

10th Toulouse Economics and Biology Workshop

Inertia in biological and cultural systems

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ABSTRACT BOOKLET

Alexandra Alvergne, *ISEM, Montpellier University*

Title: Reframing Barriers to Contraceptive Use: Understanding Uptake and Discontinuation as Strategic Behaviours in Ethiopia

Abstract: The diffusion of modern contraception has been relatively slow in sub-Saharan Africa compared to Asia and Latin America. While barriers to contraceptive use have been largely attributed to 'culture', misinformation, misperception and lack of education, this talk aims to challenge this view by showing that both contraceptive uptake and contraceptive discontinuation are best understood as strategic behaviours given the local socio-ecology. Drawing on data from Ethiopia, I will first show that the early adopters of modern contraception in rural areas are women on the highly fertile end of the spectrum who use contraceptives to space births rather than the most informed ones. I will then build on qualitative, demographic, and prospective data to demonstrate that contraceptive discontinuation due side-effects, a major determinant of unmet needs for family planning, is driven by physiological and nutritional factors rather than education level. Overall, I argue that women use contraceptives to negotiate the trade-off between current and future reproduction and that strategic responses to local nutritional and social ecologies drive cultural inertia in the diffusion of contraception.

Zachary Blount, *Michigan State University*

Title: How Historical Contingency, Inertia, and Innovation Interact in Evolution: Perspectives from a Long-Term Experiment with *Escherichia coli*

Abstract: The living world is always evolving as populations of organisms undergo sometimes astonishing modification over successive generations. Unlike many natural phenomena, biological evolution plays out in unpredictable historical sequences owing to a complex interaction between deterministic and stochastic processes. Natural selection imposes directionality on evolutionary change by sorting heritable variation based on its effects on reproductive success, or fitness, which deterministically drives adaptation of organisms to their environment. However, heritable variation ultimately arises by random mutation of existing genomic information that is the product of past evolution, and environments can change suddenly and dramatically. The interaction between chance and necessity and the lingering effects of the past makes evolution path dependent, and evolutionary outcomes contingent upon the way in which evolutionary history plays out. One way in which the past lingers in evolution comes from the way in which features and genetic information are not immediately lost when they cease to provide selective benefit. This evolutionary inertia provides organisms with a “junk drawer” features and information that can be randomly recombined by mutation. As evolutionary innovation most often occurs through this recombination, or evolutionary tinkering, the potential for the origin of novel traits is contingent on both inertia and evolutionary history.

Charles Efferson, *HEC Lausanne*

Title: Social tipping our way - or maybe not - to some kind of future

Abstract: How can a social planner use an intervention to disrupt the status quo and activate sweeping social change? When conformity and coordination incentives hold, such an intervention operates through at least two channels. It has a direct effect if some people exposed to the intervention change behavior as a result. It also has an indirect effect if some people change behavior because they observe others doing so. If the indirect effect is large, it dramatically amplifies the direct effect, a possibility that has generated considerable enthusiasm in policy discussions. That said, mundane forms of heterogeneity introduce a number of challenges. Using a mix of models, observational studies, and experimental results, I argue three points. First, some forms of heterogeneity strongly interfere with social change simply because they favor chronic disagreement. Second, even when sweeping social change is feasible, the social planner should typically expect a trade-off between the direct and indirect effects of her intervention. Increasing one effect means decreasing the other, and social planners may often lack the information they need to resolve the trade-off effectively. Finally, the link between behavior change and social welfare can be varied and counterintuitive. Intervention strategies that generate persistent disagreement and miscoordination can actually be better than alternative strategies that initiate a complete transition in the population.

Donn Feir, *University of Victoria*

Title: Natural Resource Loss, Persistence, and Indigenous Well-being in North America

Abstract: In the late nineteenth century, the North American bison was brought to the brink of extinction in just over a decade. We demonstrate that the loss of the bison had immediate, negative consequences for the Native Americans who relied on them and ultimately resulted in a permanent reversal of fortunes. Once amongst the tallest people in the world, the generations of bison-reliant people born after the slaughter lost their entire height advantage. By the early twentieth century, child mortality was 16 percentage points higher and the probability of reporting an occupation 29.7 percentage points lower in bison nations compared to nations that were never reliant on the bison. Throughout the latter half of the twentieth century and into the present, income per capita has remained 28% lower, on average, for bison nations. This persistent gap cannot be explained by differences in agricultural productivity, self-governance, or application of the Dawes Act. We provide evidence that this historical shock altered the dynamic path of development for formerly bison-reliant nations. We demonstrate that limited access to credit constrained the ability of bison nations to adjust through respecialization and migration.

Pauline Grosjean, *University of New South Wales*

Title: War, Polarization, and Collaboration

with Saumitra Jha, Michael Vlassopoulos and Yves Zenou

Abstract:

With people increasingly mobile and inter-connected, one might expect that increased social contact would also lead to homogenization and convergence in political attitudes. Instead, partisanship and polarization are on the rise to the point of threatening the political consensus that underlie liberal democratic institutions. Solving this paradox and understanding the dynamics of contact, partisanship, and polarization is challenging because of endogenous sorting, either through residential choice or media echo chambers. This paper uses a valuable historical context where peers were exogenously assigned to demonstrate how political homogenisation at the local level may displace political tensions to new frontiers, where they can degenerate into civil war.

We first develop a network model of polarization and partisanship in which partisan choices are modelled as strategic complements, so that each agent chooses an action as long as at least a simple majority of her neighbours choose the same action. The model predicts that each network will coordinate on one partisan equilibrium and will thus become locally homogeneous; however, in the presence of multiple partisanship coordination equilibria (e.g. Left, Right), overall polarization may increase.

We then study this dynamic process of homogenisation and polarization empirically, exploiting the large-scale exogenous assignment of individuals to peer groups in the context of World War I in France. Our historical context is particularly well suited to this empirical exercise. First, the circumstances of military recruitment local exogeneity in regimental assignment. Second, legislative elections were held just before (May 1914) and just after (May 1919) the war. The historical context of universal male suffrage combined with universal male military conscription in World War I ensures that our voting data, at the highly granular level of 35,000 French municipalities, captures the preferences of the population exposed to war service.

Our empirical results show that fighting together in WWI made people more politically homogeneous. This convergence is strong and persistent, since municipalities that were initially further away from the average converge faster to the majority of the votes, across the interwar elections of 1919, 1924, 1932, and 1936. Partisanship is determined by variation in the initial partisanship of different military units, with communism a stronger attractive force. Our results are consistent with the theoretical model, since we find strong homogenisation locally and polarization at the national level. This is because the local homogenisation, which is partisan (either to the left or to the right), leads to sharp local discontinuities across military boundaries.

Beyond electoral results, we also illustrate some of the real political costs of polarization. We show how such polarization in interwar France sowed the seeds of the country's "long civil war" (Jackson, 2003) and predicts either local Nazi collaboration or resistance against Nazi occupation during World War II.

Thomas Fredrik Hansen, *University of Oslo*

Title: What makes evolution so slow?

Abstract: Abstract: Most quantitative traits have ample genetic variation implying a high potential for evolutionary change, and strong selection is commonly observed. Accordingly, rapid evolutionary change is often observed on short time scales. On longer time scales, however, evolution is often slow with a pattern of stationary fluctuations that do not seem to go anywhere. I will discuss possible explanations for these patterns.

Amanda Lea, *Vanderbilt University*

Title: Evaluating the role of evolutionary mismatch in shaping human health

Abstract: The environments experienced by individuals living "modern", "urban", or "Western" lifestyles are deeply diverged from the ancestral selection pressures that have shaped human genomes through evolutionary time. Consequently, many have hypothesized that this "mismatch" —between evolved human phenotypes and modern life—is responsible for increasing rates of non-communicable diseases worldwide. However, despite the popularity and intuitive appeal of this idea, it has been difficult to test in practice. In particular, we lack direct evidence that health issues emerge when populations adapted to subsistence-level practices at the genetic level encounter modern, urban environments. Further, we lack an understanding of the molecular mechanisms that mediate the relationship between lifestyle transitions and compromised health. My research aims to address these gaps, by working with the Turkana people of Northwest Kenya who are currently transitioning from a traditional, pastoralist lifestyle to an urban, market-integrated lifestyle. By collecting genomic, anthropological, and biomedical data from across this lifestyle gradient, my research focuses on 1) how the Turkana have adapted through evolutionary time to their pastoralist lifestyle, 2) the degree to which health and disease risk are altered when individuals from this locally adapted genetic background move to cities, and 3) the molecular mechanism that mediate these outcomes. Together, this work aims to shed new light on our evolutionary and mechanistic interpretation of environmentally induced disease in a unique population.

Sara Lowes, *University of California-San Diego*

Title: The Social Consequences of Traditional Religions in Contemporary Africa

Abstract: In most of Africa, indigenous religious beliefs continue to persist despite the widespread adoption of Christianity or Islam. While African traditional religions allows for a plurality of religions, Christianity believes there is one true God. The widespread adoption of Christianity on the continent, resulted in traditional religious beliefs being linked to the Devil, labelled as 'witchcraft' or 'sorcery,' and strongly stigmatized. Descriptive accounts of this process are widespread across sub-Saharan Africa. Motivated by this, we examine the consequences of holding traditional religious beliefs in the Democratic Republic of the Congo. Using lab-in-the-field experiments, we test whether individuals who believe in African traditional religions are viewed or treated differently by those around them. In the experiments, participants are randomly paired with another player that has either strong or weak traditional religious beliefs, and this information is known by the players. We find that, across a range of different games, participants act less prosocially towards a randomly-assigned partners who is known to hold stronger traditional religious beliefs. We also find that perceptions and norms of behavior towards those who hold traditional religious beliefs are different. Antisocial behavior is viewed as being more acceptable and negative perceptions and stereotypes are more common when one's partner holds strong traditional religious beliefs. We find the effects are surprisingly universal and are not attenuated by an individual's education, income, or their intensity of Christian beliefs.

Herman Pontzer, *Duke University*

Title: Energy Economics in Evolution and Ecology: Insights from Humans and other Animals

Abstract: Energy is the currency of life, needed for all physiological tasks. Methodological advances in the measurement of physiological energy expenditure have enabled us to investigate how humans and other animals manage their energy budgets over short (days, months), long (years), and evolutionary timescales. I discuss the evolution of humans' unique strategies for acquiring energy from the environment and expending energy to fuel large brains and greater fertility. I also discuss evolved trade-offs in energy allocation in response to increased physical activity or food scarcity that appear to be shared across humans and other vertebrates. These evolved energy strategies hold implications for resource management and metabolic health in today's industrialized societies.

Zaneta Thayer, *Dartmouth University*

Title: Developmental plasticity and health: The importance of good beginnings

Abstract: Humans, like other organisms, have evolved to be sensitive to their environment. However, contemporary environments are characterized by social stressors that are inequitably distributed across society. This talk explores the concept of developmental biological inertia, and discusses how this concept shapes patterns of human biology and health today.

Stephen Vaisey, Duke University

Title: Cohort Effects and Cultural Change

Abstract: How does a society's distribution of beliefs, opinions, and values change over time? In this talk, I will argue that most change on most things (e.g., politics, gender, race) occurs via cohort replacement. After outlining the theoretical possibilities for change mechanisms, I will review a wide variety of evidence from repeated cross-sectional, longitudinal, and natural language studies that supports the cohort replacement hypothesis. Although I do not claim that individual change among adults is impossible, I do argue that it is relatively rare and confined to a narrow set of issues.

Sophie von Stumm, York University

Title: Using DNA to predict educational success

Abstract: People's differences in educational success have pervasive long-term influence over their lifespan development, affecting career paths, health, and wellbeing. It is now possible to predict educational success from inherited DNA differences, using so-called polygenic scores that enable to directly model the gene-environment interplay in education. Understanding why and how genetics contribute to producing differences in educational success is key for designing effective interventions that improve people's life outcomes. In this talk, I will show how genomic methods have begun to revolutionise social science research on education and review the growing body of literature that documents the strength of DNA-based predictors. Genomic predictions of behaviour have emerged as a fast-growing research area during the past decade, and the pace of discovery continues to accelerate. I will reflect on the meaning and possible applications of DNA-based predictions of educational success to ensure that their benefits can be maximized, while risks of misuse and misinterpretation minimized.

POSTER SESSION

Calina Durbac

Title: Cost optimisation of hybrid institutional incentives for promoting cooperation in finite populations

Abstract: We rigorously study the problem of cost optimisation of hybrid institutional incentives (combination of reward and punishment) for maximising the level (or guaranteeing at least a certain level) of cooperative behaviour in a well-mixed, finite population of self-regarding individuals where players interact via cooperation dilemmas (Donation Game or Public Goods Game). We show that a mixed incentive scheme can offer a more cost-efficient approach for providing incentives while ensuring the same level or standard of cooperation in the long-run. We establish the asymptotic behaviour (namely weak selection, strong selection, and infinite-population limits). We prove the existence of a phase transition, obtaining the critical threshold of the strength of selection at which the monotonicity of the cost function changes and providing an algorithm for finding the optimal value of the individual incentive cost. Our analytical results are illustrated with numerical investigations. Overall, our analysis provides novel theoretical insights into the design of cost-efficient institutional incentive mechanisms for promoting the evolution of cooperation in stochastic systems.

Petr Krautwurm

Title: Stochastic Identity and True Preferences

Abstract: This paper addresses the fundamental question of the existence and nature of true preferences in economics by building upon the economic concept of identity. By drawing on interdisciplinary research from economics, psychology, and multi-criteria decision-making, the paper proposes a new model that perceives identity as a stochastic phenomenon, which is the natural cause of the emergence of true preferences. The model categorizes consumer goals into terminal and instrumental. Although the identity is derived from terminal goals, the actual consumer actions are driven by instrumental goals which revolve around the terminal ones, but may occasionally deviate from them. These goals are represented as parameters in the utility function. If instrumental goals are consistent with terminal ones, the consumer acts consistently with their identity. If instrumental goals deviate, the situation is as if the consumer had momentarily different identity and thus their preferences differ from true ones. The model proposes a prediction about intertemporal consumer behavior, which has cyclic component revolving around latent and stochastic trend.

Maria Krelifa

Title: Assessing the Environmental Consequences of Aging Populations

Abstract:

Research exploring the impact of population aging on environmental outcomes is rather sparse despite the contemporary relevance of both issues. The overwhelming majority of the scholarly works on the matter are country-specific and tend to consider only one environmental outcome at a time. To the best of our knowledge, there is no study that explores the relationship of interest through a cross-country approach and by examining multiple environmental outcomes. To contribute to the literature, this paper utilises country-level panel data between 1996 and 2014, and distinguishes environmental outcomes according to nature-enhancing and action-requiring categories. The latter category designates environment-related outcomes that are considerably driven by the engagement of the general population. These require the internalization of new habits and the acquisition of specific knowledge such as recycling, for example. By contrast, nature-enhancing environmental outcomes pertain to targeted policies by the government or land use and do not directly involve the general population. The results suggest a strong and positive effect of population aging, measured per the old-age dependency ratio, on nature-enhancing environmental outcomes. Conversely, our analysis does not reveal a clear effect of aging on action-requiring environmental outcomes. These results hold through multiple model specifications and are robust to the implementation of an instrumental variable estimation strategy. Having established our results empirically at the macro level, we next aim to complement them using micro-level analysis based on survey data particularly investigating the effect of aging on environmental attitudes and concerns. A multi-disciplinary review of the literature allowed us to identify a few possible avenues for exploration. First, the generativity theory (Erikson 1993); it refers to the desire of individuals to care for future generations and could explain the positive effect of aging on environmental outcomes. Second, attachment to nature; which describes the subjective perceived connectedness of individuals with their environment. Recent research demonstrated that amongst adults, the elderly tended to exhibit stronger attachment to nature scores (Hughes et al. 2019). Both the generativity theory and attachment to nature could explain the significant and large impact of population aging on nature-enhancing environmental outcomes, specifically. Regarding the absence of a clear impact of population aging on action-requiring environmental outcomes, we plan to study this relationship by investigating habit-formation regarding ecological action through age, also using survey data.

Kodai Kusano

Title: Selected anomalies or overlooked variability?

Abstract: A theory of social change suggests that as societies become more prosperous, people rely less on religion for survival, social order, and meaning of life. While some claimed that secularization is universal, critics contended that it does not explain patterns of religious change in non-Western societies. To settle this debate, we applied multilevel modeling to analyze historical, socio-economic factors that moderated the process of secularization around the world, analyzing religiosity data with over 100 countries over 30 years. We used GDP and infant mortality as indices of modernization, the Gini index as an indicator of social complexity, and communist history (non-communist vs. post-communist) and the proportion of Christianity as historical contexts to explain variability in the within-society processes of secularization. Our analysis found that modernization results in secularization in societies where a long history of wealth and democratic institution has been established to ensure social, political, and ecological stability for citizens. However, in societies without such well-functioning institutions, modernization strengthens people's need for religion. We found support for the secularization hypothesis primarily in formerly wealthy countries: in years when economic wealth increased, religiosity declined. However, in formerly poor countries, increased wealth predicted increased religiosity. We also found that increased economic inequality was associated with greater religiosity over time only in post-communist or Christian-minority countries: when economic inequality increased in those countries, so did religiosity. We integrate these findings and the present analytical approach to discuss implications for cross-cultural research and social change.

Estee/Siting Lu

Title: Rational Inattention in Job Search

Abstract: Search frictions in the labour market are often associated with the lack of information. With provision of the online job search platforms, which provide easily accessible information, such information gap within the labour market could be as a result of workers being inattentive, and paying full attention to job details can be costly. Therefore, they need to devise an attention strategy to acquire information before applying to jobs. Current partially directed search model with rational inattention focused on homogeneous workers, who act symmetrically in the equilibrium. It did not explore mismatch due to differences in attention costs among the workers and ignored the existence of equilibria that could potentially be more efficient than the symmetric subgame perfect equilibrium. This research contributes in refining the existing search model, and to include worker heterogeneity in attention costs due to differences in default strategies or cognitive costs. Overall, it was found that heterogeneity in inattention leads to divergence in application strategies among workers, and the market will be more efficient when the distribution of workers' application rates matches the underlying distribution of firms' productivity.

Cédric Perret

Title: Modelling the role of environmental circumscription in the evolution of inequality

Abstract: Circumscription theory proposes that complex hierarchical societies emerged in areas surrounded by barriers to dispersal e.g. mountains or seas. This theory has been widely influential but the lack of formal modelling has resulted in theoretical and empirical challenges. This theory shares parallels with reproductive skew models from evolutionary ecology where inequality depends on the capacity of subordinates to escape from despotic leaders. Building on these similarities, we extend reproductive skew models to simulate the concurrent evolution of inequality in many connected groups. Our results show that cost of migration does not directly limit inequality in the long term, but it does control the rate of increase in inequality. Second, we show that levels of inequality can be reduced if there are random errors made by dominants, as these lead to variations that propagate between polities. Third, our model clarifies the concept of circumscription by relating it to geographical features: the size of a region and the connectivity between polities. Overall, our model helps clarify some issues about how migration may affect inequality.

Yating Shen

Title: Adaptive Behaviour in an Epidemic: An Evolutionary Approach

Abstract: This paper proposes an adaptive behavioural SIR (ABSIR) model as an economic extension of the classical epidemiological SIR model. Instead of assuming individuals play the equilibrium, I assume they adjust their behaviour over time and focus on the dynamic adjustment process using evolutionary game theory. Individuals can choose whether to take precautions or not and I assume taking precautions has positive externalities as it can reduce other people's risk of infection. Interestingly, from both numerical and analytical results, I find that due to individuals' adaptive behaviour, there are multiple waves and cyclical behaviour of infection even without externalities, seasonal changes or virus mutation. I also derive a particular curve where the epidemic dynamics would go around it and approach it cyclically, which gives prediction of the epidemic in general. Then from social welfare's perspective, I apply optimal control theory to investigate the optimal path of the proportion of people taking precautions and find that what is optimal for individuals is not necessarily optimal for the social planner.

Bernardo Sousa Buarque

Title: Socio-Epistemic Networks: Modeling Historical Knowledge Processes

Abstract: TBC