Cultural Evolution
Society Conference 2021
Sappro

Abstracts

Plenary talk 1

Domestication and cultural evolution of complex songs in Bengalese finches

Speaker: Kazuo Okanoya

Moderator: Masanori Takezawa

Bio: 1983 BA in Psychology, Faculty of Letters, Keio University, JAPAN. 1989 Ph.D. in Biopsychology, Graduate School of Psychology, University of Maryland, USA. 1994 Associate Professor, Department of Cognitive and Information Sciences, Chiba University, JAPAN. 2004 Lab Head, Biolinguistics, Riken Brain Science Institute, JAPAN 2010 Professor, Cognitive and Behavioral Sciences, The University of Tokyo, JAPAN.

Abstract: Bengalese finches (BF) had been domesticated from wild White-Rumped Munias (WRM) for more than 260 years. During these years, WRMs were selected for parental behavior and white plumages. But not only those, their courtship songs distinctively changed although there is no record for artificial selection. While WRMs sing song syllables in a strict sequence, BFs sing syllables in more variable sequences. We believe song sequential complexity evolved based on two factors. One is behavioral plasticity developed under domestication that increased social tolerance. The other is indirect sexual selection by females, meaning that reproductive effort is paid more by a female when paired with a complex song singer. These two factors prepared the basis of culturally evolving complex songs in BFs. To support this, evidence for domestication syndrome in Bengalese finches will be presented.

Plenary talk 2

WEIRD Minds

Speaker: Joe Henrich

Moderator: Patrick Savage

Bio: Dr. Henrich is currently a Harvard Professor and Chair of the Department of Human Evolutionary Biology. Before moving to Harvard, he was a professor of both Economics and Psychology at the University of British Columbia for nearly a decade, where he held the Canada Research Chair in Culture, Cognition and Coevolution. In 2013-14, Dr. Henrich held the Peter and Charlotte Schoenenfeld Faculty Fellowship at NYU's Stern School of Business. His research deploys evolutionary theory to understand how human psychology gives rise to cultural evolution and how this has shaped our species' genetic evolution. Using insights generated from this approach, Professor Henrich has explored a variety of topics, including economic decision-making, social norms, fairness, religion, marriage, prestige, cooperation and innovation. He's conducted long-term anthropological fieldwork in Peru, Chile and in the South Pacific, as well as having spearheaded several large comparative projects. In 2016, he published The Secret of Our Success (Princeton) and in 2020, The WEIRDest People in the World: How the West became psychologically peculiar and particularly prosperous (FSG).

Abstract: Over the last few decades, a growing body of research has revealed not only substantial global variation along several important psychological dimensions, but also that people from societies that are Western, Educated, Industrialized, Rich and Democratic (WEIRD) are particularly unusual, often anchoring the ends of global psychological distributions. To explain these patterns, I'll first show

how the most fundamental of human institutions—those governing marriage and the family—influence our motivations, perceptions, intuitions and emotions. Then, to explain the peculiar trajectory of European societies over the last two millennium, I lay out how one particular branch of Christianity systematically dismantled the intensive kin-based institutions in much of Latin Christendom, thereby altering people's psychology and opening the door to the proliferation of new institutional forms, including voluntary associations (charter towns, universities and guilds), impersonal markets, individualistic religions and representative governments. In light of these findings, I close by arguing that the anthropological, psychological and economic sciences should transform into a unified evolutionary approach that considers not only how human nature influences our behavior and societies but also how the resulting institutions, technologies and languages subsequently shape our minds.

Plenary talk 3

The Cultural Evolution of Reproduction

Speaker: Heidi Colleran

Moderator: Rachel Kendal

Bio: I am an anthropologist working at the intersection of socio-cultural anthropology, demography and cultural evolution. My main area of interest is the relationship between reproductive behaviour, culture, and population dynamics. I also collaborate with colleagues in linguistics, genetics, archaeology, psychology and political science. My work combines approaches from the humanities and social sciences and tries to bridge gaps between micro and macro levels of analysis. I maintain two interdisciplinary field projects in rural Poland and Vanuatu. I lead the BirthRites independent Max Planck Research Group at the Max Planck Institute for Evolutionary Anthropology in Leipzig, which focuses on the anthropology of reproduction and its implications for evolution and demography.

Abstract: TBA

Plenary talk 4

The evolution of cultural transmission

Speaker: Marcus Feldman

Moderator: Yasuo Ihara

Bio: Marcus Feldman, Ph.D., is the Wohlford Professor of Biology at Stanford University and External Professor at the Santa Fe Institute. He directs the Morrison Institute for Population and Resource Studies and is co-director of Stanford's Center for Computational, Evolutionary and Human Genomics. Feldman's specific areas of research include the evolution of complex genetic systems that can undergo both natural selection and recombination, the evolution of modern humans using models for the dynamics of molecular polymorphisms, especially DNA variants, cultural evolution, and the evolution of learning as one interface between modern methods in artificial intelligence and models of biological processes, including communication. He is the author of more than 670 scientific papers and ten books on evolution, ecology, mathematical biology, demography, and cultural evolution. He is a member of the U.S. National Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society. He was the 2011 Dan David laureate in Evolution and was awarded the 2016 Kimura Prize in Evolution by the Japanese Suzuki Foundation.

Abstract: Almost all theoretical treatment of cultural transmission and evolution include assumptions that rate parameters are fixed values. I will discuss two aspects of this assumption. The first is how we can model the evolution of such fixed transmission parameters over time, which addresses the kinds of cultural transmission that may be expected to become stronger, and how this expectation interacts with the strength of selection. The second concerns how the theory changes if, rather than being fixed

parameters, rates of cultural transmission, especially the degree of conformity, are random variables that change stochastically over time.

Plenary talk 5

Genetic insights into language change

Speaker: Brigitte Pakendorf

Moderator: Hiromi Matsumae

Bio: Brigitte Pakendorf is a senior scientist ("directrice de recherche") at the French National Centre for Scientific Research (CNRS). Holding PhD degrees in both Molecular Anthropology and Linguistics, she led a multidisciplinary Max Planck Research Group at the MPI for Evolutionary Anthropology in Leipzig, Germany, before joining the CNRS unit "Dynamique du Langage" in Lyon in 2012. Her research focusses on the documentation of the Tungusic languages Even and Negidal, on language contact in Siberia, as well as on the interdisciplinary investigation of population history.

Abstract: Language evolution takes place both through internally motivated changes, such as independent innovations after a split of the speaker community, and through externally motivated changes induced by contact with other languages. Such changes can be triggered or enhanced through language-independent factors such as migrations or the small size of the speaker community. A better understanding of the prehistory of speaker communities is thus important for our understanding of how languages evolve. As will be illustrated with several case studies from around the world, genetic studies can provide important insights into population history and can thus help elucidate the different factors that underlie linguistic change.

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Apparently complex re-combinative culture can arise from simple mechanisms in wild birds

There is growing evidence that non-human animals are capable of cultural evolution. The cultural evolution of efficiency recently observed in some non-human animals has led some authors to further suggest that such species have simple forms of cumulative culture, with cultural traits becoming more refined over generations. Yet few examples exist of animal cultures showing corresponding increases in complexity. Here we experimentally test whether tits (Parus major) are able to recombine socially-learned foraging skills to solve a two-step problem, and whether these complex cultural traits can be socially transmitted and inherited. Previously, we established traditions for pushing left or right to solve a "sliding-door puzzle". Here we introduce and track the spread of a second two-action puzzle in these same populations, the "dial puzzle", before introducing a two-step foraging task linking these two behaviours into 8 possible solving combinations. A second generation was then exposed to the complex foraging task without any prior experience. Our results showed that birds skilled in both components were fastest to solve the two-step task, but knowledge of one component was also sufficient. Birds often inverted the solve order while remaining faithful to component variants, suggesting that they were flexibly combining individual components. Fully naïve birds in both generations were also able to learn the complex task, however network-based diffusion analysis suggested that birds were socially learning one component and asocially learning to reconstruct the rest of the behaviour. Altogether, we reveal that apparently complex recombinative culture can be reconstructed via simple learning processes in great tits.

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Serial Reproduction of Narratives: Happiness and Sadness Survive While Coherence Suffers

We conducted the largest multiple-iteration retelling study to date with two different studies that 1) test how happiness and sadness are transmitted across retellings, using participant-generated stories and 2) make an exploratory comparison between the transmission of happiness and sadness and disgust, risk, embarrassment, using researcher-generated stories. We recruited 12,840 participants and examined data from 19,086 retellings over three iterations. Using a novel Bayesian model that tracks changes over multiple retellings, both studies reach the conclusion that retelling preserves the story's degree of happiness and sadness with a high degree of precision, even when length shrinks and aspects of story coherence and rationalization deteriorate. This finding partly goes against Bartlett's (1932) influential work that stresses increased rationalization in serial reproduction. Our exploratory comparative study found that embarrassment is also well transmitted, while disgust and risk were poorly transmitted. We propose a story-emotion model of retelling. We suggest that in a happy or sad story, people process the story by encapsulating the events and details into an overall story emotion. In retelling, the recalled story emotion provides the starting point for reconstruction and guides the selection, invention, assembly, and ordering of the story elements. Hence, we posit that thematic or story emotions, especially happiness and sadness, operate as anchors for remembering and retelling stories.

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Biases or balancing act? Investigating the flexibility of conformity

Conformity has been defined as a bias to copy the majority. This definition may not match recent research suggesting that social-learning strategies flexibly guide who, what and when to copy. This study therefore investigates the flexibility of frequency-dependent social-learning strategies across 3 domains: when learning asocial skills, social norms and cooperation. 316 participants played an economic game with a payoff matrix designed to imitate the learning of either asocial skills, social norms or cooperative norms. Participants saw the choices made by a group who had previously played the games. We investigated whether the participant would adjust to this frequency-dependent social information based on (i) whether the group learned a similar or different game-type to the participant and (ii) the reliability of this similarity information. The similarity information could be reliably correct, uninformative, or reliably incorrect. This range reflects instances when traits suggesting similarity on observable traits may not predict who is actually similar to oneself on unobservable traits. The participants adjusted their frequency-dependent social-learning strategies to both the similarity and reliability information when learning an asocial skill and a social norm, though performed better when learning from reliably similar others. The participants adjusted more to similar others when learning to cooperate, which suggests a strong in-group preference when learning cooperative norms. Together, these results contrast the view that conformist learners are biased to 'always follow the majority' and instead suggests that the decision to conform remains flexible to various social cues about who we may be conforming to.

Q&A session 01

Day1-A1

Social learning

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Hybrid social learning in human-algorithm cultural transmission

In cultural evolution, solutions have always been found by humans and transmitted to other humans. Advances in artificial intelligence have created systems that appear to bypass human cultural evolution. AlphaZero beat Go masters without learning from human play. Consequently, the behavior demonstrated by such algorithms can avoid the biases shown by humans and maintained via social learning. In this work, we explore the hypothesis that humans can learn novel strategies from algorithms via social learning and that these strategies can be further culturally transmitted to other humans.

We ran a preregistered online transmission chain experiment where we mix human and machine players and measure the performance of human-only and hybrid chains. We use a planning task where humans are known to show a suboptimal decision strategy. Participants solved the task in chains, with each participant seeing the solution of the previous participants. In half of the chains, we replaced a single participant with an algorithm that used a strategy opposite to humans. We found that people immediately playing after the algorithm benefited from it, but people further down the chain reversed back to their biased strategy and lost what was gained via hybrid social learning. We discuss the boundaries of successful hybrid social learning and the possible mechanisms behind our findings.

We address with this work a novel hypothesis in cultural evolution, namely that artificial agents can actively contribute to the discovery of new solutions and we present transmission chains as a tool to investigate hybrid cultural transmission.

Q&A session 01

Day1-A1

Social learning

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Cultural evolution of football tactics: strategic social learning in managers' choice of formation

In order to adaptively solve complex problems or make difficult decisions, people must strategically combine personal information acquired directly from experience (individual learning) and social information acquired from others (social learning). The game of football (soccer) provides extensive real world data with which to quantify this strategic information use. I analyse a 5-year dataset of all games (n = 9127, 2012–2017) in five top European leagues to quantify the extent to which a manager's initial formation is guided by their personal past use or success with that formation, or other managers' use or success with that formation. I focus on the 4231 formation, the dominant formation during this period. As predicted, a manager's choice of whether to use 4231 is influenced by both their recent use of 4231 (personal information) and the use of 4231 in the entire population of managers in that division (social information). Against expectations, managers relied more on personal than social information, although this estimate was highly variable across managers and divisions. Finally, there did not appear to be an adaptive tradeoff between social and personal information use, with the relative reliance on each failing to predict managerial success.

Q&A session 02
Day1-B1
Music 1

Eita Nakamura (eita.nakamura@i.kyoto-u.ac.jp, Kyoto University)

Statistical-learning-based model of cultural evolution and conjugate distribution laws in music data

We report some distribution laws found in music data and a model of cultural evolution that can explain an origin of these laws. Whereas studies on cultural evolution often assume simple processes of reproduction and mutation, studies in information and cognitive sciences have indicated that many cultural traits characterizing intelligent behaviors, such as styles of music creation, are transmitted over generations through stochastic data production and statistical learning. The purpose of this study is to mathematically understand how the distributions of cultural traits evolve by this transmission process.

First, we analyze several large datasets of melodies created in different societies. We found that the distributions of various statistics characterizing music styles follow the beta or gamma distribution. Interestingly, these distributions have only a few adjustable parameters, which can parameterize both prior and posterior distributions of the analyzed statistics; such distributions are called "conjugate distributions".

Next, we study a dynamical system model where individuals produce data by a statistical model and learn its parameters from past data. We analytically show that, for a large class of data production models, conjugate distributions emerge at equilibrium in the presence of oblique transmission, suggesting that they can appear ubiquitously in cultural data. The results highlight how the individual's model for cultural production determines the trait distribution form within a population. As applications of the theory, we show how one can improve the accuracy of estimating trait distributions from small-size data and how the model can describe the evolution of features in historical music data.

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Musical diversity within and between societies in India

The degree of musical diversity within and between societies is a topic of long-standing debate. Alan Lomax's Cantometrics project made it possible to quantitatively analyse the musical features of cross-cultural societies through 37 standardized musical features (nasality, text repetition, rhythm, tonal blend, etc). The Cantometrics database provides the opportunity to look into the variation in traditional Indian vocal music using these Cantometric features for 207 traditional songs from 32 Indian societies. Principal Component Analysis identifies vocal complexity as the primary factor shaping musical variation in India, consistent with Lomax's previous findings in global variation. Using the AMOVA (Analyses of Molecular Variance) framework, we find only minor musical differences (~1% to ~5% of variation) on average between speakers of different language families (Indo-European, Dravidian, and Austro-Asiatic), but greater variation (11% to ~25%) between societies within language families , This supports previous findings of greater diversity within than between societies, and contributes to debates about the evolution of diversity in music and other forms of culture. Our study also highlightshow quantitative analysis can be strengthened by observations from musicians with direct experience of local traditions and applied to local/regional questions in cultural evolution.

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Sight vs. sound in the judgment of music performance: evidence from Tsugaru shamisen competitions in Japan

How do visual and sound modalities affect the selection of cultural traits? Previous studies of sight vs. sound effects in music have focused only on Western musical instruments and musicians, with somewhat inconclusive results (Tsay, 2013; Mehr et al., 2018). We aim to generalize research beyond Western subjects by focusing on the Tsugaru shamisen, a traditional Japanese musical instrument. We aimed to match the original experimental paradigms of Tsay (2013) and Mehr et al. (2018) as closely as possible. We selected three categories in each of three Tsugaru Shamisen National Competitions, and evenly divided nine categories in total into audio-only, visual-only and audiovisual. The stimuli used in this experiment are 6s and 12s excerpts of- Tsugaru Jyongara Bushi, which is famous among Tsugaru shamisen players. Participants watch and/or listen to three performances by performers who placed 1st, 2nd, and in the bottom of a given category and judge which one of the three they believed would have won or lost the competition. Pilot experiments (n=8 participants) also show inconclusive results, with ~30-70% accuracy rates with only auditory information and ~30-50% accuracy rates with only visual information. These preliminary results differ from both Tsay's and Mehr et al.'s, and may indicate possible cross-cultural influences of genres and instruments on judgment of visual or auditory information. We will preregister these predictions and collect full data for high-powered testing. Our results may enhance our understanding of the cross-cultural generality of the role of auditory and visual information in evaluation and selection of musical performance.

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Music and sociality: Global analyses of solo vs. group singing

Music is a universal interactive technology intimately related to social life. A major source of diversity in music performance globally is its vocal organisation, ranging from unaccompanied solo singing to interlocked polyphony. Understanding this variation has implications for two major questions about music. First, is music better understood as a display signal or as an affiliative interaction? Second, does vocal organisation reflect social structure (e.g. hierarchical structures reflected by more solo singing), or is it derived from the social context of the performance (e.g religious rituals, mourning, healing)? We study these hypotheses using The Natural History of Song corpora, which contain 4,709 ethnographic descriptions and 118 audio recordings of song performance from 60 and 86 societies respectively (Mehr et al. 2019). We evaluate:

1. The relative prevalence of solo and group performance worldwide

2. The influence of vocal organisation on musical form

3. Whether variation is greater within or between societies

4. To what extent is variation explained by shared social contexts or, alternately, by differences in social organisation

Our analysis can inform longstanding debates about the nature of music, its evolution, and its functional role in society.

Aniruddh Patel (a.patel@tufts.edu, Department of Psychology, Tufts University)

Accounting for cross-cultural variation in collective music-making: why is music a solo performance in some traditional cultures?

Prominent theories of the evolution of human musicality have argued for the importance of collective, synchronous music-making, e.g., in social bonding or in advertising coalition strength to other groups (e.g., Savage et al., in press, Mehr et al., in press, Behavioral and Brain Sciences.) Yet these theories have not addressed the fact that there are traditional cultures (including hunter-gatherer groups) where this type of musical behavior is rare or absent, and in which music-making is primarily a solo behavior. Why is collective, synchronous music prominent in some cultures but largely absent in others? We recently offered three hypotheses to account for this variation (Patel & Von Reuden, in press, Behavioral & Brain Sciences): 1) Music-making is less likely to be collective where there is less collective action in general; 2) Music-making is less likely to be collective where it is a principal means of conveying expert knowledge or individual accomplishment; 3) The adoption of certain musical styles (e.g., timbre-based music) can constrain subsequent adoption of collective music-making. We have begun gathering information on cultures that emphasize solo music-making in order to test these hypotheses. This presentation will focus on methodological issues which need to be addressed in coding these data, including the challenge of categorizing different types of collectivity in music-making, as there are numerous types of coordination between individuals during musical activities across traditional cultures.

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Coevolution of religious and political authority in Austronesian societies

Authority, an institutionalized form of social power, played an essential role in the evolution of large-scale societies during the Holocene. Religious and political authority both have deep histories in human societies, but the nature of their relationship is contested. We purpose-built an ethnographic dataset of 97 Austronesian societies and used phylogenetic methods to address two longstanding questions about the evolution of religious and political authority: firstly how and to what extent these two institutions have co-evolved, and secondly the order in which more differentiated and less differentiated systems of religious and political authority have tended to evolve. We found very strong evidence for mutual interdependence between religious and political authority, as well as evidence against a progression from more differentiated to less differentiated systems of religious and political authority. Our results provide insight into how political and religious authority have worked synergistically to drive the evolution of large-scale societies.

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Magic and empiricism in early Chinese rainmaking: A cultural evolutionary analysis

Ritual protocols aimed at rainmaking have been a recurrent sociocultural phenomenon across societies and throughout history. Given the fact that such protocols were likely entirely ineffective, why did such they repeatedly emerge and persist, sometimes over millennia even in populations with writing and record keeping? To address this puzzle, many scholars have argued that these protocols were not instrumental at all, and that their practitioners were not really endeavoring to employ them in order to bring about rain. Here, taking advantage of the wealth of historical records available in China, we argue to the contrary: that rainmaking is best viewed as an instrumental, means-end activity, and that people have always placed strong emphasis on the outcomes of such activities. To account for persistence of rainmaking, we then present a set of cultural evolutionary explanations, rooted in human psychology, that can explain why people's adaptive learning processes did not result in the elimination of ineffective rainmaking methods. We suggest that a commitment to a supernatural worldview provides theoretical support for the plausibility of various rainmaking methods, and people often over-estimate the efficacy of the rainmaking technologies because of statistical artefacts (some methods appear effective simply by chance) and under-reporting of disconfirmatory evidence (failures of rainmaking not reported/transmitted).

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Ritual Evolution in Pama-Nyungan Australia

Ritual is present in all societies and plays a pivotal role in many. Its universality and importance, together with uncertain benefits, means it has long been a subject of interest to anthropologists. This study contributes to this field through a comparative examination of ritual in Pama-Nyungan Australia using phylogenetic methods. The documented language expansion of these societies, and the role ritual may have played in this, make them a particularly relevant case study for analysis. 90 traits were analysed from around 100 societies for three ritual forms important in Australian life: initiation, mortuary practice and rock motifs.

The key findings were, firstly, cultural inheritance had a significant influence on initiation and rock motif variation, but less effect on mortuary practice. Secondly, costly initiation rites were particularly associated with linguistic diversity, suggesting a possible role in Pama-Nyungan language expansion. Thirdly, there was a clear association between such rites and the occupation of desert habitats. Whilst these may have facilitated closer within-group alliances (theorised by a number of authors) contextual analysis did not indicate collective practices such as food sharing or warfare were particularly different in desert societies. What did appear different was the presence of a greater volume and complexity of mythical-geographic knowledge. Such knowledge is particularly important to those inhabiting the Australian desert, providing information on routes between water sources and productive foraging grounds. Traumatic rites may result in prolonged ritual exegesis and it is possible that accumulating this knowledge was the primary impetus for developing costly rites in Australia.

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Worldwide evidence of cultural similarity among co-religionists

Cultural evolutionary theories suggest that world religions have contributed to the expansion of human cooperation, in part by consolidating beliefs, values, and practices within a culturally integrated super-ethnic identity. To test this hypothesis, we measured cultural distance between religious groups within and between countries, using the Cultural Fixation Index (CFST) applied to the World Values Survey (88 countries, N=243,118). We found cultural similarity between co-religionists within and across countries: Individuals who shared a religious denomination and level of religiosity were more culturally similar than those with different affiliations and levels of religiosity, even after excluding overtly religious values. Moreover, distances between denominations echoed shared historical descent (e.g., Christian denominations were culturally similar). Non-religious individuals across countries also shared cultural values, suggesting the cultural evolution of secularization. Results were robust after accounting for levels of religious freedom within each country, and the linguistic, genetic, and geographic proximity between countries. Together, results reveal the pervasive cultural signature of religion and support the role of world religions in sustaining superordinate identities that transcend geographical boundaries.

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Minds of gods across cultures: A cultural evolutionary account and ethnographic data from eight diverse societies

Beliefs about gods and spirits are ubiquitous in human societies past and present, but beliefs about the concerns of these deities vary across cultures. What explains this variation? While this question has deep roots in anthropological inquiry, much contemporary work focus narrowly on the explicit moral dimension of deities and attend less to deities concerned with non-moral matters. In this talk, I develop a novel cultural evolutionary account of cross-cultural variation in god beliefs. This account derives from a survey of detailed ethnographic case studies and includes a set of predictive criteria for what we might expect deities to be associated with in various socio-ecological contexts. I then apply these criteria in an analysis of individual-level ethnographic free-list data on what please and anger locally relevant deities from across eight diverse and relatively traditional societies. I argue that the analysis is consistent with the cultural evolutionary account and discuss how alternative approaches fail to explain the results. I conclude that contemporary approaches within the cognitive and (cultural) evolutionary study of religion need to take into account the rich diversity of religious beliefs and behaviors of human societies and the socio-ecological contexts in which this diversity unfolds.

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What would classic Ethologists do? Examining the source of nut-cracking with naïve, unenculturated orangutans (Pongo abelii & Pongo pygmaeus)

Despite advances in the study of non-human animal tool behaviour, the sources of tool-use behaviours are still debated. Often, different social and individual learning variants are assumed to play a role in behaviour acquisition. However, without the use of experimental controls, it is impossible to pinpoint which type of learning is responsible for the behaviour in question. We argue that this issue should be addressed with recourse to experimental approaches rooted in classic ethology. Building on the pioneering work by the founders of Ethology (e.g., Nikolaas Tinberg and Konrad Lorenz), we suggest that baseline experiments must be carried out before conclusions can be drawn on the role of any type of learning mechanism in the acquisition of behaviours. For example, we carried out a baseline study on the mechanisms behind nut-cracking in orangutans. We tested 12 naïve, captive, unenculturated orangutans, across two testing institutions (Leipzig: Pongo abelii; Mage=20.3; age range=10-34; 4F; Zürich: 6 Pongo abelii and two Pongo pygmaeus; Mage=14; age range =2-30; 5F). The subjects were provided with the materials necessary for nut-cracking, and no demonstrations and/or training beforehand. Out of the twelve orangutans, at least four individuals, one from Leipzig and three from Zürich, spontaneously expressed nut-cracking with a wooden hammer in the baseline. These results suggest that the behavioural form of nut-cracking can emerge in orangutans through individual learning and non-copying social learning mechanisms.

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Tool use generalization and behavioral traditions in tufted capuchin monkeys (Sapajus sp)

Customary tool use by wild tufted capuchin monkeys seems to constitute behavioral traditions, i.e., to be individually acquired by socially biased learning. Social influences apparently involve attentional/motivational effects ("stimulus enhancement"), rather than imitative learning. Persistent manipulation increases opportunities for trial-and-error learning. This process can take a long time, but once proficiently successful in a given context, the use of a type of tool can be quickly generalized to new problems. The use of percussive stone tools is common in savanna populations of tufted capuchins, and where tool material is abundant, as in Serra da Capivara, can be quite diversified. This is also the only wild population where customary use of probe tools has been observed. When exposed to molasses-filled problem-boxes, after brief (unsuccessful) attempts to break them with stone "hammers", several males quickly succeeded in using twig probes to access the molasses through the top holes. Almost three years later, when exposed to a different Plexiglas problem-box, they promptly brought some twigs. In an experiment on the innovation and diffusion of probe tools' use in a semi-free group, after the slow and partial diffusion of probing a molasses' problem-box, the successful individuals quickly succeeded in extracting seeds from another box, even though the probing technique involved was different (pushing). Afterwards, a distinct sort of problem-box also elicited probing attempts. Tool use generalization can facilitate the establishing of behavioral traditions not only by increasing direct individual rewards, but also by enhancing the opportunities for socially biased learning by naïve, tolerated observers.

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Development of Teaching in ni-Vanuatu Children

Teaching -where knowledgeable individuals modify their behaviour in a way that helps others learn- is an important mechanism of social learning. Some have argued that teaching is a 'natural cognition' that emerges reliably during ontogeny. In support of this, previous studies have identified a consistent developmental trajectory. While 3-year-olds tend to teach through demonstrations and short commands, 5-year-olds use more verbal communication, abstract explanations, and combinations of verbal and gestural teaching, which has been linked to Theory of Mind. However, these findings are from Western societies and it remains unclear whether they generalize to other cultures. To address this, we implemented a peer teaching game with N = 55 children (aged 4.7 to 11.4 years) in Vanuatu, an island nation in the South Pacific where Theory of Mind has been found to develop at later ages. Most participants used one of two distinct teaching styles: a participatory approach that emphasized 'learning-by-doing' (49.1%) through demonstrations and short commands, and an abstract one where they walked their partner through the game using abstract explanations (43.6%). The latter group not only used significantly more abstract communication, but also more verbal communication and combined teaching in general. Most 4-6-year-olds (66.7%) and 7-8-year-olds (64.7%) used the participatory approach, and abstract verbal teaching only became common in 9-11-year-olds (63.6%). Contrary to Western findings, ni-Vanuatu children only began to emphasize abstract verbal teaching in late childhood. This suggests that while teaching itself is developmentally reliable, specific teaching strategies may be culturally learnt.

Q&A session 04
Day1-D1
Technology and knowledge

Ilaria Pretelli (ilaria.pretelli@eva.mpg.de, MPI for Evolutionary Anthropology)
Monique Borgerhoff Mulder (MPI for Evolutionary Anthropology)
Richard McElreath (MPI for Evolutionary Anthropology)

Development of knowledge of the environment in a population of child part-time foragers

Humans live in complex niches where survival and reproduction are conditional on the acquisition of knowledge. The rate at which individual knowledge is acquired depends on many factors, both physical and behavioral, such as the frequency of learning opportunities. Here, we developed a series of Bayesian latent-knowledge models to estimate individual knowledge, and to infer the influence of age, as well as the physical and social environment on such knowledge. We fit these novel latent-knowledge models using a set of interviews with 94 children of different ages (4-26 years of age) on the Island of Pemba, Zanzibar, focusing on their knowledge of the local environment, such as animals and plants, in a population in which many children forage for natural resources. Preliminary results indicate that—compared to previous studies—our latent-knowledge models facilitate a far clearer picture of the intrinsic and extrinsic dynamics underpinning individual knowledge acquisition, and the life history of cultural knowledge more broadly.

Q&A session 04

Day1-D1

Technology and knowledge

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Felix Riede (Department of Archaeology and Heritage Studies, Aarhus University, Denmark)

Bayesian inference of technological phylogenies using continuous traits from the archaeological record

The twentieth century saw two modes of thinking spread through biological systematics: population thinking and tree thinking. Many archaeologists investigating ancient technologies have adopted the population thinking approach for archaeological systematics, as evident from the rise of work on quantifiable, attribute-based patterns of diversity in studies of past technological systems, much of it driven by application of geometric morphometrics. Yet, tree thinking, as one of the central concepts of phylogenetic biology, remains rare in the archaeological sciences. We review some of the obstacles that have impeded the uptake of this concept by archaeologists. Some of these are conceptual, but we identify one specific methodological obstacle: the prevailing use of discrete character traits in phylogenetic analysis in many fields. This is a major challenge for archaeological applications where standardised trait-analytical protocols are scarce. To address this challenge, we present a case study that demonstrates a Bayesian framework for inferring phylogenies using continuous traits derived from artefact shape coefficients obtained via outline based geometric morphometrics. We use a previously published sample of Late Neolithic/Early Bronze Age arrowheads from Northwestern Europe to demonstrate the efficacy and accessibility of our approach. We also sketch out the potential for phylogenetic comparative methods to address archaeological questions.

Gert Stulp (g.stulp@rug.nl, Department of Psychology, University of Lethbridge, Canada)

Louise Barrett (Department of Psychology, University of Lethbridge, Canada)

Do data from large personal networks support cultural evolutionary ideas about kin and fertility?

The fertility decline associated with economic development has been attributed to a host of inter-related causes, including the rising costs of children with industrialisation, and shifts in family structure. One hypothesis is that kin may impart more pro-natal information within their net-works than non-kin, and that this effect may be exacerbated in networks with high kin-density where greater social conformity would be expected. In this study, we tested these ideas using large personal networks (25 alters) collected from a sample of Dutch women (N = 706). Kin (parents) did not exert more social pressure to have children than non-kin, nor were dense networks associated with greater pressure. Women also reported talking to friends about having children to a greater extent than kin, although here greater kin-density in the network increased the likelihood of women reporting they could talk to kin about having children. Both consanguineal and affinal kin could be asked to help with childcare to a greater extent than friends and other non-kin. Overall, there was no evidence that kin are more likely to offer pro-natal information than non-kin, but they are considered a better source of support in terms of child care.

Kenji Itao (itao@complex.c.u-tokyo.ac.jp, University of Tokyo)

Kunihiko Kaneko (University of Tokyo)

Evolution of kinship structures driven by marriage tie and competition

In indigenous societies, people are categorized into several cultural groups, so-called clans. The clan attribution governs the mating and descent relationships by certain rules. Such rules form various kinship structures. Anthropologists have revealed several classes of kinship structures and corresponding cultural characteristics. Here, we introduce an agent-based model of indigenous societies adopting the multi-level evolution of families and societies. A family is a unit of dynamics and society is an ensemble of families within which the interaction of families can take place. We assign each family a trait and a mate preference as an optimal trait of the bridegroom. Marriage takes place according to the mating preference. Families with similar traits cooperate with each other as well as with mates, whereas those with similar preferences compete for mates. The population of families is increased by such cooperation and declined by competition. With numerical simulations, families were found to form clusters in trait-preference space under a certain condition. Families in the same cluster are united by cultural similarity. Marriage occurs only between families from different clusters. Such clusters can be regarded as clans. Kinship structures emerge as the marriage and descent relationships of such clans. The emergent structures depend on environmental conditions such as the necessity of cooperation and strength of mating competition. Finally, by analyzing the global ethnographic database, called Standard Cross-Cultural Sample, we empirically verify the theoretical results on the environmental dependence of kinship structures.

Q&A session 05

Day1-E1

Kinship and organization

Graham Noblit (graham_noblit@g.harvard.edu, Harvard University)

The Evolution of Chinese Lineages

I aim to understand variation in an important and relatively historically novel socio-political institution, the Chinese lineage. Notably, extensive geographic variation exists in the historical prominence and relevance of lineages. Using ethnographic and historical-economic evidence, I construct a theory explaining lineages as risk-pooling institutions which provide lineage members with access to land. More so, variation in regional demand for risk-pooling and/or access to land likely stems from well-studied rice-wheat agro-economic differences. I test this hypothesis by examining whether lineage activity is associated with landholding size, precipitation predictability, and historically documented precipitation disasters.

Francisco Brahm (fbrahm@london.edu, London Business School)

Joaquin Poblete (London Business School)

The Evolution of Organizational Culture

We use a Cultural Evolution model to study the evolution of organizational culture. The account of culture that emerges is one of adaptation to the environment via a process of learning, consistent with the canon of Schein (2010). This adaptation is achieved via several levers. The first two levers are "technology" and "learning behaviours". The organization or group can acquire technology, broadly defined, by resorting to: i) individual learning, which is costly but generates well-adapted technology, or ii) social learning, which is cheaper (because relies on the organization's technological tradition) but may become outdated. The third lever is "cognition about the environment". Our model incorporates signals/cues from the environment that informs the members' decision between innovation (individual learning) versus inherited technology (social learning). Organizations vary in their capacity to interpret and act-on these signals. Organizations excelling at this, are better at inferring environmental changes and at changing its member's beliefs and cognition. The fourth and fifth levers are "cooperation" and "norms of social interaction". Members of the organization have the capacity to exert costly effort to help other members learn socially. Organizations can affect this behaviour by putting in place norms about cooperation, whose strength are reflected in the member's payoffs (which includes a weight to the benefit generated to others). Our key finding is the trade-off that emerges between innovation and cooperation, consistent with the tight-loose perspective (Gelfand et al, 2011). Also, we find that i) improving cognition about the environmental increases innovation, ii) increasing the weight placed on norms of cooperation, increases cooperation, iii) whether to improve cognition or place higher weight on cooperative norms depends on environmental uncertainty. We map our model and results to theories of culture in the organizations and economics literature.

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Ehud Lamm (The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University)

The Interplay of Social Identity and Norm Psychology in the Evolution of Human Groups

People's attitudes towards social norms play a crucial role in understanding group behavior. Norm psychology accounts focus on processes of norm internalization that influence people's norm following attitudes but pay considerably less attention to social identity and group identification processes (Chudek & Henrich, 2011; Bicchieri, 2016; Gelfand, 2018; Tomasello, 2014). Social identity theory studies group identity but works with a relatively thin and instrumental notion of social norms (Hogg 2016; Scheepers & Ellemers 2019; Turner & Reynolds, 2012). We argue that to understand both sets of phenomena best, it is important to integrate the insights of both approaches.

Throughout the lecture, we highlight tensions between the two approaches and conflicting observations and sketch the contours of an integrated account. We focus on processes of internalization and suggest that internalization of social norms and internalization of social identity can be seen as two complementary processes, both playing a role in norm-governed behavior. We conclude with some observations on how a twofold account may contribute to studying the evolution of human groups and understanding behavior and social norms in complex societies. Multi-level societies are characterized by their members' ability to coordinate and negotiate between norm systems, issues that are best understood by combining the insights of norm psychology and social identity theory (Bird et al., 2019; Townsend, 2018). Moreover, we suggest that to better understand and measure normative behavior in complex societies with multiple roles, identities, allegiances, and subgroups, one must also consider the negotiation of social identities (Aureli & Schino, 2019).

Q&A session 06

Day1-A2

Cooperation and norms

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Raphael Koster (Google DeepMind)

Joel Z. Leibo (Google DeepMind)

Dylan Hadfield-Menell (University of California, Berkeley)

Richard Everett (Google DeepMind)

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Silly rules enhance learning of compliance and enforcement behavior in artificial agents

How do societies learn and maintain social norms? Here we use multi-agent reinforcement learning to investigate the learning dynamics of enforcement and compliance behaviors. Artificial agents populate a foraging environment and need to learn to avoid a poisonous berry. Agents learn to avoid eating poisonous berries better when doing so is taboo, meaning the behavior is punished by other agents. The taboo helps overcome a credit-assignment problem in discovering delayed health effects. By probing what individual agents have learned, we demonstrate that normative behavior is socially interdependent. Learning rule compliance builds upon other agents having learned rule enforcement beforehand. Critically, introducing an additional taboo, which results in punishment for eating a harmless berry, further improves overall returns. This "silly rule" counterintuitively has a positive effect because it gives agents more practice in learning rule enforcement. Our results show the benefits of coordinating effective normative infrastructure (classification of disapproved behaviors and effective third-party punishment of agents who engage in disapproved behaviors) and demonstrate the role of third-party punishment in supporting social learning. Our results also highlight the benefit of employing a computational model that allows open-ended learning for the study of normative behavior and organization.

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Dana Nau (University of Maryland, College Park)

Michele Gelfand (University of Maryland, College Park)

Cooperative Norms and the Growth of Threat: Differences Across Tight and Loose Cultures

Societal threats are ubiquitous. To overcome collective threats, cooperation is essential. However, not all societies are equally successful in cooperating under threat. With three agent-based models based on an Evolutionary Game Theoretic framework, we argue that the strength of social norms, or cultural tightness-looseness, plays a critical role in whether and how a society can effectively adopt cooperative norms and fight against an evolving threat. In the first model, we show that under a constantly increasing threat, a tight society with more conformity pressures adopts cooperative norms faster than a loose society. In the second model, we show that when mass cooperation can slow down the escalation of threat, a tight society will ultimately have a lower threat than a loose society in most cases. In the third model, we show that even after the threat has gradually decreased, a tight society that has evolved cooperative norms can maintain a highly cooperative equilibrium for a long time. These findings are consistent with empirical research on the COVID-19 pandemic, which has shown that tighter societies have fewer cases and deaths per million as compared with loose societies in the COVID-19 pandemic threat (Gelfand et al., 2021).

Q&A session 06

Day1-A2

Cooperation and norms

Martin Lang (martinlang@mail.muni.cz, Masaryk University)

Advertising cooperative phenotype through costly signals

Around the world, people engage in practices that involve self-inflicted pain, wasted resources and time and energy investments. Researchers hailing from various disciplines theorise that these practices evolved to stabilise within-group cooperation by assorting individuals committed to collective action. Specifically, costly practices function as signals of hidden cooperative phenotype and these practices may be afforded only by individuals with high phenotypic quality. However, while this proposition was previously studied using existing religious practices, the trade-off in such ecologically valid studies is the lack of manipulation allowing to discern the specific role of costly practices in assorting co-operators. In this talk, I will present our pursuit of this question using experimental manipulation in multiple studies tracking the effects of costly signals on cooperative assortment in both laboratory designs devoid of cultural context as well as in studies of various cultural groups. I will discuss the difficulties and limitations of such manipulations as well as the complex picture of human signalling that the results allow us to paint, with a particular focus on religious systems, which appear to be the frequent context of commitment signalling in the human cultural setting.

Q&A session 06

Day1-A2

Cooperation and norms

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Chimpanzees seek help, but not strategically

Seeking help when unable to solve a problem alone is a highly adaptive behavior. From an evolutionary perspective, strategic help-seeking can significantly increase one's chances of receiving help and improve an individual's fitness. However, it has not yet been studied experimentally whether our closest living relatives – chimpanzees – seek help strategically.

In Study 1, we investigated whether chimpanzees seek help selectively when they need it. Chimpanzees (N=19) could decide whether to seek help to obtain a reward form an apparatus when help was necessary, or help was available (but not necessary). Chimpanzees selectively sought help when it was necessary, but not if they could solve the problem on their own ($\chi^2(1) = 30.821$, p <.001).

In Study 2, we investigated whether chimpanzees seek help strategically: do they preferentially ask a helper who can assist at a low versus high cost? Chimpanzees (N=14) had the choice to approach a helper who could obtain a reward for them from a high-cost apparatus or a helper who could obtain a reward from a low-cost apparatus. In a control condition, we tested whether chimpanzees consider their own costs when they could obtain the reward themselves. Chimpanzees had a stronger preference for the low-cost apparatus when they obtained the reward on their own, but not when they sought help ($\chi^2(1) = 7.989$, p =.005).

These findings imply that chimpanzees seek help when they need it, but they do not seem to strategically consider other's costs when deciding whom to seek help from.

Q&A session 06

Day1-A2

Cooperation and norms

Sarah Mathew (math.sarah@gmail.com, Arizona State University)

Commanded by culture: how decentralized cattle raids are organized

Humans are able to overcome coordination and collective action problems to mobilize for large-scale intergroup conflict, even without formal political institutions. To better understand how we manage these high-stakes joint enterprises, I examine how raids are organized without hierarchical coercive military institutions among the politically decentralized Turkana pastoralists in Kenya. Based on details of 54 Turkana battles obtained from semi-structured interviews with Turkana warriors, I provide quantitative and qualitative data on various aspects of Turkana battles: planning, recruitment, leadership, pre-raid rituals, travel, course of combat, retreat, division of loot, and post-raid activities. The data highlight the variation in strategies and outcomes of raids, and the multitude of coordination and collective action problems that could potentially arise in a raid. The results provide insight into how cultural norms structure individual behavior to orchestrate complex feats of coordination and collective action.

Elena Miu (elena.miu@gmail.com, MPI EVA)
Heidi Colleran (MPI EVA)

Female friendship and the horizontal transmission of low fertility values

The demographic transition - how and why most populations are having fewer offspring despite resources increasing - remains a mystery. A shift from vertical transmission (learning from parents) to horizontal transmission (learning from peers) is deemed instrumental in the quick spread of low fertility values, but we lack an explanation for how such a shift occurs. Women's personal advice networks are places where ideas about fertility practices are exchanged, therefore investigating ego networks is key to understanding this change. We expect that the expansion of markets and education into rural areas leads to shifts away from valuing kin relationships towards valuing non-kin, and from kin dominated networks to non-kin networks. We expect ego characteristics to influence these friendship dynamics. Here, using comprehensive demographic and relational data from 22 communities in rural Poland, we investigated how the characteristics of women's personal networks change with ego-level and community-level attributes, and how network characteristics affect cultural transmission. We focused on structural features of networks, frequencies and intensities of interaction and bi-lateral social support, and closeness and emotional support. We found that women characterized by market integrated values (i.e. high education, non-farming occupation, status) have less kin and more unrelated friends in their networks, who they rely on for emotional support. Women characterized by traditional rural values rely on genetic kin and affines, for practical and financial support. These networks of different compositions, characterized by different inter-personal relationships, moderate information transmission and help explain the spread of low fertility values.

Karl Frost (culturalvariant@gmail.com, Max Planck Institute for Evolutionary Anthropology)

Reproductive behavior and social transmission of reproductive behavior in changing contexts: modelling the dynamics of trade offs in relation to the demographic transition.

In the demographic transition, "modernizing" populations willingly choose to have fewer children, causing an otherwise unpredicted steadying and even decline of population.   This is on ongoing source of confusion for evolutionary modellers.

Part of what shapes reproductive behaviour are socially learned choices about how many children to have. Recent work used analytic and agent based models to compare socially learned reproductive strategies that traded off between chosen birth rate and strength of horizontal transmission of that choice (Wodarz et al 2020).   It was claimed that reduced mortality favours those strategies that invested in higher horizontal transmission, even at the cost of lower   birth rates.   This dynamic was claimed as a possible explanation of the demographic transition. However, tacitly baked into the structure of these models was an increase in infant mortality which drove the results, invalidating the claims about the demographic transition, characterized by significantly reduced infant mortality. Using both analytic and agent based models explicitly accounting for infant mortality and adult mortality, I demonstrate that decreasing infant mortality favors the cultural transmission of high birth rate reproductive strategies, while decreased adult mortality favors high horizontal transmission strategies.   As decreased infant mortality is a hallmark of the initial phase of the demographic transition, this would amplify the already expected population explosion caused by decreased infant mortality. It is, however, actually a dynamic that would have to be countered to produce the demographic transition.   Other social learning dynamics are proposed that could explain the demographic transition.

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Can environmental unpredictability predict life history strategy of young Brazilian adolescents?

Based on Life History (LH) Theory exposure to environmental unpredictability/harshness is expected to promote a fast LH strategy, shorted time horizon and high levels of risk behavior. Studies testing these predictions mainly evaluated adult samples. We evaluated the predictive power of family unpredictability, harshness and demographic characteristics of low SES Brazilian young adolescents on reproductive milestones, future horizon and risk behavior. Participants (n = 203 M = 12,7 years old) answered to the scales Family Unpredictability during Childhood and Unpredictability Beliefs, questions about the expected age to attain reproductive milestones, time horizon, life expectation, risk behavior and demographics. Results indicated that different dimensions of unpredictability significantly predicted risk behavior, expected age of first sexual intercourse and child, subjective life expectation and future horizon. Demographic characteristics (e.g. mother's age at childbirth) enhanced predictive power in some models. Harshness did not predict any of the criterion variables. Overall, our findings support LH Theory predictions about the role of unpredictability in promoting fast LH strategy, shortened life horizon and risk and demonstrate that the relations among these variables are established and can be accessed from early adolescence. Social and theoretical implications of these findings are discussed.

Terhi Kaisa Honkola (terhi.honkola@utu.fi, University of Bristol)

Fiona M. Jordan (University of Bristol)

Kinship term borrowability: Aunties more than sisters?

Kin terms are often considered basic vocabulary, as they linguistically denote family relatives, universally important in social organisation. Social learning in the family context is assumed to play a large part in the acquisition of kin terms. These factors imply that kin terms may be resistant to borrowing, and at the language level, more likely to be "vertically transmitted". However, up to 15% of kin terms are likely borrowed, according to the World Loanword Database (WOLD). Debates over horizontal and vertical transmission are longstanding cultural evolutionary questions, so kin terms offer a rich global dataset to query the process in a domain thought to be conservative. We used WOLD and our custom-built database KinBank to select 50 kin categories. We consider the following factors to potentially influence "borrowability": 1) Relatedness: closeness vs distance in kin 2) Age: generation of the kin term and 3) Gender: gender of the kin term. We describe the individual kin categories (mother, sister, etc) that have more linguistically-identified borrowings. We then categorise kin terms by these three borrowability factors, and identify which categories experience more borrowing, in a diverse global sample of 41 languages. We found that (1) close kin terms are less likely to be borrowed than distant ones, and (2) kin terms denoting relatives older than ego are borrowed more than other age groups. However, (3) differences were not found between genders. These findings highlight that vertical/horizontal cultural evolution will act differentially across this domain; we also consider the roles of use-frequency and age of acquisition in the process.

Carl Brusse (carl.brusse@sydney.edu.au, University of Sydney)

The cultural evolution of health?

When considering the effects of culture on human health, there are two traditional approaches. One is to investigate how cultural change/difference alters fixed, clinically-validated indicators of health and/or disease - where these are seen (implicitly or otherwise) as meeting or failing to meet certain standards of objective biological function. Another is to see health as culturally mutable: a social construct the boundaries of which can vary between different peoples and over time. In this paper I consider the role of cultural evolution in biological function with respect to evolutionary medicine, in order to propose a third approach that steers a course between these two dogmas. I outline several distinct ways in which the cultural evolution of traits can alter the standards of normal biological function, such that these standards remain objective in the sense of being observer-independent, yet can also be sensitive to nuances of cultural difference, cultural change, and context. This suggests that at least some difficult questions in both academic and clinical debates, over e.g. mental health, disability, and cross-cultural context, could be progressed via the integration of cultural evolutionary theory as a supplement to both traditional bio-medicine and sociological analysis.

Q&A session 08

Day1-C2

Language 1

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Atsushi Tajima (Kanazawa University)

Steven Brown (McMaster University)

Mark Stoneking (Max Planck Institute for Evolutionary Anthropology)

Kentaro K. Shimizu (University of Zurich/Yokohama City University)

Hiroki Oota (Kitasato University/the University of Tokyo)

Balthasar Bickel (University of Zurich)

Exploring correlations in genetic and cultural variation across language families in Northeast Asia

Culture evolves in ways that are analogous to, but distinct from, genomes. Previous studies examined similarities between cultural variation and genetic variation (population history) at small scales within language families, but few studies empirically investigated such parallels across language families using diverse cultural data. We report an analysis comparing culture and genomes from in and around Northeast Asia spanning 11 language families, known as a high linguistic diversity area compared to Europe. We extract and summarize the variation in language (grammar, phonology, lexicon), music (song structure, performance style), and genomes (genome-wide SNPs) and test for correlations by redundancy analysis controlling for geography to remove the influence of recent contacts. We find that grammatical structure correlates with population history. Recent contact and shared descent within a language family fail to explain the signal, suggesting relationships that arose before the formation of current families. Our results suggest that grammar might be a cultural indicator of population history, while also demonstrating differences among cultural and genetic relationships that highlight the

complex nature of human history.

Q&A session 08

Day1-C2

Language 1

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Yoko Satta (SOKENDAI (The Graduate University for Advanced Studies))

Jun Gojobori (SOKENDAI (The Graduate University for Advanced Studies))

The investigation of the sign of selection on genes associated with dyslexia of Chinese characters

Reading and writing are quite new activities, in the time scale of human evolution. Dyslexia, or reading/writing disability, is found to have a genetic basis, and several related genes have been reported. We investigated whether natural selection has acted on single nucleotide polymorphisms (SNPs) that were reported to be associated with risk/non-risk for the reading disability of Chinese characters. We applied 2D SFS-based statistics to SNP data of East Asian populations to examine whether there is any sign of selective sweep. While neutrality was not rejected for most SNPs, significant signs of selection were detected for two linkage disequilibrium (LD) regions containing the reported SNPs of GNPTAB and DCDC2. Furthermore, we searched for a selection target site among the SNPs in these LD regions, because a causal site is not necessarily a reported SNP but could instead be a tightly linked site. In both LD regions, we found candidate target sites, which may have an effect on expression regulation and have been selected, although which genes these SNPs affect remains unknown. Because most people were not engaged in reading until recently, it is unlikely that there has been selective pressure on reading ability itself. Consistent with this, our results suggest a possibility of genetic hitchhiking, whereby alleles of the reported SNPs may have increased in frequency together with the selected target, which could have functions for other genes and traits apart from reading ability.

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Negative Words Mutate Faster than Positive Words in Lexical Evolution

The concept of bad is expressed as "mal" in French and "ră
u" in Romanian, but the concept of good is expressed as some variation of "bon" in nearly all Romance languages. In studies of lexical evolution, examples such as these show how some word-forms mutate more than others, but it is still unclear what factors contribute to this variation. Here we use insights from cognitive and affective science to suggest that semantic valence (positivity-negativity) may explain patterns of lexical evolution. Using Pagel, Atkinson, & Meade's (2007, Nature) estimates of cognate replacement for 200 fundamental vocabulary meanings in 87 Indo-European languages, we find that words for negative concepts (e.g., bad, stab) have mutated faster throughout 10,000 years of Indo-European language evolution compared to words for positive concepts (e.g., good, laugh). These effects cannot be explained by other semantic properties (e.g., sociality), nor can they be explained by word frequency or borrowing. An experimental study (n = 528) shows that people are more likely to replace words for negative concepts compared to positive concepts when they adapt the English language into a new dialect and finds a strong correlation between individual-level and population-level word replacement rates. Whereas previous studies of lexical evolution have focused on population-level mechanisms, our findings show that individual-level mechanisms related to affect and cognition may also shape lexical evolution. Valence-dependent mutation also has implications for affective science puzzles, such as the predominance of negative compared to positive emotion words in many human languages.

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Yasuo Ihara (University of Tokyo)

Simulating the diffusion of Japanese dialects through a network model

Geographic distribution of human dialects has been extensively studied in the discipline of linguistic geography, and quantitative studies have often explored the correlation between linguistic distance and geographic distance. In this study, we will explore the spatial distribution of Japanese dialects by analyzing both empirical data and a network model of cultural evolution. On the basis of a nation-wide survey of Japanese dialects called Linguistic Atlas of Japan (LAJ) and its electric version Linguistic Atlas of Japan Database (LAJDB), we calculate the linguistic distance between survey locations and correlate it with geographic distance. On the other hand, we develop a network model whose nodes represent lattice sites assigned at a regular interval to all regions of Japan. Based on the geographic contact pattern among the lattice sites, we simulate the transmission, innovation, and mutation of dialect words on the land of Japan, and calculate linguistic distance between each node. The result shows that linguistic distance grows linearly when words can transmit between distant locations, while the growth of linguistic distance becomes sublinear when locations can only interact with nearby locations. Comparing the simulated linguistic distance with the empirical linguistic distance calculated from the dialect data in LAJDB, we estimate parameter values of the model: interaction range, innovation rate, and mutation rate. Our network model also predicts the speed at which a word advances, as well as the probability that words used at two different locations have divided from the common ancestor.

Q&A session 08

Day1-C2

Language 1

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Displacement and Linguistic Niche

In this abstract, by focusing on the functions of the hippocampus and basal ganglia of human brain, we propose that the highly conserved functions of subcortical structures contribute to establish our 'linguistic niche' in the process of human evolution. To be more specific, the hippocampus is assumed to store information of when, where and what with multisensory input (Tsao et al., 2018). On the other hand, the basal ganglia are the neural basis for general functions in both motor and language domains (Shi & Zhang, 2020). The coordination of these brain areas (Szczepanski & Saalmann, 2013) provides the neural basis of lexical conception and syntactic operation leading to displacement, which is one of the design features of language enabling humans to talk about things and situations outside from here and now (Hockett, 1960). As a result, in the situation when a group of humans were hunting, and one member discovered a dead deinotherium, in order to exploit it, he must exchange information with other members to persuade them to cooperate. Such cooperation as a high-end scavenging made human ancestors distinguished from bone-crunching garhi and habilis. This information exchange requires the feature of displacement of language, supported by the functions of the hippocampus and basal ganglia (Zhang & Shi, in press).

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Q&A session 09
Day1-D2
Cumulative culture

Vanessa Ferdinand (vanferdi@gmail.com, University of Melbourne)
Andrew Perfors (University of Melbourne)

The cumulative cultural evolution of category systems: when individual learning creates more complex artifacts

In a laboratory experiment with human participants, we investigated the evolution of category systems in terms of their optimality and complexity over time. We contrast two evolutionary scenarios: one where category systems are passed between individuals in a serial transmission chain and another where the systems are developed within single learners. Crucially, in both cases we control for the evolutionary age of the category systems, allowing systems developed by individual learners to be iterated the same number of times as those developed among several learners (see for discussion Miton & Charbonneau, 2018). We find that both evolutionary regimes discover a similar number of unique category systems, but individual learning discovers and maintains more complex systems than cultural transmission does. Cultural transmission, on the other hand, discovers simpler systems that are optimized to be easily learnable, and therefore transmitted among different individuals with high fidelity. This result runs opposite to our field's received notion that artifact complexity is a hallmark of cumulative cultural evolution (e.g. Boyd & Richerson, 1996). There are deep mathematical similarities between evolution and learning (Suchow et al, 2017) that allow us to analyze individual learning and cultural evolution within one framework and refine our understanding of the diagnostic differences between the two.

Seiya Nakata (snakata@eis.hokudai.ac.jp, Department of Behavioral Science, Hokkaido University)
Masanori Takezawa (Department of Behavioral Science, Hokkaido University)

Conditions under which long-term teaching contributes to the cumulative cultural evolution of technology

Objective: It has been argued that teaching promotes the accurate transmission of cultural traits and eventually leads to cumulative cultural evolution. However, several previous studies have provided a disclaim to the argument. In the current study, we constructed a computational model of social learning under teaching to demonstrate that teaching plays a causal role in the emergence of cumulative cultural evolution. We also examined the conditions teaching promotes cumulative cultural evolution.

Methods: Processes of acquiring complex technologies were modeled as a search problem in a complex random network with multiple goals. The reinforcement learning agents searched for better goals and taught their experiences to agents in the next generation. In the simulation, we implemented a trade-off between individual learning (an opportunity for innovation) and teaching (the processes of faithful transmission): long periods of teaching are required for accurate transmission of advanced technologies. However, the more extended time society invests in teaching, the less time is left for innovating advanced technologies by the younger generation.

Results: Agent-based simulations revealed that the task difficulty moderates the positive influences of teaching on the cumulative cultural evolution: when the task was too difficult and advanced technologies could not be acquired by individual learning within a lifetime, spending a longer time on teaching, even at the expense of time for innovation, contributed to cumulative cultural evolution. On the contrary, the easier the task, the more time spent on innovation instead of teaching contributed to improving performance.

Jeremy Kendal (jeremy.kendal@durham.ac.uk, Durham University, U.K.)
Lauren Scanlon (Durham University, U.K.)
Andrew Lobb (Durham University, U.K.)
Jamie Tehrani (Durham University, U.K.)

The Influence of Social and Asocial Learning on Exploration of Design Space and the Cultural Evolution of Complexity

The aim of the study is to examine how the cultural evolution of artefacts can be affected by social and asocial learning of their constituent parts. As a case study, we consider the construction of knots and links - a ubiquitous and ancient form of human material culture.

Our interdisciplinary study combines cultural evolution modelling with a taxonomy of knots and links derived from mathematical knot theory. We developed a Markov Chain model of the cultural evolution of knots and links, where the orientation of a strand crossing (left over right, or visa versa) is learned socially with a probability s, and new crossings can be added by a probability of asocial learning, a.

We report four qualitatively distinct equilibria, reflected by network topologies characterising transition probabilities (edges) between variants (nodes). Knot and link variants are highly connected in design space if there is some asocial learning combined with imperfect copying. Under these circumstances, the equilibrium frequencies of braid variants are relatively insensitive to the learning parameter values (a and s). Similar results are obtained for knots and links composed of two or three strands, and when learning events operate on chunks of crossings..

To conclude, we show how patterns of connectivity across design space can be affected by the interaction of simple learning mechanisms and properties of the strand-crossing system. Diverse and complex links and knots can evolve through imperfect copying without asocial learning while the latter enhances connectivity across design space. For this system, the evolution of diverse, complex forms does not require high fidelity copying or selective forms social learning and innovation.

Andrew Buskell (ab2086@cam.ac.uk, University of Cambridge)

Claudio Tennie (Univeristy of Tübingen)

The Problem of Mere Recurrence in the Study of Cumulative Culture

The consensus formulation of cumulative culture holds that it consists of information transmitted by high-fidelity learning that generates incremental improvement over time. And while this consensus characterization functions well for paradigm cases (e.g. Holocene-era hominin toolkits), it fares poorly in capturing and explaining marginal cases—like, for instance, the recurrent behaviors seen in multiple non-human animal species.

This philosophical paper argues that the consensus formulation lumps together concepts: distinct learning tasks are lumped in the idea of "information"; while multiple processes and structures are collapsed in "high-fidelity learning". Breaking-up these concepts allows us to identify and defend a minimal formulation of cumulative culture in terms of "copying know-how" and the transmission of "trait form". As we show, these minimal elements are sufficient to characterize— and useful to evaluate—putative instances of marginal cumulative culture.

Yet by rejecting "incremental improvement", our formulation faces the problem of distinguishing cumulative cultural traits from mere recurrence: a situation where similar trait tokens arise from processes other than copying know-how. We highlight four such processes that might explain mere recurrence: instincts, triggers, limited repertoire exploration, and recognition and retrieval.

We then put the assembled conceptual tools to use in a case study. Recently, some researchers working on cultural epidemiology ('CE') and the Zone of Latent Solutions ('ZLS') have suggested their projects are fundamentally aligned, relying on common explanatory framework to account for marginal cumulative culture. Yet as we show, the two have strikingly different commitments, revealed in their explanations of mere recurrence. The ZLS is fundamentally a thesis of limited repertoire exploration, while CE relies on a sophisticated form of "copying know-how" they describe in terms of reconstruction.

Q&A session 09
Day1-D2
Cumulative culture

James Benjamin Falandays (jfalandays@ucmerced.edu, University of California, Merced)
Paul Smaldino (University of California, Merced)

The Emergence of Cultural Attractors: How Dynamic Populations of Learners Achieve Collective Cognitive Alignment

Cultural attractor landscapes describe the time-evolution of cultural variants (i.e. behaviors, artifacts) over successive transmission events. When cultural variants sit at a local minimum of a stable attractor landscape, there will be no cumulative error over transmissions, allowing Darwinian selectionist dynamics to drive cumulative cultural evolution. But because cultural attractors are the emergent products of shifting populations (individuals can leave or die, and new individuals can be born or enter the population) of individuals with potentially-idiosyncratic and dynamic cognitive landscapes, which are in turn the emergent products of individual experience within a culture, stable cultural attractor landscapes cannot be taken for granted. Little is known about how cultural attractors form or stabilize in light of this culture-cognition feedback loop. We present a model of cultural attractor dynamics, which adapts a cognitive model of unsupervised learning of phoneme categories in individual learners to a multi-agent setting wherein individual learners are tasked with categorizing and generating signals for one another. Beginning from a state in which all agents possess a set of randomly distributed categories of uniform probability, under some conditions populations self-organize into signal clusters, which constitute an identifiable cultural attractor landscape. We explore the role of various innate cognitive biases, levels of transmission error, learning periods, lifespans, population sizes, and network structures to understand when population-level structure may emerge, what properties it is likely to have, and how stable it is. Our analyses can provide insights into the conditions that may be favorable or unfavorable for cumulative culture to emerge.

Q&A session 10
Day1-E2
Social Structure

Justin Yeh (justin.ufp@gmail.com, Max Planck Institute for Evolutionary Anthropology)

Jeffrey Andrews (Max Planck Institute for Evolutionary Anthropology)

Using agent-based simulation to investigate the adoption of market economy and specialization

The process by which individuals in a small-scale society adopt a market economy and specialize is neither instantaneous nor uniform. Furthermore, while economics predicts trade should occur whenever it increases the utility for both parties, evolutionary theories suggest that the optimal strategy may need to consider, among others, relative fitness, competition, kinship, and population size. Using an agent-based simulation, we investigate the evolution of within-household sharing, market trading, and specialization in a small-scale society. We find that sharing and trading behaviors can evolve to polymorphic equilibria at a wide range of conditions. Sharing and trading are favored when the payoff function shows a strong diminishing return. Counter-intuitively, while the number of essential goods in the system has a positive impact on the adoption of the market, it can also negatively impact specialization because a highly specialized individual risks not getting all the essential commodities from the market.

Cedric Perret (cedric.perret.research@gmail.com, University of Exeter)
Simon T. Powers (Edinburgh Napier University)
Thomas E. Currie (University of Exeter)

Modelling the cultural evolution of hierarchical social organization

The range of social organization exhibited by human groups is astonishingly wide and diverse. Yet a manifest trend in human history has been the shift from small-scale egalitarian groups to hierarchical societies with centralized, institutionalized decision-making that has occurred over the last 10,000 years. Functional evolutionary explanations for the emergence of hierarchy can be broadly classified into two types: 1) "coercive" theories propose that leaders emerge because they monopolise resources and impose inequality to increase the benefits they personally receive and their own fitness, 2) "managerial" theories propose that leaders emerge because they provide some benefit to their group (including potentially helping it compete with other groups). These explanations are not mutually exclusive, and most likely different explanations are relatively more important at different times or in different contexts. Despite being a topic of fundamental importance there has been surprisingly little formal modelling of these processes in human societies. Here we illustrate how we can better understand these processes by presenting a recently published evolutionary model where individuals have to take decisions as a group to produce a public good. The influence of an individual on collective decisions is an evolving cultural trait. We show how hierarchy can both facilitate organisation and create inequality, and how it leads to the stable emergence of followers and leaders. We will also introduce some current research where we are developing models of different theories for the evolution of hierarchy and testing their importance using archaeological data from Japan.

Q&A session 10
Day1-E2
Social Structure

Adrian Viliami Bell (avbell@gmail.com, Department of Anthropology, University of Utah)

Demographic effects on cultural expression

Our understanding of cultural complexity and broader geographic patterns is often tied to demographic explanations. While much has been learned, the state of the field is at a point where demographic complexity cannot be ignored. In this talk I will present ethnographic work suggesting that the development of more elaborated models coupling demography and cultural transmission will yield high explanatory dividends, especially for those who study populations that are modernizing, transitioning, or experiencing high levels of migration. I will also present one elaborated model, while making suggestions for other areas of theoretical development.

Jeffrey Brennan Andrews (jeffrey_andrews@eva.mpg.de, Max Planck Institute for Evolutionary Anthropology)

Monique Borgerhoff Mulder (Max Planck Institute for Evolutionary Anthropology)

Resource Characteristics and the Evolution of Sustainability

Achieving sustainability is as much about knowing what defines sustainability as it is about doing the right thing. Without complete information about global stock levels, ecological tipping points, resource dynamics, societal metabolism, enforcement costs, etc., an enlightened citizen or social planner cannot define the strategy space that constitutes sustainable action. We break from traditional modelling approaches, which assume the conditions for sustainability are known. Using an agent-based model, we investigate the evolution knowledge about the sustainable courses of action in a common-pool resource dilemma. Our models show that the structure of the resource, that is, the set of parameter governing it, in conjunction with sufficient inter-group variation in cultural beliefs, is critical to the evolution of sustainability. Specifically, sustainability can evolve if the resource maximizes the difference between sustainable cooperative outcomes and non-cooperative unsustainable outcomes. Nevertheless, we find that this equilibrium is seldom found before an initial collapse.

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Emily Nascimento Faverin (Universidade de São Paulo)

Fernando Ise Dias e Hernandez Borba (Universidade de São Paulo)

Isabela Mussato Aguiar Marcomini (Universidade de São Paulo)

Luíza Estéfany Campos Sobreira (Universidade de São Paulo)

Rafael Domingues Corrêa (Universidade de São Paulo)

Renata Caroza (Universidade de São Paulo)

Patriarchal hegemony from an ethological perspective and other social systems

The patriarchal system is hegemonic in the contemporary world. In this study we aimed at understanding the causes of this prevalence, investigating the evolutionary origins of patriarchy. Our question was whether the masculine philopatry is related to the maintenance of the patriarchal structure. We conducted an integrative bibliographic review of the ethological literature, emphasizing the development of feminist concepts about patriarchy and the parental preferences on species evolutionarily close to humans. In addition, we analysed matrilineal communities such as Minangkabau, located at Indonesia, Asia; Mosuo, at China, Asia; and Umoja, at Quenia, Africa; and also two Brazilian social groups with traces of matriarchy, denominated Noiva do Cordeiro and Quebradeiras de Coco, for current alternatives that have dissociated from the prevailing patriarchy. In particular, Umoja and Noiva do Cordeiro were created in response to the preponderant sexism and violence suffered by its founders and other women, who came together to remodel their future actively. The ethological analysis allowed understanding the emergence of patriarchy, showing some socio-cultural contexts, such as sedentarism, language and parental preference, in certain cultures, as promoting its formation. Throughout this research, it was also noticeable that the number of scientific and academic studies on non-patriarchal societies, mainly in the scope of ethology, is quite little. Overall, the present study reveals a contrast between the patriarchy and distinct contemporary social configurations which have detached from feminine subordination, evincing that it is possible for our social systems to change and that we can carry out such transformation, as we understand and reflect about these processes.

Discussion Session 1

Discussion 1

Susan Hanisch (dustin.eirdosh@eva.mpg.de, Max Planck Institute for Evolutionary Anthropology)

Dustin Eirdosh (Max Planck Institute for Evolutionary Anthropology)

Evolving an open, networked, and interdisciplinary evolution education research community

Evolutionary theory supports the development of scientific explanations of the biological, behavioral, cognitive, and cultural diversity found around the world. Despite the wide ranging interdisciplinary nature of evolution science, evolution education in the general education context remains almost exclusively within the domain of the biology classroom. To engage this challenge and opportunity in a systematic fashion, the OpenEvo project has emerged as a Networked Improvement Community for evolving an open, networked, and interdisciplinary evolution education research community. The network is organized around principles of sociocratic governance, and focused on creating the conditions for innovations in interdisciplinary evolution education to emerge and thrive. The Concepts & Theory Circle has begun a critical analysis of the internationally recognized Understanding Evolution Conceptual Framework for guiding evolution teaching across K-16 (general education and undergraduate) contexts. The Research Circle is working to develop novel assessment tools for measuring conceptual learning about evolution as an interdisciplinary science, and the supports needed to engage in empirical research on the proposed revisions to the Understanding Evolution Conceptual Framework. The Teacher Education Circle is working to develop open syllabi for model teacher education courses and professional development programs to support teaching evolution as an interdisciplinary science. We will highlight the challenges and opportunities presented by this work, describe the current state of core projects within the network, and discuss the potential for teaching cultural evolution science to emerge as an essential educational innovation needed to foster an understanding of our changing world adequate to the challenges of the moment.

Discussion Session 1

Discussion 1

Joseph Watts (me@josephwatts.org, University of Otago)

John Shaver (University of Otago)

Modelling Secularization across Nations Using Phylogenetic Causal Path Analysis

Over the past century, there has been a tenfold increase in the number of people identifying as atheist or agnostic worldwide. This growth in secular affiliation has been highly uneven across nations: less than one percent of the population of Samoa identify as agnostic or atheists, whereas over half the population of Estonia identify as agnostic or atheists. Theories differ over the factors that explain the growth and variation in secularization across nations. Some predict that existential security reduces the needs for the reassurances provided by religions. Others argue that differences in secular affiliation reflect rising levels of formal education among populations, which promote analytic thinking and scientific based worldviews. The results of previous cross-national research has largely been taken to support the importance of existential security in secularization, but has not sufficiently accounted for the historical relationships that exist between nations, nor the complex causal relationships that exist between hypothesized predictor variables. We aggregated cross-national databases and developed a method of exploratory phylogenetic path analysis to account for the common ancestry of populations, and disentangle the complex causal relationships among hypothesized determinants of secularization. Our best fitting causal models show that while secularization is associated with a wide range of factors, education is the strongest and most direct predictor of secularization across nations. Our results challenge the importance of existential security in secularization and show how new approaches to causal modelling can help disentangle complex pathways in human cultural evolution.

Discussion Session 1

Discussion 1

Rob Brooks (rob.brooks@unsw.edu.au, UNSW Sydney)

Daniel Russo-Batterham (The University of Melbourne)

Khandis Blake (The University of Melbourne)

Incel Activity on Social Media Linked to Local Mating Ecology

Young men with poor mating prospects have historically threatened internal peace and stability of societies. In some contemporary societies, such involuntary celibate, or Incel, men are responsible for much online misogyny and real-world violence. Here we test the prediction that online Incel activity arises via local (IRL) mating market forces that affect relationship formation. We geolocated 321 million Twitter posts (2012-2018) to 582 commuting zones in the continental U.S.A., of which 3649 tweets used words peculiar to Incels and 3745 were about Incels. We show that such tweets arise disproportionately within places where mating competition among men is likely to be high due to male-biased sex ratios, low proportions of women who are single, and high income inequality. Our results suggest that social media might predict the factors that lead young men toward antisocial behaviour in real-world societies.

Discussion Session 1

Discussion 1

Peter J. Richerson (pjricherson@ucdavis.edu, University of California, Davis)

Human Macroevolution

Macroevolution refers to long time scale processes and patterns of evolution. In the case human evolution, the theory of both genetic and cultural microevolution (and coevolution) is well developed. The theory of macroevolution is less well developed even though most of the questions that excite both professional and lay interest are macroevolutionary. Why did an adaptation that makes very heavy use of culture evolve in the Pleistocene and only in one ape lineage? Why is there a prolonged progressive trend in brain size and cultural sophistication over the Pleistocene? Why is our evolutionary response to the present interglacial so different from responses previous interglacials? There is much speculation about such questions, most of it not very sophisticated. For example, few studies competitively test multiple hypotheses. In general, two general kinds of explanations ought to be considered in formulating macroevolutionary hypotheses, internal and external processes. internal processes are intrinsic to the evolutionary process itself. For example, any descent with modification system will have a maximum practical rate of response to selective processes. Since culture evolves more rapidly than genes, it is likely that a gene-culture coevolutionary process' rate limit will be dictated by genetic evolution. External processes are exogenous changes in the environment. Continents drift, climates change, other species evolve, and landscapes develop largely or entirely independent of human activities. The highly variable Pleistocene climate, for example, is apparently rare if not unique in the earth's geophysical/geochemical history. It would be a bit surprising if the Pleistocene environment had nothing to do with human evolution. On the other hand, every animal species on earth has been subject to the Pleistocene environment but our response to it is quite distinctive. A purely external hypothesis seems implausible.

Robert Malcolm Ross (robross46@gmail.com, Macquarie University)

Is religious priming robust?

"Religious priming" is among the most widely studied and celebrated discoveries in the cognitive science of religion. It refers to the frequently reported finding that presenting participants with stimuli that bring religion to mind has an influence on attitudes and behaviours, even when these participants are unaware of this influence. A recent meta-analysis of 93 experimental studies came to the conclusion that "religious priming has robust effects across a variety of outcome measures". In this talk I re-evaluate the evidence for religious priming and come to a different conclusion.

Discussion Session 1

Discussion 1

Alejandro Gordillo García (alejandro.gordillogarcia@kuleuven.be, Institute of Philosophy, KU Leuven)

The inverse correlation hypothesis of cultural maladaptation.

In this research I explore the hypothesis that it can be beneficial to the fitness of cultural variants if they channel the energy of the individual who adopts the variant away from biological reproduction and toward the reproduction of the cultural variant. I label this the "inverse correlation hypothesis of cultural maladaptation." This hypothesis is based on the observation that human biological reproduction is expensive in terms of energy and time. Therefore, cultural traits that minimize reproduction consequently make available resources that an individual could utilize instead to propagate the cultural trait in question. This hypothesis is usually advanced as a plausible explanation of extreme cultural traditions that reduce sexual reproduction to zero, such as celibacy. My first task is to discuss the implications of this hypothesis and to argue that, although it has merits, it has only been given a superficial scientific treatment in the literature, which is unfortunate. The reason for this, I argue, might be due to a vague theoretical distinction between, on the one hand, cultural maladaptive traits that nullify biological fitness and, on the other, selectively neutral or non-adaptive cultural traits that do not affect fitness values. My second task is to articulate an adequate theoretical framework that makes the inverse correlation hypothesis a scientifically respectable explanation of cultural maladaptation. I discuss some theoretical and empirical challenges that this hypothesis faces, but that they are not fatal as they are well-trodden by evolutionary biologists and philosophers.

Discussion Session 1

Discussion 1

Rachel L. Kendal (rachel.kendal@durham.ac.uk, Durham University, UK)

Transforming the field of cultural evolution and its application to global human futures

I will highlight a funding scheme that I am running on behalf of the Cultural Evolution Society. The scheme will address issues that will transform the important, yet underfunded, field of cultural evolution. How our cultures evolve (including how information is transmitted, how people make decisions, and the interaction with our biology) is a pressing issue in a world in which our cultural activities are causing rapid, and drastic, social and physical changes. Through 16 research projects, 5 applied working groups, 5 workshops, 1 landmark conference, 3 capacity building training courses, and public engagement activities, the grant aims to tackle early career obstacles, western-centrism, traditional disciplinary divides, and division of scientists and public policy makers. Join me for more information, videos on specifics, and open discussions. In the meantime further details can be found on the cultural evolution society website.

Discussion Session 1

Discussion 1

Natalia Dutra (nbdutra@gmail.com, Universidade Federal do Rio Grande do Norte)

Fivia de Araújo Lopes (Universidade Federal do Rio Grande do Norte)

Lara G. de S. Silveira (Universidade Federal do Rio Grande do Norte)

The role of collaboration in cultural transmission experiments

We review and discuss the role of collaboration in cultural transmission experiments. Collaboration (or collaborative learning) is considered an important variable in human cultural evolution. However, we argue that this is an aspect often underestimated in experimental studies of cultural transmission. We conducted a critical review of cultural transmission experiments to assess whether collaboration takes place, and whether it is a variable of interest in those studies. We found that collaboration is seldom investigated in those studies. We discuss reasons for this and potential future avenues for research.

Discussion Session 1

Discussion 1

Daniela Poertl (dapoertl@gmx.net, Hospital SRH Burgenlandkreis, teaching hospital of Jena and Leipzig Universities, Department of psychiatry)
Christoph Jung (Free researcher, petwatch)
Antonio Benitez-Burraco (University of Sevilla, Department of Linguistic)

A feedback loop between human self-domestication and dog domestication contributing to language evolution?

Different factors account for the emergence of present-day languages in our species, from biological changes, to new behaviours, to cultural innovations. Compared to extinct hominins, we exhibit many of the features found in domesticated mammals, like changes of skull and brain morphology, improved social skills (including reduced aggression, increased prosocialitiy, and enhanced play behavior), and neotenic features, among others. This human self-domestication phenotype has been hypothesized to result from selection of less reactive individuals in response to changes in our ecology and environment, and it has been recently invoked as one important force favouring language complexity mostly via a cultural mechanism. As a consequence, evolutionary changes impacting on aggression levels are expected to have fostered this process. In the time window of dog domestication, starting roughly about 35KaBP, the full globularization of the human brain occurred (this enabling more complex language processing), features of self-domestication reached its peak (this seemingly favouring the complexification of our cultural niche), and important cultural changes occurred as a consequence. In our talk, we hypothesise about a positive effect of dog-human interactions on aggression management and increased social capabilities and more generally, on our self-domestication, ultimately, contributing to aspects of language evolution. We review evidence of diverse sort (ethological mostly, but also archaeological, genetic, epigenetic and physiological) supporting a positive feedback loop between dog domestication and human-self domestication that might have favoured the mechanisms promoting structural complexity in human languages.

Discussion Session 1

Discussion 1

Rebecca Ring (ringr@yorku.ca, York University)

Nonhuman Animal Culture: Meaning in Practice

Seeing nonhuman animals as cultural beings depends on perspectives and assumptions in theoretical frameworks and empirical methodologies. (Mis)recognizing animal culture comes down to what counts as teaching, imitation or cultural social transmission of information. My model of culture shifts the focus to social ontology.

Culture is a real social kind, meaning 'culture' can both do explanatory work and be explained in virtue of the causal and constitutive properties of social practices. Culture is dynamic meaning-making processes; ways of being wherein behaviours, objects, and places have salience/significance for social agents in virtue of their social practices (i.e., social meaning). Cultural phenomena are imbued with and carry information, knowledge and value that go beyond biological function and mere means to ends. I argue that some animals engage in meaning-making practices that are co-created, re-created (re)enacted, embedded, and transmitted in actions, interactions and relationships within social matrices; all of which constitutes culture.

At stake, is our epistemic access to animal culture and implications for conservation. How can we know there is social meaning? Heyes (2019) states we are a "long way from knowing how to integrate explanation and understanding, information and meaning, science and the humanities" (p.43). Inherent in her perspective are dichotomous relations of object(ive)/subject(ive). Consider information (objective) and meaning (subjective). Information is not a vacuous form awaiting content but rather meaning is always already immanent. Social information/meaning arises from intersubjectivity (even distally) and is always already objective/subjective. Epistemic access (explanation/understanding) requires science/humanities interaction to interrogate partial perspectives and situate objective knowledge.

Discussion Session 1

Discussion 1

Sara Lowes (slowes@ucsd.edu, UC San Diego)

Etienne Le Rossignol (CES)

The Economic Origins of Trust: Evidence from Mobile Pastoralist Societies

This paper investigates the economic origins of trust. We examine the hypothesis from anthropology that the economic requirements of mobile pastoralism made pastoralists highly interdependent within groups but hostile to individuals beyond the radius of extended kin. We find that historical reliance on mobile pastoralism led to the emergence of in-group oriented and family-centered individuals. Specifically, mobile pastoralism explains part of the contemporary variation in in-group relative to out-group trust. This result is valid across countries, between residents of a same country, among second-generations migrants and with an instrumental variable strategy. We also examine the implications of this cultural trait for cooperation. In a quasi-experimental setting, we find that individuals from mobile pastoralist groups are perceived as more hostile and suspicious. Finally, we highlight the role of women in the intergenerational transmission of this cultural trait. This paper contributes to our understanding of how forms of economic production shape the scope and extent of trust.

Discussion Session 1

Discussion 1

Carles Salazar (carles.salazar@udl.cat, Universitat de Lleida)

On the cultural evolution of kinship systems

Nobody doubts that human kinship has something to do with biology and reproduction and, at the same time, biology and reproduction are clearly insufficient to explain it. The unexplained part of human kinship by the biology of human reproduction is what anthropologists call 'social' kinship. Whereas the biology of human kinship does not seem to differ in any significant way from that of any sexually reproducing species, it is unclear how that social kinship should be ac-counted for, specifically, how it should be related with its biological counterpart. The purpose of this paper is to suggest a possible solution to this time-honored theoretical controversy in anthropology. My proposal shall be that it is the concept of sameness that which makes both biological and social kinship amenable to the same type of analysis.

Niek Kerssies (niekkerssies@gmail.com, Radboud University Nijmegen)

Agent-based models in cultural evolution and in opinion dynamics: a path toward CE social science?

Models used in the study of cultural evolution have increasingly been recognized as formally similar and in some cases equivalent to agent-based models(ABM). ABM was developed originally as a computational method for social science. As cultural evolution authors occasionally claim to provide a formal, evolutionary method that current social science lacks, i investigate to what extent this common formal framework may provide a way of realizing such an ambition. Focusing on models used in social learning field studies, and the popular ABM-application of opinion dynamics (OD), i survey what currently is and is not possible with these models, and argue that in some ways they can solve each others problems. I end on discussing what an actual social science application of such "CE+OD" models would look like, considering two possible examples of such an application.

Discussion Session 1

Discussion 1

James L. Everett (jmeve2@outlook.com, Coastal Carolina University)

Cultural Pools in Organizational Populations

In this paper I refine a concept of culture at the level of organisational populations. The rationale for this effort was first articulated with Hannan and Freeman's (1989) challenge to organisational theorists to describe the "other side" of organisational evolution-- the structures and processes of inheritance and transmission in organisational populations. First, any effort to specify a concept of culture at the level of organisational populations requires examination of the nature of culture and units of cultural transmission. Based on this foundation, I argue that conceptual traditions in ecological and cultural anthropology coupled with theoretical precedents in the literature of organisational ecology establish the theoretical warrant for conceptualising shared ideational phenomena at the level of organisational populations. Toward that end, I argue that since populations are composed of organisations characterised by individual cultures, the interaction of those cultures over time produces an novel evolutionary property- the culture pool of the population.

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Global cultural evolutionary model of humpback whale song evolution, revolution and transmission

Humpback whale song is an extraordinary example of vocal cultural behaviour. Within a population all males conform to a common song type. In Northern Hemisphere populations, the complex songs show long-lasting traditions that slowly evolve, while in the South Pacific, population songs are rapidly replaced by a different song adopted from a neighbouring population. The processes underlying these patterns of cultural transmission of songs are not currently understood: the whales' exceptional size and long-distance migrations make it implausible to experimentally study development. Instead, here we used individual-based models of the entire Southern and Northern Hemisphere humpback whale populations in combination with empirical data to infer the processes of vocal learning and cultural evolution. We simulated processes of song innovation and patterns of contact among populations and compared our model outcomes with patterns of song theme sharing measured in South Pacific populations. We found that low levels of mutation in combination with rare interactions between populations were sufficient to closely fit the pattern of song sharing in the South Pacific, including the distinctive pattern of West-to-East song revolutions. Moreover, the same learning parameters that gave rise to revolutions in the Southern Hemisphere simulations also gave rise to patterns of song evolution in the Northern Hemisphere populations. This study demonstrates how cultural evolutionary approaches can be used to make inferences about the processes underlying cultural transmission.

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Stability and evolution in sperm whale cultural dialects

For species with culturally distinct vocalizations, like sperm whales, cultural evolution can manifest as changes in vocal repertoires over time. In social situations, sperm whales communicate using stereotyped click patterns, called codas. Different socially segregated, cultural clans of whales have different coda dialects, but it is unknown whether and how these dialects evolve. To address this, we looked for changes in sperm whale codas over time off the Galápagos Islands. First, codas were classified into types using contaminated mixture models. Then, repertoires of codas were hierarchically clustered based on similarities in coda type usage to determine which clan made each repertoire. Generalized linear models weighted by coda sample size and with year as a predictor were used to determine if within-type coda durations varied across years for two well-sampled clans: the Plus-One clan (1,865 codas, 1985–1989) and the Regular clan (3,813 codas, 1985–1995). While there is no evidence that the Plus-One clan dialect changed over a 5-year timespan, several different Regular clan coda types were about 16% longer in 1995 than in preceding years. In showing that coda duration changes are unlikely due to sampling bias, environmental variation, or individual variation, we posit that cultural drift, or a cultural fad, occurred between 1991 and 1995. Additional Regular clan codas, recorded after 1995, will allow further testing of this hypothesis. These results suggest that sperm whale dialects can change over time, but that different codas and clans may exhibit different patterns of stability and evolution.

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Content bias in the cultural evolution of house finch song

In this study, we used three years of house finch (Haemorhous mexicanus) song recordings spanning four decades in the introduced eastern range to assess how individual-level cultural transmission mechanisms drive population-level changes in birdsong. First, we developed an agent-based model (available as a new R package called TransmissionBias) that simulates the cultural transmission of house finch song given different parameters related to transmission biases, or biases in social learning that modify the probability of adoption of particular cultural variants. Next, we used approximate Bayesian computation and machine learning to estimate what parameter values likely generated the temporal changes in diversity in our observed data. We found evidence that strong content bias, likely targeted towards syllable complexity, plays a central role in the cultural evolution of house finch song in western Long Island. Frequency and demonstrator biases appear to be neutral or absent. Additionally, we estimated that house finch song is transmitted with extremely high fidelity. Future studies should use our simulation framework to better understand how cultural transmission and population declines influence song diversity in wild populations.

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Early vocal development of bearded capuchin monkeys

Human language is a socially learned behavior, a hallmark of human culture. In non-human primates, it is generally accepted that calls are not modified during development and there is no learning in call production. Most studies, however, were conducted with Catarrhine. Our aim was describing the ontogeny of vocalizations of wild bearded capuchin monkeys (Sapajus libidinosus), a Platyrrhine species. We studied 16 wild infants between 1-24 months old by focal animal method, recording all the vocalizations emitted. The vocalizations were classified by acoustic features and categorized according to context of emission in affiliative, foraging/food, alarm, contact and stress/agonism. Infants started to call in their 2o month. The first calls were emitted in the contexts contact and stress/agonism. Contact vocalizations (Trill, CN and LDWS) were emitted more often along the 24 months. Trill was the most common call until the 12o month, when CN started to increase and become more common than Trill in the 24º month, as in adults. LDWS, a call infants emit when far from the mother, started to increase in the 6º month (when infants are still dependent on their mothers) and decreased in the 24º month (when they are already independent). Our results confirm that contact calls are present very early in the repertoire of capuchin monkeys and their production is not dependent on learning, as in human infants. Nevertheless, the use of different types of   vocalizations increased with age, suggesting that some form of contextual learning might occur, what calls for future investigation.

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Chimpanzees communicate to coordinate a cultural practice

Human culture is considered to be different from animal culture due to its communicative and interactive nature built on shared intentionality and cognitive flexibility. Here, we investigated whether chimpanzees use communication and show behavioral indications of their joint commitment to engage in cultural practices by analyzing grooming handclasp (GHC) interactions – a socio-cultural behavior for which coordination is required. In a GHC two apes engage in a joint action leading to a symmetrical postural configuration in which each of the partners extends an arm overhead and clasps the other's wrist or hand. Previous accounts attributed the enactment of GHC to behavioral shaping whereby the initiator physically molds the arm of the partner into the GHC posture. Using frame-by-frame analysis and matched-control methodology, we find that chimpanzees use gestural communication to entice group members into GHC. The use of communication instead of physical shaping to initiate GHC requires an active and highly synchronized response from the partner, which showcases a behavioral expression of joint commitment to engage in this shared cultural practice. Moreover, we show that GHC initiators used a variety of initiation strategies, which attests to their situation-contingent interactional flexibility. We conclude that chimpanzees can be jointly committed to a cultural practice, which suggests that culture predicated on shared intentionality and flexible communication may not be unique to the human species.

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The Global Jukebox: A Public Database of Performing Arts and Culture

Music, dance, and other performing arts are cultural universals that are found in all societies but that vary within and between them. The lack of standardized cross-cultural databases has impeded scientific understanding of global variation in the arts. We introduce the Global Jukebox (theglobaljukebox.org) as a resource for comparative and cross-cultural study of the performing arts and culture. Its core is the Cantometrics dataset, encompassing standardized codings on 37 aspects of musical style for 5,783 traditional songs from 991 societies. The Cantometrics dataset has been thoroughly cleaned and checked for reliability and accuracy. Eight additional datasets code elements of instrumentation, conversation, popular music and other aspects of expressive culture. For the first time, all digitized Global Jukebox data is being made available in open-access, machine-readable format, linked with streaming audiovisual files to the maximum extent allowed while respecting copyright and the wishes of culture-bearers. The data is cross-indexed with two leading cross-cultural databases: the Database of Peoples, Languages, and Cultures (D-PLACE) and eHRAF World Cultures. This allows researchers to test hypotheses about worldwide aesthetic patterns and traditions. We will use modern phylogenetic comparative methods to reanalyze the original proposals by Alan Lomax and his research team regarding coevolutionary relationships between the performing arts, social structure, and human history. The Global Jukebox adds a large and detailed global database of the performing arts to enrich our understanding of the science of human cultural diversity.

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Testing hypotheses of music-culture coevolution with a global sample of 5,783 songs

Music - like language - is a human cultural universal that displays considerable cross-cultural variation and historical continuity. But while hypotheses about language (co)evolution have been tested against large cross-cultural databases, hypotheses about music have not, principally because no such databases have been publicly available. We take advantage of a new public database of 5,783 songs from 991 societies coded for 37 "Cantometric" features of musical style (theglobaljukebox.org; cf. Wood et al., this conference) to test three sets of pre-registered hypotheses about music-culture coevolution:

1) What is the primary determinant of musical style: song structure or social context?

2) What is the primary determinant of musical distribution: genetic history, language history, or geography?

3) What is the primary social determinant of musical style: economic subsistence or kinship intensity?

Each set of hypotheses helps us paint a more complete picture of music's role in the cultural past of human evolution. We will test these competing hypotheses using latent variable modelling and phylogeographic methods, combining the Global Jukebox database of music codings with language phylogeny, genetic distances (GeLaTo), and social structure (Ethnographic Atlas; D-PLACE.org). By tying these strands of evidence together we will present a comprehensive and quantitative understanding of global music diversity and its role in the history of human society.

AB00070

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Relational Mobility Predicts Danceability in Music Preference: Evidence From 26 Countries

One common method in cross-cultural research is to compare cultural products. Here, we show that music, as a cultural product, reflects the values and norms that afford preferences for certain styles of music over others. We focus specifically on danceability features, that have been shown in previous research to correlate positively with cultural affordances for anger experiences and expressions. One potential explanation could be through relational mobility: societies that have high relational mobility (where relationships are formed or broken with low social cost) may have less reason to suppress their expressions or experiences of anger. In turn, the preference (use) of high-danceability music that embody and express these negative emotions may be more prevalent. We obtained danceability feature scores from songs on Spotify Top 50 chart data for 26 countries that had country-level relational mobility data (Thomson et al., 2018). We extracted both Spotify's 'danceability' and Essentia's 'danceability' feature scores for as many songs as possible from these charts (N = 1342). Using separate mixed effects regressions, we found that relational mobility significantly and positively predicted both Spotify's danceability feature scores (b = 0.43, t(24.0) = 3.7, p < .001), and Essentia's danceability feature scores (b = 0.4, t(24.0) = 2.4, p = .027). In sum, the higher the relational mobility, the more a society prefers danceable music. Given that one function of danceable music is to downregulate high arousal negative emotions, we argue that this is evidence of greater societal prevalence of such emotions in countries with high-relational mobility.

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The role of social context in the cultural evolution of traditional Ryukyuan songs

We analyzed the geographic variation of traditional songs in the Ryukyu Archipelago, southwestern islands of Japan, to study cultural evolution of music and compare it with linguistic and genetic evolution, with a focus on the social contexts in which the songs are sung. Published score data of 1,342 traditional songs were coded using the CantoCore song classification scheme (Savage et al., 2012) and distances between the songs were calculated. NeighborNet networks of regions/islands were generated based on the distances between songs and the delta scores were obtained to evaluate treelikeness of the networks. AMOVA was performed to calculate ΦST value as a measure of the song diversification among regions/islands. Mantel test and partial Mantel test were used to examine association among music, languages, genes and geography. These analyses were repeated separately for each of four song categories distinguished by their social context (child, ritual, work and amusement). We found that the delta scores for music networks were larger than the delta score for the corresponding linguistic network, suggesting horizontal transmission playing a large role in cultural evolution of music in the Ryukyu Archipelago. The ΦST values varied depending on the social contexts, and especially, songs with the "work" social context exhibited high degree of diversity between regions/islands and also significant association with languages, partially supporting the social bonding hypothesis of music. On the other hand, association between music and genes was not observed in the Ryukyu Archipelago.

Q&A session 12
Day2-B1
Music 2

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Cultural macroevolution of musical instruments in South America

Precolumbian South America offers a rich subject of investigation of cultural macroevolution, given the multiple innovations and transformations that document unique or parallel patterns to those of other parts of the world. One can thus examine the relation of cultural phenomena to language groups and population history, and issues such as trans-pacific diffusion or exchange among major areas (e.g., Andes, Amazon). Comparative musicology of songs has greatly developed – we extend this to the study of material culture. We examined organological data, extracted from archaeological and ethnographic sources, and produced new continental databases (e.g., matrix of 57 aerophones, membranophones and idiophones in 145 societies based largely on Izikowitz' work) and analysed them. South Americans developed a high diversity of wind instruments and drums, while lacking chordophones. Our network analysis of panpipe features identified four clusters: two each in the Tropical Forest and Andean regions. About forty percent of the instruments in the standard organological classification are present in the archaeological, but not in the ethnographic record. The archaeological record comes mostly from the central Andean region, reflecting both preservational biases and research efforts, but we report on records from other areas. Our work represents the first analysis of cultural artifacts at a continental scale, and outline possible evolutionary paths by linking

the instruments to the populations who produced them. This effort can be further developed by curating and standardizing resources from catalogues and museum collections, a task in great need of development in South American institutions.

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Group identities make fragile tipping points

Tipping points imply the potential for populations to transition rapidly from one cultural tradition to another. In applied domains, this suggests that delimited policy initiatives may incite sweeping beneficial changes in behaviour. The risk, however, is that ordinary processes like individual heterogeneity and identity concerns might restructure or even undermine tipping in ways policy makers do not understand. To examine this possibility, we implemented an experiment before and after the fractious 2020 election for U.S. President. Participants played coordination games in groups of either Republicans or Democrats. Repeated play allowed groups to develop local norms. Once a group had established a norm, we exposed a subset of group members to an intervention that promoted an alternative group-beneficial norm. In our control treatment, choice options were labelled with neutral symbols. In our identity treatment, options were labelled with partisan political images designed to activate group identities and associated affective responses. This simple relabelling generated extreme differences in cultural evolutionary dynamics. With neutral labels, groups were slow to develop norms before intervention, but they transitioned to new norms quickly after intervention. Under political labels, groups were fast to develop norms before intervention, but they persisted in a state of chronic disagreement after intervention, with large opportunity costs the net result. Tipping points, in short, were powerful but fragile. Group identities accelerated beneficial changes in local culture when choice and identity were unrelated, but even a trivial link between choice and identity destroyed the effect entirely.

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Assortative interaction leads to the emergence of subcultures even without selective imitation

There is a long-standing debate considering the possibility of sympatric speciation, the origin of multiple species from one, without geographic isolation. Although the central position of the geographical aspect of speciation had suffered significant demise recently, spatial isolation is still believed to play a pivotal role in divergent evolution by limiting gene flow between adjacent populations. Here we present a novel model combining assortative mating and multidimensional inheritance. The continuous inheritance between interacting agents can approximate additive genetic (Galton-Pearson model) or social (Parental Variability-Dependent Inheritance) transmission, or a combination of the two. We demonstrate that in a model where variance of inputs is proportional to the variance of outputs, the assortment alone can lead to the formation of distinct, cohesive clusters of individuals with low within-group and large between-group variability even in the absence of disruptive natural or cultural selection.

Subcultures can, therefore, emerge even without the preferential imitation of self-similar individuals. All it takes is the negative relationship between the probability of interaction and the distance in the culture-space.

The model explains the constant and frequent sympatric emergence of subcultures and varieties with limited gene flow that can only later diverge ecologically and possibly speciate. This model might be particularly relevant for taxa with a high capacity for cultural evolution, such as cetaceans, songbirds, and hominins, known for their increased potential to undergo adaptive ecological radiation.

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Selection pressures against multilevel selection

In this paper I depart from the traditional Price-equation formulation of multilevel selection and introduce a new theoretical approach of a multi-level selection process where phases of intra-group interactions alternate with phases of interaction among groups. I assume that a given genetic allele or cultural trait is maladaptive for individuals bearing it but increases the fitness of others in the same group (like altruism), but groups with a higher fraction of bearers of the trait have an advantage in the inter-group interaction phases and reproduce faster. Two main results are obtained that had remained somehow hidden in the traditional model: (1) For group selection to overcome the opposing effect of individual selection the key factor is the amount of "positive" variation in groups' reproduction, not the strength of group selection per se. (2) Multilevel selection is vulnerable to invasion by mutants that inhibit the phenotypic effect of the allele or cultural trait in the intra-group phases but allow its expression in the between-group phases, in a similar process that make green beards genes unlikely to evolve. By discriminating its phenotypic effects depending on appropriate cues in both environments, the mutated trait restores the selfish behavior when it serves the individual but maintains the altruistic effect when it serves both the group and the individual. This can be interpreted as breaking the "public good" link of the original allele or trait regarding its positive effect in the inter-group competition in relation to its detrimental effects in the intra-group competition phases.

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The evolution of group beneficial strategies - An experimental study of cultural group selection

Cultural group selection (CGS) has been widely applied for explaining the evolution of human cooperation. The key mechanism sustaining the CGS is called inter-group competition, which can take various forms from inter-group conflict to payoff-biased migration and imitation. In this study, we designed a laboratory experiment to examine whether the group-beneficial cultural traits can spread in a population only through the process of payoff-biased imitation without lethal inter-group conflicts.

In the experiments, participants were divided into small groups and played a repeated stag-hunt game. At the end of an experimental block, a randomly selected member migrated to a neighboring group. In the payoff-display condition, both the payoff and the strategy a migrant received /selected in the previous group were presented to the group members. In the no-payoff-display condition, only the strategy selected by a migrant was presented.

We found that the frequency of group-profitable strategies increased faster in the payoff-display condition. In addition, the participants in a migrant host group were more likely to imitate migrant's strategies when a migrant received higher payoffs in a home group. The probability and speed of convergence to the group profitable strategies were higher in the payoff-display condition than in the no-payoff-display condition. The results suggest that payoff-biased imitation facilitates the cultural group selection of group-beneficial traits in a game with multiple equilibria even without any lethal group conflict as is predicted by Boyd & Richerson (2002, Journal of Theoretical Biology, 215, 287-296).

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The coevolution of norm-internalization and frequency dependent preferences through cultural group selection

A key condition for cultural group selection to function is that substantial between-group variation is somehow maintained. It has been suggested that multiple social learning biases such as conformity and prestige-bias contribute to maintenance of intergroup variation by suppressing within-group variation. It has also been argued that such social learning biases are endowed to human beings because they are evolutionarily adaptive. However, it is not clear whether psychological mechanisms bolstering within-group homogeneity are adaptive in non-cooperative game settings. In the present study, we examined whether the frequency dependent preference which contributes to within-group behavioral homogeneity was evolvable in non-cooperative game settings. We then examined whether the frequency dependent preference could evolve and facilitate cooperation in tandem with the evolution of norm-internalization capacity, by extending the Gavrilets and Richerson (2017)'s agent-based simulation model on the evolution of norm-internalization. In making their decisions, individuals attempt to maximize a utility function that captures three distinct motives: maximizing material payoff, following the norms and the majority behavior. The second motive depends on one's ability to internalize the norm, and the third one depends on one's sense of conformity. We formulated frequency dependent utility functions in two different ways and found that any type of frequency dependent preferences was not favored by natural selection, while the ability to internalize norms could evolve under a wide range of conditions and promote the evolution of cooperation.

Q&A session 14
Day2-D1
Culture and society

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Estimating the reproducibility of social learning research, 1955-2018

Low rates of data availability and results reproducibility have been observed across the biological and behavioural sciences. Here, we attempt to quantify the rate of reproducibility in the study of social learning research. We surveyed 560 empirical publications on this topic, published between 1955 and 2018 in animal behaviour, behavioural ecology, cultural evolution, and evolutionary psychology.

Data was recoverable online or through direct data requests for 30% of this sample. Data recovery declines exponentially with time since publication, halving every 6 years, and up to every 9 years for human experimental data. Essentially no data is available for any publication before the year 2000. However, when data for a publication is available, we estimate by hierarchical modeling a high probability of subsequent data usability (87%), analytical clarity (97%), and agreement of published results with reproduced findings (96%), giving an overall reproducibility rate of any given result in the literature of 23% [0.89 HPDI: 15-28%].

Our results suggest that the primary threat to the reproducibility of published results in cultural evolution is the lack of long-term data archiving, rather than mistakes in analyses or results. Although recent innovations in research transparency, such as the FAIR data guidelines and use of version-controlled analysis code, address these failure points, individual adoption of these novel research practices, as well as incentives promoting data reuse and openness at the funding and publication level, must become more widespread to prevent similar decay of social learning results in the future.

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Modelling anti-vaccine sentiment as a cultural pathogen

Culturally transmitted traits that have deleterious effects on health-related traits can be regarded as cultural pathogens. A cultural pathogen can produce coupled dynamics with its associated health-related traits, so that understanding the dynamics of a health-related trait benefits from consideration of the dynamics of the associated cultural pathogen. Here, we treat anti-vaccine sentiment as a cultural pathogen, modelling its 'infection' dynamics with the infection dynamics of the associated vaccine-preventable disease. In a coupled susceptible–infected–resistant (SIR) model, consisting of an SIR model for the anti-vaccine sentiment and an interacting SIR model for the infectious disease, we explore the effect of anti-vaccine sentiment on disease dynamics. We find that disease endemism is contingent on the presence of the sentiment, and that presence of sentiment can enable diseases to become endemic when they would otherwise have disappeared. Furthermore, the sentiment dynamics can create situations in which the disease suddenly returns after a long period of dormancy. We study the effect of assortative sentiment-based interactions on the dynamics of sentiment and disease, identifying a tradeoff whereby assortative meeting aids the spread of a disease but hinders the spread of sentiment. Our results can contribute to finding strategies that reduce the impact of a cultural pathogen on disease, illuminating the value of cultural evolutionary modelling in the analysis of disease dynamics.

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An evolutionary demographic decomposition of Spanish-speaking among the indigenous Tsimane of Bolivia

The study of cultural evolution often focuses on mechanisms of cultural transmission, primarily social learning. Less studied is how basic demographic forces, such as differential survival, fertility and migration, affect change in the distribution of cultural traits over time.

Beheim & Baldini (2012) derived an equation to decompose the evolution of a cultural trait perfectly into the sum of six components: reproductive success, individual change, death, immigration, emigration and parent-offspring transmission. Comparing the relative roles of these forces can help identify which processes contribute most to the evolution of a cultural trait, and in which direction these forces tend to affect the trait.

Here, we leverage 16 years of longitudinal data on Spanish-speaking among the indigenous Tsimane of Bolivia, to investigate potential demographic drivers of language adoption. We use Bayesian hierarchical models to estimate the association between Spanish-speaking and each of the demographic terms (births, deaths, migration) during this time period, and thus compare the relative magnitude of each demographic force on Spanish-speaking.

Spanish-speakers have greater reproductive success and lowered mortality compared with non-speakers, predicting that Spanish-speaking will increase across the population over time. Given this, we test hypotheses about relevant factors affecting the adoption of Spanish among the Tsimane, including wealth and access to the marketplace. This research highlights the value of quantifying demographic rates of cultural evolution, while contributing to a broader understanding of the drivers of acculturation, market integration and language persistence in indigenous communities.

Q&A session 14

Day2-D1

Culture and society

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Cultural connotations of categorizing the environment: does the presence of a linguistic gender and noun class system in any way connect to cultural feature data?

Social studies indicate that a gendered language may limit equal opportunities for women (Jakiela and Ozier 2018). Likewise, the use of gender-neutral pronouns may improve gender equality (Tavits and Pérez 2019). We aim to investigate this issue using cross-cultural data. The studies of (Whyte 1978) and (Sanderson and Donoghue 1989) (W1978/SD1989) connect gender inequality to cultural features. Testing three theories, the Warfare hypothesis, the Marxian hypothesis, and the Non-marxian materialist hypothesis, they found significant effects only for the latter (lower percentage of contribution to food by women, intense agriculture, use of plow, patrilineality, partilocality). Wh1978/SD1989 used a sample of 186 cultures, selected to avoid Galton effects. We use a global set of linguistic gender/noun class (3079 languages), retrieved by automation (Virk et al. 2017) and corrected manually. We extracted the features of Wh1989/SD1989 from D-PLACE (Kirby et al. 2016). We tested (using a mixed model) the inequality features Domestic authority of women, Ritualized female solidarity, and Control of women's sexuality, against linguistic gender and/or noun class. We found no correlation. We tested the features significantly correlated with gender inequality in W1989/SD1989 and found effects for noun class, which is a Galton effect (most noun classes are found in Africa). When we merged gender/noun class and tested against the significant features, we found several negative and positive correlations, connected to, e.g., participation in agriculture, cross-cousin marriage, patrilocal residence, and intense agriculture. Therefore, we suspect that gender/noun class may correlate with subsistence and kinship, to which inequality may be another side-effect.

Q&A session 14

Day2-D1

Culture and society

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The Evoluiton of Imitation Without Cultural Transmission

The evolution and function of imitation in animal learning has always been associated with its crucial role in cultural transmission and evolution. Can imitation evolve in the absence of cultural transmission? We investigate a model of a semelparous organism with discrete, nonoverlapping generations in which the sole transmission of information between generations is genetic. We suppose that an organism can modify its phenotype in response to the phenotypes it observes in its cohort of conspecifics. We find that during a period of directional selection towards a phenotypic optimum, natural selection favors modifiers which cause an organism to bias its plastic phenotype in the direction ¥emph{opposite} to the mean phenotype of the population. As the population approaches the phenotypic optimum and shifts into stabilizing selection, selection on the modifier reverses and favors strong imitation of the population mean. Imitation can become so strong that ``genotype-phenotype disengagement'' occurs (Gonzalez, Watson, and Bullock 2017), and for multivariate phenotypes evolution can cycle between genotype disengagement and re-engagement. While in some cases the evolution of imitation and anti-imitation increase the mean fitness of the population, cycles of genotype disengagement and re-engagement can make the mean fitness nonmonotonic in time.

Q&A session 15

Day2-E1

Cultural transmisson 1

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The Natural History of Conformity

Accounts of conformist transmission have delineated two functional benefits for conformity; informational (copying the majority in order to access the most successful behaviour) and normative (copying the majority to fit in socially). Normative conformity has also been termed social conformity when majority-biased learning serving to facilitate social integration is observed in non-human animals.

We will argue that, rather than informational and social conformity being underpinned by separate mechanisms, all conformist social learning may be derived from a drive to fit in socially. We expect this to be particularly true of animals living in stable social groups. The potential ecological adaptiveness of behaviours acquired via conformist social learning may therefore be a by-product of a (likely implicit) strategy to promote social integration. Thus, in group-living animals like human and nonhuman primates, the same mechanism (a preference for behavioural synchrony) seems to be shared by ecological, weakly social (integration) and strongly social (norm compliance) functions.

This is supported by evidence from both human and non-human animals showing that similarity in both instrumental and social behaviours promotes affiliation. In addition, priming human participants with cues of ostracism leads to increased social learning, suggesting that this is a strategy used by humans to integrate socially. We will also discuss potential biological mechanisms by which this might operate, with evidence that hormonal changes may increase the tendency to conform. Finally, we will suggest new avenues for future research into conformist social learning, with a particular focus on behaviour during dispersal in wild primates.

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Culture impacts the distribution and habitat use of sperm whales in the Eastern Caribbean

Sperm whales (Physeter macrocephalus) are cetaceans with a worldwide distribution and a complex social structure. Sperm whales are members of cultural groups, called "vocal clans". Members of a vocal clan have a distinctive suite of socially learned social calls, and do not associate with individuals from other vocal clans. However, whether vocal clan membership has implications beyond the use of a characteristic acoustic repertoire had never been tested in the Caribbean. Via a dedicated survey of sperm whales in the Lesser Antilles, we observed stark differences in vocal clan distributions across relatively small distances (<100km), with little to no overlap between them. These differences in distribution appear to relate to environmental variables with one vocal clan preferring island channels and areas of high eastward current speed and the other preferring canyons with low meridional velocity variance. Such fine-scale habitat partitioning is surprising for a species which is often referred to as an "ocean nomad" and contrasts with Eastern Tropical Pacific clans, which share habitats over much greater scales (we observe a factor of 10 difference between the movements of Eastern Caribbean and Eastern Tropical Pacific sperm whales). We hypothesize that Eastern Caribbean sperm whales are habitat specialists, with vocal clans specializing on the use of certain environmental features and maintaining this specialization through social learning. This not only highlights the need to incorporate culture in the field of conservation management, as different cultural groups have different distributions and habitat use, but also the inherent ties between culture and the environment.

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Transmission of Cultural Domains among Immigrants and British nationals in the UK

This presentation will focus on two studies which looked at how individuals learn about, maintain and transmit different aspects of their cultures. Each study sampled 100 participants from three groups in the UK (50 British nationals including Black and White British, 25 Polish and 25 South Asian immigrants which are the largest immigrant groups). Both studies used mixed-methods surveys combining quantitative questions with freelists.

We looked at 3 types of cultural groups that our participants belong to: heritage, religious and national groups. Study 1 looked at which aspects of their cultures individuals believed are important to maintain, what motivated them to do so and the consequences of not maintaining these cultural practices. Study 2 looked at the aspects of these cultures individuals believed are important to teach to children and at what age. In both studies, we looked at how individuals have been taught about their various cultures, and what cultural domains they believed their cultural groups should, or should not assimilate from others and vice versa.

We compare how these cultural domains vary in two ways:

1. based on the type cultural group and

2. across the three   demographic groups we are sampling.

Data analysis for these studies is currently ongoing and will be completed in time for the presentation. Preliminary findings from the two studies show that the main sources for learning about one's culture are family (parents and grandparents), school and media (TV, music and Social media). Some of the cultural aspects that are considered important fall under categories of functional domain (e.g food and music), cooperation (tolerance, acceptance, close knit ties), tradition (language, family traditions), history (of the countries, religions and movements such as immigration) and morality.

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It happened to a friend of a friend: inaccurate source reporting in rumour diffusion

People often attribute rumours to an individual in a knowledgeable position two steps removed from them (a credible friend of a friend), such as 'my friend's father, who's a cop, told me about a serial killer in town'. Little is known about the influence of such attributions on rumour propagation, or how they are maintained when the rumour is transmitted. In four studies (N = 1824) participants exposed to a rumour and asked to transmit it overwhelmingly attributed it either to a credible friend of a friend, or to a generic friend (e.g. 'a friend told me about a serial killer in town'). In both cases, participants engaged in source shortening: e.g. when told by a friend that 'a friend told me ...' they shared the rumour as coming from 'a friend' instead of 'a friend of friend'. Source shortening and reliance on credible sources boosted rumour propagation by increasing the rumours' perceived plausibility and participants' willingness to share them. Models show that, in linear transmission chains, the generic friend attribution dominates, but that allowing each individual to be exposed to the rumour from several sources enables the maintenance of the credible friend of a friend attribution.

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Combat stress in a small-scale society suggests divergent genetic and cultural roots of PTSD symptoms

Military personnel in industrialized societies often develop posttraumatic stress disorder (PTSD) during combat. It is unclear whether combat-related PTSD is a universal evolutionary response to danger or a culture-specific syndrome of industrialized societies. We interviewed 218 Turkana pastoralist warriors in Kenya, who engage in lethal cattle raids, about their combat experiences and PTSD symptoms. Turkana in our sample had a high prevalence of PTSD symptoms, but Turkana with high symptom severity had lower prevalence of depression-like symptoms than American service members with high symptom severity. Symptoms that facilitate responding to danger were better predicted by combat exposure, whereas depressive symptoms were better predicted by exposure to combat-related moral violations. The findings suggest that some PTSD symptoms stem from an evolved response to danger, while depressive PTSD symptoms may be caused by culturally specific moral norm violations.

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Unenculturated chimpanzees fail to produce and use sharp stone tools in the absence of know-how demonstrations

The existence of sharp stone tools is sometimes used as evidence for early cultural evolution in hominins. Yet, it is an open question whether these tools required cultural transmission of their underlying know-how. The main, but previously untested, alternative is that the know-how underlying these tools was the outcome of biologically evolved abilities (adaptations/exaptations). Here we tested – for the first time – whether non-human great apes may be spontaneously able to innovate the neccessary know-how to produce and use sharp stone tools. This required us to test apes in the absence of human enculturation and in the absence of human know-how demonstrations. Eleven chimpanzees were tested   in this way. All proved motivated to engage in the tasks given, but not a single chimpanzee spontaneously made or used sharp stone tools. Our results stand in sharp contrast to the positive outcomes of earlier ape sharp stone tool experiments. However, all three apes that were previously tested (one orangutan and two bonobos) had received both human enculturation and human know-how demonstrations prior to their test (even active moulding of actions was sometimes applied).

Human enculturation and/or human know-how demonstrations may thus be necessary before apes acquire sharp stone tool abilities. This would suggests that sharp stone tool manufacture and use has evolved – culturally and/or biologically – in the hominin lineage after the split between Homo and Pan.

Q&A session 16

Day2-A2

Non-human culture 2

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Collective Knowledge and the Dynamics of Culture in Chimpanzees

Social learning in primates has been studied experimentally for over 120 years, yet until recently these efforts focused only on what one individual would learn from a single other. Evidence of group-wide traditions in the wild stimulated a shift in the present century to recognize the collective context of social learning, with the development of broader 'diffusion experiments' that have illuminated the nature and limits of transmission across communities of multiple individuals and then between them. Here we describe the results of two strands within our recent experiments that further explore the collective dimensions of culture and cumulative culture in chimpanzees. The first concerns collective innovation and cumulative culture. Exposing small communities of chimpanzees to contexts incorporating increasingly challenging, but more rewarding, tool use opportunities revealed solutions arising through the combination of different individuals' discoveries, that spread to become shared innovations. The second strand is conformity, where experiments have yielded evidence of conformist changes from habitual techniques to alternatives displayed by a unanimous majority of others, but with a curious twist akin to quorum decision making, based on only a sample of those in the community. We discuss the implications of this array of findings in the context of related studies of both other primates and non-primate species, as well as for enhancing our understanding of the extraordinary forms that cumulative culture has taken in our own species, likely built on the foundations we can infer from studies of the primates with whom we share our most recent common ancestry.

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Cumulative culture in chimpanzees? Invention and social information use in a cumulative task

Cultures can accumulate improvements over generations, resulting in variants that are beyond the scope of individuals to invent without the knowledge of their predecessors, a process argued to be unique to humans that is termed cumulative cultural evolution (CCE). We explored CCE in one of our closest living relatives, focusing on whether chimpanzees' (Pan troglodytes) innovation and/or social learning propensities may restrict their progress on a tool use task that required increasingly complex solutions. Chimpanzees (N = 53) were inventive, exploring the task space, but complex tool modifications were infrequent and predicted by individuals' past experience with similar tools. Chimpanzees witnessing rare tool modifications failed to reproduce them indicating that complex tool behaviors did not socially spread in the groups they were discovered in. We also saw no evidence of cumulative cultural learning as the complexity of group tested individuals' solutions did not surpass what individuals tested by themselves invented. Nevertheless, social information afforded communities greater task success and richer behavioral repertoires than individually tested chimpanzees. Failure to pass on particularly complex solutions suggests a potential limit to chimpanzees' social learning dispositions, with implications for the complexity of their cultural

repertoires.

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Using tools influences the association networks of bearded capuchin monkeys (Sapajus libidinosus)

Research on tool use by non-human primates has advanced our understanding of how traditions might affect biological processes. Previous studies demonstrated how nut-cracking with stone tools affect cognitive processes such as perception, attention, memory, and learning of bearded capuchin monkeys from Fazenda Boa Vista, Brazil. In this contribution, we investigated whether the social network of these monkeys while cracking nuts with tools differ compared to their social network in other contexts. We used spatial association data collected over five field collection periods to construct association networks according to the activity monkeys were performing (nut-cracking, foraging for other types of food, or non-feeding activities) and the location (on an anvil or off anvils). We compared network and node metrics among the six contexts. We demonstrate that tool use influences the properties of association networks of bearded capuchin monkeys: connectivity was lower when monkeys were on an anvil and when they were cracking/eating nuts. There was no effect of age class on node properties, and no preferential pattern of association with the same or with different age classes while cracking nuts. The features of the nut-cracking networks of bearded capuchin monkeys are not optimal for information flow, which highlights the importance of artifacts, and of individual learning for acquisition of tool use. Our results provide evidence that socially transmitted behaviors persist despite theoretically diminished opportunities for social transmission of relevant information.

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Birds and bins – innovation and culture in a human-wildlife conflict

Foraging innovations that allow wild animals access to human-provided resources can become an adaptive response to anthropogenic change when they get established as cultures, but also bear the potential for human-wildlife conflict. We describe a cultural evolutionary arms-race in an urban environment: opening household-waste bins by wild sulphur-crested cockatoos and the counter-measures taken by local residents – bin-protection.

Using a citizen-science approach, we mapped the occurrence of bin-opening and bin-protection across the Greater Sydney area. We show the geographic spread of bin-opening behaviour in cockatoos from 3 to 44 suburbs over the course of three years. Direct observations of 160 bin-openings in three hotspot areas revealed individual styles and site-specific differences in opening techniques suggesting the establishment of local sub-cultures in bird behaviour. A multi-state Markov-Chain model revealed that

bin-protection by residents over time was best explained by the time since bin-opening was first observed in a suburb. A direct survey of over 3000 bins across four suburbs identified 13 distinct types of protection devices to deter cockatoos, ranging from low to high efficiency. Bins close to each other in driving distance (compared to direct line distance) were significantly more likely to be similar with respect to overall protection (yes/no), efficiency level and protection type, suggesting that people copy protection devices they see on their daily commutes.

Bin-opening culture is a direct response to a human-provided resource, the parallel occurrence of social learning on both the cockatoo and human side highlights how human-wildlife conflict can lead to an inter-species cultural arms-race.

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Language phylogenies reveal a recent northern origin of the Utoaztecans

The Uto-Aztecan language family is one of the largest language families in the Americas. However, there is considerable debate about its origin. One scenario postulates a northern origin in Southern California, Arizona and Northern Mexico between 3,000-5,000 years ago. Another scenario argues for a similar time-frame but a southern origin in Mesoamerica and subsequent northerly spread into the American southwest. A third scenario proposes a much older origin around 8,900 in Nevada.

Here we use Bayesian phylogenetic and phylogeographic methods to analyse lexical data from 34 Uto-Aztecan and 2 Kiowa-Tanoan languages. We infer the age of Proto-Uto-Aztecan to be around 4,095 years ago (3,258 - 5,025 years), and identify the most likely homeland to be in or near what is now southern California. We reconstruct the most probable subsistence strategy in the ancestral Uto-Aztecan society using ethnographic data.

We use ancestral state inference on cultural and ethnographic data and find a high probability that the proto-Uto-Aztecans had low agricultural dependence, no casual or intensive cultivation, an absence of cereal crops, and a primary subsistence mode of gathering (rather than hunting or agriculture). Our results therefore support the northern origin scenario's proposed timing, geography, and cultural practices, and are inconsistent with the southern and ancient origin scenarios.

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Loanwords in basic vocabulary mediate the borrowing profile of a language

Basic vocabulary lists are a popular data type in the field of phylogenetic linguistics because of the vertical signal the data carries. Interestingly, basic vocabulary also features borrowings. The horizontal influence can be understood as a proxy for population contacts as well because loanwords into basic vocabulary are most likely acquired in intimate contact situations. This is valuable information for multidisciplinary studies aiming to integrate information on contact events from various sciences to gain a better insight into the prehistory of a population. As basic vocabulary lists are widely available, they can inform of the known contact history for large groups of languages or even whole language families making wide-scale comparison possible.

We call the contact history of a language reflected by its loanwords the borrowing profile. In our paper, we compare the borrowing profiles mediated by the basic vocabulary of six well-studied Uralic languages to the borrowing profiles of the whole languages represented by large vocabulary stocks. We show that basic vocabulary provides an informative snapshot of the borrowing profile; however, the trace of prehistoric loanword layers is emphasized in basic vocabulary. Known sociolinguistic circumstances explain the differences in the borrowing profiles of basic and whole vocabulary.

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What we talk about when we talk about color

Names for colors vary widely across languages, yet color categories are remarkably consistent. Shared mechanisms of color perception help explain these shared patterns and have naturally been the focus of past work. But the mappings from colors to words are not identical across languages, which may reflect differences in communicative needs – how often speakers must refer to objects of different color. A link between compression and categorization in natural language gives us a new way to infer the key factors shaping color vocabularies in 130 languages around the world, and in fact reveals a hidden diversity in communicative needs across linguistic communities. We show that the extensive variation revealed by our novel approach can be explained in part by differences in geographic location and local biogeography, while commonalities in the colors of greatest demand are correlated with the colors of salient objects, including ripe fruits in primate diets. This diversity and non-uniformity in communicative needs has functional consequences for patterns of color naming and is of interest as an object of study in its own right. Our work reconciles opposing theories of color naming, while opening new directions to study cross-cultural variation in communicative needs and its impact on the cultural evolution of color categories.

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True story: Narrative as an adaptation for the communication of social survival information

Storytelling, like language, is central to human cognition: it helps us process experiences (Wilkens et al, 2005), store memories (Nelson, 1993; Schank & Abelson, 1995), and form personal identities (Young & Saver, 2001; Yuval-Davis, 2006). Previous studies have used iterated learning to examine the role of cultural transmission in the evolution of language (Smith, Kirby & Brighton, 2003; Kirby, Cornish & Smith, 2008; Kirby, Griffiths & Smith, 2014), and reveal content biases for social and survival information in the transmission of narratives (Bartlett, 1920; Stubbersfield, Tehrani & Flynn, 2014; 2017). This experiment combined the transmission chain paradigm with task-based experiments (Bahrami et al, 2010; Bjørndahl et al, 2014; Thompson et al, 1993) to test whether exposure to social survival information through narrative improves performance in a social task: a game in which participants had to learn a set of novel, arbitrary social customs to succeed. In two conditions, participants then wrote either a story or list, designed to memorably communicate the customs to the next player, forming a transmission chain (see demo here: https://bit.ly/narrative-game). Scores in the task improved over generations in both conditions, supporting the hypothesis that narratives can effectively communicate social survival information in transmission. These results are compatible with Dunbar's (1997) social brain hypothesis, the 'problem simulation theory of storytelling' (Gottschall, 2012 p. 63), and previous experimental work on content biases (Stubbersfield, Tehrani & Flynn 2014; 2017). We provide an experimental paradigm which can now be adapted to target more specific questions about the evolution of narratives.

Q&A session 17

Day2-B2

Language 2

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A swarm robotics model of the cultural evolution of language

Swarm Robotics, which studies collective behaviors of large populations of robots with simple embodied cognition, is an ideal testbed for studying the cultural evolution of language. Our goal is to expand existing simulations in order to explore a dominant theory in evolutionary linguistics - the self-domestication hypothesis - which suggests that reduced reactive aggression led to the sophistication of the cultural niche, enabling the complexification of languages.

Current swarm robotics models, however, lack several crucial features that are considered prerequisites for this process. Robots are typically collaborative, homogenous, with little to no memory. To mimic self-domestication, an evolutionary advantage for prosociality needs to be introduced, and robots need to be treated as distinct individuals.

In our model, robots explore their environment while playing a language game. Crucially, we include two novel features: (1) robot individuation: robots have a partner-specificity memory, keeping track of the outcomes of past interactions with specific robots; (2) parameterizable prosociality: robots' tendency to interact is based on experience: successful communications between robots reduce their aggression toward each other and increase their chance to interact again. With these manipulations, community structure should emerge (robots favoring interaction with some robots over others, i.e., "in-group" bias), and different lexicons should stabilize in different sub-groups in the swarm despite their physical proximity.

Future steps will introduce an underlying task requiring robots to cooperate using their shared language to achieve a goal. In this context, more complex language structures should evolve, demonstrating the positive feedback loop between increased self-domestication and language

complexity.

Q&A session 18

Day2-C2

Cooperation, convention and law

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Third parties serve as arbitrators but not punishers in Mentawai justice

Researchers argue that third party involvement is critical for sustaining humans' unique levels of cooperation, yet it remains unclear precisely how third parties contribute, especially in small-scale, politically decentralized societies. In a detailed study of crime and punishment among the Mentawai of Siberut Island (Indonesia), we test two leading hypotheses of third-party involvement: punishment and arbitration. Across a sample of ~400 transgressions, most of which were followed by the payment of a fine (usually paid in cooking pots, pigs, chickens, etc.), we find no evidence that third parties expend costs to punish. Fines were demanded by victims or their clanmates, and if an aggressor failed to pay, second-order punishment was always taken on by the victim or an aggrieved party and never by third parties. The magnitude of punishment reflected dyadic, rather than communal, concerns: A considerable number of transgressions were followed by no punishment, and, as predicted by dyadic accounts, punishment was less likely when transgressions were less severe and among related individuals. At the same time, third parties—especially older, prestigious shamans—were overwhelmingly called as arbitrators and, as expected, third-party arbitrators were called more often as the likelihood of conflict increased. Moreover, government officials appear to fill similar roles as community arbitrators, demonstrating how governmental intervention might contribute to the decline of indigenous leadership institutions. These findings suggest that systems of justice in small-scale societies may develop more to restore cooperation than to enforce norms.

Q&A session 18

Day2-C2

Cooperation, convention and law

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The experimental emergence of convention in a non-human primate

Conventions form an essential part of human social and cultural behaviour and may also be important to other animals. Yet, despite the wealth of evidence that has accumulated for culture in non-human animals, we know surprisingly little about non-human conventions beyond a few rare examples. We follow the literature in behavioural ecology and evolution and define conventions as behaviours that solve a coordination problem in which two or more individuals need to display complementary behaviour to obtain a mutually beneficial outcome. We review and discuss the literature on conventions in non-human primates and come to the conclusion that all the ingredients for conventions to emerge are present and therefore that they ought to be more frequently observed. We probe emergence of conventions by using a unique novel experimental system in which two baboons (Papio papio) can voluntarily participate together in touch-screen based cognitive testing and we show that conventions readily emerge in our experimental setup and that they share three fundamental properties of human conventions (arbitrariness, stability and efficiency). These results question the idea that imitation is necessary to establish conventions.

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Effects of sorcery beliefs on parochial prosociality in Mauritius

While previous studies testing evolutionary models of religious morality found that beliefs in moralizing and punitive gods decrease local favoritism and increase resource-sharing with distant co-religionists, the effects of beliefs related to local supernatural agents have not been extensively explored. Nam (the spirit of a deceased person) beliefs are quite ambiguous because the spirit may be linked to ancestor worship but also to the practice of sorcery (illegal in Mauritius). Importantly, previous studies suggested that sorcery beliefs and practices can have a damaging impact on social bonds and trust, but such research is often limited by social stigma associated with sorcery and relevant comparison with other local deities is often missing. We show that endorsing the sorcery mode of belief in nam together with performing rituals toward nam was associated with larger probability of breaking the game rules for selfish outcomes in the Random Allocation Game (compared to the ancestor worship mode).

Q&A session 18

Day2-C2

Cooperation, convention and law

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The preference for cooperative and competitive games in three diverse cultural groups

Rule-based games are played across a broad range of cultural contexts and vary with cultural attributes, such as political stratification, child-rearing practices, and religious beliefs. However, few studies have examined the games played in egalitarian, hunter-gatherer societies in comparison to hierarchical societies. The current study experimentally investigates the relationship between cultural levels of social stratification and interdependence, and the preference for games in three diverse cultural groups. Children between the ages of 7 and 14, and their caretakers, were asked to play a cooperative and a competitive game, after which participants then chose their preferred game. We expected the Hai‖om of Namibia, a recent hunter-gatherer and egalitarian population, to prefer the cooperative game more than their Owambo neighbors, a recent agro-pastoralist and socially stratified society. We also expected German children to prefer the competitive game more than the cooperative game. Preliminary results will be presented.

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Macro- and Micro-Cultural Evolution of Human Law

After Homo parted with Pan 7 mil. years ago, human "law" evolved. However, cultural evolution (e.g. Mesoudi 2011) of law is understudied (e.g. Goodenough 2005). We propose new research methods, to pioneer the way to demonstrate how the macro- and micro-cultural evolution of law took place.

1) For macro-evolution, we define law as: "a set of collective norms – and the violators shall be punished by a third-party with consistency" (Wada 2017).

1-1) We hypothesize that within early human hunter-gatherer group of 30 (Hill et al 2011, Lehmann et al 2014) to 150 ("Dunbar's number") individuals, "group laws" evolved, shared by, and transmitted to the new members of, the group by use of early, only spoken language (for human's hierarchical perception, see Sano et al 2020).

1-2) Based on previous research on evolution of norms (Campenni et al 2014), cooperation and third-party punishment (Helbing et al 2010, 2010 on punishment; Boyd et al 2003; Bowles & Gintis 2004 on cooperation/punishment theories; Rand et al 2011, Jordan et al 2016 on empirical research), we proceed directly to the computer simulation analysis of macro-evolution of law.

2) Micro-cultural evolution of law came thereafter.

2-1) Environment could change rapidly collective norms and group laws based thereupon, even within one generation (cf Takahashi & Ihara 2020).

2-2) We proceed to accumulate data set (cf. Bickel et al 2017's "AUTOTYP" on languages and its use by Matsumae et al 2020) of early written law from Uru- Nammu Code, the oldest written code of 2,100 B.C., of medieval Canonic law, Islamic law, Japanese, laws of 7th-19th centuries, inter alia, finally of the modern Common Law, Civil, Penal, Commercial Codes and Constitutions of major countries.   The analysis of the new database, depicting what major components (cf Siems 2016) were newly introduced and transmitted where and when, in the past 4,000 years, will show the micro-cultural evolution of human law.

Q&A session 19
Day2-D2
Cultural transmission 2

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The roles of positive and negative observational learning in the cultural evolution of technology: an experimental investigation

Two types of social learning, positive and negative observational learning, are both commonly found in humans and other animals. Positive observational learning, learning from successful individuals, has been intensely studied both empirically and theoretically in terms of the cultural evolution of technology. In contrast, negative observational learning, learning from unsuccessful individuals, has yet to be studied empirically. Here, we experimentally investigated the roles of positive and negative observational learning with the virtual arrowhead task. We set three between-participants conditions: (1) positive observational learning condition, (2) negative observational learning condition, (3) and individual learning condition as a control. The study replicated previous findings that participants in the positive observational learning condition outperformed those in the individual learning condition. In contrast, participants in the negative observational learning condition did not outperform those in the individual learning condition, although in theory they could enjoy the benefit of additional information. The results suggested that the role of negative observational learning may be limited in the cultural evolution of technology.

Day2-D2

Cultural transmission 2

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Effects of intent (teaching vs accurate reproduction) on the cultural evolution of narratives

In cultural transmission, information flows from 'producers' to 'receivers'. Transmission biases such as content-, model- and frequency-based biases, which modulate the adoption of cultural traits by receivers, have been explored in depth. We focus instead on a bias on production and compare transmission fidelity when producers either intend to teach or intend to reproduce socially acquired information.

Eighty participants were asked to read a story and reproduce it either in order to 'teach it to someone else' or just 'recall it as accurately as possible'. In order to test whether differences in fidelity between these two tasks were related to information encoding (during reading) or to reproduction, we also manipulated the timing of instructions: Half of the participants were informed of the task (Teach or Recall) Before reding the story and the other half, After reading the story. Participants were arranged in 20 transmission chains of 4 generations. The first generation in each chain read a text about the environment (from Mesoudi et al., 2006), and subsequent generations read the previous participant's output story. We measured two aspect of fidelity: Quantity and Accuracy of information retained over generations.

We found that being informed of the task Before reading the story led to higher Accuracy and Quantity than being informed After reading.   Surprisingly, Teaching yielded lower Accuracy than Recall, but both resulted in similar Quantity retained. Additional analyses revealed differences in the content of the information under Teaching and Recall. We conclude that aspects of cultural transmission pertaining to production, in particular, intention to teach vs reproduce, influence transmission dynamics and therefore need to be integrated in models of cultural evolution.

Reference

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The importance of population turnover for the evolution of efficiency

Selection for more efficient socially learned behaviors over alternatives is crucial for cultural evolution,
however our understanding of this process of cultural selection in animals is limited. Using artificial
populations of wild-caught great tits (Parus major), we conducted a cultural diffusion experiment to
ask whether more efficient foraging traditions can replace an established tradition, and how this
process might be affected by turnover. We show that gradual replacement of individuals greatly
increases the probability that a more efficient behavior will out-compete an established inefficient
behavior. Turnover does not increase innovation rates, but instead increases adoption rates, as
immigrants are more susceptible to the novel, more efficient behavior. We go on to show that this
effect might extend beyond birds by using an an agent based model to test the effect of turnover across
populations of different types of learners. Altogether, these results provide strong evidence for cultural
selection for efficiency in animals, and highlight mechanisms that link population turnover to this
process.

Q&A session 19

Day2-D2

Cultural transmission 2

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Robin W. Na (Carnegie Mellon University)

Argument-Making in the Wild

Argument-making, the giving of reasons to believe something, is a central feature of modern life. Ideas spread and are selected for in part because of the arguments we can make on their behalf. While long-standing philosophical accounts parse arguments into deductive, inductive, and potentially abductive patterns, we know very little about the patterns people actually deploy in real-world situations. This leaves us blind to a key selection mechanism in the cultural evolution of ideas. To address this gap, we combine simple tools from natural-language processing with a corpus of over one million argument-making posts in the Reddit forum r/askphilosophy, the "rationalist" website LessWrong, and a corpus of academic articles in philosophy. Our analysis reveals a system of argument-making patterns entirely distinct from the traditional Aristotelian taxonomy. In particular, we show the existence of a certainty-doubt pattern, associated with arguments that compare and contrast relative confidence, a category-making pattern, associated with arguments that consider the sharpness or vagueness of category boundaries, and a question-rephrasing pattern, associated with revising and rewriting a standard view. These provide new insights into social cognition, the dynamics of argument-making in interpersonal exchanges, and the ways that ideas may thrive, or not, on the basis of the argument-patterns they make possible. Our work provides a "plug-and-play" tool for other researchers to analyse the argument patterns their own corpora of interest, and suggests the possibility of new, joint endeavors to look for the universals of argument-making across culture and time.

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Adam Flitton (Human Behaviour and Cultural Evolution Group, University of Exeter)

Alex Mesoudi (Human Behaviour and Cultural Evolution Group, University of Exeter)

When do people prefer dominant over prestigious political leaders?

Previous research has sought to explain the rise of right-wing populist leaders in terms of the evolutionary framework of dominance and prestige. In this framework, dominance is defined as high social rank acquired via coercion and fear, and prestige is defined as high social rank acquired via competence and admiration. Previous studies have shown that right-wing populist leaders are rated as more dominant than non-populist leaders, and right-wing populist/dominant leaders are favoured in times of economic uncertainty and intergroup conflict. In this paper, we explore and critique this application of dominance–prestige to politics. First, we argue that the dominance–prestige framework, originally developed to explain inter-personal relationships within small-scale societies characterised by face-to-face interaction, does not straightforwardly extend to large-scale democratic societies which have frequent anonymous interaction and complex ingroup–outgroup dynamics. Second, we show that economic uncertainty and intergroup conflict predict a preference not only for dominant leaders, but also for prestigious leaders. Third, we show that perceptions of leaders as dominant or prestigious are not fixed, and depend on the political ideology of the perceiver: people view leaders who share their ideology as prestigious, and those who oppose their ideology as dominant, whether that ideology is liberal or conservative. Fourth, we show that political ideology is a stronger predictor than economic uncertainty of preference for Donald Trump vs Hillary Clinton in the 2016 US Presidential Election, contradicting previous findings that link Trump's success to economic uncertainty. We conclude by suggesting that, if economic uncertainty does not directly affect preferences for right-wing populist leaders, other features of their discourse such as higher emotionality might explain their success.

Will Gervais (will.gervais@brunel.ac.uk, Brunel University London)
Aiyana Willard (Brunel University London)
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Children of mixed-faith parents are less religious

Evolutionary and cognitive scientists have taken a keen interest in religion, developing theories of its emergence and persistence across cultures. These theories make quite different predictions about atheism. Specifically, cognitive byproduct accounts describe religion as nigh inevitable, and atheism as requiring special cultural scaffolding and cognitive effort to maintain. Dual inheritance approaches, however, describe religious beliefs as emerging only in the presence of consistent context-based learning cues; in this view, atheism naturally results in the absence of consistent cultural cues that one ought to believe in a specific god. We pitted these perspectives against each other by testing the hypothesis -- derived easily from a dual inheritance perspective -- that children of parents whose religions subtly might be less religious and more prone to atheism than are children whose parents display consistent religious cues. Across three large and representative sets, we found consistent evidence that children of mixed-faith parentage are less religious than their consistent-faith-parent peers. In one analysis targeting only USAmericans who grew up in families in which both parents were Christians, children whose parents merely differed in Christian denomination were reliably more likely to become atheists than were children from denominationally-consistent families. This work speaks to the subtle cultural factors that can naturally produce atheism, the important role of context-biased cultural learning in supernatural belief, and the general utility of incorporating cultural evolutionary perspectives in the evolutionary study of religion.

Jana Nenadalová (jnenadalova@gmail.com, LEVYNA Laboratory for the Experimental Research of Religion, Department for the Study of Religion, Masaryk University)

Sensing spirits and other dangerous beings: "Hardwired" intuitions, or cultural learning – or both?

In darkness and alone, humans fear various "unseen others" – ghosts, monsters, burglars, animals. Previously, I captured such intruder fear accompanied by the intuition of unseen humans' presence: the "Unpleasant Feeling of Sensed Presence" (UFoP). Initially, Cognitive Science of Religion explained (supernatural) agents' encounters through the (hyperactive) agency detection module. Following the current critique of cognitive modularity, I argue that it is more promising to think about agency detection in the context of the domain-general mechanism of cognition, the predictive processing. Predictive processing allows context-sensitive learning of respective predators relevant to different ecological and social settings without the need for agent-related fear' innateness. However, I also argue that the basic fear of predators creeping in the shadows can be understood as a psychological adaptation, considered from Charles Darwin's times. Therefore, I see ghosts and other scary agents as a product of two intertwined traits – genetically inherited prior schemata and socio-cultural learning, both equally manifesting in a psychological level of personal experience under the condition of uncertainty. In my paper, I will closely describe the presented theoretical argument and illustrate it empirically by the specific UFoP experience captured during my previous studies.

Itzchak Tzachi Raz (iraz@mail.huji.ac.il, Hebrew University)

Learning is Caring: Soil Heterogeneity, Social Learning and the Formation of Close-knit Communities

This paper studies the impact of social learning on the formation of close-knit communities. It provides empirical support to the hypothesis, put forth by the historian Fred Shannon in 1945, that local soil heterogeneity limited the ability of American farmers to learn from the experience of their neighbors, and that this contributed to their "traditional individualism." Consistent with this hypothesis, I establish that historically, U.S. counties with a higher degree of soil heterogeneity displayed weaker communal ties. I provide causal evidence on the formation of this pattern in a Difference-in-Differences framework, documenting a reduction in the strength of farmers' communal ties following migration to a soil-heterogeneous county. Using the same design, I also show that soil heterogeneity did not affect the social ties of non-farmers. The impact of soil heterogeneity is long-lasting, still affecting culture today. These findings suggest that, while understudied, social learning is an important determinant of culture.

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Eric Mayor (Norwegian University of Science and Technology)

Adaptive collective memory in pandemic times

Collective remembering in conversations creates a feeling of connection, strengthens social bonds, fosters entrainment, and consolidates community identity. COVID-19 lockdown policies and social distancing measures have significantly affected social interactions, including conversations in which collective remembering occurs. We tested whether lockdown policies were associated with an increase in collective remembering in WhatsApp group messages (N= 32,810) collected over a period of 700 consecutive days, before, during and after imposed lockdown. Messages were produced by members of a small community with strong ties living in one the most populated metropolitan areas in Latin America. We found higher number of WhatsApp group messages where participants collaborated in the retrieval of memories of past, shared experiences during the lockdown period, in comparison to pre-lockdown and post-lockdown periods. The increase of collective remembering in WhatsApp group messages represents an adaptive collective behavior in response to changes in global social norms.

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Mark Urassa (National Institute for Medical Research, Tanzania)

He for she? Variation and exaggeration in men's support for women's empowerment in northern Tanzania

Achieving gender equality fundamentally requires a transfer of power from men to women. Yet our understanding of gender norms and related attitudes is limited, with many studies based primarily on self-report methodologies vulnerable to social desirability bias. Here, we examine men's support for women's empowerment (WE) as a sexual conflict trait, both via direct surveys (n = 590) and indirectly by asking men's wives (n = 317) to speculate on their husband's views. Data come from a semi-urban community in Mwanza, Tanzania, with surveys addressing topics such as decision-making authority, childcare responsibilities, intimate partner violence and women's participation in wage labor. Consistent with reduced resource competition and increased exposure to relatively egalitarian gender norms, higher socioeconomic status predicted greater support for WE. However, potential demographic indicators of sexual conflict (high fertility, polygyny, large spousal age gap) were largely unrelated to men's attitudes, challenging dominant beliefs that such practices are inherently at odds with gender equality. Contrasting self- and wife-reported measures suggests that men frequently exaggerate their support for women in self-reported attitudes. Discrepancies were especially pronounced among men claiming the highest support for WE, but smallest among men who held a professional occupation and whose wife participated in wage labor, indicating that these factors predict genuine support for WE. We discuss the implications of these results for our understanding how gender norms are formed and modified, including how the misrepresentation of individual attitudes may foster inaccuracies in local norm perception.

Discussion Session 2

Discussion 2

R. T. Nichols (rnichols@fullerton.edu, CSU Fullerton)

Exploring the Descendant-Leaving Theory: A study of ancestor manipulation, ancestor-descendant conflict, and extended kinship ancestor worship in China

This presentation provides a multidisciplinary review of the application of descendant leaving theory to China in an effort to understand contours of altruism emergent there. Descendant leaving theory is a cultural evolutionary theory rooted in familiar evolutionary accounts of degree of relatedness, parent-offspring conflict, sibling rivalry, and parental manipulation. After these theoretical components are reviewed, and the descendant leaving explanation of altruism to extended kin stated, the presentation turns to a chronological discussion of kinship and extended kinship relations in continental East Asia during the Neolithic. Archaeological evidence about the social function of the extended kinship ancestor worship system is found in mid-Neolithic archaeological remains revealing patrilineal worship of singular male leaders. Studies of non-recombining DNA provide partial confirmation the utility extended patrilineal kinship groups in Neolithic East Asia. Early Dynastic leaders exploited this system for war-making. Next the presentation presents evidence from early historical China, especially from the Shang and Zhou dynasties, pertaining to pro-kinship norms. These pro-kinship norms were seeded in the Shang period and received formal statement and codification in policy during the latter Zhou period. Contents of this norm psychology is reviewed as found in Analects and Mencius. The presentation concludes with a few sections pertaining to key cross-culturally differentiated features of altruism to extended kin and to non-kin that together show that altruism in China is in need of a special explanation. This evidence is drawn from behavioral economics studies, studies of bequests, anthropological studies and more. The presentation identifies several clear hypotheses, tailored explicitly for a patrilineal traditional society, for testing descendant leaving theory in this context.

Discussion Session 2

Discussion 2

Burton Voorhees (burt@athabascau.ca, Athabasca University)

Evolution of Science as an Example of Cultural Evolution

Studies of the origin and evolution of high-level cultural trait complexes have recently become a focus of attention and research has begun to show the interaction of ecological, economic, and political factors in the evolution of human societies (e.g., Whitehouse et al 2018). This paper presents a case study of the evolution of science, relating stages in this evolution to cognitive heuristics; considered from the perspective of the need to avoid their associated cognitive illusions. Science is a good subject for this since it has well-defined goals that places strict limits on methods that can be employed and forms of cognition consistent with these goals. Three decision heuristics discovered by Tversky and Kahneman (1974) correlate with three crisis periods in the history of science. Each crisis required discovery of methodological tools to avoid associated illusions. The sequential development of science serves as a phylogenetic lineage (Boyd et al 1996). The lesson this presents for today is the necessity of discovering ways to harmonizing different sets of cultural values.

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Discussion Session 2
Discussion 2

Kathryn Alexander (bridge2partnership@gmail.com, Bridge To Partnership)
Rachelle Strawther, Ed.D, MA (Gonzaga University)

The Impact of Values on Leadership Style and Culture Development

The presenter will show how values impact culture and how the difference between tacit and lived values can be assessed to create and or manage culture to better meet the needs of the organization.

As organization's shift into regenerative practices requires decisions to consistently be made in the same way and from the same principles that nature uses. This means a leadership style that will support a culture that understands and synchronizes with nature. The Resilient Value System supports this shift.

These assessments are designed to use the specific values found in the three known values systems (Protective, Effective, Resilient) as researched by Jane Jacobs and Kathryn Alexander. Thirty of these values appear to be common across national boundaries, and all 45 are well understood even though some have more resonance than others. Because these value sets are true systems, they exhibit the same dynamics as other living systems do, revealing a new understanding of corruption.

What is unique about these assessments is that they surface both tacit and lived values. By bringing to awareness tacit values that are commonly not available for discussion, and by seeing the graphic tensions between the two both individuals and groups (teams, departments and entire organizations) can recognize: fit, agreements about the desired state, and clear directions for mutually desired change.

The presenter will:
• Describe how these sets of values express living systems attributes
• Explain the impact seeing these values as systems has on ethics and corruption
• Share the three value systems and their connections to culture
• Share examples of the assessment results and describe how they can be understood and used for leadership and culture development
• Provide a short experience so attendees can experience their own preferences and understand the implications

Discussion Session 2

Discussion 2

Jeffrey Swindle (jswindle@utexas.edu, University of Texas at Austin)

Pathways of Global Cultural Diffusion: Mass Media and Stated Attitudes about Men's Violence against Women

Current theories of cultural globalization outline abstract mechanisms of diffusion. I identify specific pathways through which public cultural messages can flow to individual people, focusing on the spread of cultural scripts about men's violence against women through mass media in Malawi. I begin with a media content analysis, relying on multiple sources including a new dataset of newspaper articles. I show that transnational organizations worked with Malawian journalists to produce content condemning men's violence against women, whereas media entertainment companies disseminated content that reinforced gender stereotypes. This informs my statistical analysis, in which I find that these unique types of media content were divergently associated with people's stated rejection of men's violence against women. The results outline a multifaceted portrait of global cultural diffusion at the individual level with diverse messaging streams simultaneously reaching people.

Discussion Session 2

Discussion 2

Joseph Tesla Velikovsky (joseph.velikovsky@uon.edu.au, University of Newcastle, Australia)

The HOLON/parton structure of units of culture, and Evolutionary Culturology

The landmark 2016 discovery of the HOLON/parton structure of all units of culture - deriving from a 2016 PhD study, and first published in the book `Creative Technologies for Multidisciplinary Applications' (2016) - has since been applied in other domains of culture, being subsequently republished in the `Encyclopedia of Information Science and Technology' (2017, 4th edition), also `Advanced Methodologies and Technologies in Artificial Intelligence, Computer Simulation, and Human-Computer Interaction' (2019), and the `Encyclopedia of Creativity' (2020, 3rd edition). This powerful new tool - integrating the Three Laws of HOLON/partons - enables scientific identification and analysis of units of culture, including Numerals (Mathematics); Words (Languages); Narremes / units of story (Narratives); Transmedia (Narrative); Movies (Cinema); Television (Screen Media); Novels (Prose Fiction Books); Factual Literature (Prose Non-Fiction Books); Videogames (Games);; Plays (Theater); Popular Song (Music); Poems (Literature); Jokes (Standup Comedy); Paintings (Visual Art); Myths (Narrative); (Adaptive Fictions); Conspiracy Theories (Adaptive Fictions); Scientific Models/Theories (Science); Ideologies (Political, Economic, Religious); Inventions (Technology); Art (Communication Media); Values & Ethics. When used in conjunction with the Fractal Systems Meta-model of Bio-cultural Evolutionary Creativity, these two scientific models enable examination of the units, levels and mechanisms of cultural evolution, in any domain in culture. The 5 prior book chapters on this discovery (2016, 2017, 2018, 2019, 2020) are currently being expanded to a full-length book (due for release, November 2021). This talk presents these two new scientific models - as powerful tools - for use by students, scholars, and scientists of Cultural Evolution.

Discussion Session 2

Discussion 2

Bradly John Alicea (bradly.alicea@outlook.com, Orthogonal Research and Education Lab)

Examining Cultural Evolution with Contextual Geometric Structures

How do we integrate the evolutionary dynamics of populations with the cultural context of individual minds? One way involves combining common ancestry approaches to cultural evolution with a dynamical representation of the cultural milieu. This yields a flexible representation of complex cultural systems, encompassing trees (logistic maps and phylogenies) and highly-reticulating (fractal structures and hairball networks) structures alike.

We characterize the outputs of Contextual Geometric Structures (CGS) in the context of nonlinear and cyclic outputs. CGS models are computational kernels that represent cultural phenomena in conceptual space. CGS kernels draw from a number of theoretical concepts, including: conceptual blending, structuralism/post-structuralism, and fuzzy computation. A single CGS can be of any shape, and are used to classify perceptual inputs as singular or multiple semantic interpretations. These shapes are mapped to natural phenomena such as light, temperature, and rotational forces that a population of individuals might encounter via sensory experience. In a similar way, multiple cultural contexts can be represented in the same space, which can be accessed by a single agent, or even multiple agents.

We will show how agent-based models of cultural dynamics can be used to unlock the potential of neural representational models. CGS kernels can also be combined with connectionist and agent-based models to yield multiple representations of the cognitive world. Most relevant to cultural evolution, CGS kernels provide a generative model of cultural diversity, which allows us to examine the combinatorial richness of the evolutionary process.

Nina Kristina Nikki (nina.nikki@helsinki.fi, Nikki)

How can cultural evolution change the study of the apostle Paul?

The cultural evolutionary perspective is currently being adopted by scholars of early Christianity and the Bible. This paper looks at how the perspective can change the study of the apostle Paul and Pauline traditions. Pauline studies are still dominated by a discourse on the real, historical Paul. What did Paul really say or mean and who understood him correctly? Are all the letters in the New Testament canon written in Paul's name really by Paul himself? The questions of origins and authenticity are emphasized by religiously and academically motivated theologians alike. The perspective of cultural evolution, with its idea of the naturalness of variety, can profoundly challenge this baseline.

Another question concerns the study of the transmission of Pauline ideas in Christian and other literature and practice. This "reception of Paul," as it is called in the Biblical Studies, although widely studied, has often been captive of the authenticity discussion but also suffered from a lack of rigorous scientific methods and explanations for the transmission of cultural information. The transmission of Pauline ideas includes the idea of Paul himself as either a positive ingroup prototype or a negative outgroup stereotype. Both appear in literature with fascinating variations but tend to be discussed separately because of their affiliation with competing groups. The cultural evolutionary perspective, however, can help to highlight the shared nature of traditions between different groups and hopefully even act as a vehicle for interreligious understanding.

Agner Fog (agner@agner.org, Technical University of Denmark)

Authoritarianism and egalitarianism explained by evolutionary psychology

Humans have a psychological tendency to support a strong leader in times of danger, but not in times of peace and security. This psychological pattern has evolved in primeval times as a way to overcome the collective action problem in violent inter-group conflict, according to a new theory called regality theory. People become authoritarian and bellicose as a reaction to perceived collective danger, while peace and security leads to egalitarian and tolerant political attitudes. This balance between authoritarianism and egalitarianism is reflected in many aspects of politics, culture, morals, sexuality, religion, and even in art and music. This makes regality theory very useful for many applications in sociology, history, psychology, politics, and peace research. Examples include explanations of the rise and fall of empires, World War II, psychological warfare, witch hunts, and psychological reactions to the terrorism events of 9/11.

Regality theory is supported by statistical studies on both ancient and modern societies. The theory has successfully predicted correlations between many cultural variables.

Applications of this theory is discussed with several examples.

Discussion Session 2

Discussion 2

Stephen Vaisey (stephen.vaisey@duke.edu, Duke University)

Sociology and Cultural Evolution: Obstacles and Future Directions

Cultural evolution is an interdisciplinary movement, but some disciplines are not yet well represented. Sociology -- despite sharing many core questions in common -- has hardly engaged with the field of cultural evolution. In this presentation, I briefly consider the reasons why sociologists have been absent from this conversation. Then I outline how sociologists can make a meaningful contribution to cultural evolution research. I argue that sociological research is especially relevant to work on changing beliefs, subcultural differences, cultural mechanisms of stratification, and the role of social networks in cultural change. I conclude by describing some concrete steps I believe will facilitate a greater integration between cultural evolution and sociology in the future.

Ellen Clarke (e.clarke@leeds.ac.uk, University of Leeds)

Why does cultural selection need to be blind?

It is standard to understand natural selection as necessarily being blind or, to put it in less ableist terms, to exclude intentional design. Social scientists often critique cultural evolution theory as being redundant, on the grounds that the relevant explanatory work can be done in terms of intentional decisions made by humans. Cultural evolutionists often seek examples of outcomes that plausibly cannot be viewed as intentional – for example, Henrich focusses on the evolution of manioc processing, where the explanation of the benefits is thought to be opaque to most participants (Henrich 2017).

Mesoudi 2008 gives us reason to think that intentional design should not guide the production of variants. But less has been said about why intention must be excluded when it comes to the selection of variants, as in cases of 'direct bias' (Boyd and Richerson 1985; Amundsen 1989).

I argue that we should resist this, and simply view intentional action by humans as one possible driver of a selection process. From the perspective of Universal Darwinism, as long as there is heredity and variation in copy rate, the presence of intention in an evolutionary process is irrelevant. If I am right, then a major source of skepticism about the value of cultural evolution theory in explaining processes such as the workings of science can be undercut, and the evidence base for cultural evolution theory hugely expanded. Intentional design need not exclude cultural evolution, but can, instead, be understood as one of its variables.

Discussion Session 2

Discussion 2

Carlos Alberto Travessa Junior (ctravessajunior@gmail.com, Federal University of Uberlândia)

Luciana Karen Calábria (Federal University of Uberlândia)

Socio-spatial profile of violence in Brazilian Schools (2009-2018)

In addition to survival in the hostile world, violence has overcome its biological nature, being ingrained in the subjects and in society. Thus, it comes to these violent provocations due to the factual potential of the subjects to live and / or expect violence in Brazil. A timeless phenomenon that operates mainly among the vulnerable, reshaping their relationships in different social spaces. In the Brazilian context, schools stand out, which between 2009 and 2018 recorded an alarming increase of more than 800% in the occurrences of violence (2009, n = 661; 2018, n = 6,242). Public data from the governmental platform "Diseases and Notification Information System" also reveals that, in the time frame, the occurrences (n = 34,632) are concentrated in the Southeast and Southern regions of the country, the State of São Paulo being the epicenter (29 , 0%; n = 10,257), a space characterized by the relevant economic flow, high population density and urbanization. Set the types of violence, the most recorded are those of physical impetus, affecting mostly female victims (56.8%; n = 19.693) between 0-19 years old (87.5%; n = 30.354), following the school age indicated in the basic documents of national education. Perhaps this is not yet a reliable picture of violence in Brazilian schools, due to the more than 8 million square kilometers of territorial extension, finds it difficult to establish a comprehensive notification, challenged by a diversity of situations and purposes, individual and collective, narrate along with social inequalities the most different contexts (school or not) and perceptions of violence.

Discussion Session 2

Discussion 2

Jesse Parent (jtparent2018@gmail.com, Orthogonal Research and Education Lab)

Bradly Alicea (Orthogonal Research and Education Lab/OpenWorm Foundation)

Charting the Future of Academic Fields with Cultural Evolutionary Trajectories

What led to the evolution of theories and models across various scientific fields, and how do these arguments and paradigms frame their historical trajectory? One (unsatisfying) answer is that each field has its own personalities and historical context, generating a large number of potential trajectories in the process. By contrast, the notion of history converges on the same answer due to the universality of certain truths also raises more questions than answers.

To understand how these trajectories form and sustain over decades or even centuries, an agent-based model of intellectual cultural evolution will be proposed. At the level of individual agents, cultural evolution is characterized using a dual inheritance model: mentor-mentee transmission (genealogical) and peer-to-peer transmission (sociocultural learning). We also advocate for combining phylogenetic approaches to genealogy with cybernetic models of sociocultural learning. Common ancestral fields diverge over time as subfields form and become epistemically isolated. When ideas are constrained by field-specific boundaries, we can observe linguistic and even semantic divergence. Reintegration of genealogical branches (reticulations) are also useful in understanding how ideas are shared between fields. Collaborations and interactions resulting from sociocultural learning will produce reticulating cycles amongst our phylogenetic branching relationships.

In this way, we demonstrate that future trajectories can be approximated as a series of divergence and regulatory events. Our approach can be more broadly applied to the phenomenology of evolution. More generally, we can attach each level of inheritance to levels of evolutionary description: nonlinear regulatory processes being the proximal description, and tree structures serving as the ultimate description. These insights may also help illuminate unexplored areas within the map of possible evolutionary paths.

Discussion Session 2

Discussion 2

Avel Guénin Carlut (avel@kairos-research.org, Kairos Research)

Active inference, evolutionary transition, and the deep roots of complex societies

We will hereby discuss the evolutionary transition underlying the Neolithic transition in terms of the development of a cultural ecosystem of complementary enactive niches organised at nested scales. The goal of this discussion is to demonstrate FEP/AI's ability to conceptually integrate established frameworks in life and social sciences, while maintaining intuitive tractability across scales.

We suggest the progressive complexification (in the institutional sense) of human societies throughout deep history was driven by the developement of an ecosystem of complementary cultural niche, defined by niche modification and coevolving regimes of expectations. Our multiscale FEP/AI account integrates the emergence of the structure underlying City-States at both inter-personal (economic specialisation, class division) and structural (infrastructural niche construction, centralised administration) scales, and therefore grounds the interpretation of existing social scientific accounts as an evolutionary transition stricto sensu.

Co-dependancy patterns between City metabolism and State agency incite us to understand the emerging organism as an enactive system. This is possible through the FEP/AI account of niche construction trough active inference (building affordances into the world so as to maximise one's own embodied model evidence), which provides a natural framework to formalise State's attempts at legibilising social life both as a cognitive process and as a prolongation of social metabolism. We hereby address recent objections to the FEP/AI account of cultural evolution by demonstrating it integrates aspects of cultural evolution evoked yet unformalised by mainstream cultural evolution literature.

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Nick Rossiter (Northumbria University)

Cultural Emergentism

The Theory of Evolution is a cultural belief and itself a prime example of the evolution of culture. At first sight emergence might be thought to belong more naturally to the alternative culture of creationism. Although not explicit in Darwin's work emergence was nevertheless implicit to any notion of change and soon afterwards introduced within 'emergent evolution'. More recently the two concepts have become allied through the perceived process of self-organisation in statistics. Now however the two have been brought even closer by the move from self-organisation to self-creation. The self-creation of mutants within CORVID-19 is an example of the pressing social problem of cultural evolution.

Simple evolution is bottom up while creation is simply top down and the concept of emergent evolution seems both simultaneously. Classically problematic self creation may well relay on processes of quantum mechanics. This paper examines formally how that is to be understood in the higher logic of monadism

Discussion Session 2

Discussion 2

Peter Compo (petercompo1@gmail.com, OZC Research)

A Force-based Model of Cultural Evolution with Application to Business Strategy

Presented is a force-based alternative to the transmission-based model of cultural evolution. The premise is that the majority of cultural evolution is Darwinian selection that occurs in the mind. The selection is driven by internal and external stressors (forces) leading to creative tension. Transmission is viewed as a source of variation and stressors, not heredity.

One barrier to a force-view of cultural evolution is that biological evolution has not served as a helpful exemplar. The forces in natural selection are traditionally misidentified (or ignored). Here the forces of natural selection are environmental stressors acting on individuals, not natural selection itself. With this understanding, I will present the cultural evolutionary analogs to the dimensions of biological evolution including phenotype, variation, heredity, driving forces, fitness, and generations.

The impetus for this view of cultural evolution comes from the study of strategy and innovation developed in part during my 25 years at E.I. DuPont, the multinational chemical and materials company. In addition to my scientific role there, I held positions in business, venture management and strategic planning.

I will show how the force-based model aligns with an adaptive view of strategy theory and practice. Understanding how stressors act on ideas, processes, and technologies is key to enabling innovation in all endeavors.

Q&A session 21

Day3-A1

Cooperation

Paul Smaldino (psmaldino@ucmerced.edu, University of California, Merced)

The evolution of covert signaling in diverse societies

Identity signals are common components of communication transmissions that inform receivers of the signaler's membership (or non-membership) in a subset of individuals. Signals can be overt, broadcast to all possible receivers, or covert, encrypted so that only similar receivers are likely to perceive their identity-relevant meaning. I'll present an instrumental theory of identity signaling as a mechanism for social assortment, formalized with both analytical and agent-based models. Covert signaling is favored when signalers are generous toward strangers, when costs of being discovered as dissimilar are high, and when the ability to assort only with preferred partners is restricted. Covert signaling should be more common among members of "invisible" minorities, who are less likely to encounter similar individuals by chance. I'll also discuss empirical projects underway to test and extend this theoretical framework using online political communication. This work has implications for theories of signaling and cooperation, social identity, pragmatics, politics, and the maintenance of diversity.

Øivind Devik Schøyen (oivind.schoyen@gmail.com, UIT: The Artic University of Norway)

Avner Greif (Stanford University, Economics Department)

A Theory of Moral Authority: Moral Choices Under Moral Network Externality

Why do people choose to follow a demanding moral authority even in situations in which a less demanding alternative exists? Can social imitation alone sustain meaningful moral equilibrium? Why is moral authority concentrated in the sense that multiple individuals follow the same authority? What factors underpin and limit the power of moral authorities, and why do authorities lose influence? This paper addresses these questions by developing a formal choice-theoretic model of moral authorities, moral standards, and moral behavior. We show that sustaining meaningful moral behavior is only possible if some actors choose to provide, and others choose to follow, a person providing moral guidance through their behavior. Our theory builds on literature in cultural evolution, biology, and psychology on how human pro-sociality has become an adaptive trait. In an extension of our model, we analyze the role of the state. We show that only two types of states can maximize social welfare: morally liberal states with low redistribution, or, morally conservative states with high redistribution.

Kristopher M. Smith (krsmit@sas.upenn.edu, University of Pennsylvania)
Coren Apicella (University of Pennsylvania)

Hadza hunter-gatherers with greater exposure to other cultures preferentially share with generous campmates

Researchers hypothesize that we have an evolved partner choice psychology that tracks the cooperative reputations of others and compete for access to cooperative partners, such as by sharing more with cooperative partners. However, recent models and evidence suggest cultural institutions shape this partner choice psychology, questioning its universality. We test the universality of a preference for more cooperative partners in the Hadza hunter-gatherers of Tanzania. Ninety-two Hadza ranked eight of their campmates on generosity and foraging ability and then played a game in which they could direct finite resources to those campmates. We found that Hadza with greater exposure to other cultures, such as via schooling or participating in the market economy, shared more preferentially with campmates they ranked higher on generosity, whereas Hadza with lower exposure showed no preference to sharing with generous campmates. However, this moderating effect was specific to generosity—regardless of exposure, Hadza did not share more preferentially with campmates ranked higher on foraging ability. These results suggest that cultural institutions can shape Hadza partner choice psychology and that preference for more generous and cooperative partners is a product of cultural, rather than genetic, evolution.

Liam Gleason (lgleaso6@asu.edu, Arizona State University)

Thomas J. H. Morgan (Arizona State University)

Sarah Mathew (Arizona State University)

How gossip and reputation shape high-stakes cooperative decisions among Turkana warriors

Gossip is essential to sustaining cooperation through indirect reciprocity, but it is unclear if and how individuals obtain accurate information through gossip. We examine how information acquired through hearsay influences cooperative decisions in warfare among the Turkana, a politically uncentralized semi-nomadic pastoral population in Kenya. The Turkana engage in cattle raids against neighboring groups in which there is a substantial risk of injury or death. Using vignettes and surveys with 63 Turkana warriors, we obtained information regarding warriors' ratings of the qualities of other warriors, norms about information sharing over different social scales (from kin level to the cultural group at large), the level of consensus in reputation, and real-world instances of decision making in warfare based on gossip. The results indicate that 1) a warrior's reputation is associated with altruistic bravery, leadership, and combat skill; 2) there are norms regulating sharing other warrior's reputations; and 3) warriors actively assess reputation when determining who to cooperate with. The findings suggest norms may play a role in making gossip sufficiently accurate, thus facilitating indirect reciprocity as a mechanism of human cooperation.

Q&A session 21

Day3-A1

Cooperation

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Shintaro Fukushima (Tokyo Women's Christian University)

Hidefumi Hitokoto (Kwansei Gakuin University)

Yukiko Uchida (Kyoto University)

Individualism for mutual aid systems under uncertainty: Survey data of fishing communities in Japan

Individualism/independence has been well-studied to capture characteristics of some cultural groups such as nomadic people and residents of WEIRD societies—they are less susceptible to social influences and behave independently. These previous findings may sound supporting a view that individualistic people are less social. Contrary to this view, we hypothesized that individualism may help mutual-aid systems under uncertainty. As suggested by previous studies, mutual aid (e.g., social sharing of food) can function as a collective risk-reduction against uncertainty in resource acquisition. For example, fishers face variability in resource supply and risks of accidents due to their uncertain work environment. Social norms for aiding those in need can buffer those risks collectively. However, for mutual-aid systems to fully function to reduce uncertainty, individuals need to behave independently from each other in resource acquisition. If they rather conform to each other, erroneous judgment may cascade across individuals and they fall together. We thus hypothesized that individualism is positively linked to aiding behavior especially for communities that routinely face uncertainty such as fishing communities. We analyzed data from a large-scale survey (533 communities) and a follow-up survey (33 communities) in the west part of Japan. Participants included residents of a wide range of communities such as fishing communities and urban communities. Across two studies, the community-level correlation between individualism and aiding behavior toward those in need was more positive among fishing communities than for others. Possible links from our findings to individualism in WEIRD societies will be discussed.

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Russell Gray (Max Planck Institute for Evolutionary Anthropology)

Carlos Botero (Washington University in St. Louis)

A quantitative test of Jared Diamond's axis of orientation hypothesis

Jared Diamond controversially suggested that the unique east-west orientation of Eurasia might have facilitated the spread of cultural innovations in that region and could have given it a substantial advantage in global political, technological, and military dominance over other continents. This intriguing, yet largely untested hypothesis is based on the idea that innovations can spread more easily over similar latitudes due to potential similarities in environmental conditions. Operationalising Diamond's hypothesis has proven difficult because it requires integrating vast amounts of data from multiple sources that were not easily accessible in the past. Here we explicitly test the critical assumptions of Diamond's hypothesis through quantitative analyses that leverage global cultural, linguistic, and ecological databases now publicly available. We show that although environmental factors associated with a vertical orientation can hinder the spread of cultural traits, there is no evidence indicating that these factors consistently favoured a fast cultural diffusion within Eurasia. We conclude that the uneven turn of human fortunes around the world was not primarily driven by intercontinental differences in ecological homogeneity.

Q&A session 22

Day3-B1

Archeology and history

Mercedes Okumura (okumuram@usp.br, Institute of Biosciences, University of Sao Paulo)

Astolfo Araujo (Museum of Archaeology and Ethnology, University of Sao Paulo)

The Cultural Evolution in Eastern South America during the Late Pleistocene and Early Holocene: tradition, innovation and persistence

In this paper, we will present an outline of the cultural evolution in eastern South America during the Early Holocene. We will discuss the main characteristics of the stone tool industries of Pleistocene and Early Holocene Brazilian archaeological sites, including some technological innovations (unifacial and bifacial technology), as well as some case studies showing an extraordinary persistence of these technologies in Eastern South America once they are stablished in the Early Holocene. Our results suggest the existence of a stable lithic technology, indicating the maintenance of a technological tradition, with its embedded functional and stylistic components. In some cases, such persistence across time can be observed regardless of demographic changes in these human populations. Combining theoretical expectations from Evolutionary Archaeology and Cultural Transmission Theory, we propose that the preservation of a tradition is an active mechanism and not a mere "absence of innovation". Moreover, our data suggests that extreme cultural persistence occurred in several different cultural systems, and therefore that such strategy was more common than previously suspected.

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Tiago Tresoldi (Uppsala University)

Runestaves and the transmission of cognitive technologies

Runestaves are perpetual calendars marked with runic symbols, usually carved into wood in the shape of a staff or sword. They were used in Sweden and surrounds, and are documented from the 1100s until the early 1800s. The typical runestaff has three rows of carved symbols allowing calculation of days of the week, dates of the new moon, and dates of religious feast days and other important annual events. As part of Cultural Evolution of Texts project (Riksbankens Jubileumsfond 'Mixade Metoder' programme) focussed on computational stemmatology, we have transcribed and analyzed a large corpus of runestaves with a goal of understanding the cultural transmission of this complex and specialized class of cognitive technology.

Runestaves have strong structural constraints on their design. The feast day markers have the most scope for variation. Phylogenetic analysis of their placement (binary traits for the presence of a feast on each given day) shows extensive admixture, but also some clearly distinguished clades. Some of these clades can be associated with the medieval dioceses of Sweden, or with particular workshops. The lunar runes are also variable (showing different patterns of spacing for the lunar months), and give clues to whether runestaves were copied from other exemplars or reproduced from expert algorithmic knowledge. Analysis of runestaves with manufacturing errors suggests that both copying and algorithmic strategies have been used in their production at different times.

Our results show how quantitative, evolutionary methods can contribute to understanding the history of technology and the cultural transmission of specialized knowledge.

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Evolutionary radiation of mid-Holocene lanceolate points from the highlands of the south central Andes

This work analyzes the evolutionary diversification of the lanceolate points of the South Central Andes focusing on the pace and the patterns of this evolutionary radiation. Through phylogenetic reconstruction and by analyzing the time series of innovation, extinction, and taxonomic diversity we show that the divergence process began around 9500 cal BP and extended to 5000 cal BP. We distinguish a first instance with a greater diversity of points, a higher rate of innovation and less class longevity. These trends progressively stabilized, giving rise to an inverse pattern of less innovation, decreasing taxa diversity and greater class longevity. Also, we documented a progressive reduction in the length and the increase in the width of the points. We suggest that the adoption of new prey hunting tactics, since the end of the early Holocene, and the evolution of new weapon systems gave rise to an adaptive environment that favored the selective evolution of innovations in projectile points to fill different technological niches. The adaptive radiation of the lanceolate points contributed to more diverse weaponry that increased the chances of successful hunting in a greater diversity of contexts, allowing humans to specialize in camelid hunting.

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Angelica and sorrel salad? Ethnobotanical, historical, archaeological, and linguistic evidence for Viking-Age plant use

Plants are central to human life and yet, apart from the role of major crops, people-plant relations have been marginal in cultural evolutionary research. Here we investigate how recent ethnobotanical data can be used to trace back ancient Nordic plant use and knowledge to the Viking Age, 700-1000 BCE. While archaeological, linguistic, and historical evidence each provide vital perspectives on the past, they are often limited; this is the case in the Nordic countries, where extensive collections of various plant use records are absent until the 1700s. We propose a "triangulation method" that combines phylogenetic inferences of ancestral plant use (derived from ethnobotanical data), with historical, linguistic, and archaeobotanical evidence. We investigate 12 culturally important plant species, reconstructing both general (e.g. medicine, food) and specific uses (e.g. respiratory, digestive medicines). Triangulation of multi-disciplinary evidence offers a more nuanced approach to uncovering Viking plant use than any one approach alone, and the exercise allows us to discuss the opportunities and shortcomings of using phylogenetic comparative methods to study past botanical knowledge.

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Graphic complexity in writing systems

A writing system is a graphic code, i.e., a system of standardized pairings between symbols and meanings in which symbols take the form of images that can endure. The visual character of writing implies that written characters have to fit constraints of the human visual system. One aspect of this optimization lays in the graphic complexity of the characters used by scripts. Scripts are sets of graphic characters used for the written form of one language or more. Using computational methods over a large and diverse dataset (over 47 000 characters, from over 133 scripts), we answer three central questions about the visual complexity of written characters and the evolution of writing: (1) What determines character complexity? (2) Can we find traces of evolutionary change in character complexity? (3) Is complexity distributed in a way that makes character recognition easier? Our study suggests that (1) character complexity depends primarily on which linguistic unit the characters encode, and that (2) there is little evidence of evolutionary change in character complexity. Additionally (3) for an individual character, the half which is encountered first while reading tends to be more complex than that which is encountered last.

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Constraints on complexity in artistic traditions

Art from an evolutionary perspective presents many puzzles since humans invest substantial effort to generate apparently useless displays. A careful synthesis of evolutionary signaling theory with ethnography can help us understand individual's strategic investments into mastery of specific artistic skills and how they optimize their artistic displays within certain constraints.

Using a large corpus of kolam art from South India, we illustrate a new analysis pipeline that can be used to systematically investigate variations in art, and test a number of hypotheses about the ways in which social stratification and individual differences affect the complexity of artistic designs.

Consistent with evolutionary signaling theories of constrained optimization, we find that kolam art tends to occupy a "sweet spot" at which artistic complexity, as measured by information entropy, remains relatively constant from small to large drawings. This stability is maintained through an observable trade-off between richness and evenness. Although these drawings arise in a highly stratified society, we do not find strong evidence that artistic complexity is influenced by the caste boundaries of Indian society. Rather, the trade-off is likely due to individual-level aesthetic preferences and differences in dedication and time, as well as the fundamental constraints of human cognition and memory. Our results on entropy trade-offs and various constraints on complexity operating on art encourage us to distance ourselves from underspecified attempts to explain the evolution of art and think deeply about (other) artistic traditions in terms of evolutionary signaling theories of constrained optimization.

Arturs Semenuks (asemenuk@ucsd.edu, University of California, San Diego)

Does Linguistic Transmission Affect Cultural Evolution?

Culture and cultural evolution, previously considered to exist only in humans, have been observed in a variety of other species, including non-human primates, cetaceans, and songbirds. Nevertheless, human culture stands out among cultures of other animals in several aspects, perhaps most intriguingly including its complexity and the amount of variability it exhibits. What can explain this? Language - another aspect of human behaviour with similar distinctively unique properties - might provide a partial explanation, as humans can and do use it in cultural transmission, in contrast to other animals.

Using evidence from theoretical and evolutionary linguistics, semiotics, comparative psychology and anthropology, the talk will provide a theoretical overview arguing that language might provide an explanation to the aforementioned question due to the uniquely heavy reliance of language on symbols in meaning expression and construction. Specifically, we will argue that expression of meaning through symbolic signs corresponds to higher rates of abstraction and thus information loss or change. This would often lead to deleterious loss of cultural knowledge, but sometimes also lead to cultural innovation, and thus, analogously to mutations in biological evolution, result in a higher rate of evolutionary change. This in turn would produce both higher rates of complexity and variability.

Additionally, the talk will present results of an ongoing experiment using an iterated learning transmission testing this hypothesis. The experiment manipulates the modality of cultural information transmission (instruction through language or visual imitation) in a tangram puzzle construction task and measures the rate of innovation and complexity of the patterns that participants produce.

Q&A session 23
Day3-C1
Complexity

Vojtech Kase (vojtech.kase@gmail.com, University of West Bohemia)
Tomas Glomb (Masaryk University/University of Bergen)

Social Complexity, Affluence, and the Emergence of Moralizing Gods in the Ancient Mediterranean

The paper attempts to contribute to an ongoing debate in the cognitive science of religion and cultural evolution concerning factors responsible for the emergence of moralizing religions. Scholars propose either social complexity or economic prosperity as the key forces in these cultural processes and often refer to the religious history of the ancient Mediterranean in their arguments. In this paper, we mainly explore the so called Affluence Hypothesis, which suggests that the emergence of moralizing religions was caused by shifts in life-history strategies in response to the increase in economic prosperity. We evaluate this hypothesis by analyzing economic, demographic and religious dynamics of the ancient Mediterranean. In particular, we employ the methods of Distributional Semantic Modeling to analyze temporal trends in moralizing religions motifs in a large corpus of ancient Greek texts and compare these trends with the dynamics of social complexity and economic prosperity as captured by various archaeological proxies.

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Does social complexity promote musical pitch complexity?

Music, like language, is a human universal that varies widely between cultures. The use of musical scales-a set of pitches which divides one octave into specific intervals-is a dominant feature in most societies, yet it is still debated what biological or cultural factors have built that diversity of pitch distribution. The relationship between society and music has been discussed based on the idea that music functions as a functional enhancer of social structure (Lomax, 1968). The Cantometrics Project examines the broader relationship between musical elements and social structure, but has not yet examined the correlation between indicators focused on the mathematical ratio level of scale structure and song type. Therefore, we will empirically test whether the patterns of pitch distribution differed depending on the social complexity of the society or the functional purpose of the song, using a global sample of 118 songs (Mehr et al, 2019). Social complexity data will be taken from D-Place (Kirby et al., 2016), while song function classification will follow Mehr et al., 2019: dance, healing, love, and lullaby. Pitch complexity is quantified using scale structure and interval size, while social structure is coded by converting Ethnographic Atlas 15 Social structure (Murdock, 1967) into variables such as population density, social stratification, family size and political hierarchy. Our hypothesis is that the complexity of variables in social structure correlates more with the complexity of pitch distribution, compared to the amount of change in pitch distribution with the song functions.

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Drift drives noun regularization in an artificial-language experiment

Frequent words have lower replacement and regularization rates. However, it is not clear why this is so. One hypothesis is that cultural selection (i.e., a directional bias) against regularization and replacement is stronger on high-frequency words. Another hypothesis is that low-frequency words have higher rates of replacement and regularization due to drift (i.e., a non-directional bias).

To test these hypotheses, we conducted a preregistered experiment. Participants learned a miniature artificial language consisting of two nouns (N1/N2) and two plural markers (M1/M2). In the Drift Condition, N1 occurred less frequently than N2; both N1 and N2 occurred with M1 and M2 at a 1:1 ratio. In the Selection Condition, N1 occurred less frequently than N2; N1 occurred with M1 and M2 at a 1:5 and N2 occurred with M1 and M2 at a 5:1 ratio. We measured selection using the Wright-Fisher model; we inferred drift based on noun frequency. We measured regularization as the fraction of nouns that participants used with either M1 or M2 exclusively.

Our results show that N1 regularized more than N2 in both conditions, with no detectable effect of selection in causing this difference. Our study therefore adds to a growing body of evidence that drift is a major driver of language change, including regularization. Additionally, our results show that the participant pool was heterogeneous with respect to the experimental task. Our study therefore also highlights the risk of assuming---rather than showing---that participants approach experimental tasks as a homogeneous population.

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Reliability of human and automated transcriptions of global songs

Obtaining reliable, musically interpretable representations of sound in standardized notation is essential for cross-cultural analysis of the cultural evolution of music. However, musical transcription is usually conducted manually by ear, which is time-consuming and subjective, and its reliability for non-Western songs is largely unknown. In this study, we examine the reliability of 3 human and 10 automated transcriptions of 32 song excerpts from diverse cultures around the world taken from the Natural History of Song dataset (Mehr et al. 2019) and the Cantometrics songs dataset (theglobaljukebox.org; cf. Wood et al., this conference). The degree of agreement is evaluated by comparing pairs of human-human and human-machine transcriptions. We found that human transcription can be sufficiently reliable ($\kappa \sim .6-.9$, ~80-90% agreement), but current state-of-the-art automated methods are not ($\kappa < .4$, <60% agreement). No automated method clearly outperformed others. As the agreement between human transcriptions could reach much higher agreement than the pairs of human and machine transcriptions, there is still room for improvement in developing the computational tools for analyzing the pitch structure of traditional music. Reliable automatic music transcription methods can broaden the scope of cross-cultural analysis of music, which is challenging to tackle with conventional manual transcription. Establishing objective, reliable methods for cross-cultural music transcription is critical for diversifying studies of the cultural evolution of music.

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Evolution of musical scales

Musical scales, defined as a set of discrete pitches from which melodies are constructed, are one of the most universal features of music. Some important analogies can be drawn between the evolution of scales and biological evolution: they both entail evolution of a linear sequence of discrete units; their study is focused on extant species; they exhibit large variations in mutation rates (e.g. vocal scales vs. metallophone scales). In comparison to the seemingly infinite space of biological sequences, however, the space of possible scales (typically 7 or fewer notes, just-noticeable-differences of at least ~5 cents) is comparatively tiny; and little is known the relative effects of drift and selection in scales. Despite these properties of scales, quantitative studies of the evolution of scales are scant.

To study of the evolution of scales, we first create a sample of extant scales, by scouring the ethnomusicological literature of the last century to assemble a cross-cultural database of scales. This allows us to first consider the 'drift' forces inherent due to imperfections in both vocal production, and pitch perception. We then consider a set of selection biases, and test which hypotheses may best predict the distributions of extant scales. Finally, we think about how the different forces (physical, perceptual, cultural) involved in drift and selection, in comparison to biological evolution, may vary considerably across populations and histories in what sometimes may appear an arbitrary fashion.

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Explaining redundancy in linguistic morphology: evidence from Yam and Kartvelian

The existence of stable redundant structures in linguistic morphology are a challenge to an evolutionary, i.e. adaptive, view of language change. Redundant morphological structures are defined as involving two or more co-occurring morphological formatives which provide information such that the interference of one or more of these formatives does not result in information loss for the hearer.

One possible solution comes from modelling of genetic redundancy. Nowak (1997) shows how two co-occurring genes of the same function and with differing efficacy of encoding that function can be maintained indefinitely if the rate of which the gene with the lower efficacy will change to its different functioning allele is higher than that of the more efficacious gene.

In this paper, I examine the inflectional morphology of verbs in two language families known for their redundant morphology, Yam (southern New Guinea) and Kartvelian (Georgia) (Carroll, 2020; Evans et. al., 2016; Harris, 1981). I equate efficacy with the information-theoretic notion of entropy (Ackerman and Malouf, 2013) and estimate rates of change by counting cognate forms and branch length across phylogenies (O'Meara, et. al., 2007); with this, I show that all examples of morphological redundancy from our sample minimally conform to Nowak's model. That is, in each example of morphological redundancy the formative which displayed higher entropy (i.e. lower efficacy) also had at least as many cognates (i.e. same or lower rate of change).

This preliminary study shows a promising avenue for an explanation for non-adaptive aspects of linguistic structures grounded in language-internal system dynamics.

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The Origins of Common Language in Nations: Evidence From a Natural Experiment in France

This paper studies the evolution of language in the process of nation-building. We identify the institutional origins and consequences of the advent of common language in the course of the emergence of nation-states in the nineteenth-century. In France, at the time of the French Revolution, less than fifteen percent of the population spoke standard French---a dialect of langue d'oil and only one of forty-six different languages spoken historically. Today, French is the only official language and a first language to most Frenchmen. We comprehensively document the process of homogenization by digitizing a novel, detailed town-level dataset on spoken languages in France. Using a natural experiment, we show in a regression discontinuity framework that state-sponsored education played a substantial role in the widespread adoption of standard French language. We additionally find that elites and secular public education were important vectors of homogenization, while places with low returns to education were less likely to adopt standard language. Finally, we document a persistent effect of nation-building on national identity and social interactions.

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Looking at others' faces may be more important in early infancy

Living in a social group confers an individual many advantages, one being the possibility to obtain relevant information from others. However, one must be able to discriminate what is useful. For instance, human and non-human primates must know who and what to learn from. Here, we investigated the opportunities to obtain visual information from the face of others, which we call VAF (Visual Access to Faces) in a wild population of capuchin monkeys from Brazil. We looked at four infants, aged two and nine months old and aimed at testing the hypothesis that both the identity of the individual the infants were having VAF from and the infants' age influenced the duration of these opportunities to obtaining information from others' faces. We looked at 323 VAF events (mean=2.539 seconds±0.489). We used a GLMM (infants as a random factor) including duration of VAFs as dependent variable and individual with whom the VAF occurred and month (2nd or 9th) as fixed factors. We found that the identity of the other monkey was not significant, neither its interaction with month. However, month alone was significant (p=0.016), with a higher mean for the 2nd (3.296±0.653) than the 9th (1.415±0.560) month. From these results it appears that whom the infant is looking at is not relevant, however "when", if earlier or later in infancy, is critical for the acquisition of this sort of social information. That is, accessing and processing this type of visual information provided by faces may be an initial social development pattern.

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Biases on social learning: the effect of model's competence on children's overimitation

Overimitation is defined by a tendency to copy all actions executed by a model, even the clearly irrelevant ones. The motivational mechanisms and functionality of overimitation are still not well understood, but its possible adaptive meaning could be related to causal opacity of a great part of socially learned behaviors. This phenomenon has been widely replicated in several contexts and has been observed in the behavior of children over 2 years of age and even in adults. Studies have shown that overimitation is sensitive to some characteristics of the model observed such as age, familiarity, proficiency, and reputation. Our work intended to investigate the effect of information about the competence of an adult model on the copying of irrelevant actions by preschool children (5 years old) in a task. We tested the influence of self-declared information about the model competence and of the same kind of information given by third parties in a conversation about the model. Our results reveal no effect of both "self-declared competence" and "reputation" biases on overimitation. We discuss that this result may have occurred because other information available to participants, and not manipulated by us, was used to infer model competence such as the model's age and success in the task directly observed by the participants. Another potential explanation is that children use a "copy all, correct later" strategy in a context where only one model is available.

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Lotte Thomsen (University of Oslo)

Infants use bowing as a cue to represent legitimate leadership

Research suggests that infants can distinguish between fear-based social power (bullying) and respect-based social power (leadership). However, it is unknown what cues infants use to represent legitimate leadership. To find out, we started by asking whether the act of bowing (which both matches the respect and deference displays found across cultures, and the prostration cues for subordination found across species) suffices in generating representations of leadership. We tested this hypothesis by assessing whether 21-month-olds expect agents to obey a character if they have previously bowed for it. In Experiment 1, infants saw three geometric agents bowing to a character who responded with a hint of a bow. Next, the character instructed the agents to go to bed, and they either complied while it watched but disobeyed after it left (disobedience) or continued to comply after it left (obedience). Infants looked reliably longer at disobedience than at obedience, indicating that 21-month-olds expect agents to obey a character if they have previously bowed for it. In Experiment 2, infants were presented with the same events of Experiment 1 except that the character no longer responded to the bowing. Experiment 2 replicated the finding of Experiment 1. Lastly, in Experiment 3 infants saw the same events of Experiment 2 but the agents no longer bowed to the character, but instead moved back-and-forth sideways. Now, infants no longer expected obedience nor disobedience. These findings suggest that young toddlers expect even novel agents to keep on following the directions of individuals for whom they bowed.

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Variation is the universal: Making cultural evolution work in developmental psychology

Culture is a human universal, yet it is a source of variation in psychology, behaviour and development. Developmental researchers are now expanding the geographical scope of research to include populations beyond wealthy Western communities. However, culture and context still play a secondary role in the theoretical grounding of developmental psychology research. In this talk, I highlight four false assumptions that are common in psychology, and that detract from the quality of both single-culture and cross-cultural research in development. These assumptions are: (i) the universality assumption, that empirical uniformity is evidence for universality, while any variation is evidence for culturally derived variation; (ii) the Western centrality assumption, that Western populations represent a normal and/or healthy standard against which development in all societies can be compared; (iii) the deficit assumption, that population-level differences in developmental timing or outcomes are necessarily due to something lacking among non-Western populations; and (iv) the equivalency assumption, that using identical research methods will necessarily produce equivalent and externally valid data, across disparate cultural contexts. For each assumption, I draw on cultural evolutionary theory to critique and replace the assumption with a theoretically grounded approach to culture in development. I support these suggestions with positive examples drawn from research in development. Finally, I conclude with a call for researchers to take reasonable steps towards more fully incorporating culture and context into studies of development. This will lead to a more inclusive and therefore more accurate description of human development.

Q&A session 25

Day3-E1

Development

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Andrew Whiten (University of St Andrews)

Nicola McGuigan (University of the West of Scotland)

The ontogeny of selective social learning: Young children flexibly adopt majority or payoff-based biases depending on task uncertainty

Humans have adapted well to diverse environments in part because of their ability to efficiently acquire information from their social environment. However, we still know very little as to how young children acquire cultural knowledge, and in particular the circumstances under which children prioritize social over asocial learning. In this study we ask whether children will selectively adopt either a majority-biased or a payoff-biased social learning strategy in the presence or absence of asocial learning. Three- to 5-year-old children (n = 117) were first shown a video in which four other children took turns in retrieving a capsule housing a reward from one of two boxes. Three of the children (the 'majority') retrieved a capsule from the same box and a single individual (the 'minority') retrieved a capsule from the alternative box. Across four conditions we manipulated both the value of the rewards available in each box (equal or unequal payoff), and whether children had knowledge of the payoff before making their own selection. Results show that children adopted a majority-biased learning strategy when they were unaware of the value of the rewards available, but adopted a payoff-biased strategy when the payoff was known to be unequal. We conclude that children are strategic social learners who use both social and asocial learning to maximize personal gain.

Q&A session 26

Day3-A2

Non-human culture 3

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Elephants as a new animal model of cultural evolution resulting from self-domestication

The discovery of complex culture in different species is a major interest in cultural evolution research, with work so far uncovering evidence for cultural traits in some species of primates (e.g., baboon, chimps), whales (e.g., killer whales, humpback whales), and birds (e.g., Caledonian crow). Here, we offer a new animal model for studying culture evolution: The Elephant. Specifically, we present evidence that elephants possess many of the prerequisites associated with cultural evolution, including tool use, social learning, language, and complex community structure. For example, there is evidence of cultural learning in elephants, as they are able to acquire specific techniques for exploiting specific resource sites merely by observing conspecifics and by practicing and exploring new behaviors by themselves. Crucially, we argue that elephants have gone through a similar evolutionary process as humans - self-domestication - which is at the heart of our ability for cultural niche construction and the sophistication of language through cultural evolution. We use cross-species comparison and genetic analyses to show that elephants display the cognitive, behavioral, and physiological features that are associated with self-domestication, including changes in the brain, cortisol sensitivity to the social environment, reduced reactive aggression, and extended juvenile period. Moreover, elephants might stand as the only case of self-domestication outside the primate group, i.e., domestication that happened organically without human intervention. As such, it is a powerful model for investigating questions regarding language evolution and how convergent evolution of cultural learning can result in similar cognitive and communicative abilities.

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Zanna Clay (Durham University)

Can apes ape? What about with the addition of biases?

Modern human culture relies on copying of behavioural forms beholden to past cultural evolution. It remains debated whether such 'action copying' underlies any wild ape culture. It is unclear whether this ability was present in the last common ancestor or whether it first appeared after their divergence. Evidence of untrained apes spontaneously copying novel action forms, under controlled conditions, would favour the 'copying hypothesis', this data is lacking. Given that majority influence appears to affect ape social learning, we hypothesised that the dearth of evidence, in untrained apes, could be due to a lack of majority demonstrations in research. If evidence were found, in such a population, this would lend credence to the argument that wild apes and even the last common ancestor, had the capacity to spontaneously copy novel actions. Here, we performed the first controlled, action copying study that incorporated majority-bias with untrained non-human great apes (all species; n=19). Our results show a total lack of copying ability, all untrained mother-reared apes failed to copy, or approximate, the demonstrated action forms, despite majority demonstrations. Our findings reinforce the view that apes do not spontaneously copy action forms - not even majority demonstrations changed this empirically-grounded picture. Our finding also adds to increasing evidence that wild ape cultures are never, or very rarely, based on action form copying. This also means that action form copying likely arrived in the human lineage - after the divergence from the last common ancestor.

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Anndrew Whiten (School of Psychology & Neuroscience, University of St Andrews, UK/Inkawu Vervet Project, South Africa)

Field experiments illuminate three phases of social learning in a wild primate

Learning from others - social learning - is the basis for cultural behaviour to evolve and is a widespread process across the animal kingdom. A recent review documented the pervasive role of social learning in primate lifetimes, and developed a hypothesis that it typically occurs in three main phases. A first phase consists of infants learning their core behavioural repertoire mainly from their primary care giver, usually the mother. Then older juveniles will extend their learning to other role models within their group, and this is expected to take place for the acquisition of specific skills or knowledge. Finally, the third phase occurs in adulthood at dispersal, with immigrants learning local skills from residents or residents learning foreign knowledge from immigrants. In this presentation, we summarise multiple field experiments on a population of six groups of wild vervet monkeys that offer support for all three phases described above. The first phase, infants do as mother do is supported by food choice and foraging technique experiments. For the second phase, results of a novel food experiment highlight the spread of innovations to juveniles from more efficient models than the primary care giver. For the third phase, we find immigrants conforming to the food choice of residents as well as immigrants triggering the spread of novel food. Taking this ontogenetic approach to social learning enables a better understanding of the context linked to the various social learning biases documented in this wild primate.

Jennifer Allen (jenny.allen@griffith.edu.au, Griffith University)

The diversity of animal culture across community structures

It has become increasingly clear that culture and social learning play a vital role in species ecology. While much attention has been paid to its presence in vertebrates such as primates and cetaceans, which often have complex social structure, it also occurs in a broad and diverse variety of animal communities including reptiles, fishes, and insects. As we learn more about the breadth of species that utilise social learning, it has expanded the scope of what social learning and culture can tell us beyond a single species. This is particularly relevant as the conservation value of culture and social complexity becomes more established. Here I review social learning across species with varying community structures, providing an overview of how culture can manifest across animal societies and the different ecological roles it may play as a result. Such a review is critical to how studies across different species and community structures may inform one another. It further illustrates the intrinsic value of animal culture in practice as well as theory. When these separate pieces are brought together, they will provide the necessary infrastructure to move the field of animal culture forward in how it can be both understood and applied.

Thibaud Gruber (thibaud.gruber@gmail.com, University of Geneva)

Are emotions a Rubicon or a bridge between non-human and human cultural learning?

Research on cultural learning, particularly aimed at pointing out differences between humans and non-humans, has overwhelmingly focused on cognitive processes over the last few decades, building on arguments that specific processes would be responsible for human uniqueness. Yet, it appears that we have reached a theoretical wall: while paradigms are being developed to study the extent of other animals' representations of their own or others' knowledge, such results remain fiercely debated with little hope of change in entrenched positions. In this talk, I will propose emotions as a way out of the conundrum of animal versus human cultures. A benefit, and arguably a result, of social life, is an extended emotional life, which underlies social interactions. The newly proposed framework of Affective Social Learning (ASL) aims to focus on the acquisition of values, building on particularly influential emotional theories such as social appraisal, and participating to the building of an Affective, Behavioural and Cognitive (ABC) approach to social learning. ASL is particularly interesting for cultural evolution, considering that much of our norms exist through the affective reactions we display towards them. Here, I will discuss what an ABC approach to social learning brings to cultural evolution research, taking examples relevant to the evolution of norms and language. In particular, I will argue that ASL provides a continuum between so-called 'simple' and 'complex' cognitive processes and thus, by firmly establishing emotions as an integral part of cultural transmission, could assist in solving the decade long debate on human and non-human cultures.

Q&A session 27

Day3-B2

Magic, ritual and religion 2

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Witchcraft, Envy, and Trust among Hindu Mauritians

Envy-based magic beliefs, including witchcraft, are prevalent in societies around the world. These beliefs can create distrust due the belief that one's misfortune can be magically caused by others in their community. We examined the relationship between witchcraft rituals, motivation, and distrust in a sample of 428 Hindus Mauritians. Despite these beliefs being largely taboo, Hindu Mauritians have a pervasive belief in witchcraft and evidence of the performance of witchcraft rituals is readily found throughout Mauritius. Participants were shown a picture of fruits claimed to be purchased for a religious or witchcraft ritual or to be eaten, and given one of three motivations for the purchaser (envy, selfishness, or neutral). Participants in the witchcraft and envy conditions rated the purchaser as less trustworthy and more harmful to the community than in the other conditions. Participants who were told the purchaser was envious or selfish were more likely to accuse the purchaser of witchcraft even when told he was buying fruit for a religious ritual or to eat. Free list questions confirmed that envy as a motivation increased participants willingness to see this person as less trustworthy and to claim his actions will have negative reputational impacts and cause harm. This work suggests that a belief that others are practicing magic decreases trust and is believed to cause harm across motivations. Further, the claim that a person is envious or selfish can increase the willingness to make a witchcraft accusation.

Luke Joseph Matthews (lmatthew@rand.org, RAND Corporation)

Multiple socio-cognitive processes lead to the cultural evolution of magic

Magic is of longstanding interest to researchers studying the cultural evolution of religion, philosophy, and even science. Recent research supports that magical thinking tendencies affect individuals' susceptibility to modern day misinformation, which suggests insights on the cultural evolution of magic may have policy applications today. Using newly collected survey and comparative datasets, I test three leading hypotheses for the cultural evolution of magic, 1) unilineal replacement of magic first by religion and then by science, 2)   magic functioning to provide market goods that are distinct from religion or science, and 3) magic arising from long-evolved cognitive tendencies that constrain human psychology. I find empirical support for all three hypotheses but in differing contexts. Thus, rather than evolving through any single process, magical beliefs and practices appear to be induced through multiple processes of cultural evolution. Greater awareness of the contexts in which magical thinking operates, and when it may be adaptively useful, may allow people to better guard against misfiring of magical thinking that can result in the spread of scientific and journalistic misinformation.

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Origin of human ritual behavior

We propose an evolutionary model of the origin of ritual behavior in the hominin lineage that treats collective ritual as a communication technology facilitating mutualistic cooperation. In our model, we first synthesize the literature dealing with hunter-gatherer ethnography and hominin archaeology and identify gradual coalescence of similarity signals, coalitionary signals, and signals of commitment to collective action as the main building blocks of human ritual behavior. Subsequently, we turn to primatology and paleoanthropology to trace the presence of these signals in both non-human primates and past hominins. Adding the proximate level to our analysis, we pinpoint distinctive neurocognitive mechanisms scaffolding the three types of ritual signals (overimitation, shared intentions, recursiveness, prospection, cross-domain association) and track down their presence in past hominins. Finally, we connect this evidence with the prevalent socio-ecological selective pressures for cooperative communication (environmental variability, interdependence, inter-group interactions) and offer estimates both for when the first of the ritual signals started to evolve as well as when ritual signals coalesced into an adaptation affording to overcome collective action problems.

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Supernatural Explanations Across 109 Societies Are More Common for Natural Phenomena Than Social Phenomena

Nearly all human societies use supernatural beliefs to understand the world. But what kinds of events do people most commonly attribute to supernatural agents? No evidence to date has examined supernatural meaning-making on a global scale. Here we analyze supernatural meaning-making in 109 non-industrial societies from the ethnographic record to test whether supernatural explanations are more common for natural events (famine, natural disasters, and disease) or social events (warfare, murder, and theft). We find that across all world regions and subsistence styles, people are universally more likely to explain natural phenomena with supernatural beliefs than social phenomena. Almost all societies had at least one supernatural explanation for natural phenomena, and the frequencies of natural and social supernatural explanations were highly correlated. We show that the likelihood of a supernatural explanation is unrelated to the frequency of the documented event. Further, supernatural explanations of natural phenomena had higher phylogenetic signal compared to those of social phenomena, suggesting that supernatural explanations of natural events are more likely to be transmitted over time. These results support past theories of animism and agency detection which suggest that humans have a tendency to anthropomorphize natural forces. Our findings also demonstrate that the motivation to categorize and explain natural phenomena may have played a significant role in the evolution of religious meaning-making in humans.

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Moralization of Religiosity Explains Worldwide Trends in Religious Belief

Religious belief is declining in many regions of the world, but some societies have remained highly religious. What explains why people and countries abandon their beliefs while others stay faithful to their religion? We propose that the Moralization of Religiosity (MoR)—the belief that religion is necessary and essential for morality—is key to answering this question. MoR likely emerged as a by-product of the historical rise of prosocial religions, but we propose that it has an additional side-effect—it discourages deconversion due to perceived reputational costs. We further suggest that cultural differences in MoR foreshadow patterns of nation-level secularization and individual-level deconversion. Our model is supported by historical cross-cultural, retrospective longitudinal, survey, and experimental studies. Study 1 (N = 218,603) shows that cross-cultural differences in MoR in 44 nations predict why some countries secularized faster than others from 1995-2014. Study 2 (N = 701) shows that childhood exposure to MoR predicts a stronger likelihood to maintain religion across the lifespan, controlling for several other factors. In Studies 3a-3c (N3a = 299; N3b = 300; N3c = 325), present-day MoR negatively predicts participants' likelihood of deconverting in the future. Study 4 (N = 513) showed that endorsement of MoR predicted prejudice towards deconverts and atheists, suggesting that MoR inhibits deconversion due to perceived reputational costs. Finally, Study 5 (N = 461) replicates our key findings with an experimental design.

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Emergent Patterns of Cultural Change: Modeling Psychological Mechanisms and Social Network Structures

The present research investigates how psychological mechanisms and social network structures generate patterns of cultural change and diversity. The two psychological mechanisms studied here are cultural drift and indirect minority influence; the former is parameterized by an error rate and the latter by a leniency threshold. The patterns of cultural change are examined in terms of magnitude (small vs large), speed (gradual vs rapid), and frequency (frequent vs rare). Diversity and polarization in a society are examined in terms of global cultural variation (inverse Simpson index) and local neighborhood difference (Hamming distance). Key findings are that in networks with high connectivity or local community structures (complete, scale-free, random, and modular networks) cultural drift can produce a rapid, large, and rare pattern of cultural change (punctuated equilibrium), whereas in lattice or small world networks, it produces a more gradual change pattern. Indirect minority influence robustly produces a gradual, small, and frequent pattern of cultural change (gradualism) across various network structures. When cultural change occurs in social networks that have a modular community structure, indirect minority influence generates a regime of cultural diversity whereas cultural drift generates a polarized regime. Finally, cultural drift and indirect minority influence generate distinct tipping points for social change in different network structures, but prediction of whether and when cultural change emerges is difficult at tipping points in both cases.

Q&A session 28

Day3-C2

Cultural evolution and diversity

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Effective population size for culturally evolving traits

Population size has long been considered an important driver of cultural change. Results from population genetics, however, demonstrate that it is not the census population size, N, but the effective size of a population, N_e, that determines important evolutionary parameters. This effective population size governs the rate of change in a population due to drift and affects genetic variability both within and between populations. Here, we systematically examine effective population sizes for traits that evolve culturally, i.e. through processes of innovation and social learning, rather than genetically. We use different modeling approaches to investigate how cultural N_e and levels of diversity depend on the way traits are learned, population connectedness and social network structure. We show that one-to-many and frequency-dependent transmission can temporally or permanently lower effective population size compared to census numbers. Contrary to expectations in the literature, migration does not increase N_e and a process of cultural exchange among groups increases only the less meaningful inbreeding effective number but not the variance effective number. While network density in random networks leaves N_e unchanged, scale-free networks tend to decrease and small-world networks tend to increase N_e compared to census numbers. Finally, for one-to-many transmission and different network structures, effective size and cultural diversity are closely associated. For connectedness, however, small amounts of migration and cultural exchange result in highest diversity independently of N_e. Our results highlight the importance of effective population size for cultural evolution and show that inferring N_e requires detailed knowledge about underlying cultural and demographic processes.

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Cultural Diversity in Unequal Societies Sustained Through Cross-Cultural Competence and Identity Valuation

In much contemporary political discourse, valued cultural characteristics are threatened by interaction with culturally-distinct others, such as immigrants or a hegemonic majority. Such interaction often fosters cross-cultural competence (CCC), the ability to interact successfully across cultural boundaries. However most theories of cultural dynamics ignore CCC, making cultural diversity incompatible with mutually-beneficial inter-group interaction, and contributing to fears of cultural loss. Here, interview-based field methods at an Amazonian ethnic boundary demonstrate the prevalence of CCC. These data motivate new theory, incorporating competing developmental paths to CCC and group identity valuation, that illuminates how a common strategy of disempowered minorities can counter-intuitively sustain cultural diversity: Given strong group identity, minorities in a structurally-unequal, integrative society can maintain their distinctive cultural norms by learning those of the majority. Furthermore, rather than a rejection of, or threat to, majority culture, valuation of a distinctive minority identity can characterize individuals committed to mutually-beneficial coordination with the majority as members of an integrative, multi-cultural society.

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Cultural ancestry and the global diffusion of democracy

There has been long-standing interest in the factors that predict global variation in democracy, but less attention has been given to cultural factors and the importance of cultural ancestry. Here we combine cultural phylogenetic and network modelling approaches to examine the role of cultural ancestry (linguistic and religious affiliation) in explaining the spread of democracy among 221 modern and historical nations over the past 200 years. We find strong cultural and geographic effects during the 20th century, spiking during its latter half, in predicting three democracy outcomes. Linguistic affiliation explains a substantial fraction of variation in democracy, and nations and their cultural neighbors become closer in democracy over time. This suggests the legacy of deep cultural ancestry still shapes the fortunes of modern nation states.

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Beasts of Burden, Trade, and Hierarchy: The Long Shadow of Domestication

For most parts of human history, wealth has been unequally distributed between the regions of the world. This paper analyses how the prehistoric geographic distribution of domesticable transport animals has contributed to shaping such differences in development. I identify the historic ranges of the ten animal species that fulfill the criteria (1) to be suitable for domestication and (2) to be suitable for transportation tasks. Based on these ranges, I create a measure of the prehistoric presence of domesticable transport animals around the world on a 1x1 degree pixel level. In the empirical analysis, I find that the geographic prevalence of domesticable transport animals, but not of other domesticable animals, strongly predicts the emergence of early long-distance trade routes as well as early forms of hierarchy. These results hold through various specifications and also cannot be explained by reversed causality, domestication in general, or geographic and climatic conditions that might be correlated to the spread of these animals. I also find important implications in the very long-run: Ethnic groups at the onset of the modern era are more involved in trade and have built more complex hierarchy structures, including larger levels of labor specialization as well as social class stratification, if their ancestors had been living in regions that where also home to species of domesticable transport animals.

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Young children spontaneously invent different types of associative tool use behaviour

The use of two or more tools in combination - Associative tool use (ATU) – has played a crucial role in human cultural evolution and is also part of chimpanzee tool cultures. Research into the cognitive processes underlying ATU produced evidence for the spontaneous invention of some forms of ATU in some non-human primate and bird species. In contrast, developmental studies with children have been sparse. Whether young children are also able to spontaneously invent different types of ATU and at what age this ability emerges is still unknown. This study aimed to start filling this gap in the literature with two experiments with samples of European, predominantly White preschoolers (E1: N = 66, 3y 6m - 4y 9m; E2: N = 119, 3y 0m - 6y 10m) who were administered a series of novel, non-verbal tool-use tasks measuring three different types of ATU: Tool set, Metatool use, and Sequential tool use. Children had 3 min per task and did not receive any demonstrations. Results from both experiments showed that from 3 years of age, children were able to spontaneously invent the three types of investigated ATU behaviours, suggesting that no immediate social learning was needed for the emergence of these behaviours. E2 showed that performance significantly increased with age. However, success rates were low, demonstrating that the spontaneous invention of ATU in novel tasks with brief exposure is challenging for preschoolers. The tasks add to the pool of tests that can be used to study problem-solving in humans and non-humans.

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Claudio Tennie (University of Tübingen)

The Method of Local Restriction: In search of potential great ape culture-dependent forms

A species is deemed cultural when there exists behavioural variation across populations that can be at least partly attributed to social learning. Understood in this way, culture has been found in all species of great apes. However some ape behaviours have additionally been claimed to be culture-dependent, implying that copying social learning mechanisms underlie their acquisition (as it occurs in human culture). If that was the case, these ape behaviours should have become locally restricted as a consequence of the unavoidable copying errors accumulated during their transmission between connected individuals. Based on this logic we developed the "Method of Local Restriction" in order to identify potential cases of culture-dependent forms in great apes which distribution is compatible with acquisition via copying (i.e. these behaviours are restricted to a single ape population). After conducting an exhaustive literature search across ape species, populations and behavioural domains, we found that the vast majority of great ape behaviours re-appear in unconnected populations and therefore do not necessarily rely on copying to be acquired. However, we found 25 locally restricted behaviours, three of which were locally unique to a single population of a single great ape species. These behaviours represent the best available candidates of culture-dependent forms in great apes, which reliance on copying social learning should be tested in targeted experiments. Overall our results suggest that great ape cultures are sustained by different learning mechanisms from those at play in human cultures, namely by individual learning mediated by non-copying social learning mechanisms.

Q&A session 29

Day3-D2

Evolution of technologies

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Jean-Francois Bonnefon (Toulouse School of Economics)

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The burden of the past: preexisting solutions constrain the evolution of technology in a cultural evolution experiment

A key feature of our species is our unprecedented capacity to develop cultural practices that have allowed us to colonize and permanently occupy environments for which we are poorly suited genetically. A central claim made by cultural evolution researchers is that the emergence of these cultural practices results from our tendency to faithfully copy others, which allows adaptive (and sometimes counter-intuitive) cultural information to be preserved and accumulated across generations. This view has been challenged by cognitive anthropologists who argue that humans do not blindly copy others but, instead, typically evaluate the plausibility of social information against their background beliefs. Here, I will present an experiment that investigates the extent to which individuals who are asked to improve a physical system are influenced by social information that varies in its usefulness. Participants received social information in the form of a theory (either correct, partially correct or incorrect) about the physical system before being given the opportunity to improve their solution upon several trials. Our results show that social information strongly affects individuals' solutions, regardless of its usefulness to improve the system. I will discuss how our tendency to being influenced by others canalizes learners' exploration, promotes the persistence of arbitrary cultural information and can sometimes hinder progress towards higher achievements.

Q&A session 29

Day3-D2

Evolution of technologies

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Insights from Artificial Life: Measuring and Classifying Open-Ended Evolutionary Dynamics

Many features of Human cultural evolution, such as technology (Kolodny et al., 2015), language (Carr et al., 2016), and scientific knowledge (Lehman, 1947) seem to exhibit unbounded evolutionary dynamics; growing in complexity, introducing new innovations, and having no obvious bounds. Evolutionary systems exhibiting unbounded evolutionary dynamics are commonly referred to as being open-ended (Bedau et al., 1998). The creation and analysis of systems that exhibit open-ended evolutionary dynamics is an open problem in the field of Artificial Life (Bedau et al., 2000). Motivated by the observations that nature exhibits unbounded evolution, with the ongoing generation of adaptive novelty and complexity, Artificial Life researchers want to create open-ended evolutionary systems in artificial media (e.g. computer simulations, robots, ...). The goal of achieving open-endedness in artificial evolutionary systems has led to the formalisation of measurements for unbounded evolutionary dynamics - these measurements take the form of evolutionary activity statistics, and are often called the "ALife Test" for unbounded evolutionary dynamics (Bedau et al., 1998). This test has been applied to the fossil record (Bedau et al., 1998), the patent record (Bedau et al., 2019) and artificial evolutionary systems (Channon, 2003). The activity statistics enable researchers to take any evolving system over time and assess changes to diversity, alongside measuring the introduction and adaptive persistence of new components in the system. Despite having numerous datasets, models, and evaluation methods, the field of cultural evolution is yet to effectively determine whether any given component of a culturally evolving system is bounded or unbounded. Determining what species exhibit open-ended cultural evolution, and in which behavioural domains, should be a key focus of cultural evolution going forward, and the the ALife test provides us with a consistent approach for doing this.

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Uncovering the Impact of External and Internal Competition on Long-Run Social Dynamics

Previous work utilizing Seshat: Global History Databank, a major resource for studying patterns of sociocultural evolution in world history, has sought to explain how and why complex societies rose, spread, and, at times, collapsed. Utilizing a large empirical dataset, we have explored the factors that drive social complexity and a host of related social features, from agricultural productivity to ideological developments to governing institutions.

Here, I will summarize these findings and highlight our recent work trying to uncover the main causal forces behind the evolution of military technologies, a key factor in and indicator of intense interstate competition. I will discuss how this helps us not only understand the evolution of technology generally but also carries far-reaching implications for social dynamics more broadly. I conclude by previewing current efforts within the Seshat project linking these insights on interstate conflict to an exploration of internal competition and how this research can help shed light on not only the rise and continued development of states, but their periodic declines and falls as well.

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Children's third-party norm enforcement in eight societies

Third party interventions against norm transgressions play an important role in sustaining social norms and in stabilizing cooperation. Western, middle-class children already show third party norm enforcement during the preschool years (e.g., Rakoczy et al., 2008). Yet, cross-cultural evidence from adults has revealed substantial variation in norm enforcement, both in frequency and in cultural enforcement styles (e.g., Heinrich et al., 2006; Wiessner, 2005). We investigated third party norm enforcement in five- to eight-year-olds from eight diverse societies worldwide (N = 382 children; 3 urban and 5 rural samples) across four continents (Asia, South America, Africa, Europe). Children participated in the study in peer dyads and were taught a novel sorting game: one group learnt to sort by colour, another group by shape. Next, children observed (1) another child who had learnt the same rule (control condition) and (2) a different child who had learnt an incompatible rule (test condition). We developed a comprehensive coding scheme for children's verbal and non-verbal behaviours. We found across all eight populations that observers intervened more frequently in the test condition than in the control condition – this was true for both non-verbal and verbal behaviours. However, there were societal differences in children's norm enforcement styles. These findings show that a functionally similar behavioural outcome, norm enforcement, can be achieved through culturally variable means.

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Intent-based morality: evidence from Colombian and Spanish children

The majority of the developmental literature about the role of outcomes and intentions in moral evaluations has been conducted on English-speaking children and focused on harm and property transgressions (Hilton & Kuhlmeier, 2019). We tested instead a Spanish-speaking sample of 5- to 11-year-old children from Colombia and Spain (N=123) employing moral scenarios involving disloyalty and unfairness.

The outcome-to-intention shift in judgements of transgression severity was moral domain-dependent in Colombian but not Spanish children. Colombians judged failed intentional transgressions more severely than accidental transgressions in case of disloyalty, but not (yet) in case of unfairness. In line with cultural group selection (Richerson & Boyd, 2008), it makes evolutionary sense that children's sensitivity to intentionality develops earlier within the moral domains (e.g., loyalty) privileged by their own cultures (e.g., collectivistic culture).

Regarding punishment severity, Spanish but not Colombian children began to punish failed intentional transgressions of both moral domains more severely than accidental transgressions around 8 years of age. Moreover, while punishment severity decreased with increasing age for both unfairness and disloyalty in Spanish children, in Colombian children the downward pattern was observed only for unfairness. This might indicate that selective concerns become more pronounced with development because of culture-directed learning processes.

Finally, neither Colombian nor Spanish children enjoyed engaging in punishment. Colombian children in particular even anticipated punishment to feel worse than how it actually felt during and after

punishment allocation. This suggests that retribution is unlikely to be the primary motive for children's punishment behaviour (Carlsmith et al., 2008).

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Coordination payoffs do not stabilize continuous norms

Norms are unwritten behavioral codes. They regulate individual behaviors and so have played a crucial role in human evolution. Research has focused on norms that have a few discrete variants subject to coordination payoffs. Individuals with a variant that differs from the one that characterizes majority of the population are at a disadvantage. As a result, there may be multiple stable equilibria, and different populations may evolve different norms even though they are exposed to the same environmental conditions or are linked by migration. Many norms, however, have a continuous range of variants. Examples include the norms governing tipping percentages, phonological norms and social interactional norms like how far away to stand from the person one is talking to. Here we present a model of the dynamics of a continuously varying norm which incorporates the same assumptions about coordination payoffs as discrete models, but has qualitatively different dynamics. Coordination payoffs do not result in multiple stable equilibria. Instead, direct payoffs controlled by the environment, moral beliefs or cognitive processes determine the outcome even if these effects are weak, and two populations linked by migration converge to the same norm. Discretizing the behavioral space, however, can restore the effects of coordination payoffs in maintaining multiple equilibria.

Q&A session 30

Day3-E2

Morality and norms

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An Evolutionary Political Science: How Modern Nations Evolved Institutionally

Institutions of modern societies have often been argued to evolve, but their evolution is rarely examined in Darwinian and empirical terms. Here we use the categorical data set MaxRange on nations' regime-types and their constituting institutions historically for analysis of their phylogeny. The MaxRange data set covers all nations in the world system of nations since 1600 with details on accountability structures, executive strength and degree of centralization, constitutional strength, democracy and other aspects of the political systems. We describe and analyze the character of the "true phylogeny" of regime-type evolution in the nations of the world 1600--2020. Our results indicate that evolutionary network rather evolutionary tree models have superior fit to data. Using the extracted phylogeny, we also investigate the dynamic networks of nations in terms of regime-types, accountability structures and their related background factors such as religions and language. Network centrality measures of nations and regime-types provide new important explanatory variables for network-adjusted survival analyses of various institutions, from types and levels of democracy to details of regime-types, including institutions like parliamentarism, presidentialism, and their hybrid forms.

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We find the dual foundations of political ideology across the diversity of human social life

Politics today is often characterised as a single dimension which represents a conflict, brought about by modernisation and industrialisation, between the hierarchy and traditionalism of the establishment and people seeking equity and change. Here we review evidence that contemporary politics reflects not one, but two fundamental dilemmas, and that these 'dual foundations' of politics are not unique to modern nations, but are inherent to life in all human groups. Human interdependence creates two dilemmas which require people to hold ideas about what is to be done. One dilemma concerns conflict between cooperation and competition. This dilemma leads to differences of opinion regarding the extent of equality and inequality. The other dilemma is about the coordination of collective activities. This dilemma leads to conflicts about the extent of social control. We use anthropological evidence from the Human Relations Area Files, and other literature from anthropology and related disciplines, to extend psychological work showing that these two fundamental dilemmas of group living lead to two dimensions of political conflict and ideology across a large diversity of societies. We end by arguing that quantitative approaches to studying political psychology beyond the experiences of industrialised nations will advance research in both anthropology and psychology. The dual foundations provide the big picture which can tie together the study of human politics across societies and disciplines.