Culture Conference

Culture Conference 2019: Communication in Culture

1st – 2nd July 2019

Cultural Evolution Society

erc

European Research Council

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Day 1: Monday 1st July	
9:00-9:30	Registration & Coffee
9:30-9:45	Welcoming remarks
9:45-10:45	**Lightning talks**
10:45-11:30	**Posters** and coffee
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12:30-13:30	Lunch
13:30-14:30	**Marina Bazhydai**, Lancaster University: *I don't know but I know who to ask": 12-month-olds actively seek information from knowledgeable adults* **Petra Susko**, Abertay University: *Learner performance does not impact knowledge exchange between experts and novices*
14:30-14:45	Coffee Break
14:45-15:45	**Marieke Woensdregt**, University of Edinburgh: *A computational model of co-evolution of language and mindreading* **Aliki Papa**, Heriot-Watt University: *Copying from observing a model vs. listening to verbal instructions: comparing children vs. adults, and causally relevant vs. irrelevant actions*
15:45-16:15	Coffee Break
16:15-17:15	**Keynote 2**: **Ellen Garland,** University of St Andrews *Vocal learning and cultural transmission in cetaceans: lessons from humpback whale song*

Day 2: Tuesday 2nd July	
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11:30-12:30	**Matt Spike,** University of Edinburgh: *The evolutionary ecology of linguistic complexity* **Thomas Müller,** Max Planck Institute for the Science of Human History: *Color terms: Natural language categories and artificial language category formation*
12:30-13:30	Lunch
13:30-14:30	**Monica Tamariz**, Heriot-Wat University: *Replication of actions achieves adaptive, cumulative evolution* **Cara Evans**, Max Planck Institute for the Science of Human History: *Children's response to non-verbal cues of cultural communication suggests they are broadly "optimal-" rather than "over-" imitators*
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15:00-16:00	**Keynote 4: Martin Doherty,** University of East Anglia *By any other name: labelling and theory of mind.*
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Keynote Abstracts

Professor Cecilia Heyes ***All Souls College and Department of Experimental Psychology, University of Oxford***

Cultural Learning as Communication

What is cultural learning? How does it differ from other kinds of social learning in humans and other animals? What is it about cultural learning that enables accumulation and cultural selection? I will suggest that, in addressing these questions, it is helpful to think of cultural learning as a form of communication – as learning *from*, rather than learning *about*, other agents. What is culturally learned from other agents can be about other agents or the inanimate world, but it must involve transfer of competence. What I learn must depend on what you know. Drawing on studies of face recognition, reading, motor learning and moral cognition, I will suggest that, although teaching and intentional communication play important roles in human cultural inheritance, they are not required for cultural learning. It can happen when information leaks out of one agent and into another.

Dr Ellen Garland ***Centre for Social Learning and Cognitive Evolution, and Sea Mammal Research Unit, School of Biology, University of St. Andrews***

Vocal learning and cultural transmission in cetaceans: lessons from humpback whale song

Cetaceans show some of the most sophisticated and complex vocal and cultural behaviour we know outside of humans, including learning, shared traditions and gene-culture coevolution. Male humpback whales (*Megaptera novaeangliae*) sing a long, stereotyped, vocally learnt and culturally transmitted song display. At any point in time most males within a population will sing the same version (arrangement and content) of this complex sexual display. However, the song is continually evolving and males must constantly learn and incorporate these changes into their own song to maintain cultural conformity. In addition to evolutionary change, song also undergoes radical 'revolutions' where a novel song introduced from a neighbouring population rapidly and completely replaces the existing song. Multiple humpback whale song revolutions have spread across the South Pacific region from the east coast of Australia across to French Polynesia, with a one to two year delay. This has occurred regularly, rapidly and repeatedly across the region; however, we still have a limited understanding of the underlying mechanisms driving this cultural phenomenon. Using empirical data, I will present our current understanding of the mechanisms involved in the song learning process, how these processes may be disrupted, and finally the evolutionary implications for this cultural phenomenon.

Dr Zanna Clay *University of Durham*

Communication, culture and social bonds: Evolutionary insights from our great ape relatives

A fundamental basis of what it means to be human is our ability and motivation to copy others. Through copying, we can acquire and build upon cultural technologies, norms and rituals, understand social rules and crucially- acquire and transmit languages along with other systems of communication. The intimate relationship between communication, social bonding and culture is not limited to our species however, but instead permeates right across the animal kingdom. In this talk, I will discuss the interplay between communication, culture and social bonding in our closest living relatives, the great apes while also touching on examples from other species. Understanding the communicative and cultural capacities of our primate relatives is essential for building an informed evolutionary model of how our own complex and sophisticated forms of communication and culture, most notably language, might have evolved.

Dr Martin Doherty *University of East Anglia*

By any other name: labelling and theory of mind.

How something is labelled is critical to communication, both to identifying what is being talked about and how it is presented. Labelling affects word learning from infancy, and adults' tendency to form 'conceptual pacts'. I present the claim that the ability to think about labels shares the same conceptual basis as the ability to think about representational mental states. Fundamental common developments around 4 years allow children to think about false beliefs, and about alternative labels. This finding has clear relevance for claims of infant theory of mind, word learning, and adult conversational practice. Supporting data will focus on recent research on preschool word learning biases, including bilingual and cross-cultural comparisons. Development will be explained using the metaphor of mental files.

Lightning Talk & Poster Abstracts

Eleanor Fleming, Durham University
Introducing StORI: A Global Database of Storytelling practices in Indigenous and Small-Scale Societies

Storytelling is a complex communicative behaviour common to every human culture on the planet, and yet researchers know astonishingly little about how and why it evolved, or what patterns the massive variation we see in storytelling behaviour. This gap can be partially attributed to a lack of detailed, accessible resources on the subject. In this paper I introduce the Storytelling and Oral Record Index (StORI), the first anthropological database dedicated to examining cross-cultural patterns of storytelling in indigenous and small-scale societies. The database combines information from hundreds of sources on the broad storytelling practices of 109 globally distributed cultures with a variety of demographic, environmental, ecological, and socioeconomic variables. The aim of this database is both to collate and record key information on global storytelling behaviour and to enable researchers to examine how these variables work to pattern the cross-cultural prevalence of certain types of stories. Early investigation shows statistically significant variation in the distribution of several story types when measured against indices of local ecological and social challenges. This indicates that storytelling helps cultures preserve and communicate adaptively valuable information. Through this research, we may hopefully reveal more about how this central human behaviour operates, and perhaps ultimately why it emerged in our species sometime in our evolutionary past.

Toby Handfield, Monash University
What is the function of gossip? A dual-function model of indirect reciprocity and moral evaluation

This paper uses models of indirect reciprocity as an opportunity to study a possible co-evolutionary relationship between moral communication (gossip) and cooperative behavior. Indirect reciprocity is based on one-shot encounters, in which agents use publicly available reputation information to decide whether or not to interact with others. Reputations are derived from some variety of communication, and the evolution of this aspect of indirect reciprocity has been undertheorised to date. Earlier literature assumes that all individuals in the population evaluate reputation in the same way — they share the same "social norm". In our model, we allow the social norm to vary across individuals and to evolve. We show that, without additional mechanisms to stabilize the norm, cooperation cannot be sustained. Agents who use alternative norms lower the quality of reputation information for other agents but suffer no relative fitness disadvantage. By processes of random drift, undiscriminating norms thus take over, depleting the value of reputation information. Cooperation then collapses.

We then extend this framework to show how cooperation can be sustained using a mechanism we call “gossip discrimination”. In gossip discrimination, agents do not choose to cooperate on the basis of whether or not their partner has a good reputation, but on the basis of whether or not they share the same social norm. The name is inspired by the idea that much gossip behavior does not involve exchanging useful information about the reputation of others, but involves using notorious exemplars of good/bad behavior as a way to assess whether the prospective partner shares the same system of assessing reputations.

Neither pure reputation discrimination nor pure gossip discrimination can sustain cooperation, but we show that for a broad range of parameters, a mixture of these strategies can achieve high levels of cooperation in the population. We further suggest that the model of gossip discrimination may provide a framework to explain the popularity of social media as an instrument to share morally charged information about celebrities and politicians, and the propensity to share material which generates outrage.

Sean Roberts, University of Bristol

CHIELD: The Causal Hypotheses in Evolutionary Linguistics Database

How do social, economic and ecological conditions affect the initial emergence and ongoing evolution of complex communication systems? By now, there are a huge number of studies addressing this question using a range of methods including cross-cultural studies, cross-species studies, lab experiments and computational models. Weaving these sources of evidence together into a coherent story is a vital but daunting task.

I present the Causal Hypotheses in Evolutionary Linguistics Database (CHIELD, https://chield.excd.org): a tool for understanding the field of evolutionary linguistics and for designing effective research. CHIELD represents hypotheses as causal graphs (nodes represent measurable quantities and edges represent causal influences). This makes the hypotheses, and links between them, searchable with ‘smart’ tools. Users can find all hypotheses which connect two variables, discover additional evidence for a causal link or compare hypotheses, locating points at which they overlap or disagree. For example, figure 1 shows 19 theories of how population size is linked to a language’s morphological complexity. CHIELD also codes the type of support each link has (experiment, statistical test, etc.), allowing users to visualise “robust links” that are well supported and “weak links” which have less empirical support, suggesting targets for future studies. Connections between theories abound: about 75% of studies are connected in a single network, many of which may not have been noticed before.

CHIELD currently includes over 2,700 causal links from 335 publications, hand-coded by a team of experts. The database is growing thanks to the online interface which allows any researcher to contribute, review or edit data. It’s hoped that CHIELD will unify the field and help design more effective studies. CHIELD is open source, allowing the tools to be adapted for other fields.

Barbara Pavlek, Max Planck Institute for the Science of Human History
The evolution of the informational value of ancient Greek coins

Human cultural evolution is characterized by the exponential growth of our capacity to store and transmit information. Coinage is one manifestation of this trend. The practice of minting small bits of metal with distinctive marks appeared in Greek city-states at the end of the 7th century BCE and had a transformative impact upon ancient economies and societies. The issuing authorities were marking their coins with designs that served as a guarantee for the coin's value. Early coins did not bear any written indications of their value, leaving graphic designs (images of gods, heroes, animals, etc.) to encode and communicate this information. However, the designs of early coins have not always successfully fulfilled this informative function.

Applying information-theoretic measures to a corpus of 6916 distinct coin types from the ancient Mediterranean world, dated between c. 625 and 31 BCE, we show that the symbols minted on coins became increasingly informative about a coin's value due to a general increase in the diversity of coin designs. This trend was specific to value-relevant information, as distinct from information concerning issuing states. High-denomination coins, being more valuable, tend to bear designs that carry more value-relevant information than low-denomination coins. The Greeks, like us, had a non-linear currency structure, with larger value gaps between higher denominations (e.g. 1€ and 2€) than between lower ones (e.g. 1c and 2c). Differentials in the high denominations range, being more important, were worth signaling to a greater extent.

These results show how cultural evolution gradually imparts symbols with meaning. They also show how even one of the most obvious functions of coins, optimally signaling value, took centuries to develop.

Jose Segovia-Martin, Universitat Autonoma de Barcelona
Hegemony and homogeneity accelerate the extinction of cultural traits in biased populations

Cultural diversity is crucial to maintain healthy societies and is related to economic growth, social cohesion, productivity and biodiversity indexes. But little is still known about how the interactions between individual cognitive biases, hegemony and homogeneity of the cultural system affect cultural diversity. Hegemonic cultural systems -dominance of one cultural variant over the others- and homogeneity -a uniform cultural structure across the population-, may accelerate the extinction of cultural traits. Following previous research (Segovia-Martín, Walker, Fay, & Tamariz, 2019), we use agent based models to simulate an interactive micro-society in which individuals play recurring games. We look at the spread dynamics of *n* competing variants of a specific cultural trait within a micro-society and then we borrow from information theory and biology well-established alpha diversity indexes to estimate cultural diversity (Shannon, 1948; Simpson, 1949). Two conditions were compared: homogeneity, where all the subpopulations used the same variant quality distribution; and heterogeneity, where each subpopulation used an independent variant quality distribution.

For each condition, three scenarios for quality dispersion across variants were tested: a) One-takes-all (OTA), where one variant had the highest value (hegemonic) and all other variants the lowest; b) competition (C), where two variants had the highest value; and c) pseudo-random (PR), where intrinsic values were randomly assigned to the variants (this condition served as a null model against which the other conditions could be compared). Our results show that both hegemony and homogeneity of the cultural system systematically accelerated the extinction of cultural variants in biased populations (Fig. 1), and in turn, a massive extinction of cultural variants can increase the uniformity of the abundance of surviving variants. Our study extends previous work showing that, in moderate and highly content biased populations, strong external constraints may dramatically affect the way in which cultural evolution proceeds.

Lara Wood, Abertay University

Evidence of a developmental shift from own-gender to gender-stereotyped social learning transmission biases on a language task

Culture is shaped by transmission biases determining what and who is copied. Children's social learning is influenced by such biases, and who children copy is relative to context and their own demographics. In a number of WEIRD cultures, in relation to language ability, pre-teen children have a tendency to rate their own sex as superior whereas older children endorse a gender-stereotype that females are superior. The current study investigated whether such views translate to social learning transmission biases on a language competency task.

Younger (9-10yo N=39) and older (13-14yo N =35) children were asked to write down the spelling of ten non-existent words presented by audio. Participants were given social information in the form of one male and one female model, each paired with an alternative spelling suggestion. Participants were also assessed for explicit and implicit gender-stereotypes relating to language competency.

For the ten items, children generally copied one of the provided spelling suggestions (M = 8.69/10) over an alternative spelling, indicating a high reliance on social over personal information. Generally, children showed a gender-stereotype of girls having better language ability, but only boys showed a corresponding implicit stereotype.

Overall, children showed a bias for copying the same-sex over the opposite sex model ($t_{1,73} = 2.04$, $p < .05$) over a bias of copying girls over boys ($t_{1,73} = -0.09$, $p = .93$). Analysis of age differences showed that younger children implemented a significantly greater own-sex copying bias than older children ($F_{1.72} = 1.022$, $p < .05$). Older children implemented a significantly greater female copying bias than younger children ($F_{1.72} = 6.28$, $p < .05$). This translated to a developmental shift in boys from younger boys copying their own-sex to older boys copying the gender-stereotyped sex (girls). Stereotype-based transmission biases will be discussed in the context of cultural evolution.

Andres Karjus, University of Edinburgh
Changing communicative need predicts lexical competition and contributes to language change (Poster only)
We present work on identifying and quantifying competition between words and test the hypothesis that increased communicative need in a semantic subspace supports co-existence of similar words, while low communicative need leads to a survival of the fittest situation.

'Competition' is used here to refer to any processes where the usage dynamics of some word or words affect the usage of other words. An example of direct competition would be a word that goes out of usage due to being replaced by a new borrowing, or by another native word that has undergone semantic change and is being used in an overlapping sense. An example of less direct competition would be a word that goes out of usage because its entire discourse topic is going out of usage, in turn due to the rise of new topics.

We use large diachronic corpora from multiple languages. The detection of competitive dynamics relies on semantic proximity estimated using word embeddings. Changes in communicative need are estimated using a simple topic model. We also control for a number of lexico-statistical measures, including commonality of the form, formal similarity to nearest neighbours, semantic subspace density, semantic change, polysemy, frequency, momentum, and dissemination in the corpus segment. These variables are subsequently modelled in a standard regression framework. Increasing communicative need in a semantic subspace does predict decreased competition, while high semantic similarity in subspaces with neutral or negative advection often leads to competition.

Daniel Finney & Monica Tamariz, Heriot-Watt University
Attitudes and Behaviours towards LGBTQ Communities (Poster Only)

Societal perception of the LGBTQ communities has been changing dramatically in the last few decades. Using a method inspired on Cavalli-Sforza et al.'s (1982), we explore the patterns of vertical and horizontal transmission that shape our behaviours and attitudes towards these communities.

We collected responses from 86 participants aged 17-80 (M=39.27, SD=16.14), 64 male, 19 female and 2 other, and 11 who identified with an LGBTQ community. Respondents rated how favourable their Attitudes and Behaviours towards Gay, Lesbian, Bisexual, Transgender, Non-Binary and Otherkin people were. They also rated how favourable their Mother, Father, Sister, Brother, Partner and Close Friends were towards the same groups.

The results of linear mixed-effects regressions reveal:

• Respondents thought they are more favourable towards LGBTQ than their family, partners and friends. Their own ratings are indistinguishable from those of their Close Friends and Partners, but very different from those of their Mothers and Fathers.
• Younger respondents report more positive Behaviours and Attitudes towards LGBTQ --and were more aware of the different LGBTQ communities-- than older respondents.

• Reported Behaviours towards LGBTQ were more favourable than Attitudes, but only for the LGBTQ communities that are less widely known (Non-Binary and, especially, Otherkin).

These results suggest that attitudes and behaviours towards LGBTQ communities are transmitted horizontally rather than vertically, and that attitudes and behaviours are becoming more favourable over time. Additionally, our analysis shows that behaviours towards LGBTQ communities tend to be more positive than attitudes towards the same groups, and that favourable attitudes and behaviours may be boosted by awareness of and familiarity with a community.

Studies like this would benefit from validation by obtaining direct responses from family and friends in addition to self-reported responses from target individuals (like Cavalli-Sforza et al. 1982 did).

Marianne de Heer Kloots, University of Amsterdam and Max Planck Institute for Psycholinguistics

Memory and generalization: How do group size, structure and learnability relate in lab-evolved artificial languages?

Experimental studies investigating the cultural evolution of language have demonstrated the emergence of structure in artificial miniature languages over time: through iterations of learning and use, languages develop increasingly systematic mappings between form and meaning. One way of studying this is through group communication game experiments. During these experiments, participants communicate in alternating dyads by making up words to describe very simple scenes displayed on laptops. Over communication rounds, participants become more successful at communicating, while the words they use become more systematically structured (parts of words consistently reflect parts of the described scenes).
In an experiment examining the role of group size in these experiments, larger groups (of 8 participants) end up with more structured languages than smaller groups (of 4 participants). This aligns well with studies on group size and cumulative cultural evolution in other domains, as well as large-scale correlational studies investigating relations between population size and linguistic complexity in natural languages. More structured languages are more compressible, supposedly making them easier to learn and use -- experiments studying the vertical transmission of artificial languages accordingly show that transmission error decreases over generations while the languages become more structured. This begs the question whether the large-group languages created in the communication game, being more structured, will also be easier to learn for naive participants.
We present preliminary results of a new experiment, in which individual naive participants learned languages which were created in the group communication games. These results indicate that how well participants *reproduce* a learned language does not increase linearly with how structured the language is. However, similarity in how naive participants individually *generalize* a language, to describe unseen scenes, increases significantly with structure score. Structure increases the predictability of forms for unseen meanings, making structured forms more likely to survive the communication bottleneck.

Elise Imison & Corinne Jola, Abertay University
Experts' sensorimotor, visual and frontal areas of the action observation network are tuned into dance-specific actions.

Over the last decade, dance has been successfully employed in numerous scientific studies on the neuronal mechanisms in action observation (AO), showing evidence for evolving mirror neuron activity through physical or visual expertise (Bläsing et al. 2012). Despite the accumulated evidence involving dance, the question of how the brain differentiates between dance and everyday movement remains unexplored. Moreover, while it is unquestionable that dance has a communicative function; its ephemeral character left us with few artifacts. We thus know very little on the role of dance in human culture evolution (Laland, 2016). The aim of this study was therefore to investigate which brain regions are processing the perception of dance differently from everyday actions. Using fMRI, we contrasted the brain activity of 22 dancers while they watched short video-clips of dance-improvisation with the activity during the observation of everyday movement in matched naturalistic scenes. Whole-brain analysis revealed dance-sensitive activity across somatosensory areas, the premotor and extrastriate visual cortex, inferior temporal gyrus, and supramarginal gyrus, common AO areas (Gardner et al. 2015). A ROI analysis on the inferior frontal region (BA44/45) including expertise as a covariate (total hrs of training across the lifespan), revealed significant cluster peaks for the factor expertise. Albeit known for language processing, Broca's area has previously been identified in structural processing of dance (Bachrach et al. 2016). To our knowledge, this is the first study to investigate neuronal correlates sensitive to dance-specific processing in relation to expertise and indicates that dance might be instrumental in the development of human communication.

This research was supported by the French National Agency for Research (ANR-10-LABX-80-01, Labex ARTS-H2H) awarded to Dr Christophe Pallier (INSERM/CEA) and Dr Asaf Bachrach (CNRS), whose contribution was crucial in the experimental design and stimuli creation. We thank Christophe and Asaf for the use of the data.

Mark Atkinson, University of Stirling
Robust source-independent biases in children's use of socially and individually acquired information (Poster Only)

It has been proposed that children possess domain-specific mechanisms for social learning, and that these mechanisms function to promote the rapid acquisition of cultural traits. We assess this by comparing children's performance on simple stimulus choice problems when they are provided with information from either a social source or from their own personal experience. Over three experiments, involving both samples of 18-month- to 5-year-old children recruited in Glasgow, Scotland (Study 1; N = 172) and in Beijing, China (Study 2; N = 159), and a variant of Studies 1-2 with a counter-intuitive reward structure (Study 3; N = 184), we find little evidence that children perform differently in response to information acquired from a social source compared to information received via their own individual

exploration. Expectations about the predictive value of information thus appear to be independent of source. Furthermore, error rates show evidence of a consistent bias driven by motivation for exploration as well as exploitation, which was apparent across both conditions in all three studies. We conclude that some apparent peculiarities identified in human social information use likely reflect domain-general learning and motivational biases rather than domain-specific enculturation mechanisms.

Mark Atkinson, University of Stirling
Inferring behaviour from partial social information and the cultural transmission of adaptive traits (Poster Only)

Many human cultural traits become increasingly beneficial as they are repeatedly transmitted, thanks to an accumulation of modifications made by successive generations. But how do later generations typically avoid modifications which revert traits to less beneficial forms already sampled and rejected by earlier generations? And how can later generations do so without direct exposure to their predecessors' behaviour?

One possibility is that learners are sensitive to cues of intentional production in others' behaviour, and that particular variants (e.g. those containing structural regularities unlikely to occur spontaneously) have been produced deliberately and with some effort. If this non-random behaviour is attributed to an informed strategy, then the learner may infer that apparent avoidance of certain possibilities indicates that these have already been sampled and rejected. This could potentially prevent performance plateaus resulting from learners modifying inherited behaviours randomly.

We test this hypothesis in a series of experiments in which participants, either individually or in interacting dyads, attempt to locate rewards in a search grid, guided by partial information of another participant's performance. We assess the roles of task structure, information transparency, and coordination on task success, the avoidance of previously-sampled unrewarded selections, and structural regularities in search behaviour.

Kirsten Blakey, University of Stirling
Development of strategic social information seeking in children (Poster Only)

Selective social learning allows human adults to filter out less useful aspects of available information, therefore enabling them to actively seek and effectively use that which is most relevant. The majority of developmental social learning paradigms examine children's responses to information specifically provided for use in a particular task, but do not address children's ability to seek out the information for themselves.

To assess 3-to-8-year-old children's ability to seek out and use the most appropriate social information we presented children with a box locked with a distinctive padlock and two keys. Children had to select and watch one of four possible demonstration videos before selecting one of the keys in an attempt to unlock the box. In each trial a single target video depicted a demonstrator with the same box and keys as the child, while three non-target videos showed demonstrators with different boxes and keys. The age and gender of the target demonstrator varied across four trials, as did the success of the target demonstration.

Results revealed that appropriate social information seeking improved significantly with age, and that target video selections were greater when the genders of the child and the target demonstrator were congruent. Following successful information seeking, social information use was found to improve with age after both successful and unsuccessful demonstrations, though was higher following successful demonstrations.

Julie Coultas, Noemi Pataki & Nicola Yuill, University of Sussex

Ipe Who? Investigations into the transgressive and irreverent nature of the jokes that primary-age children pass on (Poster Only)

Joke telling is a form of communication that is likely to have played a role in human social evolution through the enhancement of cooperation, coordination and well-being by the triggering of laughter. Jokes are an important part of the language and lore of English and New Zealand schoolchildren, as shown in the famous 20th century works by the Opies and Sutton-Smith respectively. Jokes are communicated through social interaction and more frequently now through social media channels, and it seems that the themes and structures of jokes are very widely shared. The earlier work implied that transmission was largely horizontal, through relatively unsupervised peer networks, although Sutton-Smith (2008) cites the growing role of other agencies that might be considered more vertical, such as social media, and perhaps the closer supervision (and censorship role) of adults. In this poster we analyse a selection of recent southern English primary-age children's jokes, collected in informal settings, in terms of the dominant themes and we sketch a means of studying them. Some content biases are identified e.g. emotional selection and specifically disgust. We question whether our means of gathering data inhibits the responses of the children and the potential of self-censorship when asking adults. This study is a first exploration of transmission processes in children's sharing of jokes in informal contexts. Jokes are likely to have a number of adaptive functions. We highlight the main themes and structures of jokes in our data set and make predictions about which jokes will be successfully transmitted in our proposed series of experiments.

Gemma Mackintosh, University of Stirling

Does intentional communication facilitate cumulative cultural evolution?

Cumulative culture is widespread in humans, but not apparent in other animals. One potential explanation for this is that humans are unique in communicating to inform. Previous research has demonstrated that this capacity does facilitate cumulative cultural evolution in human adults, and that this can be attributed to theory of mind reasoning, which not only allows the information sender to tailor signals to the needs of the learner, but also allows the learner to infer more from a limited subset of information than what is available. While there are numerous accounts of the emergence of theory of mind reasoning in children, it is not clear at what point this begins to influence the ability to send intentional communication that aims to benefit the learner. This series of studies will use an experimental transmission chain design to investigate the point in development where intentional information sending begins an accumulation of beneficial information, relative

to transmission via inadvertent information. Similar to previous tasks run with adults, participants will complete a landscape-searching task, scoring points by finding hidden targets. Information will be transmitted between participants such that receivers are informed of the results of part or all of their predecessor's search attempt. There will be three information conditions: Intentional, Inadvertent, and Full. In the Intentional and Inadvertent conditions, a small subset of the search will be transmitted to successors, either selected by the information producer themselves for informativeness (Intentional), or randomly sampled from their full search history (Inadvertent). In the adult sample, it was concluded that intentional information sending led to an increase that was comparable to when full information from a previous participant's search was available, thus indicating that intentional information sending does promote cumulative cultural evolution. Preliminary results from the follow up child study will be reported.

Charlotte Wilks, University of Stirling

Does children's developing understanding of others' minds affect their social learning strategies? (Poster Only)

Social learning strategies (SLSs) are well documented heuristics describing the biased use of social information and are important for populations of learners to retain beneficial traits. It is thought that many SLSs, in both humans and nonhumans, rely on domain general associative learning mechanisms. However, it has recently been suggested that as humans we are sometimes aware that we are using SLSs (named metacognitive SLSs) and that this may require higher-level (System 2) processing: some human SLSs may be "cook-like" whereas all nonhuman SLSs may be "planetary" (Heyes, 2016). Moreover, it has been proposed that human ability for explicit metacognition (encompassing both introspection and mentalising) enables us to use social information more flexibly to seek out and copy more useful models/information (Dunstone & Caldwell, 2018). The work presented here thus aimed to determine whether there is a developmental shift from the proposed nonhuman-like (planetary) task responses to more adult-like (cook) responses as children's understanding of others' minds, and how evidence relates to knowledge, increases. In our first study children aged 3-8 observed three, uninformed puppet demonstrators and one, informed demonstrator search two locations with the goal of locating hidden objects. The results of these search attempts remained opaque and we then asked children to identify where they thought the objects were hidden. We predicted higher success, and therefore a more flexible use of the social information, with increasing age i.e. older children would be more likely to choose the same location as the informed demonstrator and over-ride any bias to "copy the majority" of uninformed demonstrators. However, we found no main effect of age on the percentage of children who chose the correct location.

Talk Abstracts

Marina Bazhydai, Lancaster University
"I don't know but I know who to ask": 12-month-olds actively seek information from knowledgeable adults

Active social communication is an effective way for infants to learn about the world. Do preverbal infants pose epistemic requests to their social partners when motivated to obtain information they cannot discover independently? Recent experimental work has shown that infants are sensitive to the distribution of knowledge among social partners (Poulin-Dubois & Brosseau-Liard, 2016) and expect to learn from previously reliable informants (Begus & Southgate, 2012; Goupil, Romand-Monnier, & Kouider, 2016; Tummeltshammer, Wu, Sobel, & Kirkham, 2014). Infants' pointing has been proposed to serve an information-seeking function (Southgate, Van Maanen, & Csibra, 2007), however, little is known about pre-verbal and pre-pointing infants' ability to make epistemic requests.

The present study investigated whether 12-month-olds selectively seek information from knowledgeable adults in situations of referential uncertainty. We measured social referencing as a behavioural correlate of the active information-seeking process. In a live experiment, infants were introduced to two unfamiliar adults, an Informant (reliably labeling objects) and a Non-Informant (equally socially engaging, but ignorant about object labels). At test, infants were asked to locate a novel referent among two novel objects – that is, to make an impossible choice. Infants selectively referred to the Informant rather than the Non-Informant, but showed no such preference at the familiarization and training phases, when no uncertainty (and no need to ask for information) was present. These results suggest that preverbal infants use social referencing to actively and selectively seek information from social partners, prior to their active use of pointing as part of the interrogative communicative toolkit.

Petra Susko, Abertay University
Learner performance does not impact knowledge exchange between experts and novices

Can responses of experts to feedback from novices shape emergent properties of language? To overcome disagreement about the nature and universality of teaching, it is important to study its potential role in language transmission. Previous research had shown that when participants in iterated language learning experiments (Kirby et al., 2008) were asked to teach novices, certain functional characteristics, like language expressivity, were maintained while transmission fidelity was reduced (Kempe et al., 2017). The present study explored whether the observed innovations were due to experts accommodating erroneous feedback from novices.
Participants learned binary auditory sequences to express eight meanings differing in size, shape and brightness. Unlike in typical iterated language learning strategies, our participants were asked to 'teach' these signals to a novice. Unbeknownst to participants, novices were confederates who reproduced signals either almost correctly or with a

substantial degree of error. Each participant's final demonstrations were then presented to the next participant in the chain. We tested six chains of eight generations in each feedback condition.
Results showed that unlike in simple iterated language learning studies, expressivity was not compromised confirming that when placed in the role of an expert, participants retained important functional characteristics of language. Transmission fidelity improved in both feedback conditions but there was no effect of novice feedback on the degree of accommodation of the expert to the novice.
These findings suggest that teaching might serve to consolidate functionality of language based on a priori assumptions about its purpose and use. At the same time, there was no evidence that accommodation of novices shaped language structure over the course of transmission. Although in need of further replication these findings do not support claims that accommodation to novice learners drives linguistic structure (Frank & Smith, 2018; Lupyan & Dale, 2010).

Marieke Woensdregt, University of Edinburgh

A computational model of co-evolution of language and mindreading

Cultural evolution in humans relies on both language and mindreading, and these two skills in turn rely on each other. Language users use mindreading to entertain and recognise communicative intentions. And mindreading skills in turn profit from language, which provides a means for explicitly expressing and talking about mental states. Given this interdependence, it has been hypothesised that language and mindreading have co-evolved. We will present an agent-based model which formalises this hypothesis.
This model treats communicative behaviour as the outcome of an interplay between the context in which communication occurs, the agent's individual perspective on the world, and the agent's lexicon. However, each agent's perspective and lexicon are private mental representations, not directly observable by other agents. Language learners are therefore confronted with the task of jointly inferring both the lexicon and perspective of their cultural parent.
Simulation results show that Bayesian learners can solve this task by bootstrapping one from the other, but only if the speaker uses a lexicon that is at least somewhat informative. This leads to the question under what circumstances a population of agents can evolve such an informative lexicon from scratch. Here we will discuss the effects of two different selection pressures: a pressure for successful communication and a pressure for accurate perspective-inference. We will also compare two different types of agents: literal communicators and pragmatic communicators.
Pragmatic speakers optimise their communication behaviour by maximising the probability that their interlocutor will interpret their signals correctly. Iterated learning results show that populations of literal agents evolve an informative lexicon not just when they're under a pressure to communicate, but also when they're under a pressure to infer each other's perspectives. Populations of pragmatic agents show similar evolutionary dynamics, except that they can achieve improvements in communication and perspective-inference while maintaining more ambiguous lexicons.

Aliki Papa, Heriot-Watt University
Copying from observing a model vs. listening to verbal instructions: comparing children vs. adults, and causally relevant vs. irrelevant actions

Cultural transmission and evolution depend crucially on copying fidelity [1]. Humans are extraordinary copiers: both children and adults tend to over-imitate: they not only copy causally-relevant actions, which contribute to achieving a goal, but also causally-irrelevant actions, which do not contribute [2-5]. We know that adding verbal input to observational, visual modelling improves copying fidelity for complex tasks [5]. However, we do not know how verbal and visual input independently contribute to copying actions.

We investigate how transmission mode – modelling (seeing someone perform an action) versus verbal descriptions (listening to how someone performed an action) – affect the probability that actions in a sequence will be copied. In addition, we compared 6-8 year-old children with adults, and manipulated the actions' causal relevance.

We allocated 120 participants to 40 chains, half of children and half of adults, with 3 generations per chain. Each participant either watched silent video or listened to audio input about an action sequence leading to the extraction of a reward from a box [2]. Half of the actions were causally relevant, and half causally-irrelevant. The input for each participant was the video footage or audio description of the actions in the previous participant in the chain (or the experimenter). A control group interacted with the box to determine which actions they performed spontaneously.

Apart from expected results that relevant actions are copied more than irrelevant actions, we found that children copy more than adults, and an interesting interaction: children copied causally-irrelevant actions more from verbal description, and adults more from visual modelling (but they behaved the same for causally-relevant actions). Also, we found that relevant actions are mutated significantly more than irrelevant ones, and in the visual modelling condition. Our results show for the first time how verbal vs. visual modelling transmission affect the fidelity of action copying.

Matt Spike, University of Edinburgh
The evolutionary ecology of linguistic complexity

There is a growing consensus that some languages are more complex than others, and that this has something to do with extra-linguistic, i.e. social factors. A variety of semi-connected hypotheses have been advanced for what these factors are, including population size (Nettle, 1999), the type of society (e.g. Wray & Grace, 2007) and adult language contact (e.g. Trudgill, 2011); these theories are supported by quantitative work (e.g. Lupyan & Dale, 2010), experimental work (e.g. Atkinson, Smith & Kirby, 2018), and formal models (Reali, Christiansen & Chater, 2018).

Much of this work has been framed in cultural evolutionary terms. However, what remains unclear is which evolutionary model is most appropriate for addressing this inherently difficult and multifaceted topic. For example, can we ignore selection as a driving force behind complexity, and instead regard it as a natural consequence of neutral evolution combined with high rates of innovation in small populations? Or does selection play a

crucial role in, for example, the fixation of more easily learned structures in larger populations? Perhaps a more nuanced approach is warranted, for example along the lines of a cultural analogue of Ohta's nearly neutral theory? And maybe we are better off thinking of complexity in terms of structural diversity rather than a property inherent to individual structures?

I propose that evolutionary ecology provides a natural framework for thinking about these issues. Starting with a very simple model, and building up piece-wise to a more ecologically valid representation of language and its use, I show that some of the critical distinctions made in the literature are robust at multiple levels of representation (e.g. population size), others less so (e.g. whether complexity or simplicity are selected for), while some previously less-investigated criteria (e.g. the locus of innovation) become more prominent.

Thomas Müller, Max Planck Institute for the Science of Human History
Color terms: Natural language categories and artificial language category formation

By providing labels, language facilitates category formation. Categorical structure, in turn, allows languages to reduce continuous meaning spaces to a discrete set of words. Making use of these categories in their natural language, interlocutors are able to communicate successfully. But how do the categories arise and evolve culturally? This study investigates this in the domain of colour terms, which have been the most important test case for the relation between language and thought in the past.
We investigate the impact of natural language on category formation in a large-scale smartphone application designed to study the cultural evolution of language. Additionally, we test direct effects of natural language categories on communication, and especially on communicative success. The application asks players to communicate about colours using only abstract black-and-white symbols, thus creating artificial languages over repeated interaction.
For our analyses, we rely on an online survey mirroring classical studies on colour terms. It gathers data from speakers of English, German, French, and Spanish. By applying exploratory factor analysis, we reduce the 32 colours in the application to the same number of categories as the number of basic colour terms in the respective languages. We then use confirmatory factor analysis on the interactions observed in the application; the hypothesis is that category formation in the game follows natural language categories. Further hypotheses tested in the study are concerned with categorical perception for the colours in the game, and the specificity and performance related to encoding colours with the symbols. As data acquisition for the project is still under way and will run until April as per our study plan, we are not able to report the full results yet but would do so in the oral presentation.

Monica Tamariz, Heriot-Wat University
Replication of actions achieves adaptive, cumulative evolution

How do adaptive, cumulative cultural traits evolve? What cognitive mechanisms support their transmission? The literature tells us that social learning involves imitation and

inference: we observe behaviour and infer the model's goals and intentions [1-3]. Some puzzles arise: Cumulative cultural evolution produces opaque traits, whose function is not easy to infer from behaviour. How, then, do we learn opaque traits? Overimitation gives us a clue: humans, but not other primates, faithfully copy function-irrelevant actions regardless of their function [4-5]. But then, how do we learn the goals? Finally, how can we reconcile overimitation's faithful, blind, almost irrational adoption of content-irrelevant traits with the creativity and intelligence necessary to elaborate, refine and recombine those cumulatively?

These puzzles are solved by a cultural evolutionary model that demarcates two aspects of cultural transmission [6]. First, naive learners achieve *replicative inheritance* of actions. Crucially, they copy actions regardless of their normal, effective or conventional functions. Second, learners become experts as they repeatedly deploy the learned actions and experience their outcomes during *usage*. Experts have goals and intentions, and now that they understand the relationship between action and output, they may change the actions and they will preferentially produce the more efficient or effective actions.

We present an agent-based computational implementation of this model that shows that *social learning of actions alone*, without regard for the actions' outcomes and goals, plus individual learning, is able to support adaptive, cumulative evolution.

This model suggests that a cognitive shift of focus from goals to actions was essential for the emergence of cumulative culture in humans. If goals are irrelevant (e.g. when infants play or babble), opaque actions will be faithfully copied. In contrast, imitators' (e.g. chimpanzees') focus on goals make them take shortcuts and simplify observed complex actions [7].

Cara Evans, Max Planck Institute for the Science of Human History

Children's response to non-verbal cues of cultural communication suggests they are broadly "optimal-" rather than "over-" imitators

Human children are frequently cast as prolific "over-imitators" or blanket copiers. However, most previous "over-imitation" research has been conducted using consistent demonstrations to the observer, overlooking many important real-world social dynamics. For instance, learning often involves observing multiple individuals behaving differently, and learners' decisions are expected to be adaptive and guided by cues communicated by both demonstrators and bystanders. Here we investigate "over-imitation" using a cultural evolutionary approach, focusing particularly on the key adaptive learning strategy of majority biased copying. The majority behaviour is expected to communicate safe, efficient and reliable cultural information, and to represent a particularly salient copying heuristic. We therefore asked if children would copy the majority inflexibly: Children who "over-imitate" should copy the majority regardless of whether the majority solution omits or includes causally irrelevant actions, and should not integrate into their decision-making cues such as bystander approval.
We systematically varied the frequency of demonstrators that 4- to 6-year-old children (N = 320) observed performing a causally irrelevant action, and further varied cues relating to nonverbal bystander approval. Participants were assigned to one of seven conditions, and

watched a video of demonstrators obtaining a reward from a puzzle box (bystanders were viewable screen-in-screen), before receiving a chance to obtain the reward themselves. We found that children flexibly calibrated their tendency to acquire the majority behaviour. Majority-biased copying did not extend to majorities that performed irrelevant actions, unless approval of the majority behaviour was communicated – implying the causally irrelevant actions had socially functional properties – by bystanders. These results are consistent with a highly functional, adaptive integration of social and causal information, rather than explanations of "over-imitation" implying unselective copying or causal misunderstanding.

This suggests that our species might be better characterized as broadly "optimal-" rather than "over-" imitators.