS, STUDENTS or WHAT?

Main Subjects pool - Undergraduate students

- ▸ readily accessible
- ▸ low opportunity costs
- ▸ steep learning curve
- ▸ they do not know much about experimenter's hypothesis

PhD students

unreliable subjects because they get interested in what are you doing and respond to their understanding of your topic rather than to incentives you have constructed

Classes or friends

dominance or salience at risk, conflicts between personal, teaching and scientific aims

Professional subjects

‣ comparisons show that students are more adept at maximizing their profits and learning in the lab

‣ high opportunity costs

‣ pre-specified and innate characteristics are too strong

‣ when involved in laboratory markets they attempt to apply rules of thumb, which, valuable for dealing with uncertainty in the parallel natural market, are meaningless guides in the lab.

Controversial evidence

Burns (1985): professional wool buyers and students in a progressive auction (professionals apply familiar rules and not adjust to design requirements)

Dyer, Kagel, and Levin (1985): bidding behavior of students and construction workers (no difference)

Dejong et al (1988): Businessmen and students in sealed-offer markets (same profits, but higher variance for businessmen)

What about **gender**, **age**, **risk attitude**, **experience**?

A BIT OF HISTORY

Nobel Prize in Economics 2002

Kagel, John H. - Roth, Alvin E.
The Handbook of Experimental Economics
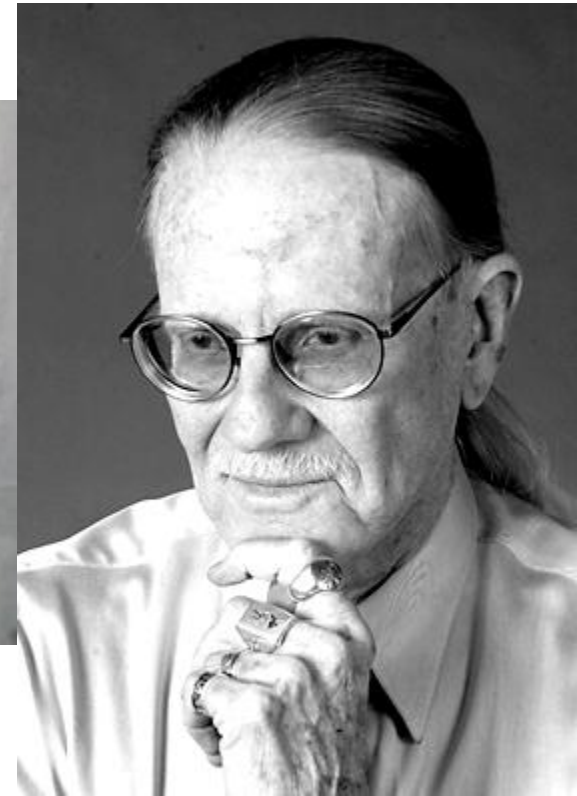
INDEX

a) **public goods**

cooperation vs. selfishness (social dilemmas, free-riding, institutions) - what improves cooperation (thresholds, learning)

b) **coordination problems**

experiments with overlapping generations - coordination games with Pareto ranked equilibria - decentralized matching environments

c) **bargaining experiments**

agreements - causes of disagreements and costly delays - bargaining protocol and preplay communications

d) **industrial organization**

trading institutions centralized and decentralized - monopoly regulation and potential entry - market structure and market power - collusion factors - product differentiation and multiple markets

e) **experimental asset markets**

informational efficiency of markets - state-contingent claims and bubbles - learning and dynamics of adjustment paths - investment and public policy

f) **auctions**

symmetric independent private-values models -common value auctions -collusion

g) **individual choice behavior**

INDIVIDUAL CHOICE BEHAVIOR
1. JUDGMENT

A. Calibration
  1. Scoring Rules
  2. Confidence Intervals

B. Perception and Memory Biases

C. Bayesian Updating and Representativeness
  1. Underweighting on Likelihood Information (Conservatism)
  2. The Law of Small Numbers and Misperceptions of Randomness

D. Confirmation Bias and Obstacles to Learning

E. Expectations Formation

F. Iterated Expectations and the Curse of Knowledge
  1. False Consensus and Hindsight Bias
  2. Curse of Knowledge

G. The Illusion of Control

INDIVIDUAL CHOICE BEHAVIOR
2. CHOICE UNDER RISK AND UNCERTAINTY

A. Mounting Evidence of Expected Utility Violation (1965-1986)

The Allais Paradoxes, Process Violations, Prospect Theory, Elicitation Biases

B. Generalizations of Expected Utility and Recent Tests

Predictions of Generalized EU Theories, Empirical Studies Using Pair-wise Choices and Measuring Indifference Curves, Cross-Species Robustness: Experiments with Animals

C. Subjective Expected Utility

The Ellsberg Paradox, Conceptions of Ambiguity

D. Choice over Time

E. Description Invariance

Framing Effects, Lottery Correlation, Regret, and Display Effects

F. Procedure Invariance and Endowment Effect

Preference Reversal, Endowment Effects, Some Psychology and Implications

EXPERIMENTS IN POLITICAL SCIENCES

A bit of history. The first experiment 1962

The precursor (1926)
Harold F. Gosnell (1896-1997)

Experiment on voter registration
and turnout in 1925 Chicago elections

"An Experiment in the Stimulation of
Voting"
The American Political Science Review
1926

http://www.jstor.org/stable/1945435

An Experiment in the Stimulation of Voting. In the fall of 1924 an attempt was made in selected districts in the city of Chicago to measure the effect of a non-partisan mail canvass to get out the vote. This experiment was a continuation of the study of non-voting begun in Chicago in connection with the mayoralty election of 1923. The basis of the non-voting study was the collection of six thousand personal interviews. The reasons for not voting given by the persons interviewed were classified and tabulated so as to bring out the relation between typical reasons and the situations resulting in non-voting. A survey of persons who failed to vote in the presidential election of 1924 showed that the distribution of causes of non-voting in the previous study was fairly accurate. The experiment in the stimulation of voting was an attempt to test the causes of non-voting in an objective fashion.

In order to set up this experiment it was necessary to keep constant, within reasonable limits, all the factors that enter into the electoral process except the particular stimuli which were to be tested. The factors known to have some relation to non-voting are: sex, the dramatic quality of the election, the convenience of the voting system, mobility, foreign birth, and the nature of the local party organization. The method of random sampling was used to control these factors during the testing of the particular stimuli used in the experiment.

A thorough canvass was made of six thousand adult citizens living in twelve selected districts in the city. Special efforts were made to list all the eligible voters living in these areas. The second step in the experiment was the division of the citizens in each of the districts

increase the proportion of registrants that vote in any election. There are several states where such notification is now required by law.

Finally, the experiments showed that knowledge of English, formal schooling, and familiarity with the simplest features of American political institutions are all factors which greatly influence the extent of popular participation in elections. A system of education reaching all adult illiterates would be a great step toward the permanent solution of the problem of non-voting. Too much emphasis cannot be placed upon the value of education as a method of stimulating a sustained interest in voting. The present experiment was largely educational, and the results produced can be traced to the confidence which the information imparted gave to certain persons who had been timid regarding the election process.

HAROLD F. GOSNELL.

University of Chicago.

Invalid Ballots Under the Hare System of Proportional Representation. One of the most widespread objections to the Hare system of proportional representation is its complexity. A Chinese puzzle seems

A bit of history. The first field 1943

Moore, Underhill, and Charles C. Callahan. 1943. Law and learning theory: A study in legal control. Yale Law Journal

THE YALE LAW JOURNAL

VOLUME 53   DECEMBER, 1943   NUMBER 1

LAW AND LEARNING THEORY: A STUDY IN LEGAL CONTROL*

By UNDERHILL MOORE† and CHARLES C. CALLAHAN‡

THIS study lies within the province of jurisprudence. It also lies within the field of behavioristic psychology. It places the province within the field and, in doing so, fragments the province into disconnected pieces. The problems of jurisprudence become psychological problems to be attacked by the use of the propositions of a psychological theory of behavior and by quantitative and experimental methods.

Although analytical, natural-law, historical, sociological, and "realistic" jurists, legislators, administrators, cultural anthropologists, sociologists,

A bit of history - The first lab 1956

Samuel J. Eldersveld (1917-2010)

"Experimental Propaganda Techniques and Voting Behavior." American Political Science Review 1956

First lab experiment in the *American Political Science Review* on propaganda and voting behavior

Design
The author randomly assigned potential voters to
- control group that received no messages
- treatment groups that received messages encouraging them to vote via personal contact (which included phone calls or personal visits) or via a mailing.

Results
- more voters in the personal contact treatment groups turned out to vote than those in either the control group or the mailing group
- personal contact caused a relative increase in turnout

A bit of history – Game theory

William H. Riker
Bargaining in a Three-Person Game
American Political Science Review 1967

BARGAINING IN A THREE-PERSON GA

WILLIAM H. RIKER
University of Rochester

Application of game theory and mathematics to political sciences

Games are paradigms of many political events, especially those that involve partial or complete conflicts of interest among the participants. As paradigms, they display in relatively simple social interaction the same fundamental forces found in the more complex interactions of the grander political events whose structure they share. This is the feature of games that makes them attractive vehicles for both theorizing and experimentation in the social sciences. The scientific expectation is that, by studying the quasi-political interaction of games—where the variations among institutional, psychological, and ideological components of behavior are minimized—one will be able to understand more profoundly the

scientifically useful bec
whether or not they a
what people do in the
there has been a conside
mentation with games,
cerned psychological at
relatively little has be
theory or at extending
Given these lacunae, t
with verifying a theory
three-person non-zero-s
question is: Does the
people do? And subsidi
associated with the solu
in the temporal worl
laboratory are given t

A bit of history – The first journal 1970

Experimental Study of Politics (1970)
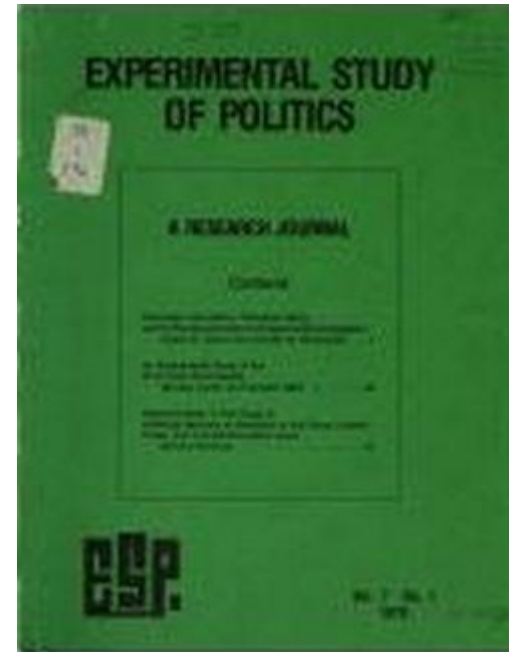
Journal of Experimental Political Science (2014)

Trend in APSR

American Political Science Association

American Political Science Review

MAY 2015
VOLUME 109
NUMBER 2
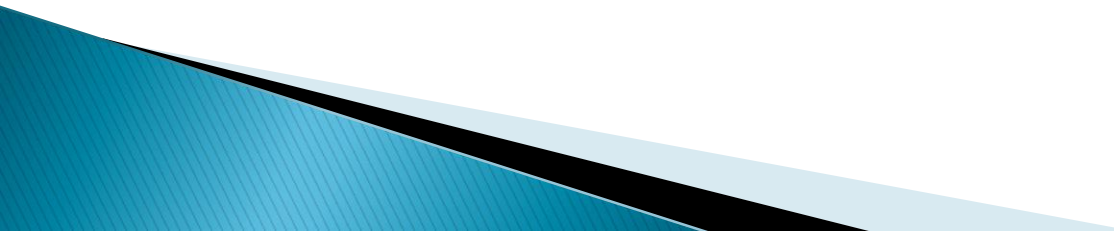
Figure 1
Experimental Articles in the *APSR*
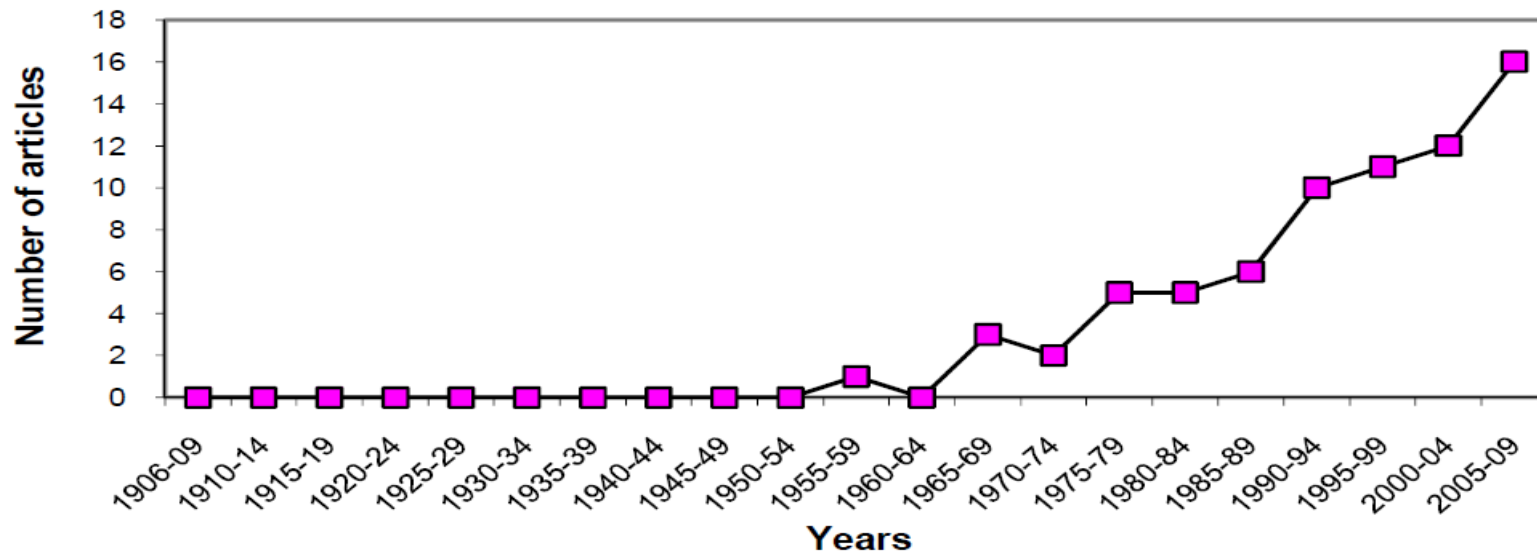
Methodology

- **Surveys** – phone, in-person or web-based opinion surveys

- **Laboratory** – controlled and artificial setting (web-based and virtual included)

- **Field** – in naturally occurring setting

Topics

Cambridge Handbook of Experimental Political Science (2011)

Index

- Decision making
- Vote Choice, Candidate Evaluations, and Turnout
- Interpersonal Relations
- Identity, Ethnicity, and Politics
- Institutions and Behavior
- Elite Bargaining

Cambridge

HANDBOOK OF

Experimental

Political

Science

EDITED BY

JAMES N. DRUCKMAN
DONALD P. GREEN
JAMES H. KUKLINSKI
ARTHUR LUPIA

CAMBRIDGE
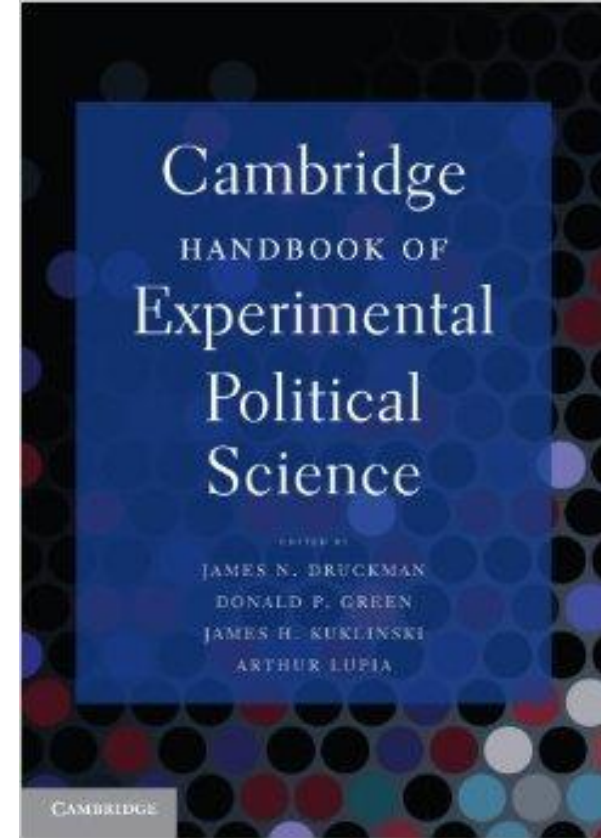
Economics vs Politics
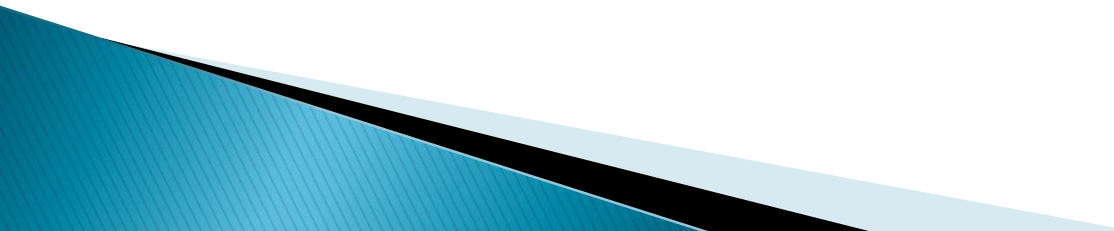
A) STYLIZATION

Context-free environments vs. descriptively realistic scenarios
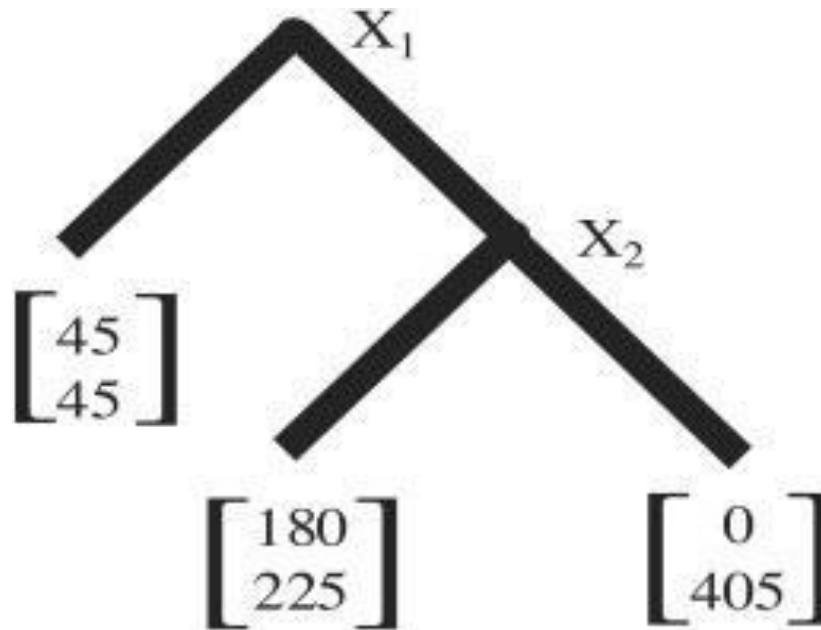
Economics vs Politics

B) MONETARY INCENTIVES
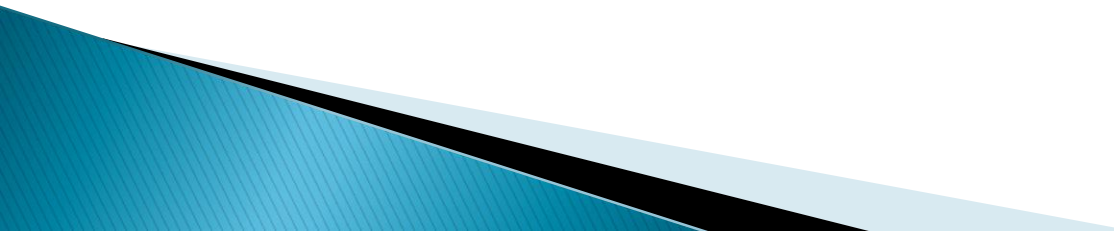
▸ Induced-value theory: use of a reward medium allows to induce pre-specified characteristics in experimental subjects and to make subjects' innate characteristics largely irrelevant

▸ In some experiments, it is as if subjects take into the lab the preferences applied to real choices and stick to them with high probability. These biases or inclinations may tend to override the incentives effect

Economics vs Politics

C) DECEPTION

- provision of information that actively misled subjects regarding some aspect of the study
- an explicit mis-statement of facts
- to give subjects misleading or erroneous information

Ob.: To maintain a reputation in order to make subjects motivated by the induced monetary rewards rather than by psychological reactions to suspected manipulation

A CRITIQUE OF VERBAL SELF-REPORT

Much of what political scientists claim to know about citizens' political beliefs and attitudes is based on **verbal self report**

Citizens can only verbalize thoughts and behavioral intentions that they are aware of

(Lodge, Taber and Verhulst 2011)

The reliance on explicit measure of political attitudes ad behaviors is problematic, as these measures assume people have direct access to their 'true' beliefs or attitudes and are willing and able to accurately report them

(Wittenbrink 2007)

Behavioral Approaches

Pars destruens

Cognitive Biases
Heuristics

Noisy information
Overconfidence

Pars construens

Dual Process Theories
Information Processing

Imitation
Informational Cascades

Cognitive Biases

Representativeness

Probability assessment of a state of the world is based on the degree to which the evidence is perceived as similar to or typical of the state of the world (people tend to rely too heavily on small samples and too little on large samples)

Overconfidence

(Psych) over-optimism about the individual's ability to succeed in his/her endeavors

(Economics) to overweight the importance of private information with respect to public information

Dual process theories

Attention orienting as a dual processing activity (Cohen 1993, Birnboim 2003)

Selective attention is defined as "control of information processing so that a sensory input is perceived or remembered better in one situation than another according to the desires of the subject" (Schneider and Shriffin 1977, p. 4)

This selection process operates according two different patterns: automatic detection and controlled search

Dual system

SELECTIVE ATTENTION

Automatic Detection   **Controlled Search**

Automatic detection works in parallel, is independent of attention, difficult to modify and suppress once learned

Controlled search is a serial process that uses short-term memory capacity, is flexible, modifiable and sequential

THINKING, FAST AND SLOW

DANIEL KAHNEMAN

KAHNEMAN'S PROJECT

To explore the systematic biases that separate the beliefs that people have and the choices they make from the optimal beliefs and choices assumed in rational-agent economic models

intuitive judgment and choice
vs.
preferences and attitudes

Model of judgment heuristics

Key principles

- reasoning is done deliberately and effortful

- intuitive thoughts come spontaneously to mind without search, computation or effort

- most judgments and most choices are made intuitively

- rules that govern intuition are generally similar to the rules of perception

	PERCEPTION	INTUITION SYSTEM 1	REASONING SYSTEM 2
PROCESS		Fast Parallel Automatic Effortless Associative Slow-learning Emotional	Slow Serial Controlled Effortful Rule-governed Flexible Neutral
CONTENT	Percepts Current stimulation Stimulus-bound	Conceptual representations Past, Present and Future Can be evoked by language	

SYSTEM 1 AND SYSTEM 2

The perceptual system and the intuitive operations of System 1 generate **impressions** of the attributes of objects of perception and thought. These impressions are not voluntary and need not be verbally explicit.

In contrast, **judgments** are always explicit and intentional, whether or not they are overtly expressed. Thus, System 2 is involved in all judgments, whether they originate in impressions or in deliberate reasoning.

Difference in effort provides the most useful indications of whether a given mental process should be assigned to System 1 or System 2.

Intuitive judgments occupy a position—perhaps corresponding to evolutionary history—between the automatic operations of perception and the deliberate operations of reasoning.

SYSTEMS 1 AND 2 ACTIVITIES

SYSTEM 1	SYSTEM 2
Detect that one object is more distant than another	Focus attention on the clowns in the circus
Complete the phrase "bread and…"	Focus on the voice of a particular person in crowded and noisy rooms
Make a "disgust face" when shown a horrible picture	Maintain a faster walking speed than is natural for you
Detect hostility in a voice	Monitor the appropriateness of your behavior in a social situation
Answer to 2+2=?	Tell someone your phone number
Drive a car on an empty road	Park in a narrow space
Find a strong move in chess (if you are a chess master)	Compare two washing machines for overall value
Understand simple sentences	Check the validity of a complete logical argument

SYSTEM 1 VS. SYSTEM 2

The capabilities of System 1 include human skills that we share with other animals

People are born prepared to perceive the world around us, recognize objects, orient attention, avoid losses, and fear spiders

Other activities are learnt by System 1 by making associations between ideas (such as the master chess player)

Many activities of System 1 are completely involuntary while others, such as chewing, are susceptible of voluntary control but normally run on automatic pilot (**accessibility**)

System 2 is tuned to **pay attention** and has some ability to change the way system works by programming the normally automatic functions of attention and memory

When you rent a car in UK you should pay attention to drive on the left side of the road

ACCESSIBILITY AND CONTEXT

ACCESSIBILITY AND EXPECTATIONS

Expectations (conscious or not) are a powerful determinant of accessibility.

Ambiguity and uncertainty are suppressed in intuitive judgment as well as in perception

It is different to see the two versions in close proximity or separately because observers will not spontaneously become aware of the alternative interpretation.

Doubt is a phenomenon of System 2, an awareness of one's ability to think incompatible thoughts about the same thing.

Klein (1998) experienced decision makers working under pressure (e.g., firefighting company captains) rarely need to choose between options because, in most cases, only a single option comes to mind.

BERNOULLI'S ERROR

Perception is **reference-dependent**: the perceived attributes of a focal stimulus redirect the contrast between that stimulus and a context of prior and concurrent stimuli.

Immersing the hand in water at 20°C will feel pleasantly warm after prolonged immersion in much colder water, and pleasantly cool after immersion in much warmer water.

In contrast, **standard decision theory** assumes that the utility of decision outcomes is determined entirely by the final state of endowment, and is therefore **reference-independent**.

Kahneman defines **Bernoulli's error** the proposition that decision makers evaluate outcomes by the utility of final asset positions which has been retained for almost 300 years.
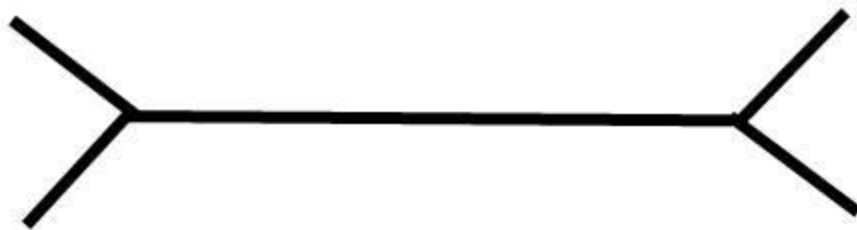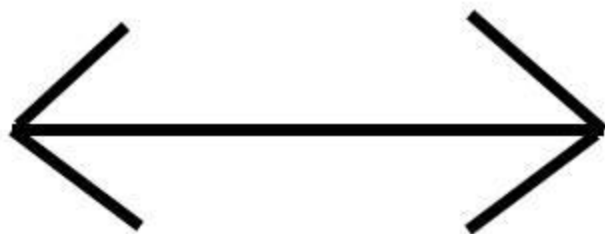
MÜLLER-LYER ILLUSIONS
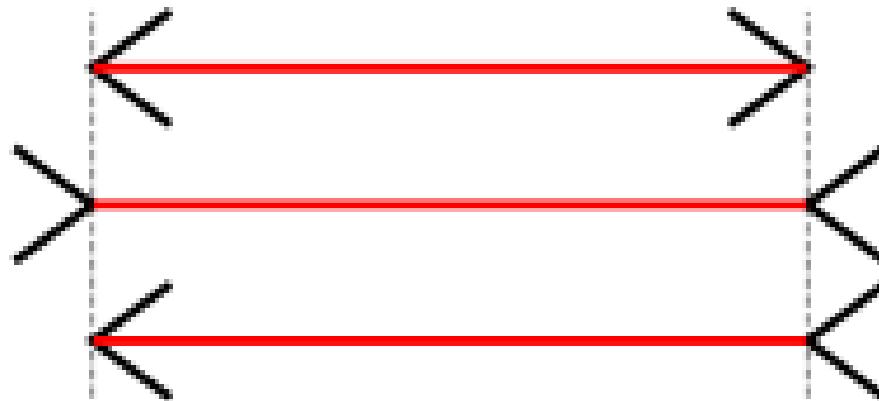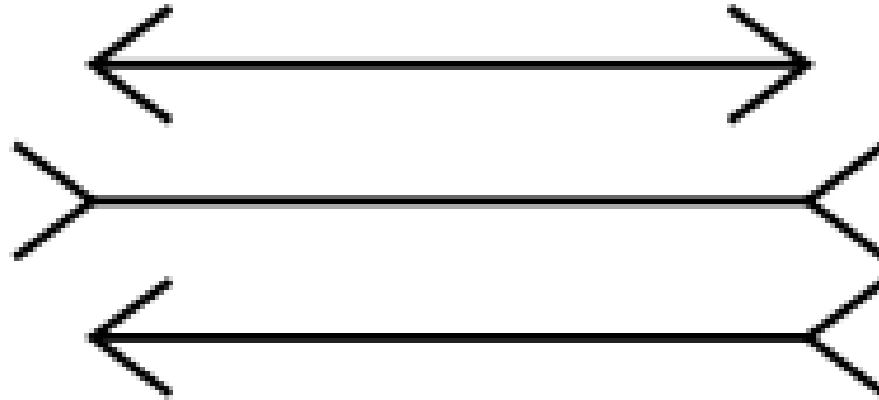
COGNITIVE AND VISUAL ILLUSIONS

System 1 sees that the bottom line is longer than the top line

System 2 realizes from measurement in the second slide that the lines are equally long

But if you look again at the first slide the bottom line appears longer

There is no way to prevent System 1 from generating a wrong impression because it operates automatically and **cannot be turned off at will**

Biases cannot be avoided because System 2 have no clue to the error and is to slow and inefficient to serve as a substitute for System 1 in making routine decisions

Solution: learn to recognize situations in which mistakes are likely and to monitor them

(c) 2010 Daniel J. Simons

SELF-CONTROL

System 1 has more influence on behavior when System 2 is busy

People who are cognitively busy are also more likely to make selfish choices, use sexist language and make superficial judgments in social situations

Add-3 loosens the hold on System 2 on behavior as few drinks or a sleepless night

Too much concern about how well one is doing in a task sometimes disrupts performance by loading short-term memory with pointless anxious thoughts (fast and frugal)

Self-control requires attention and effort and is a task of System 2 who monitor and control thoughts suggested by System 1

EXCERPTS FROM
THINKING, FAST AND SLOW

"it is natural for System 1 to generate overconfidence judgments, because confidence is determined by the coherence of the best story you can tell from the evidence at hand." (p. 194)

"The most coherent stories are not necessarily the most probable, but they are *plausible*, and the notions of coherence, plausibility, and probability are easily confused by the unwary." (p. 159)

"System 2 is not impressively alert. (…) Its laziness is an important fact of life, and the observation that representativeness can block the application of an obvious logical rule is also of some interest." (p. 164)

THE ORIGIN OF BIASES

System 1 detects simple relations (i.e. "they are all like") and integrate information about one thing at a time but it does not deal with multiple distinct topics at once

System 2 follow rules, compare objects on several attributes and make deliberate choices between options, adopt "task sets", i.e. program memory to obey an instruction that overrides habitual responses

But people are overconfident and prone to place too much faith in their intuitions because they find cognitive effort mildly unpleasant and avoid it as much as possible

System 1

System 1 collects all the properties of automaticity and heuristic processing as discussed by literature on bounded rationality (Simon) and heuristics (Kahneman and Tversky)

System 1 is fast, automatic, effortless, largely unconscious, associative and difficult to control or modify

The perceptual system and the intuitive operations of System 1 generate non voluntary **impressions** of the attributes of objects and thought
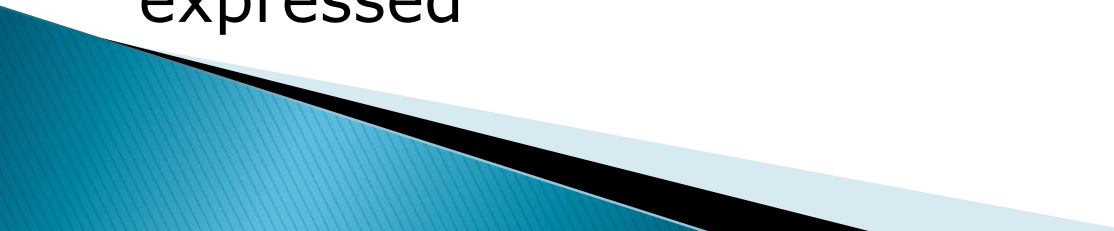
System 2

System 2 encompasses the processes of analytic intelligence, traditionally studied by information processing theorists

System 2 is slower, serial, effortful, deliberately controlled, relatively flexible and potentially rule-governed

In contrast with System 1, System 2 originates **judgments** that are always explicit and intentional, whether or not they are overtly expressed
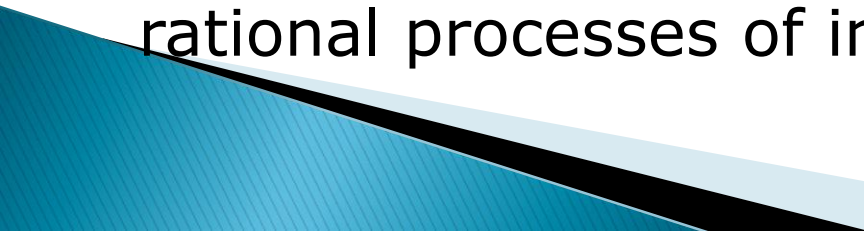
1. An experiment
Gaze Direction and Dual Systems

"Gaze Bias Parallels Decision Making in Binary Choices under Uncertainty" Innocenti, Rufa and Semmoloni (JNEP 2010)

System 1 and System 2 are evolutionary products

People heterogeneity as the result of individually specific patterns of interaction between the two systems

If eye movements and attention shifts are tightly tied, gaze direction could represent a signal of how automatic and immediate reactions to visual stimuli are modified or sustained by conscious and rational processes of information collecting

Informational cascades

Informational cascade - model to describe and explain herding and imitative behavior focusing on the rational motivation for herding (Banerjee 1992, Bikhchandani et al. 1992)

Key assumptions

Others' actions/decisions but not information are publicly observable

Private information is bounded in quality

Agents have the same quality of private information
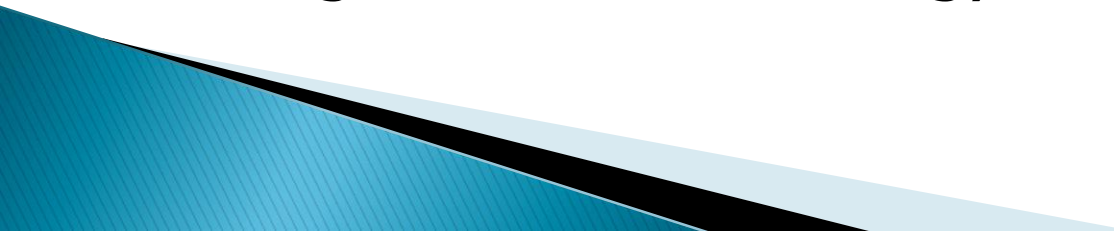
The restaurant example

Consider two restaurants named "A" and "B" located next to one another

According to experts and food guides A is only slightly better than B (i.e. the prior probabilities are 51 percent for restaurant A being the better and 49 percent for restaurant B being better)

People arrive at the restaurants in sequence, observe the choices made by people before them and must decide where to eat

Apart from knowing the prior probabilities, each of these people also got a private signal which says either that A is better or that B is better (of course the signal could be wrong)

The restaurant example

Suppose that 99 of the 100 people have received private signals that B is better, but the one person whose signal favors A gets to choose first

Clearly, the first chooser will go to A. The second chooser will now know that the first chooser had a signal that favored A, while his or her own signal favors B

Since the private signals are assumed to be of equal quality, they cancel out, and the rational choice is to decide by the prior probabilities and go to A

The restaurant example

The second person thus chooses A regardless of her signal

Her choice therefore provides no new information to the next person in line: the third person's situation is thus exactly the same as that of the second person, and she should make the same choice and so on

Everyone ends up at restaurant A even if, given the aggregate information, it is practically certain that B is better (99 people over 100 have private signal that is the case)

This takes to develop a "wrong" information cascade, i.e. that is triggered by a small amount of original information followed by imitations

What is wrong?

A is chosen although almost all people receive private signal that B is better than A and there is no clear prior evidence that A is better than B (51% vs. 49%)

If the second person had been someone who always followed her own signal (overconfident), the third person would have known that the second person's signal had favored B. The third person would then have chosen B, and so everybody else

The second person's decision to ignore her own information and imitate the first chooser inflicts a negative externality on the rest of the population

If she had used her own information, her decision would have provided information to the rest of the population, which would have encouraged them to use their own information as well

Model's key features

People get private information ("signals") and can also observe public information

Public information is the history of all the actions (not information) of predecessors

People are rational because they are assumed to update their prior probabilities by using Bayes' rule to process the public and private information they possess

An individual herds on the public belief when his action is independent of his private signal

If all agents herd there is an informational cascade that may be both "wrong" or "right"

Heuristics and biases in cascades

The theory of informational cascades assumes that decision makers behave rationally in processing all the available information

Experimental evidence points out cognitive biases:

 1. One third of the subjects exhibit a tendency to rely on the mere counting of signals (Anderson-Holt 1997)

 2. Subjects' overconfidence consistently explains the deviations from Bayes' rule (Huck-Oechssler 2000, Nöth-Weber 2003, Spiwoks et al. 2008)

Experimental setting

Subject monitor

Operator monitor

$u(t)$

$H(s)$

Subject

P&T Infrared Camera

$y(t)$

Controller

Software
ET-6000
Data analysis and record
Stimulus generator

RS232
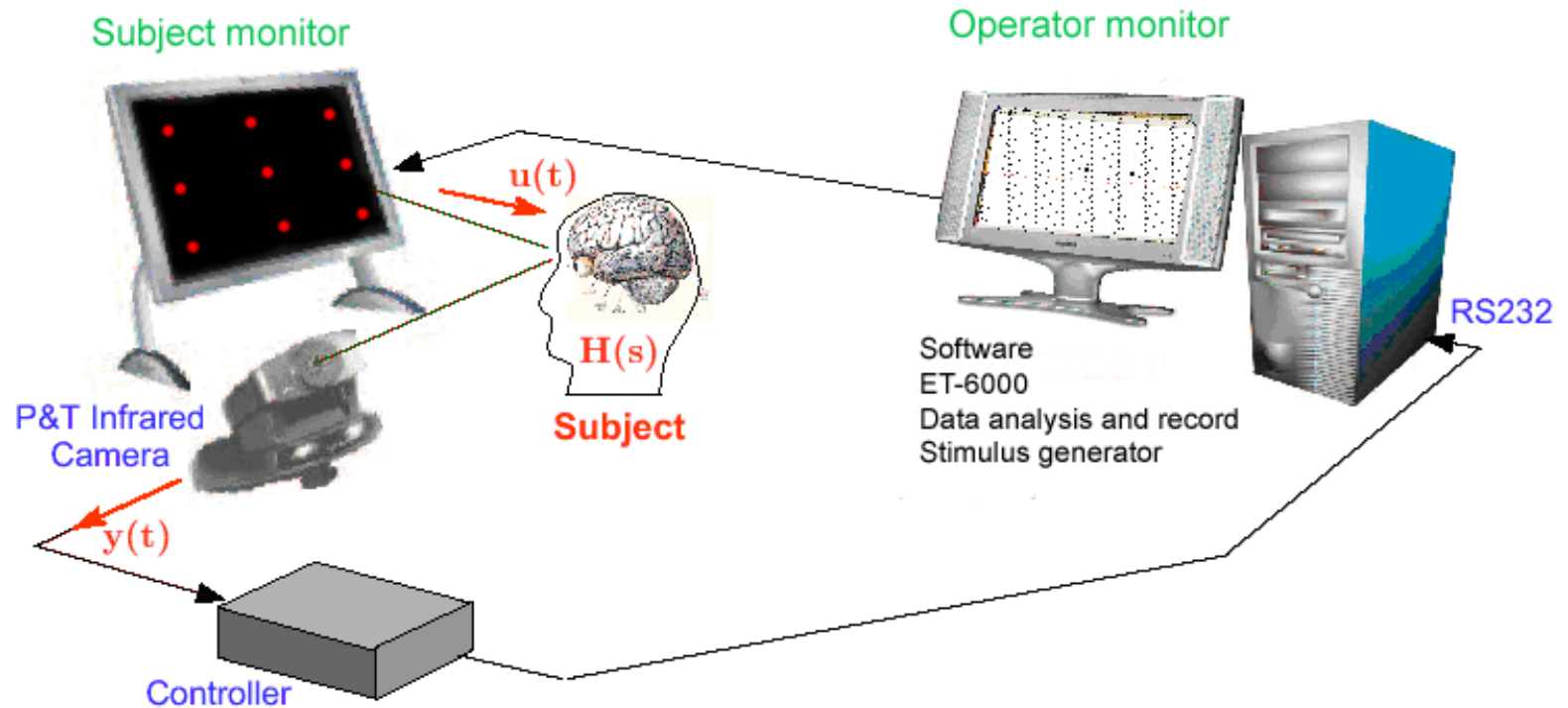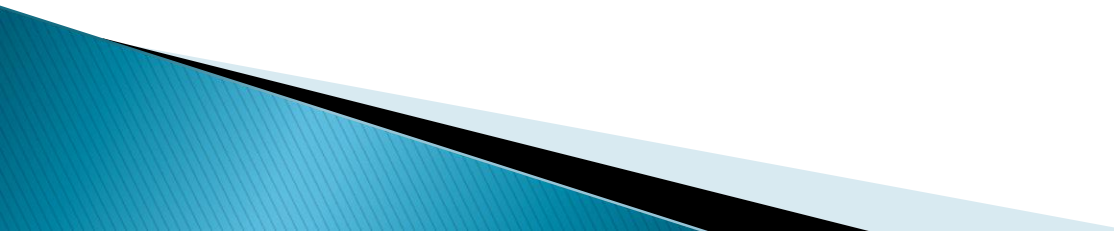
Experimental Design

Two events - Square and Circle - may occur with equal probability.

For each session, **9 subjects** (students) were arranged in a pre-specified order and asked to predict the state with a monetary reward for a correct prediction

Each subject observes:

an independent and private signal (**Private Draw**) which has a 2/3 chance of indicating the correct event

the predictions (**Previous Choices**) made by the subjects choosing previously that are public information

Bayesian learning

HP: rational subjects process information according to Bayes' rule and predict the event indicated as more probable by the combination of private signals and publicly known predictions

This implies that the choice of the first decision maker reveals the private signal he has drawn

For example, if he chooses A, later decision makers will infer that he has observed the signal a

$$[Pr(a|A)=2/3 > Pr(a|B)=1/3]$$

Bayesian learning

If the second decision maker observes the same private signal *a* he will predict accordingly.

If she receives the other signal *b*, he will assign a 50% probability to the two events and both predictions will be equally rational.

If the second decision maker chooses A, the third decision maker will observe two previous choices of A. If her private signal is *b*, it will be rational to ignore this private information and to predict A as the previous choosers (information cascade).

Bayesian learning

If (a,b) indicates the numbers of signals a and b received or inferred, Bayes' rule imposes:

$$\text{Pr}(A|a,b) = \frac{[\text{Pr}(a,b|A)\ \text{Pr}(A)]}{[\text{Pr}(a,b|A)\ \text{Pr}(A) + \text{Pr}(a,b|B)\ \text{Pr}(B)]}$$

In the example, the third decision maker observes two signals a inferred and receives one signal b received and the expression above gives:

$$\text{Pr}(A|a,b) = \frac{(2/3)^2(1/3)(1/2)}{(2/3)^2(1/3)(1/2) + (1/3)^2(2/3)(1/2)} = 2/3$$

Bayesian learning

Being signals balanced [$Pr(A|a) = Pr(B|b) = 2/3$], the difference between the number of signals a and b inferred or observed determines the more probable event.

In this simplified case, Bayes' rule corresponds to a very simple and intuitive counting heuristic, which is easily computable by all subjects.

In the example above, the third decision maker has to count two previous choices over his/her only one private signal to determine her choice of A as rational
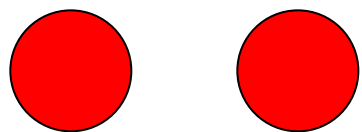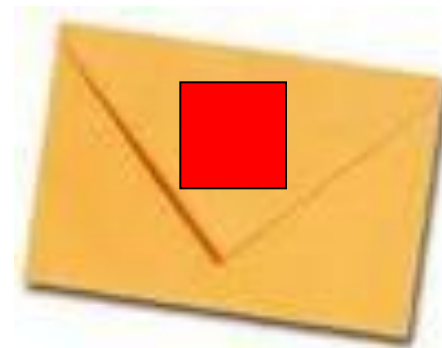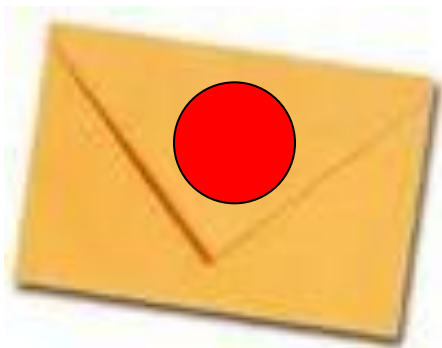
2/3
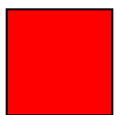
1/3

2/3
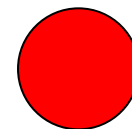
1/3

Private draw- PD (right)

Previous choices-PC (left)

1

2 sec

2
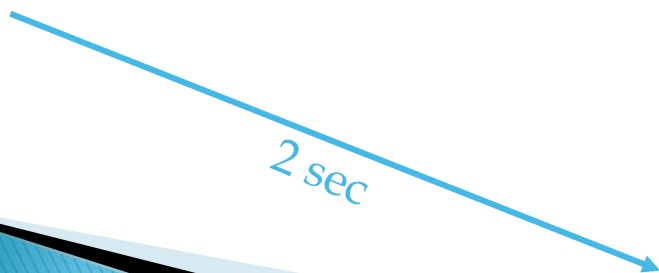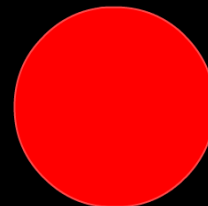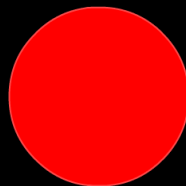
Private signal- PD (left)

Previous choice-PC (right)

5000 m sec

1000 msec

1000 msec

1000 msec

500 msec
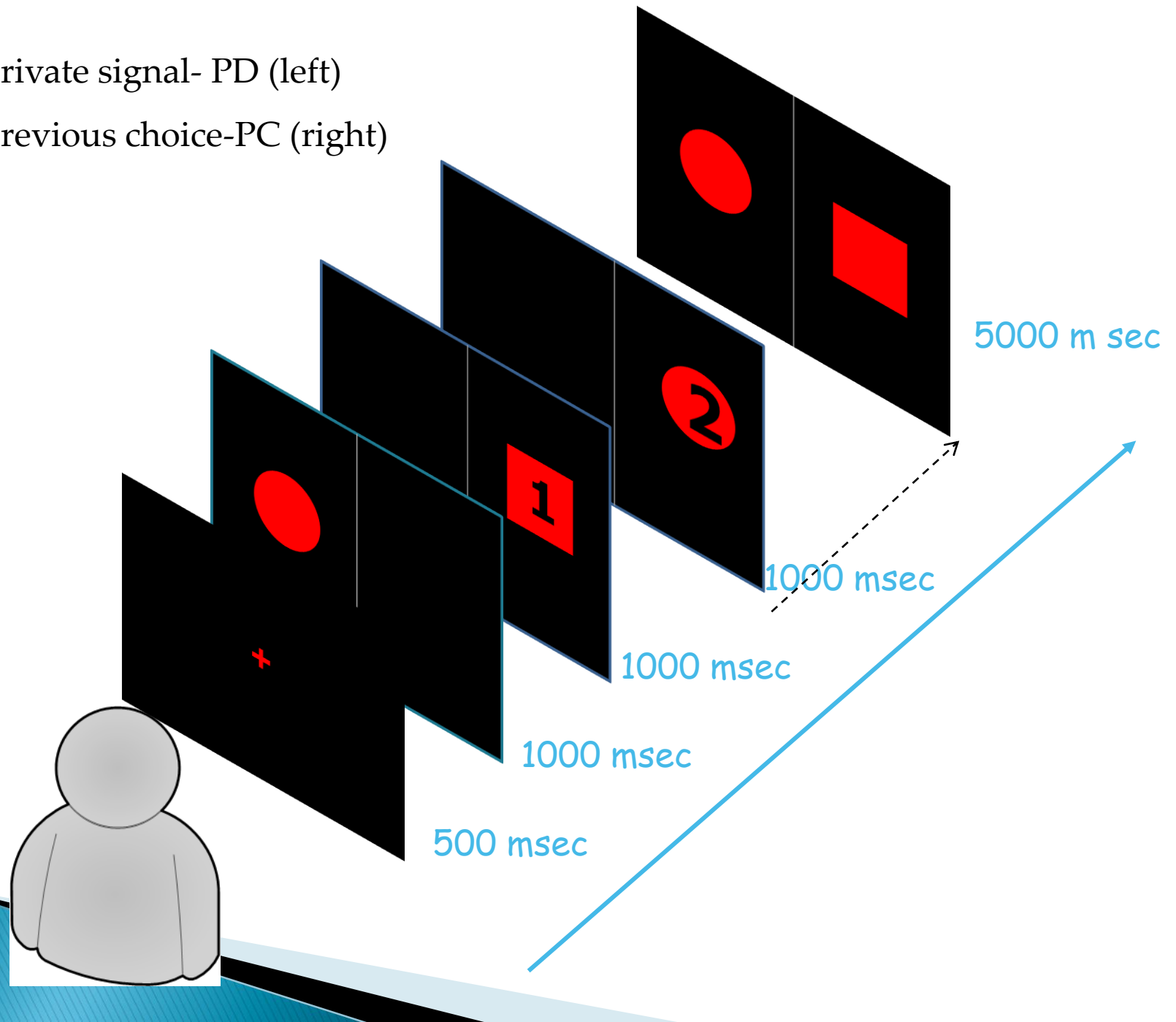
Experimental design

Session	Treatment	Participants (women + men)
1	(PD left - PC right)	9 (4 + 5)
2	(PD left - PC right)	9 (5 + 4)
3	(PD left - PC right)	9 (6 + 3)
4	(PC right - PD left)	9 (4 + 5)
5	(PC right - PD left)	9 (5 + 4)
6	(PC right - PD left)	9 (5 + 4)
7	(PD left - PC right)	9 (3 + 6)
8	(PD left - PC right)	9 (5 + 4)
9	(PD left - PC right)	9 (4 + 5)
Total		81 (41+40)

Participants: 81   Mean age: 22,4 Years

Experimental variables

First Fixations

Total number of fixations (Fixations = gazing at region of interest –ROI- for at least **200 milliseconds**)

Relative time spent fixating ROI (relative time = time in a ROI divided by the total time spent on a task)

Sequence of last fixations

Subjects' types

BAYESIAN - the equal probability of the two states implies that the optimal Bayesian decision rule is to predict the state which obtains the greatest number of observed (Private draw) and inferred signal (Previous choices).

If subjects **choose differently** from what implied by Bayesian update:

OVERCONFIDENT - if subject's choice is equal to his Private draw

IRRATIONAL - if subject's choice is not equal to his Private draw

Results

Order of choice	Bayesian	Overconfident	Irrational
1st	6	0	3
2nd	9	0	0
3rd	5	2	2
4th	6	2	1
5th	7	1	1
6th	6	2	1
7th	6	3	0
8th	6	3	0
9th	6	3	0
Total	57	16	8
Total (first chooser excluded)	51	16	5

First fixations

| | Latency of first fixations | Private Draw | | Previous Choices | | Average duration |
		N. of first fixations	%	N. of first fixations	%	
Bayesian	0.306 sec	27 (13L+14R)	52.9	24 (13L+11R)	47.1	0.838 sec
Overconfident	0.412 sec	13 (6L+7R)	81.2	3 (1L+2R)	18.8	0.523 sec
Irrational	0.191 sec	3 (2L+1R)	60.0	2 (0L+2R)	40.0	0.835 sec
Total	0.321 sec	43 (21L+22R)	46.8	25 (14L+15R)	53.2	0.775 sec

•Overconfident subjects allocated their initial attention to private draw in 81% of the cases, and exhibited a longer average reaction time (0.412 sec.) and a shorter average duration of first fixation (0.523)

Total allocation of attention

TABLE 5. TOTAL ALLOCATION OF ATTENTION (PERCENTAGE OF TOTAL TIME)

	PRIVATE DRAW (PD)	FORMER CHOICES (FC)	NO FIXATION	TOTAL	FORMER CHOICES/ N. OF FORMER CHOICES
BAYESIAN	26.9	63.0	10.1	100	22.4
OVERCONFIDENT	10.4	86.4	3.2	100	19.5
IRRATIONAL	47.1	39.9	13.0	100	22.6
TOTAL	25.6	65.3	9.1	100	21.8

TABLE 6. TOTAL ALLOCATION OF ATTENTION BY SCREEN SIDE (PERCENTAGE OF TOTAL TIME)

	PRIVATE DRAW			FORMER CHOICES / N. OF FORMER CHOICES		
	LEFT SIDE	RIGHT SIDE	TOTAL	LEFT SIDE	RIGHT SIDE	TOTAL
BAYESIAN	19.5	29.5	26.9	25.5	21.2	22.4
OVERCONFIDENT	9.2	10.9	10.4	16.8	20.7	19.5
IRRATIONAL	52.0	12.7	47.1	21.4	27.5	22.6
TOTAL			25.6			21.8

- Only irrational subjects were significantly more inclined to look at private draw (47.1%) than at former choices (22.6%).

First fixations by side

TABLE 4. FIRST FIXATION BY SCREEN SIDES (FIRST CHOOSERS EXCLUDED)

	PRIVATE DRAW (PD)						FORMER CHOICES (FC)					
	LEFT			RIGHT			LEFT			RIGHT		
	N.	TOT.	%	N.	TOT.	%	N.	TOT.	%	N.	TOT.	%
BAYESIAN	8	14	57.1	20	30	66.6	16	38	42.1	6	16	37.5
OVERCONFIDENT	5	9	55.6	9	15	60.0	2	6	33.3	1	3	33.3
IRRATIONAL	1	1	100	2	3	66.6	2	4	50.0	0	3	0
TOTAL	14	24	58.3	31	48	64.6	21	48	43.7	8	24	33.3

- No statistically significant difference between left and right orientation of the screen was detected and the pattern of first fixations across subjects' types

Likelihood to look at the chosen item
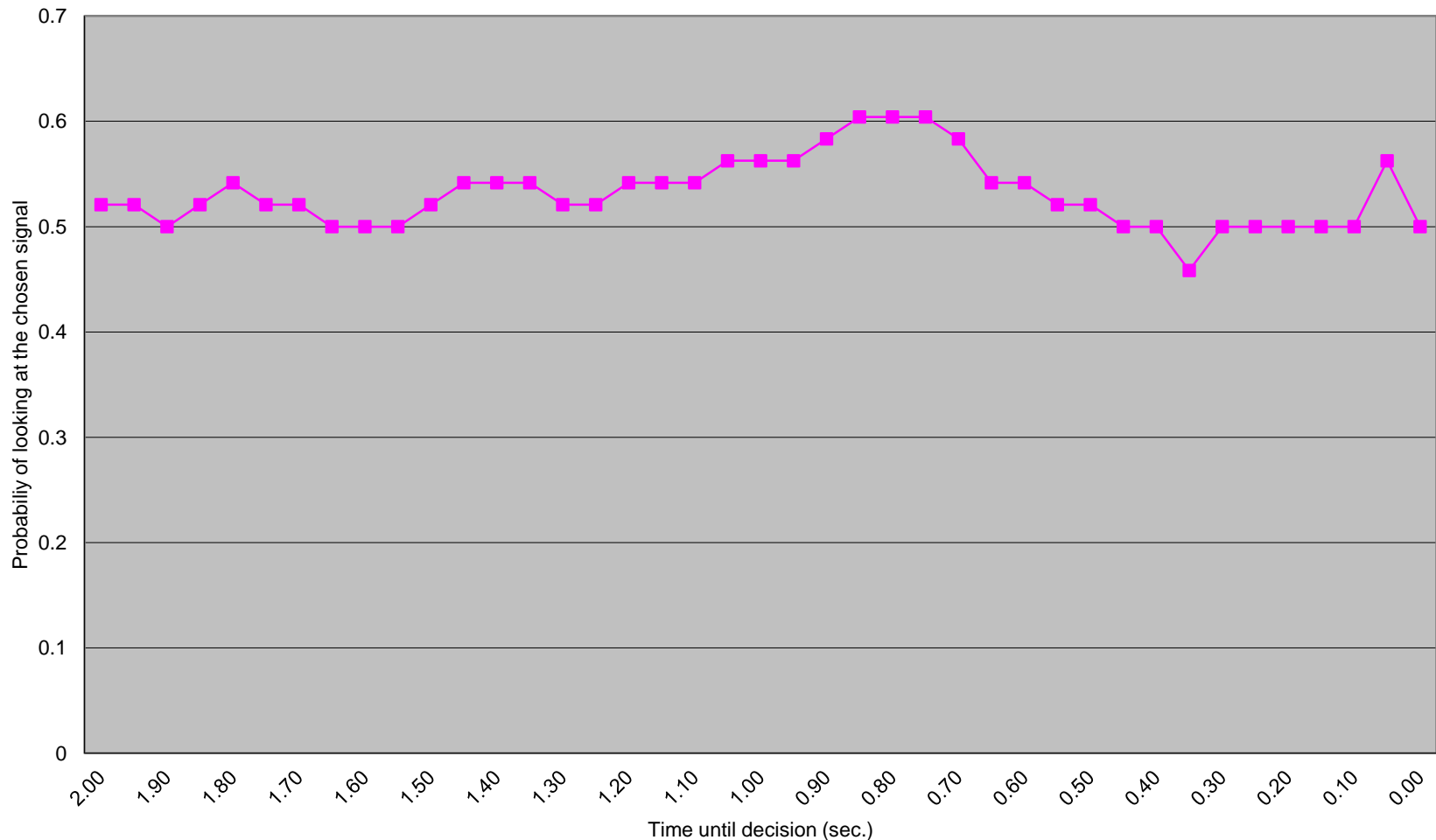
No gaze cascade effect: observers gaze was not increasingly directed towards the chosen signal

Likelihood by types

Fig.2 Likelihood that subjects look at the chosen signal as a function of time until decision (by subjects' types)
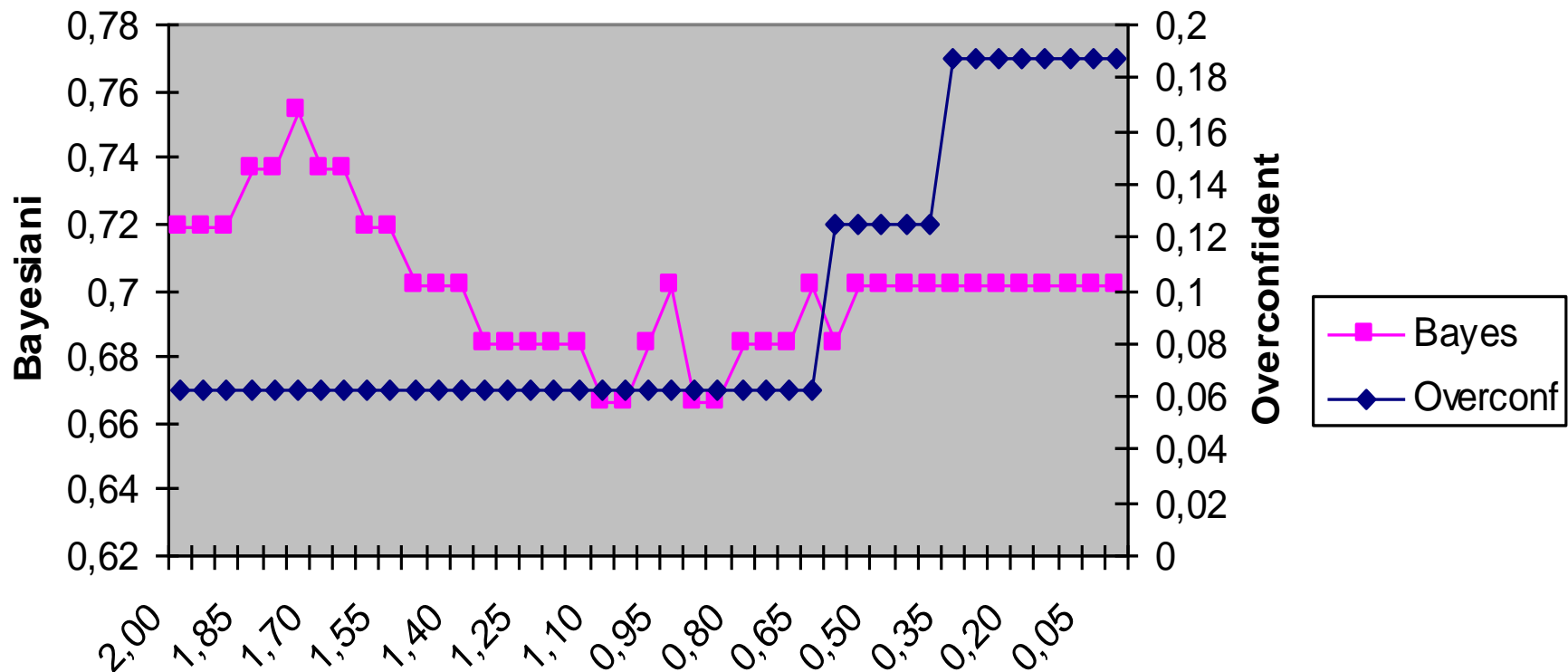
Findings

Overconfident subjects allocate the first fixation (initial attention) towards private draws and take more time than others to decide if the private signal is on the right or the left of the screen.

Bayesian subjects allocate their initial attention to both kinds of information without exhibiting any particular bias

No evidence of the gaze cascade effect

2. Noisy and redundant information

Soccer betting

Data set

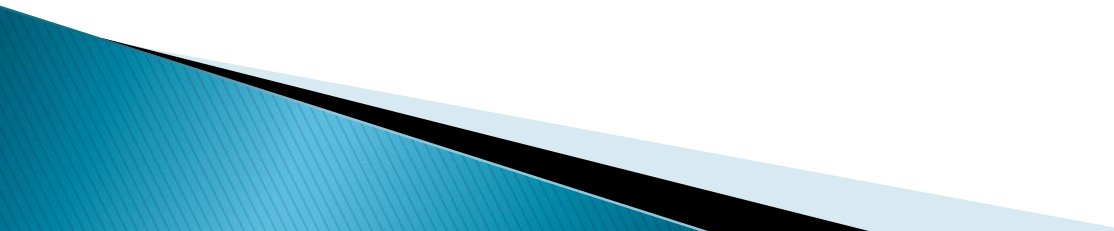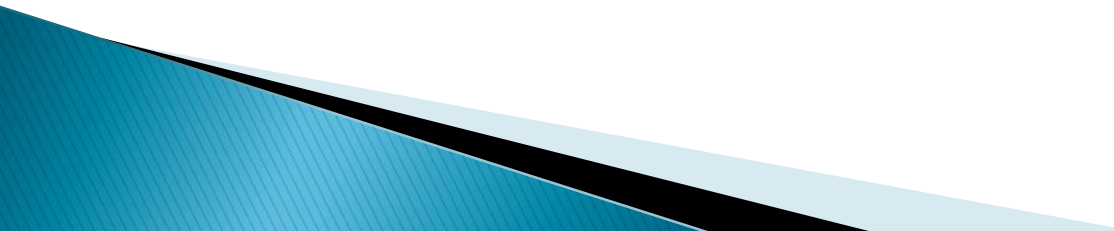- Dataset 1.205.000 bets on the Italian Soccer League Serie A (January 2004- November 2004)

- Mainly small bettors on multiple bets (on average 5 euros)

- Average odd of each event 2.49

- Young men (18-30 years old) from Southern Italy

Table 4 – Baseline regression: *timing_late*

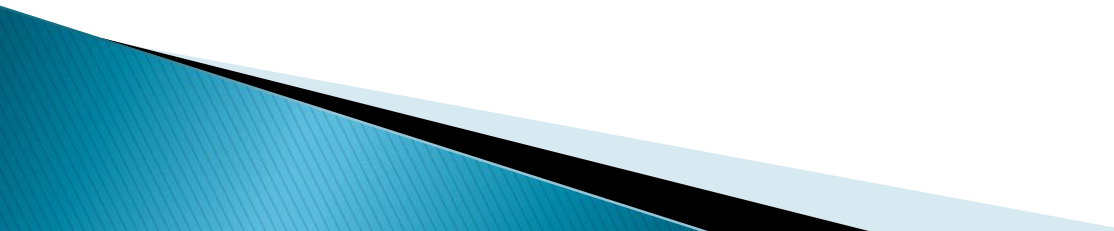|	(1)	(2)	(3)	(4)	(5)	(6)
Timing_late	0.013***	0.013***	0.010***	0.013***	0.013***	0.011***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Home wins	0.184***	0.184***	0.183***	0.184***	0.184***	0.183***
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Strong wins	0.290***	0.290***	0.305***	0.290***	0.290***	0.305***
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Gameweek	-0.003***	-0.004***		-0.003***	-0.004***	
	[0.000]	[0.000]		[0.000]	[0.000]	
Other events	0.024***	0.024***	0.023***	0.024***	0.024***	0.023***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Amount user	0.017***	0.018***	0.011***	0.018***	0.018***	0.011***
	[0.006]	[0.006]	[0.004]	[0.002]	[0.002]	[0.002]
Main teams	0.070***	0.070***	0.068***	0.070***	0.070***	0.068***
	[0.002]	[0.002]	[0.002]	[0.001]	[0.001]	[0.001]
Dummy gameweek	NO	NO	YES	NO	NO	YES
Individual FE	NO	NO	NO	YES	YES	YES
Gameweeksq	NO	YES	NO	NO	YES	NO
Observations	1,205,597	1,205,597	1,205,597	1,205,597	1,205,597	1,205,597
N. of individuals	7,093	7,093	7,093	7,093	7,093	7,093

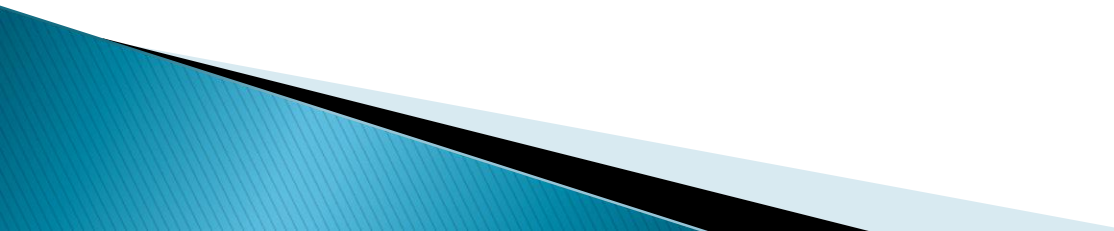Columns (2) and (5) include the variable *gameweeksq*, which is significantly positive only in (5), but extremely

Findings and Interpretation

- We do not detect any learning during the course of the season

- Statistically very significant and stable difference in the winning probability of early versus late bettors.

- The estimated effect controls for time-invariant unobservable heterogeneity, learning, betting odds, and observable characteristics of the event.

- Therefore, when we refer to "late" versus "early" bettors we are comparing the same individual making bets at different distances from each event.

Findings and Interpretation

- The poorer forecasting performance of late bettors is attributed to an inefficient processing of information.

- The late bettors' decision process is affected by various cues that, unknown to the earlier bettors, have scarce relevance for predicting the outcomes.

- The excess of noisy information (especially harsh if the same individual decides to bet on the main teams or on multiple events) reduces the possibility of using very simple prediction methods, such as team rankings or home team winning.

Findings and Interpretation

- The use of these criteria and cues greatly improves the possibility of placing a winning bet.

- Some skilled bettors partly anticipate the issue, as individuals with larger fixed effects tend to bet from 3 to 5 days in advance.

- Our findings support the hypothesis that simple heuristics – fast and frugal à la Gigerenzer - perform better than complex information processing steps in environment affected by noisy and redundant information.

3. Anomalies in Financial Markets

The Cycle of Market Emotions
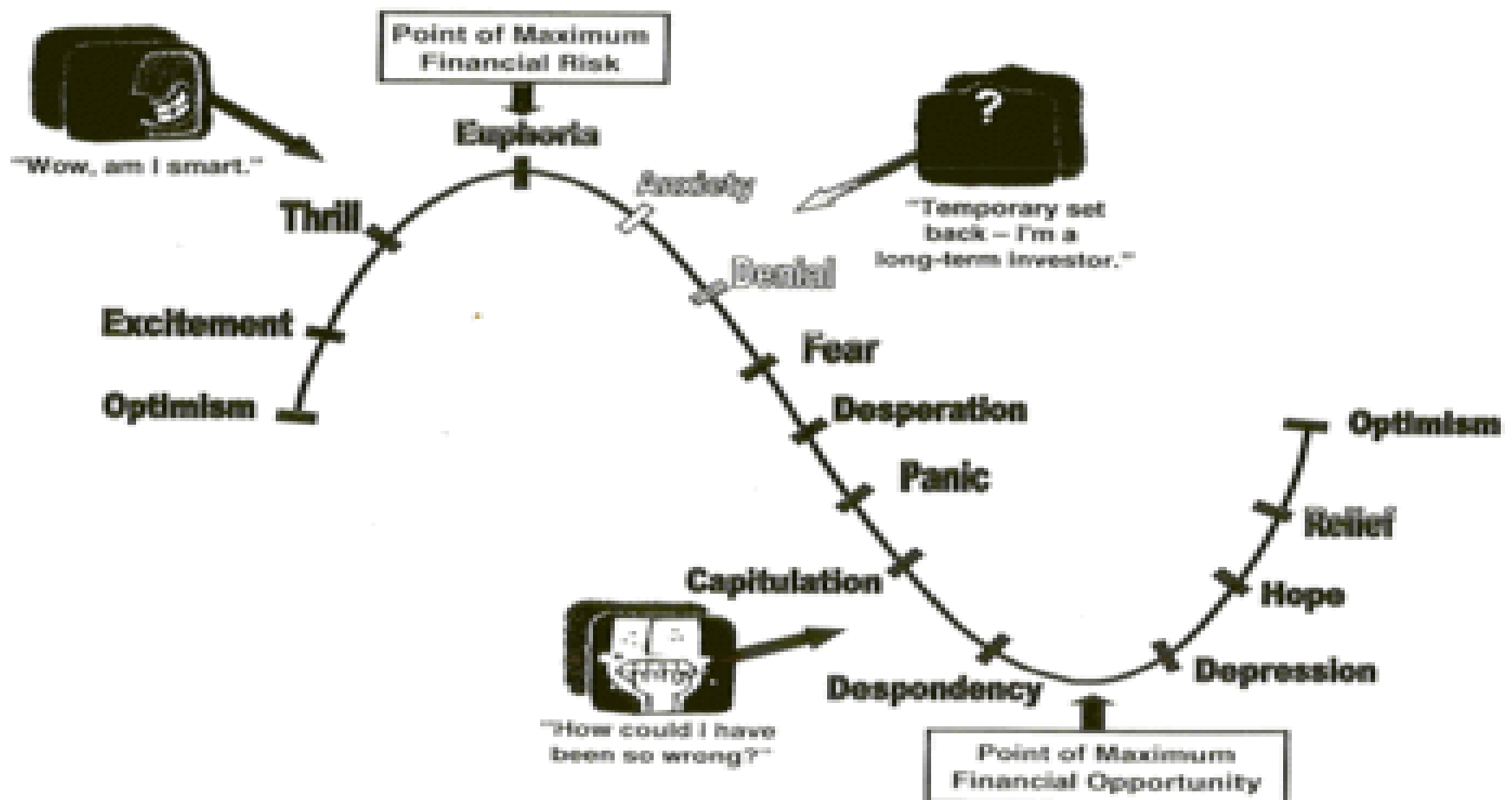
U.S. Futures vs. European Stocks

- The relationship between the price series of stocks and futures is one of the most widely researched topics in finance

- Empirical evidence that the realignment of prices in the two markets is not instantaneous

- Stock indexes follows the corresponding future indexes with a time lag ranging from five minutes (Stool-Whaley 1990) to forty-five minutes (Kawaller et al. 1987).
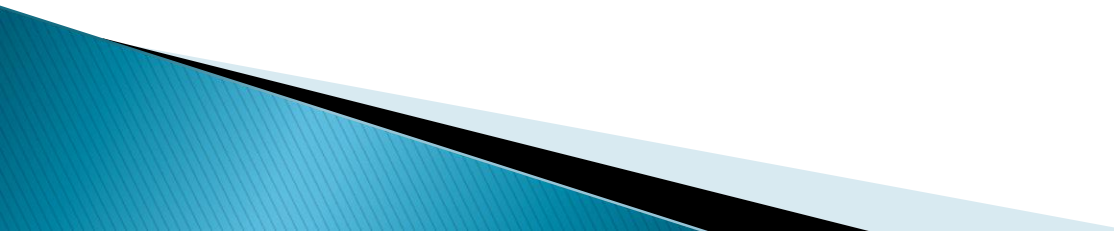
Correlation US-Europe

▸ We provide evidence on the relationship between the price dynamics of the U.S. S&P 500 index futures and the three major European stock indexes (CAC 40, DAX, and FTSE 100)

▸ Our findings show that the widely documented strong correlation between futures and stock indexes extends to this specific cross-country case.

▸ The correlation is particularly strong in the opening and closing of the European

Figure 4.1.1 Correlation between S&P futures and DAX, CAC, FTSE stock indexes from January to May 2010 (30 minutes)
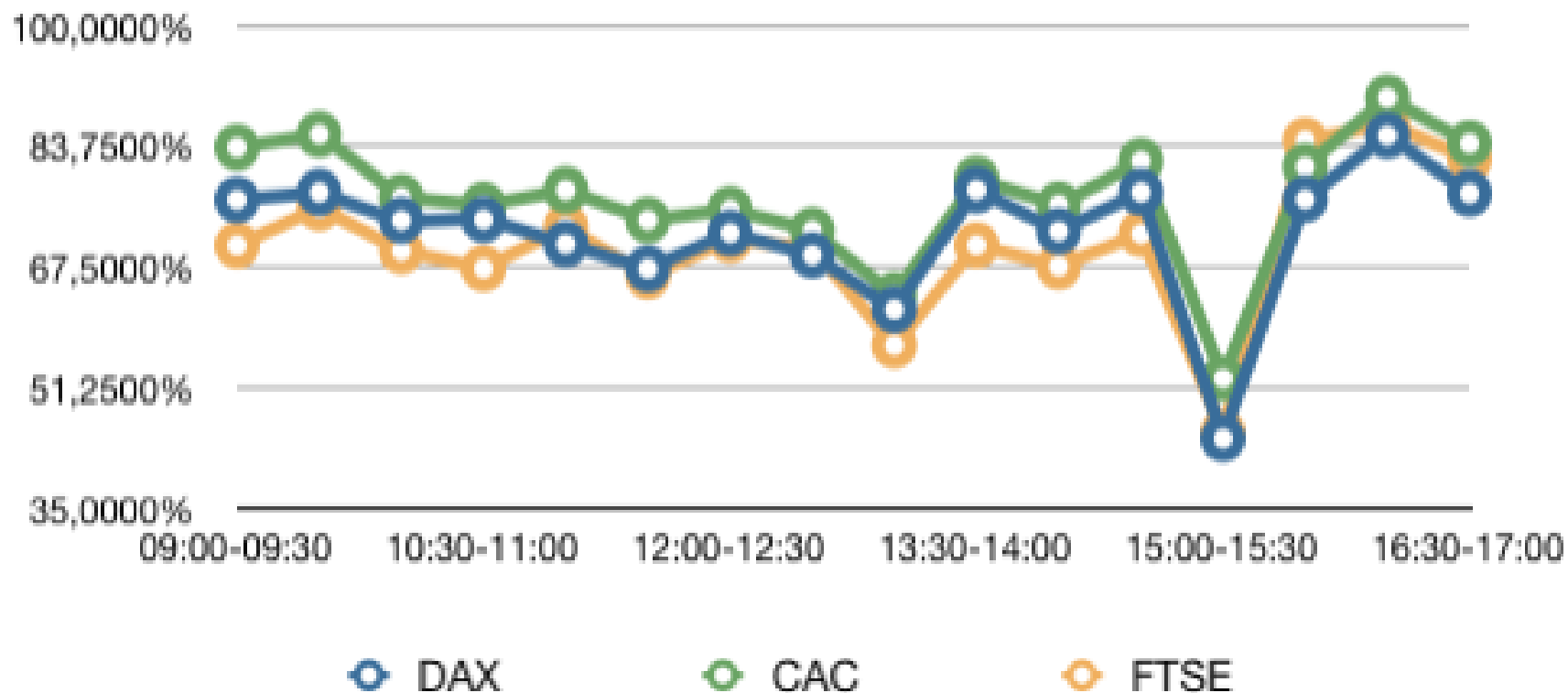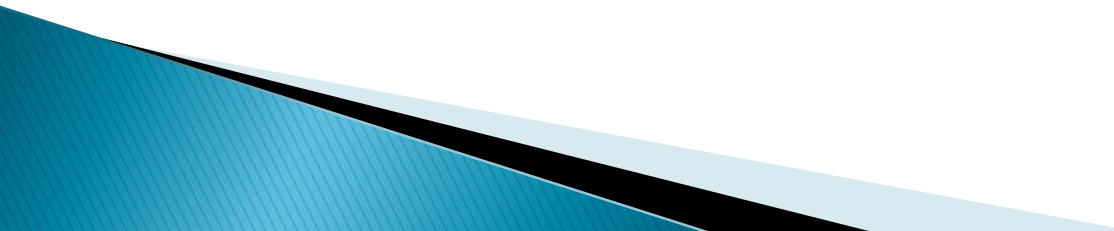
Table 4.1.1 Correlation between S&P futures and DAX, CAC, FTSE stock indexes from January to May 2010 (30 minutes)

Time Period (CET time)	DAX	CAC	FTSE
09:00-09:30	76.68%	83.66%	70.49%
09:30-10:00	77.67%	85.42%	75.62%
10:00-10:30	73.91%	76.99%	69.76%
10:30-11:00	74.01%	75.94%	67.38%
11:00-11:30	70.69%	77.99%	73.02%
11:30-12:00	67.34%	73.95%	66.38%
12:00-12:30	72.19%	75.39%	71.27%
12:30-13:00	69.17%	72.56%	70.17%
13:00-13:30	**61.88%**	**63.79%**	**57.11%**
13:30-14:00	78%	79.42%	70.52%
14:00-14:30	72.43%	75.98%	67.67%
14:30-15:00	77.69%	81.82%	72.08%
15:00-15:30	**44.41%**	**52.54%**	**45.23%**
15:30-16:00	76.75%	81.07%	84.59%
16:00-16:30	85.25%	90.36%	86.9%
16:30-17:00	77.54%	84.2%	82.06%

Intraday Anomaly

- The correlation drops quickly and remarkably between 13:00 and 13:30 (CET time)

- This fall is interpreted as derived from the release of news coming from U.S. corporate announcements scheduled each day at 7:00-7:30 (US Eastern time)

- US and European markets react differently to the release of new information. In US future markets traded volumes decrease until the announcements are made. In European markets, information asymmetry influences price sensitivity by originating arbitrage opportunities, due to the imperfect international integration of financial markets

Interpretation

- The correlation fall originates time-zone arbitrage opportunities between US futures and European stock markets

- Traders do not exploit this opportunity because the European markets react more slowly to the release of new information than US markets

- Asynchrony of information processing due to **information overload** which is also supported by the observed decrease of traded volumes

Conclusions

"Highly accessible impressions produced by System 1 control judgments and preferences, unless modified or overridden by the deliberate operations of System 2." (Kahneman and Frederick 2002)
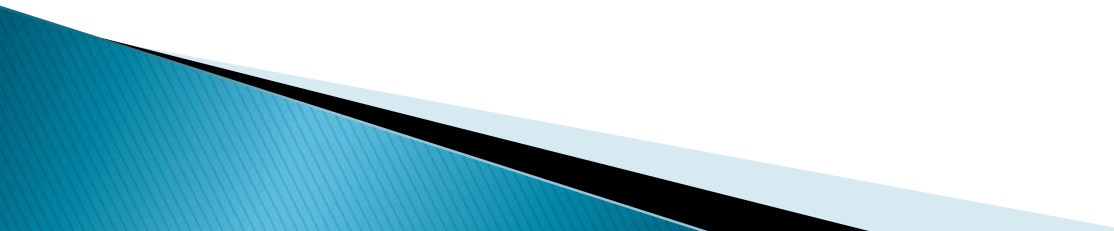
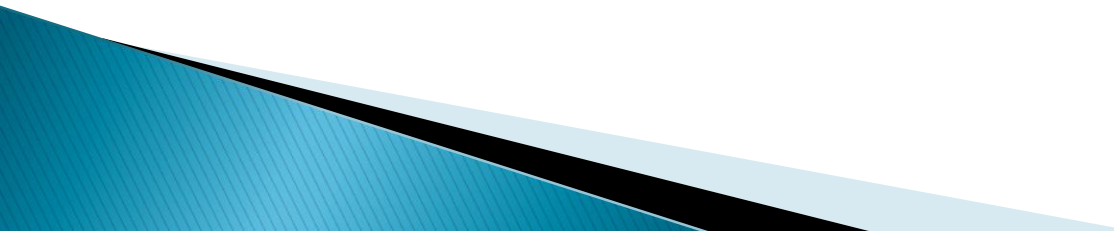System 1 → orienting choice

System 2 → reinforcing choice

Dual System

- Heuristic processes of System 1 select the aspect of the task on which attention is immediately focused

- Analytic processes of System 2 derive inferences from the heuristically-formed representation through subsequent reasoning

- This dual account of attention orienting may explain the emergence of cognitive biases whenever relevant information is neglected at the heuristic stage for various reasons (overconfidence, noisy and redundant information, information overload)

Back to Political Sciences

▸ Pervasive effects of unconscious thoughts, feelings and behaviors on attitude formation, opinions, decisions

▸ Most of our daily life is experienced unconsciously, outside awareness

▸ Political scientists are interested in behavioral variables such as voting, contributing, bargaining, but they rely on verbalized intentions (surveys) and not on observed behaviors

Back to Political Sciences

▸ Dual theories -> both conscious and unconscious processes are continuously at work, not only when people make snap judgments but even when are asked to weigh pros and cons before forming a political opinion or voting

▸ Lab and field experiments (virtual simulations too) allow to incorporate unconscious cognition into models of political beliefs challenging the extant understanding of mass beliefs

Research areas in the lab

- **online information processing -** people form impressions of persons, events, or issues spontaneously and without awareness by extracting the affective value of the message
- **implicit attitudes -** most attitudes are latent constructs, they cannot be directly observed but must be inferred from self report or nonverbal responses such as reaction time (IAT)
- **unconsciously information processing -** perceptual thresold (60 and 100 milliseconds) anticipate subjective threshold – after which conscious processing is possible