



## Jornada d'Investigadors Predoctorals Interdisciplinària

February 2<sup>nd</sup>, 2016. Universitat de Barcelona

*The talks must go on!*

8.30–9.00	Registration
9.00–9.30	Opening
9.30–10.30	Session I - Technology
10.30–11.15	Speed Networking
11.15–12.00	Posters + Coffee Break
12.00–13.00	Session II - Humanities
13.00–13.50	Debate: scientific communication
13.50–14.00	Awards I, II and morning posters
14.00–15.00	Lunch (not included)
15.00–16.00	Session III - Natural sciences
16.00–17.00	Debate II: doctors and the private sector
17.00–17.45	Posters + Coffee Break
17.45–18.30	Session IV - Social sciences
18.30–19.20	Debate III: PhD community
19.20–19.30	Awards III, IV and afternoon posters
19.30–20.00	Closing

### Session I. The Man Who Solved The World

**Technology**  
Chairman: Marc Olm

### **Computer Simulation to understand the co-evolution of culture and economy.**

Cultural changes comprise processes that modify the spread of information by social interaction within a population. To model and understand those processes, a growing number of social scientists are using Evolutionary Theory and formal models. We follow this trend and present a multi agent model to study how social learning strategies and cultural changes impact economic and trade dynamics. Economics is seen here as a social activity that depends on particular cultural traits: the value attributed to the goods traded during the economic activity. This value will more or less directly determine the way people will exchange the different goods they have access to, and the results of this trade activity will in turn transform the economic context. This change in economic context will then lead to a reevaluation of the value of the different goods previously used. Multiple cultural processes could influence the way those values are learned, transmitted, shared and reevaluated throughout time from individual to individual. We propose a multi agent model to study these mechanisms and how the nature of such processes affects a given economy. This model allows us: To unveil general and theoretical patterns that emerge from such system where two processes are co-evolving, the result of one impacting on the dynamic of the other and vice versa, in a complex retroaction loop making analytical exploration difficult. To compare such observations with real world case study in order to understand the cultural and economics dynamics acting during past societies, on which knowledge is often partial, biased and uncertain.

*Keywords:* evolution, culture, economy, simulation

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### **Teaching word and sentence stress to Catalan and Spanish students using the Quantum Leap Pronunciation Tutorial**

The purpose of this study is to demonstrate how students at tertiary level can improve their pronunciation learning skills by using an online pronunciation tool. It will explore in depth students progress in English pronunciation as far as stress is concerned, this being one of the most difficult areas of English for Spanish and Catalan speakers, by creating online materials to develop their pronunciation skills. Interaction and cooperation between the learners themselves and the teacher will definitely add to the effectiveness of this project in that learners will benefit not only from the teacher's evaluation but also from the other learners' assessment, too. The project deals with one of the most important aspects of the pronunciation of English, word and sentence stress. In order to show the benefits of the online materials that will be developed, a study will be carried out with two groups of university students. The first group will receive instruction on English stress in a conventional manner, while the second group will make use of an online tool for learning pronunciation. It is expected that the results obtained with the second group will be significantly better than those obtained with the first. This will support the usefulness of information technologies in the learning of English Pronunciation.

*Keywords:* Teaching English Pronunciation online environment

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### **Quaternary ferroelectric perovskite oxides for photovoltaics**

Ferroelectric perovskite oxide based photovoltaic (PV) cells arise as an innovative and promising alternative to current PV technology

1. Unlike traditional silicon based PV cells, perovskites provide unique routes to spontaneously separate charge carriers achieving extremely large, above bandgap voltages by a single phase material, abnormal photovoltaic effect. Most ferroelectric oxides have bandgaps in the range of 2.7-5 eV, which allow the use of less than 8-20

2. Ferroelectric perovskites, sharing a general ABO<sub>3</sub> structure, can accommodate a large variety of cations in the A and B positions. Importantly, small changes in the metal-oxygen bond and cation electronegativity leads to octahedral distortions and local strain and thus modify the ferroelectricity and lower the bandgap. Chemical deposition techniques offer great opportunities to nanoengineer ABO<sub>3</sub> thin films into functional layers that enhance the electronic and optical properties required for the preparation of efficient solar cells. In this work, we are studying for the first time the A and B cation substitution in BiFeO<sub>3</sub> thin films by low cost and scalable chemical solution deposition using non-toxic elements. Regarding the B cation substitution, epitaxial BiFe<sub>1-x</sub>Co<sub>x</sub>O<sub>3</sub> thin films have been obtained even with challenging high cobalt concentration (up to  $x = 0.7$ ) identifying a strong decrease in the bandgap, from 2.7 to 1.4 eV, while preserving the ferroelectric behavior. Photoconductivity is observed under illumination from a 100 mW/cm<sup>2</sup> white light source. On the other hand, we are studying the Bi substitution by rare earth cations as a robust approach to further improve film purity, epitaxy and surface morphology.

1 P. Lopez-Var, M. Coll et al. Physics Reports, (2016) 653,

2 I. Grinberg et al., Nature, (2013)

3 R. Nechache et al. Nature Photonics, (2014)

*Keywords:* Photovoltaics, Ferroelectric perovskite oxides, Chemical Solution Deposition, bandgap engineering

## **Session II. Humans just wanna have fun**

**Humanities**

Chairman: Edgar Olivares

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### **Digging your rubbish: a (no) new perspective to understand the amphorae production in the Roman Empire**

The aim of this study is to analyze the evolution changes of amphorae to understand the production dynamics in the Roman Empire. In particular, cultural evolution approach will be applied to the material culture study because it is considered an useful tool to understand the variability of the mechanisms of changes.

This analysis can be used to detect differences in the amphorae production through time that could explain this dynamic of change. However, one of the main problems of this research is the lack of a formal framework to apply on the conventional techniques for the analysis of the amphorae dataset. In this case, it will be presented a research project where cultural evolution provides a capacity to detect cultural changes in the production of olive oil amphorae.

Specifically, our case of study has been focused to understand the dynamic of changes of the olive oil amphorae production found in Baetica (currently Andalusia) during the Roman Empire (Ist-IIIrd century AD). To achieve this goal, phylogenetic and statistical analysis were applied to distinguish pottery assemblages among different kinds of shapes that could be used to identify discontinuities in archaeological and historical sequences. The changes detected by these methods allow to quantify the rates of changes in the amphorae production mechanisms. In particular, we want to identify if these changes were produced by cultural reasons as they may be economical, political and social developments.

Therefore, cultural evolution theories can be used successfully for the interpretation of the change processes in the material culture to difference to the classic taxonomy. The main results suggest that different factors can influence changes and that changes will be more or less likely depending on them.

*Keywords:* Cultural evolution, Roman Empire, amphorae

## Section III. Across the (bio)universe

**Natural sciences**

Chairwoman: Marina Uroz

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### **Let's go to the nano: Scanning Probe Microscopies**

Scanning Probe Microscopies (SPMs) are a type of microscopy that can obtain images of a surface up to the atomic level. SPM covers lots of different techniques, all of them based on a tiny probe that scans the sample in a really precise way. The most commonly used SPMs are the Atomic Force Microscopy (AFM) and the Scanning Tunnelling Microscopy (STM). AFMs work by measuring the interaction force between the probe and the sample, whereas STMs work by measuring the current between both parts. With both of these techniques, we can get not only high resolution images but also obtain information about the mechanical and electrical properties of a sample at the atomic level.

One of the most important advantages of these techniques is that both AFM and STM can work at different environmental conditions: air, liquid, vacuum. Consequently, these techniques have a large variety of applications in very different fields: from biology to molecular electronics, passing by medicine or material science.

In our laboratory, we work with both AFM and STM applied to bio-systems. We mainly study lipid membranes and several proteins that play an essential role for life. We look at the tiniest details of them, and try to figure out how they work so nicely.

*Keywords:* SPM, nanotechnology, AFM, STM, biosystems

## Section IV. I want to link free.

Social sciences

Chairman: Ignacio Morer

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### **How online social networks grow and compete: a complex systems perspective**

The overwhelming success of the Web 2.0, within which online social networks are key actors, has induced a paradigm shift in the nature of human interactions. The user-driven character of Web 2.0 services has allowed researchers to quantify large-scale social patterns for the first time. However, the mechanisms that determine the fate of networks at the system level are still poorly understood. Here, first we study how online social networks grow in an isolated environment. Their particular growth path allows us to quantify the relative importance of the two key dynamical processes, namely a viral spreading mechanism and mass media influence. However, the simultaneous existence of multiple digital services naturally raises questions concerning which conditions these services can coexist under. Analogously to the case of population dynamics, the digital world forms a complex ecosystem of interacting networks whose survival depends on their capacity to attract and maintain users' attention, which constitutes a limited resource. We introduce an ecological theory of the digital world which exhibits stable coexistence of several networks as well as the dominance of a single one. Interestingly, our theory predicts that the most probable outcome is the coexistence of a moderate number of services, in agreement with empirical observations. Heterogeneity in the network intrinsic fitness can be applied to understand the competition between an international network, like Facebook, and local services. We find that above a certain threshold, the level of global connectivity can lead to the extinction of local networks. In addition, we reveal the complex role the tendency of individuals to engage in more active networks plays for the probability of local networks to become extinct and provide insights into the conditions under which they can prevail.

*Keywords:* Complex Systems, Complex Networks, Online Social Networks, Digital Ecology, Digital Revolution

## Posters. Morning Session

Chairwomen: Maria Coto and Mariña López

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### **Los perfiles profesionales de egresados en posgrados mexicanos**

A nivel mundial durante el siglo XX, se experimentaron cambios estructurales en materia económica, bajo el concepto de la sociedad del conocimiento y en estos últimos años con el de sociedad de la innovación. Los países invierten en formación de capital humano e investigación, lo que se hace evidente en el número de publicaciones, descubrimientos, tecnología, patentes y bases de datos que generan. Las universidades e instituciones de educación superior comprometidas con el desarrollo social, desde todas las áreas de conocimiento, busca perfilar su oferta educativa fundamentándola con pertinencia y calidad. En tal sentido, basados en la política de ciencia, con un proyecto iniciado desde la Universidad Veracruzana en México, se analizaron las transiciones académicas y laborales de graduados: la inserción laboral de los egresados al trabajo académico y científico orientado a la producción y difusión del conocimiento, las acciones de vinculación y la formación de capital humano; su propia inversión en capital humano, en relación con la orientación profesionalizante o de investigación del plan de estudios de posgrado cursado. Para lo cual, se usó una metodología de corte cuantitativo con test estadísticos y se determinó con base en la inserción laboral al trabajo académico y científico el comportamiento institucional por niveles de posgrado, comparando las variables: perfil profesional (áreas de conocimiento, nivel de posgrado, orientación), con la inversión en su capital humano, la producción del conocimiento, la difusión del conocimiento, las acciones de vinculación y la formación de capital humano. Los resultados señalan: ¿En realidad los egresados desempeñan su práctica profesional desde una actividad laboral afín a su formación en cuanto a la inversión en capital humano e inserción al sector productivo? y ¿En qué medida reconocen los empleadores las competencias de los graduados?.

*Keywords:* graduados, transiciones, posgrado, competencias, capital humano, inserción laboral

## Posters. Afternoon Session

Chairwomen: Maria Coto and Mariña López

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## Meta-analysis reveals that transforming perennial rivers into intermittent rivers will be a major driver of biodiversity loss

Despite research on intermittent rivers (IRs) has increased during the last decade, no studies have been done so far that provide a general overview of the biodiversity of IRs. Therefore, there is still controversy about whether IRs host more or less biodiversity than permanent rivers (PRs). Our aim was to determine if biodiversity in IRs differs from PRs, and how biodiversity in both river types is influenced by several factors, such as climate, catchment area, sampling season, taxonomic group, sampled habitat, and the level of anthropogenic disturbance.

A meta-analysis was conducted on 68 published papers that compared biodiversity in PRs with that of IRs, 48 with replicated data and 20 with non-replicated data. Richness means and standard deviations were extracted from both river types in replicated studies, and effect sizes were obtained using Hedge's *g*. Publication bias on the replicated studies was visually analysed by applying funnel plots. Because of the heterogeneity of the studies, a random effects model was applied on replicated studies to obtain the weighted mean effect size and its confidence interval. A forest plot was used to illustrate the individual and overall results of the model. Finally, publication bias and random effects models were also applied splitting studies by each factor and all the corresponding categories.

Overall, biodiversity was significantly greater in PRs than IRs, which was a large effect size. Among the factors that did not show publication bias, the B, C and multiple general climates, multiple catchment areas, autumn, multiple and summer seasons, macroinvertebrates taxonomic group, multihabitat samples, and medium anthropogenic disturbance had a significant difference and a positive effect size with and without trim-and fill methods, showing a greater diversity in PRs than IRs. Our meta-analysis suggests a worrying scenario: global change is increasing the intermittency of PRs in many regions.

**Keywords:** macroinvertebrates, temporary rivers, biodiversity, anthropogenic, flow intermittency, meta-analysis

**Organizing committee:** Jesús Bonilla, Luis Botaya, Simon Carrignon, Joan Codina, Paula Córdoba, Maria Coto, Alba Hierro, Mariña López, Ignacio Morer, Edgar Olivares, Marc Olm, Daniel Pacheco, Matias Rivero, Marina Uroz i Xavier Viader.

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