

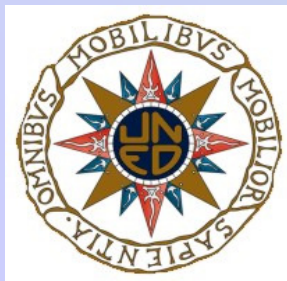
# ON THE ECONOMIC MODELLING OF EPISTEMIC PROBLEMS

*JESÚS ZAMORA BONILLA*

*UNED (MADRID)*

*&*

*HELSINKI COLLEGIUM FOR ADVANCED STUDIES*



Helsinki Collegium for Advanced Studies  
University of Helsinki

# WHAT DO SCIENTIFIC DISCOVERY AND THE EUROVISION SONG CONTEST HAVE IN COMMON?



**Beamlines at Spring-8**

- BL01B1 XAFS
- BL02B1 Single Crystal Structure Analysis
- BL22B2 Powder Diffraction
- BL04B1 High Temperature and High Pressure Research
- BL04B2 High Energy X-ray Diffraction
- BL05B2 Accelerated Beams Diagnostics
- BL06B2 High Energy Inelastic Scattering
- BL08B2 Nuclear Resonance Scattering
- BL09B2 High Pressure Research
- BL11B2 JASRI Materials Science II
- BL12B2 NMR/EC-CD
- BL13B2 Surface and Interface Structures
- BL14B1 JASRI Materials Science I
- BL15B2 VLSI/SEM
- BL16B2 Industrial Consortium ID (SUNBEAM-ID)
- BL16B3 Industrial Consortium IM (CO-2/JASRI-AM-SS)
- BL17B2 RXEN Coherent Soft X-ray Spectroscopy
- BL18B2 RXEN SFT Physics
- BL19B2 Engineering Science Research
- BL20B2 Medical and Imaging I
- BL21B2 JASRI Advance Science I
- BL22B2 JASRI Advance Science I
- BL23B2 JASRI Advance Science I
- BL24B2 Hygro
- BL25B2 Soft X-ray Spectroscopy of Solid
- BL26B1 RXEN Structural Genomics I
- BL26B2 RXEN Structural Genomics II
- BL27B2 Soft X-ray Photochemistry
- BL28B2 White Beam X-ray Diffraction
- BL29B2 RXEN Coherent X-ray Optics
- BL30B2 Laser Resonant X-ray Scattering
- BL31B2 Laser Resonant X-ray Scattering
- BL32B2 Trace Element Analysis
- BL33B1 REX-DL
- BL34B2 Accelerator Beam Diagnostics
- BL35B2 Magnetic Materials
- BL40B2 High Flux
- BL40B3 Structural Biology I
- BL41B2 Structural Biology I
- BL41B3 Structural Biology I
- BL42B2 Macromolecular Assemblies
- BL43B2 RXEN Structural Biology I
- BL43B3 RXEN Structural Biology I
- BL44B2 REX-DL
- BL47B2 REX-DL

**STRUCTURAL MODEL OF SINGLE WALLED CARBON NANOTUBE ENCAPSULATING ORGANIC MOLECULES RESIDE**

Prof. Yoshitaka Inoue, Osaka University, and his collaborative research group revealed the structure of single-walled Carbon Nanotubes (SWNT) encapsulating organic molecules inside using the Spring-8 Powder Diffraction Beamline and succeeded in controlling the electric conductivity of SWNTs.

**LARGE DEBYE-SCHERRER CAMERA INSTALLED AT THE POWDER DIFFRACTION BEAMLINE BL22B2**

**APPLIANS FOR BEAMTIMING**

The powder diffraction camera for the powder beamline BL22B2 is installed at the end of the beamline. It is equipped with a large Debye-Scherrer camera with a large detector. The camera is equipped with a large detector. The camera is equipped with a large detector.

**ESRF 2004**

The powder diffraction camera at ESRF and Synchrotron Radiation sources, which had at the time "high" speed, was installed in the beamline. The camera is equipped with a large detector.

**Spring-8**

[www.spring8.or.jp](http://www.spring8.or.jp)



***IN BOTH CASES, THE 'WINNERS' ARE  
CHOSEN BY THE 'VOTING' OF THEIR  
COMPETITORS***

***BUT, WHY TO VOTE FOR A RIVAL THEORY,  
IF YOU HAVE YOUR OWN ONE?***

**BY THE WAY, DO YOU PREFER TO DISCOVER THE  
TRUTH, IF IT IS INCOMPREHENSIBLE AND NOBODY  
WILL ACCEPT IT...?**

**...OR 'DISCOVER' A (REALLY) MISTAKEN THEORY THAT  
PERSUADES EVERY COLLEAGUE AND WINS A NOBEL  
PRIZE FOR YOU?**

# A MAP OF THE EPISTEMOLOGY OF SCIENCE

**Logic - Epistemology**  
(*a priori?*)

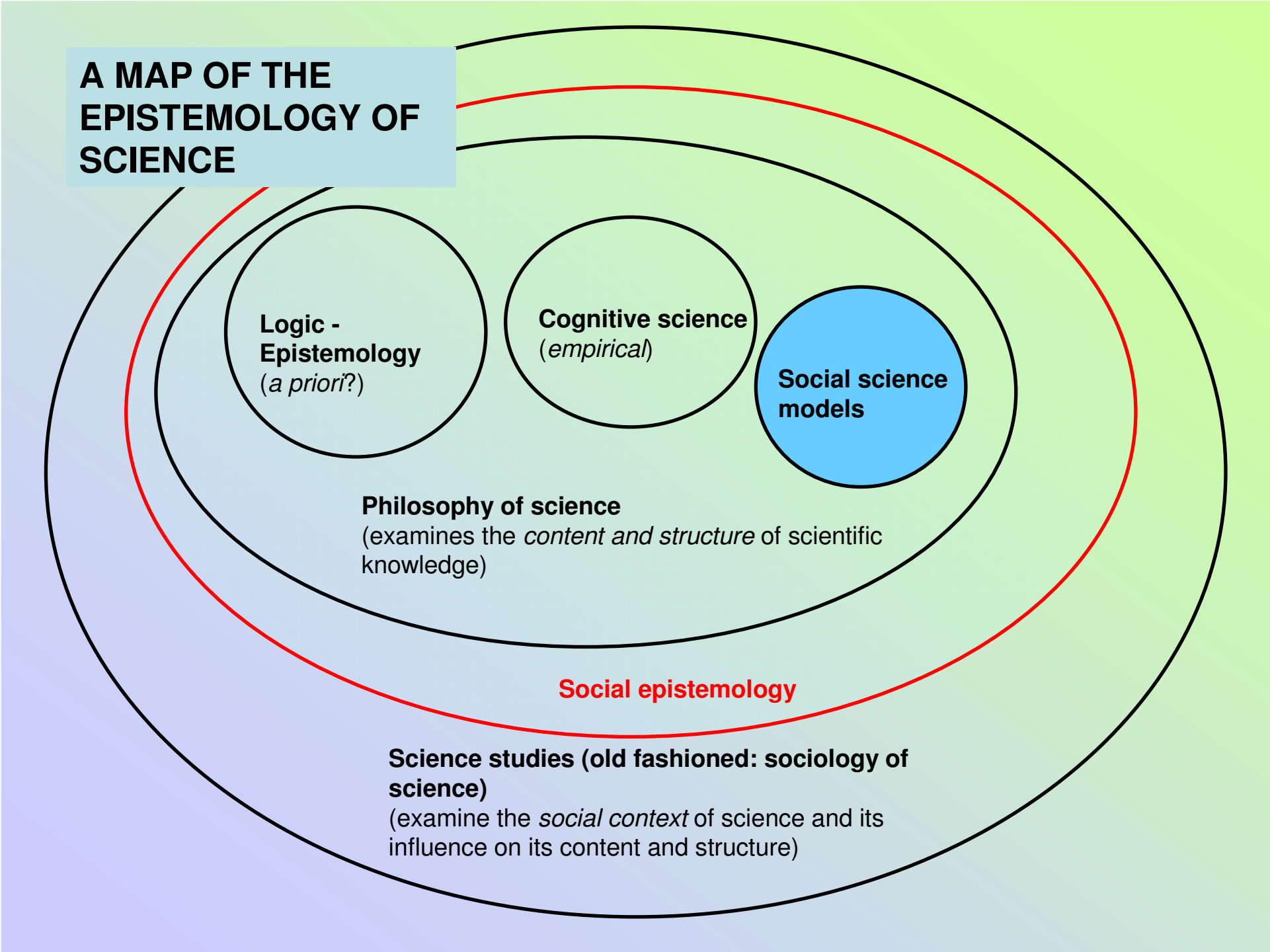
**Cognitive science**  
(*empirical*)

**Social science models**

**Philosophy of science**  
(examines the *content and structure* of scientific knowledge)

**Social epistemology**

**Science studies (old fashioned: sociology of science)**  
(examine the *social context* of science and its influence on its content and structure)



# ***SOME COMPLAINTS ABOUT THE CURRENT STATE OF SCIENCE STUDIES***

- 1. EXCESSIVE RELEVANCE ATTACHED TO THE  
*METHODOLOGY OF CASE STUDIES***
- 2. RELATIVE SHORTAGE OF (GOOD) *EXPLANATORY  
MODELS AND THEORIES***
- 3. EXCESSIVE WEIGHT GIVEN TO *SOCIOLOGY* FOR THE  
STUDY OF 'THE SOCIAL'**
- 4. LACK OF *CLARITY* IN MANY ANALYSIS**
- 5. LACK OF *USEFUL* NORMATIVE IMPLICATIONS IN  
MOST CASES**
- 6. A STRONG *ANTI-OBJECTIVIST* BIAS**

# ***HOW CAN ECONOMIC MODELLING HELP?***

- 1. ECONOMIC MODELS ALLOW TO OFFER A CLEAR ANALYSIS, THANKS TO IDEALISATION**
- 2. ECONOMIC MODELS HAVE *REAL EXPLANATORY FORCE* (THOUGH OF COURSE, THEY CAN PROVIDE 'WRONG' EXPLANATIONS)**
- 3. MODERN ECONOMICS DOES NOT REDUCE TO RATIONAL CHOICE AND FREE MARKET**
- 4. PREFERENCES AND VALUES IN THE MODELS ALLOW CLEAR NORMATIVE IMPLICATIONS**
- 5. PROVIDE A FRAMEWORK FOR ASSESSING THE RATIONALITY AND OBJECTIVITY OF SCIENCE**

# ***WHAT IS AN ECONOMIC MODEL?***

**AN ECONOMIC MODEL SPECIFIES:**

- 1) A set of *agents*
- 2) The *decisions* they can make
- 3) *Constraints* on these decisions (both 'natural' and 'institutional')
- 4) Their *beliefs* (mainly about the possible consequences of those decisions)
- 5) Their *preferences* about those consequences
- 6) A *behavioural assumption* (in general, maximisation of expected utility)

***THEN THE MODEL IS 'SOLVED' IN ORDER TO FIND AN EQUILIBRIUM (A SITUATION WHERE NO AGENT HAS A REASON TO CHANGE HER DECISION)***

# ***WHAT DOES AN ECONOMIC MODEL DO?***

**IT ALLOWS:**

- 1. TO DERIVE A *PREDICTION* (OR SETS OF PREDICTIONS) ABOUT THE DECISIONS OF THE AGENTS AND THEIR CONSEQUENCES**
- 2. TO ASSESS HOW GOOD THE FINAL SITUATION IS FOR THE AGENTS (ACCORDING TO *THEIR* PREFERENCES)**
- 3. TO INTRODUCE '*EXTERNAL*' VALUES (E.G., OUR OWN) TO ASSESS THE FINAL SITUATION**
- 4. TO DEVICE NEW *INSTITUTIONAL RULES* THAT HELP TO REACH A 'BETTER' EQUILIBRIUM**



# ***ECONOMIC MODELS OF EPISTEMIC SITUATIONS***

**1.AGENTS: Scientists (also funders, citizens, firms...)**

**2.EPISTEMIC DECISIONS:**

- What problems to explore
- What methods to use
- What experiments to perform
- What claims to make
- What claims of other colleagues to accept
- What criteria of acceptance to use

**3.PREFERENCES: Epistemic and non-epistemic**

**4.BELIEFS: both 'scientific' and 'institutional'**

**5.CONSTRAINTS: Cognitive limitations, social norms...**

# ***THREE EXAMPLES***

## ***A. THE CHOICE OF A STANDARD OF CONFIRMATION***

- **A Popperian story: no scientific hypotheses can ever be ‘empirically confirmed’**
- **But, in practice, scientists act as if some of them were**
  - **Also, confirmation is a comparative notion**
- **Why to act as if some scientific claims were confirmed?**
- **An ‘economic solution’: only with a collectively accepted standard of confirmation can researchers have an expectation of ‘winning’ in the race for a discovery.**
  - **The epistemic preferences would determine *in what a sense* ‘good’ scientific claims are good, but the prospects for getting recognition determine *how good* acceptable claims have to be**

## ***B. WHAT HYPOTHESIS TO ACCEPT***

- **A Kuhnian story: theory choice depends on ‘fashion’**
  - **You invent a hypothesis to explain some facts**
    - **What facts?**
- **Those you think are true? Or those accepted by your colleagues?**
- **(In many cases, the only reason you may have to think a fact is true is because your colleagues say so)**
  - **If you have a preference for having your hypotheses *accepted*, you will prefer to invent theories that your colleagues are *compelled* to accept (i.e., theories that explain the facts your colleagues accept)**
  - **An economic model: the more colleagues accept a claim, the more likely it is that you also accept it**
    - **What follows from here?**

### ***C. HOW TO INTERPRET AN EXPERIMENT***

- **A Knorr-Cetinian story: experiments can be interpreted in a high number of ways**
  - **Also, authors of scientific papers and referees have different preferences on what the papers should assert**
    - **A game-theoretic model: epistemic preferences (of *readers*) determine whether a claim is acceptable or not, but scientists (as *authors*) have also a preference for being recognised as proponents of ‘bold’ claims**
- **The interpretation preferable from the point of view of the authors can be ‘too bad’ for the epistemic preferences of readers, and so, a process of ‘negotiation’ is needed**
- **‘Negotiation’ does not entail that the cognitive quality of the papers is poor; it’s just the process of attaining a *satisfactory* equilibrium between conflicting preferences**

## References

**For A: 'Scientific inference and the pursuit of fame: a contractarian approach', *Philosophy of Science*, vol. 69, 2002.**

**For B: 'Science studies and the theory of games', forthcoming in *Perspectives on Science*.**

**For C: 'Rhetoric, induction, and the free speech dilemma', forthcoming in *Philosophy of Science*.**

**A general survey: 'The Economics of Scientific Knowledge', forthcoming in U. Mäki, ed., *Handbook of the Philosophy of Economics*, Elsevier.**