Applications in Cultural Evolution: Arts, Languages, Technologies

Conference abstracts

University of Tartu
June 6–8, 2018

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Schedule*

June 6
Näituse 2, room 102

09:00   Registration
10:00   Opening/welcome
10:15   **Keynote: *Jamie Tehrani*.** Languages, genes and folktales: The plot thickens [7]
11:15   Coffee
11:45   **Session 1**
E. Gjesfjeld. Modeling patterns of macroevolution in modern and ancient technologies [14]
A.V. Jiménez, J. Stubbersfield & J. Tehrani. "The dipherpox controversy": The cultural evolution of a vaccine-related narrative and its influence in vaccine decisions [49]
12:45   Lunch break
14:15   **Session 2**
J. Winters, P. Kelly, H. Miton & O. Morin. Compression effects in the cultural evolution of the Vai script of West Africa [55]
S. Passmore & F. Jordan. A phylogenetic review of kinship terminology determinants [42]
P. Strimling, I. Vartanova, F. Jansson & K. Eriksson. Trends in public opinion explained by the moral psychology of liberals and conservatives [17]
15:45   Break
16:15   Coffee (*Ülikooli 16, room 214*)
16:15   **Poster session** (*Ülikooli 16, room 214*)
M. De Barra. Why is folk medical knowledge rarely useful? Lessons from online medical product reviews [11]
K. Konsa. Creating our own cultures: evolution of artificial cultures [26]
A. Kulikauskas. A universal grammar of games as the basis for language and human culture [28]
V. Mikheev. Professional biographies of current bishops of Russian Orthodox Church (1965-2017): dynamics of factors for career development [36]

R. Miśta. Spatial dimension of transmission of folk tunes [38]

T. Müller & J. Winters. Homogeneity and structure in the emergence and evolution of visual art: The cultural evolution of compressed, interdependent artworks in Reddit Place [41]

O. Sobchuk & P. Tinits. Films become more complex: three case studies [48]

P. Tinits & S. Hartmann. Social learning of knowledge representations in Wikipedia [50]

R. Veede. Cultural evolution in Wikipedia: A case study in the evolution of social epistemology [54]

18:30

19:00   **Welcome reception**

June 7
Näituse 2, room 102

09:30   **Keynote: *Nathalie Gontier*.** Cultural evolution and explanatory pluralism: The applied evolutionary epistemological approach [8]

10:30   Coffee

11:00   **Session 1**

M. Derex, J.-F. Bonnefon, R. Boyd & A. Mesoudi. Investigating the effects of social information on individuals' ability at refining and understanding a physical system [12]

A. Karjus. Selection above the baseline: quantifying the advection effect in four domains of cumulative culture [21]

T. Honkola. Environmental differences contribute to divergence of dialect groups [15]

12:30   Lunch break

14:00   **Keynote: *Kristian Tylén*.** The cumulative cultural evolution of prehistoric symbolic behavior [9]

4

15:00   **Session 2**

B. Pavlek & O. Morin. Heads and tails: The informational value of Greek coinage and its evolution (650–336 BCE) [43]

L.A. Scanlon, A. Lobb, J. Tehrani & J.R. Kendal. Social learning errors and the evolution of material culture: cognitive factors affecting forms of granny and reef knots [23]

16:00   Coffee

16:30   **Flash talks**

K. Baraghith. Linking micro- and macrolevel models of the cultural evolution of language: From graph theory to game theory [10]

V. Furs. New possibilities of storytelling in the new media era [13]

G. Iannucci. Scaffolded-self: How culture makes our selves [16]

K. Kruup. Online culture in an evolutionary pressure cooker [27]

D. Learmouth. Creating and analysing a database of Australian ritual [30]

M. Mets. What experimental semiotics teaches us about conventionalization of graphical sign systems [33]

E. Milyakina. Modern U.S. sitcom: Crisis of the genre and prospects of evolution [37]

H. Miton & O. Morin. A Zipfian effect in heraldry? [39]

M. Tita. The evolution of disease narratives in Italy and Western world: how people keeps on reacting to danger with stories [51]

M. Youngblood. The cultural transmission of sampling traditions in a network of musical collaborators [57]

18:00

June 8

Lossi 36, room 214

09:30 **Session 1**

A. Jon-And, M. Parkvall & A. Funcke. Is language less cumulative than other culture? Indicators of breakdown and build-up of complexity in pidgins, creoles and non-contact languages [18]

L. Kanger. Is Cultural Evolution useful for Science, Technology & Innovation Studies? An outsider perspective [20]

M. Youngblood & D. Lahti. A bibliometric analysis of the interdisciplinary field of cultural evolution [56]

11:00 Coffee

11:30 **Discussion: Q & A about Cultural Evolution**

12:30 Lunch break

13:30 **Session 2**

G. Martini. Cinderella: Evolutionary approach to the study of folktales [31]

A. Shelya. The success of the shortest literary forms: Why did poetry become small? [44]

D. Learmouth. Reconstructing Australian rock art history [6]

D. Skorinkin & F. Fischer. Measuring the 'epification' of drama [46]

15:30 Coffee

16:00 **Session 3**

P. Tureček, J. Slavík, M. Kozák & J. Havlíček. Changes in adaptation dynamics in systems with non-particulate inheritance [53]

J. Michaud. Modelling the micro dynamics of cultural traits [34]

E. Koile. Phylogeography of the Bantu expansion [24]

17:30 Closing up

Keynote Lecture 1

Jamie Tehrani (Durham University)
Languages, Genes and Folktales: The Plot Thickens
Wednesday, June 6, 10:15–11:15

Folktales, like genes and languages, are products of "descent with modification": stories get passed on from generation to generation, mutate, and eventually diversify into distinct but related lineages. But how far are the descent histories of folk traditions linked to the descent histories of genes and languages? In this talk I will discuss how my collaborators and I have addressed this question using data on the international folktale record, language phylogenies and whole-genome sequences. I will also reflect on some of the wider implications of these findings for understanding the cultural success and stability of traditional stories, what they can tell us about the past, and the complex relationships between the different inheritance systems that shape human worlds.

Keynote Lecture 2

Nathalie Gontier (University of Lisbon)
Cultural Evolution and Explanatory Pluralism: The Applied Evolutionary Epistemological Approach
Thursday, June 7, 9:30–10:30

Sociocultural and linguistic evolution has mostly been researched from within a universalized Neo-Darwinian framework. Theories associated with the extended evolutionary synthesis have now identified new mechanisms and processes of evolution that in turn broaden our notions of what information is and how it becomes transmitted between organisms and populations. When taken on their own, each and every one of these approaches is insufficient to explain all aspects of evolution, but none of the approaches have been falsified either. Instead, different theories demonstrate different aspects of how evolution can proceed. The challenge of our generation is therefore to build theoretical frameworks that are able to incorporate these different findings into metatheories and to come to terms with epistemic and explanatory pluralism. One aspect of such a metatheory is the need to develop a theory-neutral definition of evolution. From within the applied evolutionary epistemological approach, I define evolution as the process whereby units evolve at levels of ontological hierarchies by mechanisms. I explain how this definition also generates a neutral methodology to study evolution, and how it enables new views on causality that can advance theory formation in the sociocultural and linguistic sciences.

Keynote Lecture 3

Kristian Tylén (Aarhus University)
The Cumulative Cultural Evolution of Prehistoric Symbolic Behavior
Thursday, June 7, 14:00–15:00

Recently, there has been great interest in connecting archeological findings to knowledge and hypotheses about human cognitive evolution including the evolution of language. Dating back as far as 100 ka, the Blombos ochre and the Diepkloof ostrich egg engravings from South Africa are considered among the earliest fossilized evidence of human symbolic behavior. Of special interest is the temporal trajectory spanning more than 40 thousand years from earlier simpler parallel line patterns to later complex cross-hatchings suggesting an adaptive, compositional development. There are several suggestions in the literature concerning the potential symbolic function of the line engravings spanning from simple aesthetic displays to full-blown denotational symbols. In a series of cognitive science experiments, we investigate whether the development of the artefacts is an expression of an adaptive process of functional optimization for human perception and cognition, that is, if line carvings evolve over time to become more salient, reproducible, intentionally expressive and memorizable. The experimental approach allows us to test concrete hypotheses concerning suggested symbolic functions of the artifacts.

Linking Micro- and Macrolevel Models of the Cultural Evolution of Language: From Graph Theory to Game Theory

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I shall investigate whether a proper theory of cultural evolution (CE) possesses the ability to synthesize the social sciences (cf. Mesoudi 2011), and if CE is a good candidate for closing explanatory gaps between micro- and macrolevel phenomena in the social realm – at least in principle.

In order to achieve this, it should be possible to classify macrolevel patterns CE. But the serious doubt is raised whether it is possible to identify something like "species" (classes defined by their phylogenetic history and intrinsic reproductive barriers and not merely defined by similarity) in CE. However, since this is a crucial requirement for any evolutionary classification, a macrolevel cluster of a similar sort is necessary to realize the expectation that this paper aims to realize. I will suggest to apply the "Causal Interactionist Population Concept" (CIPC), recently formulated by Millstein (2009, 2015) in the philosophy of biology. According to some critical authors, CE is in need of a valid population concept anyway (Reydon & Scholz 2015). Since CIPC is a non-formal hypothesis, I will also present a possible formalization of CIPC using graph-theory. Finally, a possible candidate for the micro foundation of this model is presented within the framework of the evolution of language and meaning: the signaling game of coordination, which has been widely examined in the context of evolutionary game theory (Huttegger 2008, Skyrms et. al 2014). It will be shown that this game theoretical micromodel can seamlessly be transferred into a macrolevel population cluster given by the CIPC.

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Why is Folk Medical Knowledge Rarely Useful? Lessons from Online Medical Product Reviews

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Until the late 19th century, cumulative cultural evolution in medicine rarely produced treatments that benefited anyone besides the doctor. This apparent lack of adaptive, beneficial innovations makes medicine an unusual domain of human cultural evolution and raises interesting questions about the conditions in which beneficial/harmful cultural variants emerge and diffuse. Here, I use a dataset of >3,000 online medical product reviews to explore how biases in (A) how people evaluate the usefulness of medical treatments and (B) how these evaluations are shared with other people undermine the evolution of effective therapies. The results indicate that (A) physiological changes that occur after the treatment (e.g., feeling energised after a weight loss pill) play an important role in people's determination of the treatment's value. However, often such physiological changes are not predictive of the desired outcome (e.g., weight loss). (B) People with good outcomes are more likely to share information with others. For example, approximately 90% of online reviewers of weight loss diets have a better outcome than the mean outcome in a clinical trial of the same diet. Thus, ineffective treatments can be culturally successful when they capitalise on people's bias toward sharing "good news stories" or when they generate surrogate effects which people use as evidence of efficacy. Moreover, processes that undermine the usefulness of the medical scientific literature (surrogate outcomes and publication bias) also operate to undermine the usefulness of medical knowledge generated by cumulative cultural evolution in non-scientific contexts.

Investigating the Effects of Social Information on Individuals' Ability at Refining and Understanding a Physical System

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The tools essential for life in even the simplest foraging societies are very complicated artefacts with multiple interacting parts made of many different materials. A widely held view is that these tools evolve gradually through the aggregate efforts of generations of individuals. In theory, cultural evolution can give rise to these complex, highly efficient technologies even though individuals do not necessarily understand how they work. This prediction, however, has never been properly tested and it is not clear how the gradual improvement of tools affects individuals' understanding about how these tools work. Here we provide such a test by asking chains of participants to improve the configuration of a wheel going down on rails. The wheel was composed of 4 spokes and 4 weights that could be moved along these spokes. Two treatments were compared. In the first one, participants had 5 trials to improve their wheel before passing their last two configurations to the next participant in the chain. The second treatment was similar except that participants could also transmit their theory about what makes the wheel going fast to the next participant. At the end the experiment, participants' understanding was evaluated in isolation by presenting them with pairs of wheel and by asking them to predict which wheel would reach the bottom of the rails in the shortest amount of time. This experimental design allowed us to investigate the effects of various kinds of social information on individuals' ability at refining and understanding a physical system.

New Possibilities of Storytelling in the New Media Era

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According to H. Jenkins, the new media era is characterised by the emergence of the new types of culture: the convergence culture and the participational one. It means that the old mass communication model with one-directed flow of messages from media producers to the audiences doesn't work in these new conditions. Instead, we can observe the rise of the media audiences activity – not only in proposing a visible feedback to the mass-media messages, but also in providing the new content, in particular, in what the media franchises is concerned.

Convergence culture can be regarded as a result of the media industries enlargement, when the media owners are interested to diffuse the stories through different media to attract the new audiences and to provide the new points of access to the same story, while the notion of participatory culture deals with the activity of the audience members in searching, exchanging and sharing the information about media franchises as well as with the stories development (fan-fiction) to fill the narrative gaps and to contribute in the creation of the fictional world of the media franchise.

One of the key notions in this new media culture is that of transmedia storytelling. Appeared at the end of 1990s, it was then developed by H. Jenkins, J. Long, C.A. Scolary and has to describe the situation of the story enlargement and development through different languages and media. As the result of such development the contemporary media franchises provide us with more or less detailed fictional worlds which can be enlarged or become more and more elaborated when the new fragment of story appears.

Although the notion of the transmedia storytelling is a relatively new one, the very idea of telling the same story through different media is an old one (the examples can be easily found in the history).

Modeling Patterns of Macroevolution in Modern and Ancient Technologies

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Humans display astonishing diversity in their material culture. Although archaeologists have spent decades painstakingly describing this diversity, we continue to lack a comprehensive understanding about the evolution of our technologies. This work takes a comparative perspective to examining macroevolutionary patterns of technological change by using a Bayesian modeling approach to estimate rates of diversification within various technological systems. This approach offers improvements over existing methodologies by providing a quantitative framework to estimate rates of technological innovation and extinction through continuous time, correlate the effects of various factors on technological diversity and assess whether technological diversification dynamics conform to existing hypotheses of technological change. Technologies that are examined in this work explore a range of domains including digital technologies (AppStore apps), highly regulated technologies (pharmaceutical drugs), large scale technologies (automobiles) and ancient technologies (pottery from the American Southwest). Results of this work highlight that modern technological systems exhibit a common pattern of higher innovation early in their life history with gradual slowing of origination rates later on, occasionally referred to as an adaptive radiation or dominant designs pattern. Ancient technologies do not exhibit these same dynamics, although I argue here that this is likely due to sampling biases and the inability to see novel and rare technological variants in the archaeological record. Broadly, this work contributes to a growing set of methods that provide greater opportunities for comparing and contrasting the dynamic patterns of technological change.

Environmental Differences Contribute to Divergence of Dialect Groups

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Human individuals that continuously interact with each other and share the same culture are likely to share the language as well. While some cultural features, e.g. subsistence strategy, are connected to fitness of the individuals (Currie & Mace 2014), some others, such as language, are not. Therefore, language can be seen as a neutral marker of the cultural history of human populations (Mace & Jordan 2011). Here we studied the divergence of dialect groups, which essentially reflects the divergence of the speaker populations. The inducers of linguistic divergence have usually been sought from sociocultural factors and from physical barriers to human migration like mountain ranges or sheer geographical distance (e.g. Paul 1886). However, one can also expect that individuals, who are culturally adapted to certain environmental conditions, may have more interaction with individuals who live in a similar kind of environment than with those who live in different kind of conditions, even though these areas would be geographically close. We studied this possibility together with the traditional explanations to explain the spatial pattern of Finnish dialects. We investigated whether geographical distance or differences in environmental and cultural conditions explain linguistic differences. We also studied the relative explanatory roles of these factors. We analyzed historical dialect data of Finnish language from the time before extensive urbanization together with historical and modern spatial data. We did this with multiple regression on distance matrices (MRM) and with variation partitioning. We found that environmental differences are important inducers of linguistic divergence. Their importance, especially when compared to the small role of geographical distance, was unexpected. In addition, we found the role of cultural differences to be notable. These findings suggest that cultural adaptation to the natural environment has had an impact on the separation of the speaker populations and on linguistic divergence.

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Scaffolded-Self: How Culture Makes Our Selves

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According to the Extended Synthesis perspective, an empirical description of humans should refer to the ecological niche the organism lives in (Laland et al., 2001). Having that in mind, I would like to explore how the niche-construction framework – which focuses on cultural evolution as constituent part of biological evolution (Laland et al., 2000) – could be useful to describe the evolution of human selfhood. My aim is to consider the notion of scaffolded-mind proposed by Sterelny (2010) to argue for a scaffolded-self. The main idea is that to account for how individuals become self-aware it is necessary to refer to their cultural relational environmentally embedded experiences.

Sterelny claims that the extended-mind examples (Clark & Chalmers 1998) – in which some artefacts are considered constituents of human minds – are special cases of a more general capacity to make and use material and/or symbolical tools to amplify our cognitive capacity. In his view, the relation between minds and external resources is more dynamic than the extended-mind theorists propose: the world (firstly the epistemic one) shapes and builds-up our cognition through our active engagement. Clark and Chalmers yet noted that if the mind goes beyond the skin barriers the self could be pictured as a distributed phenomenon enacted across those boundaries too. Following this suggestion in a phylogenetic research, Malafourius (2008a, 2008b) argues for the causal role of some prehistoric tools – e.g. personal ornaments – in

16

the emergence of human self-awareness. He thinks that those decorations do not prove a yet given self, rather they helped humans to develop both a bodily and inner self-awareness that is therefore extended in these artefacts.

I would like to consider the 'material engagement' thesis as a case of ecological scaffolding: interacting with their material, symbolic, social environment humans modify the world that, simultaneously, shapes their minds-system.

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Trends in Public Opinion Explained by the Moral Psychology of Liberals and Conservatives

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We here apply a cultural evolution model on public opinion to moral issues in the United States. Surveys show a dramatic movement in public opinion on certain issues, such as gay rights, whereas public opinion has barely moved at all on other issues, such as abortion rights. What accounts for these differences in cultural evolutionary success of issue positions? Here we show that the long-term success

of a position is strongly related to its advantage with respect to support in individualising (relating to care and fairness), as opposed to binding (e.g. authoritative), arguments. These results indicate that the speed and direction of the evolution of societal morality can be predicted by an analysis of arguments. The reason, we argue, is that individualising arguments influence both liberals and conservatives, whereas binding arguments tend to influence only conservatives and therefore have little impact on the population level. As predicted by this theory – but contrary to intuitions about ongoing political polarisation – we demonstrate that opinions trend in the same direction among both liberals and conservatives and that liberals are leading the trend. Our theory suggests a new understanding of why conservatives often feel as if the morals of society are moving away from them: liberals' refusal to be influenced by certain kinds of arguments allows them to move public opinion in their direction, leaving the conservatives in a constant state of catching up to the changes occurring.

Is Language Less Cumulative than Other Culture? Indicators of Breakdown and Build-up of Complexity in Pidgins, Creoles and Non-contact Languages

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In the study of cultural evolution, human culture is generally assumed to be cumulative, implying increasing complexity and diversity over time (Enquist et al. 2011, Lewis & Laland 2012). Recent studies suggest that evolutionary mechanisms operate differently in different cultural domains (Tamariz et al. 2016), but it has not been discussed whether all mechanisms result in cumulativity. Experiments have shown that compositional language structure emerge as a trade-off between learnability and expressivity (Kirby et al. 2008, 2015), but there is no evidence of languages generally becoming more compositional, or regular, over time. As all modern natural languages are expressive enough for human communicative needs and compressed enough for generational transmission, we suggest that linguistic complexity is

not currently cumulative but breaks down and builds up in cycles triggered by demographically determined variation in learnability and expressivity pressures. We focus on pidgins, a special case of natural languages where the expressivity pressure is presumably weaker and learnability pressure stronger than in other languages. We compare pidgins to creoles, where both expressivity and learnability pressures are presumably high, and non-contact languages where the learnability pressure is presumably lower, allowing for more complexity. We analyze compiled material from spoken and written pidgins, spoken creoles and non-contact languages and a parallel bible corpus, applying two complexity measures: the relation between word length and frequency, and pronominal morphology. We observe a smaller degree of exponentiality in the negative correlation between word length and frequency in pidgins than in their lexifiers, likely reflecting the loss of short and common grammatical words. Creoles expose a higher exponentiality in this correlation, which may reflect a newly built up analytical grammar. For pronouns, we observe expected reduced marking of person, number, case and gender in pidgins, increasing in creoles, being highest in non-contact languages.

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Is Cultural Evolution Useful for Science, Technology & Innovation Studies? An Outsider Perspective

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The field of Cultural Evolution (CE) is increasingly making inroads to the study of technology (e.g. Valverde & Solé 2015; Youn et al. 2015; Gjesfjeld et al. 2016). To date, however, few connections have been established between CE and the field of Science, Technology & Innovation Studies (Sismondo 2010). Drawing on the author's own disciplinary experience in STI this presentation suggests that the current situation is caused by both, historical and substantive factors. First, in the 1980s an influential community of scholars mobilized around the metaphor of co-constructivism (Bijker et al., 1987; Bijker & Law 1992) which largely led to the omission of the potential insights of evolutionary theory. The metaphor of co-evolution was taken up in innovation studies (e.g. Tushman & Murmann 2002; Schot & Geels 2007) but has since been criticized for its broad scope and accompanying imprecision (Malerba 2006). Second, and perhaps more importantly, while CE offers interesting avenues for the quantified exploration of specific evolutionary mechanisms its actual findings tend to be somewhat underwhelming. In particular, so far CE does not seem to offer much in terms of the identification of long-term patterns on the middle-range level, a goal considered important by many STI theories such as the Multi-level Perspective on socio-technical transitions (Geels 2005) or the Techno-economic Paradigm framework (Perez 2002). The talk explores the possible crossovers between CE and STI suggesting how the intersection of these fields might lead to mutual benefits in the future. The presenter will also wield a sock puppet that, during the course of the presentation, would attempt to devour a middle-sized Mars bar.

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Selection Above the Baseline: Quantifying the Advection Effect in Four Domains of Cumulative Culture

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A commonly used proxy to the selective fitness of elements over time, in language as well as culture, is their frequency, estimated from what are assumed to be representative datasets (such as large diachronic corpora in the case of language). However, naive frequencies may be misleading. In language, elements (e.g., words) may well rise or fall due to their relevant topics being discussed more (or less) than before; in culture, elements may appear or disappear due to larger scale changes in the system they find application in. Conversely, if an element becomes more frequent than would be predicted based on the increase of its related

elements (e.g., its topic or genre in the case of language), then that would constitute reasonable grounds to posit selection and identify the need to look for selective biases and causes that may be driving this change.

This notion is straightforwardly quantified in the cultural-topical advection model (Karjus et al. 2018), originally proposed as a control mechanism for topical fluctuations in diachronic language corpora. The term 'advection' here refers to transport by bulk motion - particles or elements being carried along by the flow of other particles.

We apply the advection model to three datasets chronicling changes in three different domains of culture: cuisine, cinema, and board games, as well as the original domain of language (using the following datasets, respectively: Feeding America, IMDb, BoardGameGeek, and the Corpus of Historical American English). We find that the advection effect accounts for 30–80% of variation in frequency changes over time, depending on the domain and the time periods under observation. We further demonstrate how departures from the prediction (regression residuals) can be used to highlight cases of selection that occur above the cultural-topical baseline.

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Social Learning Errors and the Evolution of Material Culture: Cognitive Factors Affecting Forms of Granny and Reef Knots

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Research into the evolution of material culture has focused on the cognitive capacities that enable the high fidelity transmission of complex knowledge and skills between individuals and across generations. However, the causes and consequences of copying error remain relatively poorly understood. We focus on variation in micro-structure (forms of granny and reef knots) within the ancient and ubiquitous technology of knot tying. We apply a mathematical model to experimental data to make quantitative estimates from three classes of cognitive factors that can affect the production of cultural variation during the process of social learning. In particular, despite a high fidelity of copying or imitation, we find evidence for an absolute learning bias towards an un-observed cultural variant (handedness), a relative transformation of the observed cultural variant (mirroring), and a propensity to repeat a previously performed chunk of behaviour in a sequence. Our analysis shows how these cognitive factors interact to affect cultural evolutionary dynamics, revealing steady state frequencies that are consistent with the prevalence of granny over reef knots and the mathematical equivalence of reef knot forms. We discuss how parameterisation of cognitive factors involved in social learning can be used to assess their effects on the unintended production of cultural variation and evolutionary dynamics.

Phylogeography of the Bantu Expansion

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Bantu expansion is among the most important and least understood human migrations. Bantu-speaking populations, which amount today to 240 million people, speaking around 500 languages, and spanning through 9 million square kilometers [1] are the result of a huge migration originating in a homeland near the border of Nigeria and Cameroon [2] between 4,000 BP and 5,000 BP [3, 4].

There is robust evidence [1–8] that the expansion of Bantu-speakers into the broad area occupied today was predominantly due to an actual movement of people, not a language shift. Although the location of the homeland and the time depth of Proto-Bantu are well established, the main uncertainty is the precise migration route taken.

Recent phylogenetic studies [1, 6–9] support the late-split [10–14], which claims that East-Bantu and West-Bantu languages' common ancestor crossed the African Rainforest, splitting after this. It is thought that this crossing was made through the Sangha River Interval (SRI), a N-S savanna opening into the rainforest. However, in dated phylogenies [7], dates don't match consistently: They should have crossed this corridor around 4,000 BP, while it was completely open only 2,500 BP.

We propose two different hypotheses for competing with the traditional SRI late-split. The first, that they used the savanna corridor opened along the coast of Gabon 4,000 BP [15], instead of the SRI. The second, that they have crossed the rainforest, but a millennium before the opening of the SRI.

We compare the three hypotheses with a Bayesian phylogeographic approach based on linguistic trees. We use lexical and geographical data for 400+ Bantu and Bantuoid languages, inferring the linguistic and geographic history in parallel, by implementing the break-away model [16] in BEAST2 [17]. We conclude that the way through the rainforest happened indeed around 4,000 BP.

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Creating Our Own Cultures: Evolution of Artificial Cultures

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Culture is one of the most important characteristics of humans. Culture has a dual nature for humans: we create it ourselves, and we receive it from outside. Culture is created through interactions of individuals in the social world, but it is also given to people from external agents such as other people and by social systems and structures. Culture is usually understood as a given structure and process. The concept of artificial culture changes culture into something creatable by humans depending on our needs and goals. Artificial culture is purposefully and intentionally created culture; a system of assumptions, values, norms, and artifacts created purposefully to build a context for the actions of a specific group of people. The specified values and norms are the basis for the social structures and systems of the created artificial culture. Social software is the connecting media of the artificial culture and participants form a collective narrative. Shared stories, metaphors, and mental models create a dynamic reality of artificial culture, which in turn affects the behavior and decisions of its participants. Unlike real culture, all elements of artificial culture and all activities taking place in it are observable.

In this presentation, I will discuss the formation of artificial cultures and try to outline the main features of a society with an artificial culture. The main premise is the recognition of the importance of technology in the formation of post-humans and their cultures. The difference from earlier discourse on techno-culture is the idea that post-human artificial cultures are artificial environments created at will and as needed that will replace the present natural cultures.

Online Culture in an Evolutionary Pressure Cooker

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What is the cultural equivalent of using a petri dish to force the evolution of antibiotic resistance in bacteria? Could such an environment be constructed online? What would its consequences be?

This paper describes how certain online communities, specifically 4chan, have played the historically unprecedented role of such petri dishes in digital culture, and discusses the cultural, political, and scientific implications of the evolutionary outcomes.

First, a model is presented, explaining how the design decisions of 4chan led to extreme selective pressure on cultural expressions and forms (colloquially known as memes) and the skills of the participating agents while encouraging variation and transmission.

Second, the fitness function of the cultural forms which survived these selective pressures is speculated upon. A description is given of how these forms are especially suited to capturing attention and commanding behavior in various online settings.

Third, research questions, approaches, and possible sources of data are sketched, which could be fleshed out into both qualitative and quantitative research projects, thus filling gaps in the academic understanding of digital culture. This would enable researchers to understand the broader cultural and political impact of these forms, both online and offline, in phenomena ranging from changing language use in political communication to "troll armies".

Digital culture is both increasingly important and increasingly complex. Understanding its evolutionary roots would help researchers and professionals in various fields adapt to it. Such research could thus elevate the study of cultural evolution into higher relevance.

A Universal Grammar of Games as the Basis for Language and Human Culture

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Noah Chomsky speaks of a universal grammar as the basis for language. We outline a universal grammar of games as the basis not only for language but all of human culture.

The evolution of the central nervous system is driven towards abstraction, with ever more sophisticated resources devoted to modeling the unknown. The great apes appear to share many aspects of consciousness, creativity and social behavior. Biologically, humans may be distinguished by a little discussed instinct for synchronized activity by which they tend not only to mirror each other's body language but to honor a shared space. This physical "sixth sense", which autists appearently lack, facilitates Tomasello's joint intentionality. Ultimately, this allows humans to play a game, which is to say, create a shared world which they enter by asking a question and leave by establishing an answer. Synchronization, singing in unison, dancing and game playing would have developed vocal chords, hand gestures, vertical posture and a cerebral cortex which expands one's virtual reality.

We share and apply results from a study of 80 innovation games played in Silicon Valley businesses. 24 different kinds of games serve different roles in a framework for innovation. Similarly, every game may potentially consist of 24 kinds of games. In this way, all of culture consists of games upon games. We apply this model to note ways in which the syntax of human language goes beyond linear syntax as used by great apes and discussed by Jackendoff.

There are games for initiating a game; for leaving a game; for playing a game within a game; for identifying the meaning of a game; for clarifying that meaning; for grounding that meaning in the real world in different levels (whether, what, how, why); for making sense of that meaning by making sure those levels are distinct.

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Reconstructing Australian Rock Art History

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There are many hundreds of rock art sites located throughout Australia. Whilst researchers have identified distinctive regional styles, there has been little consensus on how these styles might relate to each other and whether such relationships might help contribute to questions related to Australian population history. Using an existing dataset of 104 sites, analysed by the presence or absence of 38 rock art motifs (Layton 1992), an Australian rock art phylogeny was derived using Bayesian statistical software (*Mr Bayes*). Grouping site locations into 12 regional families, and using a majority rule for motif presence/absence, six tree nodes were resolved with greater than 50% posterior probability. The phylogeny shows distinct groupings for Arnhem Land, Kimberley and a third group encompassing the remainder of Australia. This correlates with analysis suggesting these groups are also separated linguistically, with the latter group having been resolved as the Pama-Nyungan phylogeny (Bowern & Atkinson 2012). More detailed comparison with this phylogeny indicates further similarities, such as an East/West divide separating both rock art style and language. It also highlights some differences with a south-east (Sydney) group that is somewhat isolated in the rock art phylogeny compared to its linguistic correlate. Although most rock art images so far dated indicate an origin within the last 5,000 years (Langley & Taçon 2010) it is possible that the Sydney region is linked to an older tradition which might explain its anomalous position in the phylogeny. An area close to these sites has previously been highlighted as a possible refuge location for populations during the last ice over 20,000 years ago (Williams *et al.* 2013). Whilst these results are preliminary, they indicate that phylogenetic methods can

be applied to reconstructing visual histories thereby providing new material for understanding past human population movements.

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Creating and Analysing a Database of Australian Ritual

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The ritual systems of Australian Indigenous people have been the subject of detailed ethnographic analysis over the past 200 years yet little of this material has been studied from a quantitative, comparative perspective. Complex rituals linked to initiation, mortuary and fertility have been, and in many cases still are, the mainstay of Indigenous Australian social life. The creation of a new database will enable ritual variation to be studied comparatively with the aim of including 50-60 societies and 250-300 ritual character traits. Importantly, all Australian groups are hunter-gatherers and it is anticipated that the data may be useful for answering questions related to the evolution of ritual in ancestral human society. For example, is the presence of costly physical rituals correlated with the need to sustain high levels of within group commitment? This could be measured by the presence of inter-group conflict or other cooperative need such as food sharing in desert environments. It is expected that analyses will employ phylogenetic comparative methods to allow for correlation due to shared ancestry and to provide powerful statistical capability. To test whether ritual traits had evidence of vertical ancestry a pilot study was conducted using an existing cross-cultural database

(Binford 2001). Binary data for 18 ritual traits in 36 Australian groups was mapped to an Australian (Pama-Nyungan) language phylogeny (Bowern & Atkinson 2012). 9 ritual traits had a statistically significant phylogenetical signal measured by D value (Fritz & Purvis 2010) suggesting that Australian ritual traditions are, at least to some extent, inherited through a pattern of vertical transmission. The creation of an Australian ritual database, combined with the application of modern phylogenetic techniques, is expected to provide an important new resource for addressing questions related to the evolution of ritual in human society.

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Cinderella: Evolutionary Approach to the Study of Folktales

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Cinderella is arguably the most famous and widespread folktale in the world. However, it is not currently known where the tale originated or how it developed as it spread from society to society. For this reason, my PhD project aims to bring new theoretical and analytical perspectives to shed light on its evolutionary history. However, coding remains an inescapable problem in studying narratives. To date scholars have been identifying the characters to analyse based on their own individual judgement [1–2]. Consequently, the risk that both dataset and results were affected by biases and idiosyncrasies is very high. For this reason, we combined methods from cultural transmission theories and phylogenetic analysis, to design a novel experiment based on a transmission chain that resembles a branching tree. By comparing different

methodologies of coding derived by theories of structural analysis [3–4], we were able to establish an effective coding system for narratives and validate the use of phylogenetic analysis.

Assessing these two key points was essential to the next steps of my project. In fact, based on the previous results I am now applying the coding methodology on an empirical dataset that includes more than three hundred variants of Cinderella tale from many different traditions, including those of Asia, America, Europe and Africa, widely documented and published by folklorists [5–7]. The aim is to trace back Cinderella's origin and development as well as reconstructing its first prototype and establish the evolutionary inheritance of the different features of the tale. Lastly, by borrowing methods from population genetics, I will infer possible correlation between human population structure and human cultural evolution described by the distribution of variants of the folktale.

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What Experimental Semiotics Teaches Us About Conventionalization of Graphical Sign Systems

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The field of experimental semiotics uses laboratory experiments that require participants to cooperate on establishing novel communication systems (Galantucci et al. 2017). These experiments demonstrate how different properties of novel communication systems of various kinds and modalities emerge. The main research themes of this paradigm deal with the establishment of motivated signs and their development into conventional symbolic signs and the emergence of a combinatorial design (*ibid.*). I will firstly give an overview on how experimental semiotics has demonstrated the emergence of two of these properties — iconicity and symbolicity, in graphical communication systems. High iconicity indicates that the relationship between a sign and what it refers to is based on similarity, and is therefore highly motivated. High symbolicity means that this relationship is arbitrary and based on the regularities or conventions. As an example, Garrod et al. (2007) conducted a study where participants first created iconic signs to communicate with a partner. These signs then developed into more symbolic signs with the help of feedback through social interaction with a communication partner. Secondly, I will analyse the role of conventionalization in the emergence of icons and symbols in experiments with graphical communication systems. Conventionalization is the process by which the communicators agree upon sign and referent relationship by a habit or a convention. Different kinds of experiments show different aspects of conventionalization as well as the emergence of iconic or symbolic signs: whether it´s communication in a communicating pair (e.g. Garrod et al. 2007), community (e.g. Fay et al. 2004), between communities (e.g. Healey et al. 2007) or in an iterated learning paradigm (e.g. Garrod et al. 2010).

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Modelling the Micro Dynamics of Cultural Traits

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Cultural traits are very diverse and understanding their evolution is challenging. One possible approach to modelling the dynamics of cultural traits is to take inspiration from evolutionary biology and adapting the models of genetic evolution to cultural evolution. In the context of language evolution and change, such an approach has been taken by Baxter et al. (2006) (see also Blythe & Croft (2012)) when they proposed the utterance selection model (USM) for language change. This model is formally equivalent to the Wright-Fisher model of population genetics, where the analogue of genes are linguistic variables and the analogue of alleles are variants of these variables. This model is an instance of the generalized theory of evolution by Hull (2001), who defined the concepts of replicators (things that are selected) and interactors (actors through which replicators are selected).

One of the drawbacks of the USM is that it predicts very irregular trajectories of change that only fit actual trajectories of language change under specific circumstances. In this talk, we propose an extension of the USM that takes into account the preferences of actors over the different variants (Michaud, 2018). Furthermore, these preferences are allowed to change during the evolution of the model, since the fitness of a variant depends on its use by other members of the community. Using quantitative measures of the trajectories, we show that the trajectories of change predicted by this model are more regular and reproduce the typical S-shaped curves observed in language change (Blythe & Croft, 2012).

This model has only been applied to language change, but it could in principle be applied to any cultural evolutionary system under mild assumptions. We will discuss the requirements that cultural data needs to fulfill for this model to be used.

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Professional Biographies of the Current Bishops of Russian Orthodox Church (1965–2017): Dynamic of Factors for Career Development

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Russian Orthodox Church has closed structure and personal qualities of elite's members like social background and ideological preferences play significant role in policy formation of this social institute. However the process of moving up in ecclesial hierarchy remains very obscure for outsiders and it seems quite intriguing to investigate details of this process. This puzzle became more exciting giving that modern orthodox elites consist of different fractions with contradicting views on different issues (Mitrochin 2004). However there are a few biographical researches of religious elites (Edwards 1959; Ravitch 1965; Morgan 1969) and they are concerned to XX century and they neglect to consider Eastern churches.

In my report I tend to fill this gap and investigate origins of contemporary Russian Orthodox bishops. The sample is formed by the current orthodox elite, the persons occupying highest degree of holy order, which lives in Russian Federation and actively serving their duty. Data is taken from official sites of Moscow Patriarchate. My aim is to find out the most influential selective pressures governing the elite formation of the institution such as:

1. Social background (religiosity of parents, military service, secular and religious education);
2. Hierarchical social networks (patrons during their deaconate and presbyterate, bishops provided ordination or tonsured to monk etc.);
3. Activities on deacon and priest positions in the various domains of Moscow patriarchate.
4. Nowadays, the database of all archbishops is already created (*N=89*) and some preliminary features explaining their successful career could be presented. It seems that the most influential factors are:
5. The theological seminary: Moscow TS (39 + 11 in absentia), Saint-Petersburg TS (14), Odessa (5), Ryazan and Stavropol TS (3)

6. Synodal Department/ other activity: education (30), monastery (22), Department for External Church Relations (22), parochial activity (16), diocesan secretariat (10)
7. Personal links: four bishops who made the highest number of tonsures and deacon ordinations of future archbishops – Aleksander and Eugenij (9), Nikodim and Isidor (8).

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Modern U.S. Sitcom: Crisis of the Genre and Prospects of Evolution

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The current state of TV production is considered to be "high-quality" by many TV studies researchers (McCabe 2007: 1). However, the analysis is usually focused on drama shows (Nelson 2013), and comedy series are being disregarded. Nevertheless, we can see a definite progression in technical (Mills 2009: 136), aesthetic (Mills 2009: 127), and contextual (Savorelli 2010: 14) production of U.S. situation comedies over the last 15 years. The aim of our research is to understand current tendencies in the transformation of the sitcom, and whether it should be considered an evolution of the genre or its "death". Our project combines analysis of the classic sitcom format found in *Friends* (1994–2004, Crane D. and Kauffman

M.) and *The Big Bang Theory* (2007–, Lorre C.) with the modern definition of the genre as exemplified by *Arrested Development* (2003–2006, 2014, Hurwitz M.) and *Modern Family* (2009–, Lloyd C. and Levitan S.). The paper will try to explore the ways in which modern sitcoms rethink the classical definition of the genre while focusing on technical and narrative complexities as well as the introduction of new trends in the sitcom production. The research will be based on the quantitative analysis of the presented examples. We are interested in analyzing the structure of the sitcom episode, whether new shows have more scenes and more shots per scene, and how the number of characters and storylines has changed. Our main goal is to collect data on instances of narrative complexities, such as manipulation of fabula and syuzhet (i.e. flashbacks, flashforwards), the presence of narrator and breaking of the 4th wall, cases of remediation and others. This will allow us to gather more precise and in-depth data on the current state of the sitcom genre. We hypothesize that we will be able to elicit the popular trends in the modern sitcom that eventually could become the new norm in tv production.

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Spatial Dimension of Transmission of Folk Tunes

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As Savage [2017, Measuring the cultural evolution of music: With case studies of British-American and Japanese folk, art, and popular music (PhD thesis), Tokyo] has shown, the transcriptions of folk tunes can be helpful in understanding the evolution of orally transmitted music, especially, when computational and statistical

methods are used. But many quantitative studies of folk music collections concern only analyses of musical scores with limited consideration of contextual information (e.g. geographic location of a notated performer).

The set of Oskar Kolberg's transcriptions of 19th-century tunes from the area of Poland is an example of a collection that allows for such extended investigations. Oskar Kolberg (1814–1890) was one of the first collectors of folk music, who was also interested in the diversity of melodic variants, and who wrote remarks about the location and the context of performance. Moreover, in the period he worked, the oral transmission was still the main way of learning melodies, what makes his collection even more interesting.

A simple matching the tunes notated by Kolberg with the geographical locations of their performers allows for studying the spatial dissemination of melodies and their variants with statistical methods. What pertains to the more general question: what is the influence of geographical distance on the evolution of transmitted cultural traits?

In this contribution, I would like to present my research on this issue. I will show the preliminary results of my analysis of chosen tunes from Kolberg collection, which relied on a comparison of distances between tune variants and geographical distances between locations of their sources (with Mantel statistics). Besides, the methodological and theoretical issues will be highlighted, as the interpretation of the results requires some assumptions about the evolution of orally transmitted music.

A Zipfian Effect in Heraldry?

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George K. Zipf's name is linked to two phenomena: the power law distribution of word frequencies («Zipf's law»), and the correlation that he observed between word length and word frequencies - that we call «Zipf's correlation» (Zipf 1949). This correlation has recently been refined by Piantadosi and colleagues (2006), showing that the

relationship between a word's frequency and its length is mediated through its informativeness. The current research is conceived as an attempt to document a graphic equivalent of Zipf's correlation for heraldic motifs (the specific figurative or abstract figures composing coats of arms), which have been extensively documented by several authors throughout Europe, from the Middle Ages on. One reason to expect such a correlation is that an image's graphic complexity is similar in certain respects to a word's length: more complex images take longer to process and contain more information. Following Zipf's correlation, are, in our case, popular images simpler?

Graphic complexity is operationalized in two ways, similarly to Tamariz & Kirby (2015), with both algorithmic and perimetric measures of complexity, and applied to a standardized collection of thousands of drawings, all from the same hand. In doing so, we import experimental methods and apply them to historical materials. Algorithmic (descriptive) complexity is the smallest possible file size for a given image. Perimetric complexity is a ratio of inked surface and perimetric length, and has been shown to correlate with ease of processing (Pelli et al. 2006). Our frequency data – the number of coats of arms a given motif appears on – comes from two corpuses. The first one was constituted by us from secondary sources (mainly Renesse 1894) and a second one based on Clemensen (2017), covering respectively 462 motifs and 344 motifs. While simpler motifs were to some extent more frequent in the Clemensen dataset, we observed a correlation in the opposite direction (more frequent motifs were also more complex) in our other dataset.

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Homogeneity and Structure in the Emergence and Evolution of Visual Art: The Cultural Evolution of Compressed, Interdependent Artworks in Reddit Place

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Cultural evolutionary theory aims to link individual-level processes to population-level patterns via cultural transmission (e.g. Boyd & Richerson 1988; Kirby 1999). A consistent finding in the cultural evolution literature is that multiple transmission episodes often result in compression effects (e.g. Kirby, Cornish, & Smith 2008; Kemp & Regier 2012): when a set of cultural traits transitions to a more compressed configuration than its ancestral state. Importantly, compression effects can become manifest in two different ways, either via the removal of variation or through maintaining variation and organizing it into structured patterns.

Using a novel, large-scale dataset from Reddit Place, a collaborative art project involving over 1 million participants, we investigate the *de novo* emergence of visual art on a 1000x1000 pixel canvas. All Reddit users could select a single coloured pixel, place this pixel on the canvas, and then wait until a cool-down period had elapsed before placing another pixel. By analyzing all 16.5 million pixel placements by over 1 million individuals, we test whether (a) compression effects are present in Place, (b) this overall compression is driven by variation being reduced or structured, and (c) the canvas becomes increasingly stable.

Our model results indicate that compression in Place follows a quadratic trajectory through time. Through additional measures computed from the 250000 images in our analyses, we demonstrate that compression effects happen through the structuring, rather than removal, of variation. Methodologically, we thus show how different types of compression effects can be distinguished. Lastly, the canvas is shown to become more stable over time. The results suggest that compression in Place emerges through artworks being organized into structured, interdependent patterns; these can be seen as the consequence of a trade-off between preservation and innovation.

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A Phylogenetic Review of Kinship Terminology Determinants

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Anthropological literature propose that patterns of descent, marriage, and residence determine which terminology a society uses (eg. Fox 1967; Murdock 1949). But these theories have been perpetuated without critical review. Here, we re-evaluate 26 commonly cited hypotheses of kinship determinants in an evolutionary framework with modern, comparative phylogenetic techniques. Previous anthropological support for these theories relied on simple statistics and ethnographic reporting. The statistical approaches fail to account for shared ancestry, violating a core axiom of statistics, which phylogenetics aim to correct. While observational reports need to be validated cross-culturally. To assess the pervasiveness of these hypotheses, all are tested in the Austronesian, Bantu, and Uto-Aztecan language families, with data drawn from D-PLACE. Of the 26 hypotheses, we only find evidence of correlated evolution in four. Only one hypothesis holds in more than one language family and none hold in all three. These results place a question mark over foundational theories in kinship. Ethnographic observation proves the existence of the hypothesised relationships, however, when placed into a global and historical context, they do not hold. Treating each language family as an evolutionary experiment, these results suggest that social structures are not solely responsible for kinship system change. This opens the door to a more complex view of kinship system use and its

determination. One which should account for the interaction of social structures, but also ecological and historical influence.

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Heads and Tails: The Informational Value of Greek Coinage and Its Evolution (650–336 BCE)

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Graphic identifiers are images used to distinguish items in a population. They fulfil that purpose best when one unique identifier denotes each class of items. However, cultural diffusion prevents this: cultural items such as first names, national flags or heraldry spread through the population and get imitated (Bentley et al., 2004; Morin and Miton, submitted). Their informational value as identifiers subsequently diminishes.

In this study we tested three predictions about informational value of Ancient Greek coin designs. The main purpose of a coin design is to signal the coin's issuing authority and value (denomination) (Kraay, 1976). However, early coin designs were not always successful in communicating this information equally well. The intensive communication and trade between Ancient Greek city-states from the 6th to the 4th century BCE facilitated the diffusion of coins throughout the Greek world (Schaps, 2014). We expected coin designs to become less informative about their issuing authority with time, and to become more informative about their denomination. We also expected the designs to be more informative about the lower denominations: the production of small coins was prone to errors, for which the designs could be used to compensate (Bresson, 2006).

We measured the informational value of coin designs using conditional entropy (Shannon, 1948). The results show that coin designs do become more informative about the denominations with time, but they also become more informative about the authorities.

One possible cause for this trend is that coin designs became more differentiated through time, without becoming more organized to reflect authorities or denominations. Contrary to what we expected, the coin designs seem to be more informative about higher denominations than the lower ones. We attribute this to the fact that value discrepancies are more important between higher denominations than between lower denominations, leading to a pressure to identify high-value coins.

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The Success of the Shortest Literary Forms: Why Did Poetry Become Small?

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The paper studies long-term changes in the length of Russian poetry (1750–1921) to reveal the relation of poem length (counted in lines) to a poetic form and its evolution. Computations were based on the data of 45,000 poems from National Corpus of Russian Language (ruscorpora.ru/search-poetic.html). The research has shown a notable decrease in the mean and median poetry lengths during the 19th century. On the figure below the clear decline could be seen even when the corpus is limited to rather „smaller" poems of 5–50

lines. Shorter text were filtered from observation because they constitute traditionally small poetic genres like epitaph, epigram or inscription.

This decrease is followed by the decline in length diversity, which resulted in short poems (8–20 lines) overpopulating the literature during the age of Modernism. We argue that this transformation towards the short (predominantly lyrical) form could be understood in the general framework of cultural evolution and „environmental" literary pressures: Russian poetry (and arguably other European poetry traditions) struggled to keep its literary niche, while being continuously under the pressure of successful large narratives of the 19th century. Therefore, it was forced to develop complexity while being highly constrained formally (accentual-syllabic verse and rhyme maintained for a long time) by the shrunk length of a lyrical poem. We also argue that similar processes could be noticed in other European literary traditions (based on Chech and English poetry datasets).
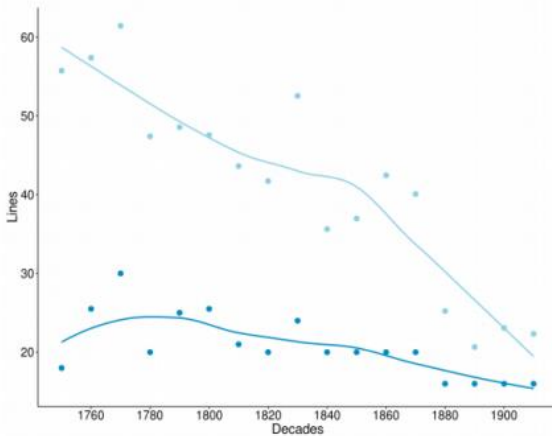
Measuring the 'Epification' of Drama

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This paper is a quantitative research on the evolution of dramatic texts since the 1740s to the first quarter of the 20th century. Using our TEI-encoded corpus of plays [Fischer et al. 2017], we analyze the changes in length and linguistic composition of stage directions. These changes, in our view, reflect the general 'epification' of drama – a process that later culminates with the emergence of Brecht's 'epic theatre'.

"A stage direction can be detailed and evocative <...> More typically, however, is direction that lacks specific details but instead invokes a formula where the implementation of the onstage effect is left to the players or to the imagination of a reader" [Dessen 2011]. When one reads a play from the 18th or early 19th century, she or he may not even notice stage directions at all. They are usually short and purely technical: 'characters A and B', 'enter character A', 'leave character B' etc. However, as new types of drama evolve, stage directions become more elaborate (see Fig. 1) and content-rich, turning into a significant part of the dramatic narrative. Some examples from our corpus include 'The Puppet Show' by Blok, 'Gondla' by Gumilev and 'Jubilee' by Chekhov.
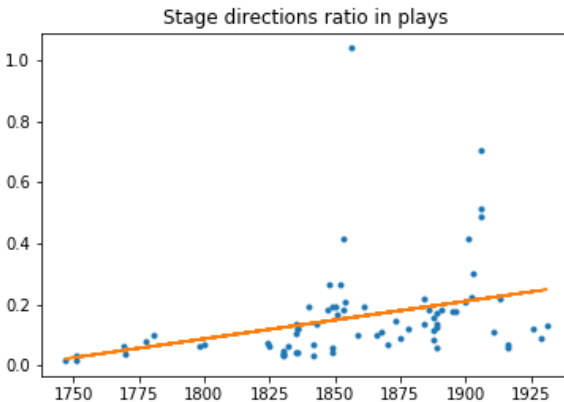

Figure 1

Much like Moretti in his study on the evolution of novelistic titles [Moretti 2009], we made an attempt to quantify and measure these changes in dramatic texts. We implemented some simple measures, such as the overall ratio of stage directions (in words) to the total length of the play, the share of verbs in stage directions (a marker of narrative text), and the total number of unique verbs in them.

As one can see from figures 1–3, all measures show steady increase over time. And though the dependency is not strictly linear,
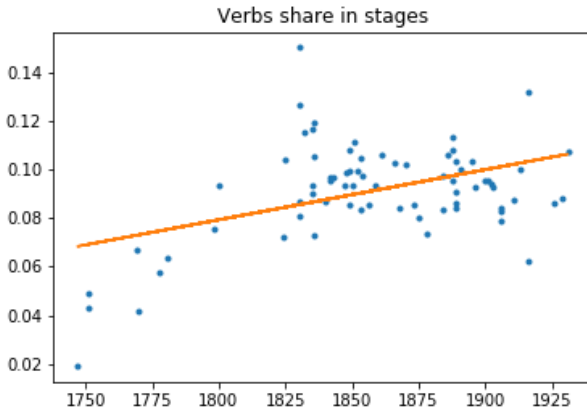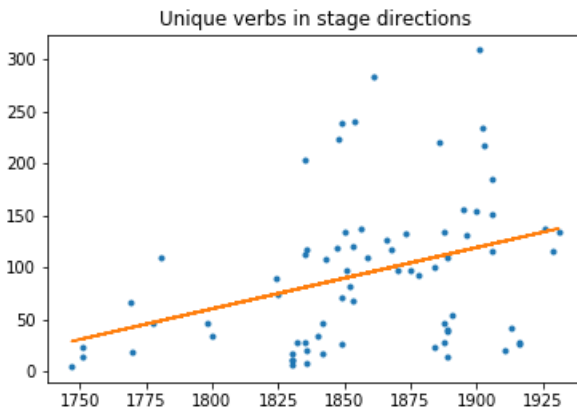

Figure 2

Figure 3

we can certainly claim that no play in the 18th or early 19th century has traits of 'epification' in it.

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Films Become More Complex: Three Case Studies

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Does art become more complex over time? Is Stephen King more complex than Leo Tolstoy, and Beckett more complex than Shakespeare? In general, the question of progress in arts has been a controversial topic in arts research, and the (silent) consensus is that no, there is no progress. In this paper, we intend to empirically demonstrate three cases where there is a clear progress in film history.

In cultural evolution, complexity has been considered in relation to cumulative cultural evolution: through the retention of beneficial traits, culture can become more complex or better fit to its functions (Caldwell et al. 2016). Cumulative culture has been found a hallmark of human culture in areas where progress is easy to notice, for example technologies (Kline & Boyd 2010) or institutions (Turchin et al. 2017). However the relevance of cumulative culture for arts remains to be more closely scrutinized.

We will present three case studies on the evolution of complexity of films. Over the course of the 20th century (1) films on average tend to include a greater number of shots - due to the shortening of average shot length; (2) film production crews for popular films became much larger and obtained a more complex hierarchical structure. (3) During the 1970s–2000s popular American mystery films obtained a more complex temporal structure - with more

flashbacks and flashforwards, as well as more "timelines": individual stories located in different points of time.

These results indicate that at least for some areas of art, cumulative cultural evolution can prove a relevant and a productive research topic. Not only films, but also other arts could grow in complexity, although the exact areas where this "progress" is happening are yet to be discovered in further research.

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"The Dipherpox Controversy": The Cultural Evolution of a Vaccine-Related Narrative and Its Influence in Vaccine Decisions

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Although vaccines have been enormously successful in controlling infectious diseases, vaccination has often been the subject of controversy. The origins of vaccine controversies are often the claims of some parents and some medical experts who are convinced that vaccines have seriously harmful outcomes (e.g. brain damage). These controversies often negatively affect the rates of vaccination coverage, which, in turn, lead to outbreaks of infectious diseases. The present study experimentally simulated the cultural evolution of a vaccine controversy using a transmission chain paradigm. Participants (*N*=64) were exposed to positive and negative views regarding a vaccine for a fictional disease ("dipherpox") which were held by either a parent or a doctor. Participants recalled this

information and their recall were transmitted along chains of 4 generations. Participants were also asked whether they would be willing to vaccinate against dipherpox or not. The personal experience-based view held by the parent was better transmitted than the expertise-based view held by the doctor. Importantly, the transmission advantage for the information attributed to the parent did not interact with their stand on the controversy (pro-vaccine vs anti-vaccine). Moreover, the exposure to the controversy caused a considerable number of participants (39%) with neutral or positive attitudes towards vaccination to decide not to vaccinate. People with neutral or slightly positive attitudes towards vaccination were more likely to decide not to vaccine. The present findings have consequences for vaccination campaigns, suggesting that vaccination campaigns may be more effective by including personal experiences about the diseases vaccines prevent. The results also provide further support for an emotional bias in cultural transmission but suggest that this is true of both positive and negative content.

Social Learning of Knowledge Representations in Wikipedia

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Recorded history knows many attempts to gather and systematize knowledge to represent it in an efficient and accessible way, ranging from historical chronicles through enlightenment encyclopedias to online discussion boards. Typically, this efficiency is found in describing similar phenomena in similar terms: standardization of representations follow the expectations of an experienced reader and gradually better and more effective ways to represent the phenomena may be found.

We investigate the degree of standardization of knowledge representations in the edit history of Wikipedia and the potential role of social learning in supporting it. Particularly, we consider the aspects covered in Wikipedia articles as represented by their section headers. For example, the article on platypus has sections on "Description", "Evolution", "Conservation", as well as "Venom" and

"Electrolocation". Other animals are likely to include also the first three, while "Venom" can be expected only for venomous animals.

We analyse the prevalence of different headers in a custom multilingual corpus in Wikipedias of 13 different languages with more than 4,000 active contributors of articles on ~9000 biological species that are present in at least 20 languages. We found that over time articles come to share more headers, particularly so within their respective categories. This can be seen as a pattern of standardization – however, this pattern can be detected to a different degree in the different Wikipedias (e.g. German around 2x more than English).

We also estimate the explanatory value of different social learning mechanisms in the process, through which the choice of headers in a new article may be dependent on the prevalence of headers in the existing population. We contrast the mechanisms of simple copying, popularity bias, prestige bias, recency bias and a time-invariant content bias. While they all provide a fairly good match due to equifinality and correlations between measures, simple copying seems to provide the best approximation in this case.

The Evolution of Disease Narratives in Italy and Western World: How People Keep on Reacting to Danger with Stories

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This poster presentation will cover narratives sometimes used and spread orally in cases of urgency and danger, real or perceived, about widespread and/or epidemic diseases. I will focus mainly on some historical cases in which forms of narrative beliefs, legends, tall stories and hoaxes are often told and used with the purpose of public prevention (despite the scientific inaccuracy of these kind of narratives). The country I will mostly focus on will be Italy, due to its long historical and even literary tradition about the topic (let's just think about *Storia della colonna infame*, 1840, by Alessandro Manzoni or the widespread belief about Jews poisoning wells) and my own knowledge of the sources in that context.

Moreover, this poster presentation will show how these different narratives evolved in the Modern and Contemporary Age, passing from brief and explosive forms of mass hysteria to complex and long term tales and beliefs in recent times, helped also by change in communication and in issues publicly perceived as urgent: above all, the internet has had a dramatic impact on people's narratives

about illness in Western countries, bringing them for instance to spread fake news and statistics about Ebola virus possibly brought by African immigrants, or to enforce on the web some forms of non-conventional medicine (anti-vaccination, simple and scientifically rejected therapies against cancer and so on); I will hence briefly analyse these cases.

Many examples like these show how technology changed the way of creating and sharing these narratives, and this presentation is aimed to underline this point. This change is intended obviously as a problematic form of cultural evolution in folk narratives, requiring new political strategies and solutions.

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Changes in Adaptation Dynamics in Systems with Non-particulate Inheritance

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Cultural change is mostly modelled as a competition between discontinuous particulate traits and their subsequent abundance in population. This approach is, however, insufficient as many traits transmitted through social learning are of non-particulate nature.

The non-particulate inheritance was originally simulated by Galton-Pearson model which is characterized by uniform transmission error which allows individual cultural "offspring" to differ from the mean of cultural "parents". However, the uniform transmission error is problematic as it unrealistically assumes uniform distribution of "offspring" independent of the variability of influential individuals.

Here, we present an alternative non-particulate inheritance model, where the cultural "offspring" are still distributed around "parental" average but the transmission error is a function of the difference between parental individuals. That means that higher variability of influential individuals leads to more variable cultural "offspring" and model thus approximates inheritance based on social learning more realistically.

The results of computer simulations show that the current model, despite its simplicity, can lead to two stable states: successful adaptation and variability loss. The process of adaptation usually contains long period of relative stasis and shorter periods of quick change in populational mean. On average 30.2% (SD=10%) of transgenerational changes in populational mean were responsible for 80% of total transition from the initial populational mean to the optimum. The average correlation between subsequent changes in populational mean was .91. This adaptation dynamics resembles a well-known pattern of punctuated equilibria. The punctuated character of the evolution was most apparent in small populations with weak selection and variable offspring.

Cultural Evolution in Wikipedia: A Case Study in the Evolution of Social Epistemology

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In the presentation, some features of the development of social epistemology in the context of modern Western encyclopedia tradition will be examined, focusing on Wikipedia as an important part of the epistemological infrastructure of our society. Nearly as long as modern science itself has been one of the fundamental traditions shaping our society, being one of its main epistemological means, encyclopedias of our modern Western tradition have been a relevant part of the ecosystem of science, providing epistemological tools for the society at large, filtering scientific knowledge into formats more accessible for the general population. With the rise of technologies for decentralized real-time communication brought along by the Internet, traditional encyclopedia model has gone through a rebirth into new, more dynamic and competitive model of online encyclopedias created and developed by grassroots initiative, as epitomized by Wikipedia.

Along with the case study, covering some of the encyclopedia articles concerning cultural evolution, certain mechanisms will be explained that induce and facilitate the competition, merging, and diversification of different perspectives, cultural traditions, and paradigms on Wikipedia, creating a rich system of knowledge ecology. Through its powerful dynamism. this knowledge ecology has brought to the foreground the processes of evolutionary development of human knowledge that, for most cases at least, were already present in the traditional encyclopedia model yet were less noticeable due to their slower rate and the according lower competitive pressure.

Finally, some trends will be discussed that have revealed itself during the development of Wikipedia in last decades and might allow us some insight in the potential futures of our social epistemology. The factors influencing those include different epistemological approaches both within and contrasting to Western scientific tradition (cf. different interpretations of *indigenous knowledge*), as well as current social developments (partly

summarized by keywords like *post-truth* and *postcolonialism*), predictable technological advances (from augmented reality to censorship machines), and the inner trends of the global Wikimedia community.

Compression Effects in the Cultural Evolution of the Vai Script of West Africa

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As a potential mechanism for change in human culture, the effects of social transmission have been fruitfully explored using diffusion chain experiments (e.g., Bartlett, 1932; Kirby, Cornish, & Smith, 2008). In the simplest version of this task, an individual produces a behaviour, and this behaviour becomes the input for a second individual who in turn produces the input for a third individual, and so on. A robust finding across these experiments is that behaviours become optimised for efficiency in terms of information storage, retrieval, and reproduction by human agents, resulting in a set of behaviours which are more compressed than their ancestral forms (Tamariz & Kirby, 2015).

It is tempting to argue that these compression effects are at work in the evolution of writing systems (Garrod, Fay, Lee, Oberlander, & MacLeod, 2007). However, there are two issues in generalising from diffusion chain experiments to real-world scripts. First, other than anecdotal evidence, we do not know if attested writing systems are becoming increasingly compressed over time. Second, the task constraints in these experiments are of questionable ecological validity when compared to the real-world constraints of learning and using writing.

To address these concerns, we test for the effects of compression on Vai: an emergent writing system from Liberia created by non-literate individuals (Tykhostup & Kelly 2018). What makes Vai special is that the script has been independently documented on fifteen separate occasions between 1834 and 2005. By measuring

the algorithmic and perimetric complexity of the Vai characters, our study predicted and found that: (i) Overall visual complexity decreases over time; (ii) The complexity of characters with higher visual complexity decrease more than characters with initially low visual complexity; (iii) Variance in complexity among characters decreases with successive versions of the script. Together, our findings provide real-world evidence for the idea that compression effects are at work in the cultural evolution of writing systems.

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A Bibliometric Analysis of the Interdisciplinary Field of Cultural Evolution

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The science of cultural evolution is a particularly interdisciplinary endeavor that has captivated researchers from a variety of disciplines. This emerging field is unified in its application of evolutionary logic to socially transmitted behavior, but diverse in methodologies and assumptions. Qualitative reviews of the subject demonstrate an effort to integrate cultural evolutionary studies by illuminating points of divergence and fostering interaction. This effort would be greatly enhanced by quantitative data on patterns of collaboration and idea sharing as represented in the literature. In

the present study, we apply a novel combination of VOS mapping and bibliometric analyses to an extensive dataset of publications on cultural evolution, in order to represent the structure of the field and evaluate the level of disciplinary integration. We first construct a co-authorship network and identify clusters of collaborators, which we consider as proxies for subdisciplines. We then use bibliometric analyses to describe each cluster and investigate overall trends in collaboration and productivity. Lastly, we assess the topographical distance and degree of citation sharing between clusters, and generate science overlay maps to evaluate the diversity of subject categories within clusters. Our results reveal an increase in productivity and collaboration over time, albeit a higher inequality in author productivity than expected. Our structural approach reveals research subcommunities with differential levels of integration, citation sharing, and subject diversity. These findings confirm the emergence of a vigorous and growing interdisciplinary field, and indicate ways to drive targeted efforts to foster integration and synthesis in the study of cultural evolution.

The Cultural Transmission of Sampling Traditions in a Network of Musical Collaborators

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The role that demographic variables play in biasing cultural transmission remains one of the most critical questions in the field of cultural evolution. Network-based diffusion analysis (NBDA) is a recently developed statistical tool used to determine whether network structure biases the emergence of a novel behavior in a population. As NBDA is most useful in identifying social learning, a trait that is assumed to be present in our own species, it has been primarily applied to non-human animal models such as birds, whales, and primates. Despite this, the ability to include demographic variables in NBDA makes it uniquely suited to determining what factors bias information diffusion more broadly. The aim of the current study was to determine what demographic variables bias the diffusion of a sample through a network of musical

collaborators, utilizing an extensive dataset mined from crowd-sourced, online databases. Sampling, or the adaptation and recycling of recorded material in a musical composition, is a nearly ubiquitous practice among hip-hop and electronic music producers. It provides an ideal research model for this question because of (1) the high copy fidelity of sampled material, (2) the reliable documentation of transmission events, and (3) the availability of demographic data for the artists involved. We conducted a case study of all documented transmission events involving "Amen, Brother" by The Winstons, which is thought to be the most sampled song of all time. We found that first-time sample usage was biased by the structure of the collaboration network, and that transmission was influenced by the sex and geographic location of the artists involved. These findings further illustrate the role that demographic variables play in biasing cultural transmission, and lay the methodological groundwork for future studies utilizing large datasets mined from the internet.