2nd Annual Workshop of the Association of Early-Career Social Learning Researchers in St Andrews, Scotland

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Introduction

The 2nd Annual Workshop of the Association of Early-Career Social Learning Researchers was held at the University of St Andrews in Scotland, June 21st-22nd, 2018. St Andrews has a strong and diverse community of social learning and cultural evolution researchers, which made it an ideal place for this year's

workshop. The workshop included 2 keynotes, 6 activities, a senior researchers' podium discussion and an open-door poster session. 37 researchers (Masters, PhDs, and Post-docs), from 9 European countries and 21 institutions ventured to the two-day meeting. The audience represented a diverse scientific background including anthropology, archaeology, evolution and ecology, linguistics, psychology, and neuroscience. The primary intentions of this workshop were (1) to foster interdisciplinary discussions on the state of social learning research, new techniques, and methodologies, (2) to create an environment to exchange on early-career issues, and (3) provide a platform for cross-disciplinary networking and research showcasing. In the following, we will summarise comments, insights, and results from the two-day meeting.

Figure 1: Participants of the workshop at the Medical Science Building, St Andrews.

Keynotes

The workshop opened with Dr Eoin O'Sullivan's (University of Stirling) keynote: *Searching for a psychological science of social learning in the 20th century's schools of behaviour and cognition*. O'Sullivan provided a critical review of the history of the key concepts of the main schools that impacted the field that is now known as social learning. Spanning an ark from the early starts with Geroge Romanes and Lloyd Morgan, to behaviourism (Thorndike and Skinner), and the emerging field of ethology and cognitivism (Tinbergen and Lorenz) he presented the rich heritage of ideas and perspectives on social learning. While reaching back many decades, these ideas still impact today's research in many ways, of which O'Sullivan pointed out

the three. First, while the *nativist-empiricist dichotomy* is considered surpassed by most, implicit biases are often introduced that indicate assumptions on the extent to which behaviours are innate or learnt. An example is the often made assumption of domain-specificity over domain-generality. Second, *observational studies* are still important and are the basis for the identification of trends, context-dependencies and other features relevant to the study of behaviour that are unknown or understudied with the current experimental frameworks. Finally, the *nominative fallacy* - the tendency to overestimate the extent of available knowledge for concepts with a well-established name - often leads to the failure of identifying knowledge gaps for such widely-used concepts. An example is the bad fit of our current model of imitation with the observed hardship of this task in monkeys. At the end of his talk, O'Sullivan remarked that one of the upcoming themes in social learning research is based on embodied learning, an approach that lies at the crossroads of environment, cognition, and body.

Alexis Breen (University of St Andrews) held the second keynote, entitled *Social influences and consequences in animal construction*. Animal construction is a widespread phenomenon, ranging from simple stick tools to intricate woven nests. Yet, the social factors involved in acquiring this skill are little understood. Breen presented her PhD work that focused on the social factors involved in the development of nest building abilities in young zebra finches. The results of her experiments show that the choice of nest building material was affected by juvenile experience with nest material in combination with the presence of an adult, whereas, the sole experience of the nest material during early-life had no effect on their preference. The second study focused on nest building competence and results suggest that the presence of an adult bird is sufficient to overcome the lack of individual experience with nest building material. Breen's talk highlighted the complex interaction of social and environmental factors on the species-specific development of skills, and that future experiments need to focus more on them.

Social Learning – Milestones

Ideas, concepts, and theories regarding social learning of valuable life skills reach far back, past Darwin's anecdotal mention of it. It is only in the 1980's, however, that the study of culture and social transmission are formalised within an evolutionary frame by Boyd and Richardson (1985), Cavalli-Sforza and Feldman

(1981), and Rogers (1988). The 1990's saw the introduction of several key concepts in the field, as the number of studies on social information transmission increased. For example, the study on social foraging by Caraco and Giraldeau (1991), introduced the idea of producer-scrounger dynamics that can still be found in social learning models today. In 1994, Heyes published her influential paper on the psychological mechanisms of social learning: often referenced for the definition of social learning, it kicked off the debate on differences in the mechanisms underlying social and asocial learning. The field expanded as concept of culture in non-human animals was pioneered at the turn of the century, by Whiten and colleagues (*Cultures in Chimpanzees*, 1999), followed by Rendell and Whitehead with *Culture in Whales and Dolphins* (2001). In 2004, Laland's paper *Social Learning Strategies* offered the first synthesis of the various different studies on social learning and described contextual differences in when and what an individual learns, and from whom. More recently, the debate on social learning within a functionally versus a socially adaptive context was initiated by Horner and Whiten's discovery that children imitate behaviour that is clearly unnecessary to their goal while chimpanzees do not (2005), somewhat later this will become known as overimitation. And only recently has the field seen another surprising turn, when the study by Alem and colleagues (2016) presented social transmission of complex behaviours in social insects, opening up new questions about the need for large brains to learn socially. Currently, the field experiences an increase in analytical and empirical methods, diversification and expansion.

Social Learning – Methods and Techniques

The diverse backgrounds of social learning researcher has lead to a multitude of approaches and methods. Starting with theoretical work, it was emphasised that it will be necessary to combine mathematical proof-of-concept models (testing the logic of verbal explanations) and computational approaches (exploring evolutionary dynamics in complex scenarios) to identify and develop new theories. In experimental work, a diverse set of methods is currently employed. For example, to investigate how new traits spread and how cultural adaptations arise transmission chain and open diffusion experiments are used, and to make set experiments in more ecologically relevant contexts observational fieldwork is still the hallmark. Of special significance for these studies are statistical modelling techniques, which use time series data to draw infer-

ences about pathways of learning, like experience-weighted attraction models and network-based diffusion analysis. In the foreseeable future a couple of methods will likely play an even more important role than they currently do. The combination of machine-learning and neuroimaging techniques will help uncover the computational and physiological mechanisms underlying social learning, which might also elucidate how learning differs in a social from a non-social context. Body and eye-tracking of interacting individuals in combination with adequate analyses of time-series data, such as cross-recurrence quantification and the Granger causality test, will allow to unravel attentional and motivational biases as well as communicative cues in social learning contexts. The internet and other big data sources will provide opportunities to study cultural evolution in unprecedented complexity, but also pose new conceptual and methodological challenges. The breath of methods and techniques, which are sometimes entirely confined to a single discipline, illustrates how important interdisciplinary exchange is, and how this might increase future cross-discipline adoption of those methods.

Social Learning – Future Directions

For the future of social learning research three important themes were discussed. The first theme regarded data collection. To move the field forward there is a clear need for more long-term as well as for more longitudinal studies. This will allow insight into how social learning changes over time within individuals, groups, and societies. Also, current advances in technology such as the development of miniature tracking devices promise new possibilities for studying social networks and social interactions in the wild, particularly for species difficult to observe and monitor in natural conditions. Finally, in order to appreciate the diversity and complexity of learning processes, it is necessary to move beyond canonical model systems for social learning. The second theme focussed on data processing. Advances in data processing will make it possible to analyse vast amounts of low-cost information from web-based activities and social media, an important source of data to study information transmission in our own species. The third theme aimed at terminology. In line with the workshop's aims, collaborations and communication between related research fields were recognized as essential aspects for the future of social learning research. This, however, requires substantial efforts to clarify, harmonise, or even unify terminology across disciplines on central concepts, such as social

learning, traits, and culture. This will facilitate collaborative efforts and inter-disciplinary communication.

Issues for Early-Career Researchers

During one of the open-discussion sessions issues scientists encounter during the early-stages of their career were discussed. Some participants asked for advice on how to handle the many different tasks when finishing their PhD thesis, such as writing up chapters and papers, applying for funding, and looking for jobs. But also how to use conferences strategically, and how to build-up an interdisciplinary scientific career? More existential questions on the restless life as a researcher were raised near the end of the session: how to deal with constant relocation? Can you have a partner who is also a sceintist? When is a good time to have children? And even more existential: have you considered leaving academia? The session showed that universities do well at teaching what it means to *do science*, but still have some way to go at teaching what it means to *be a scientist*. Workshops like this one will hopefully help achieving this goal.

Public Outreach – Improving Wikipedia

Given that scientific knowledge often is a privilege to those that have access to academic journals and conferences, one of the workshop activities aimed at engaging directly with the most popular public online encyclopedia, Wikipedia. The goal was to improve existing articles, or create new ones for common themes and methods in social learning. While one group successfully added an entire new page (on network-based diffusion analysis), the activity was generally more demanding than initially anticipated, mainly because important pages inadequately represent the current state of social learning research (see e.g. the page on *social learning theory*) and require much more work. Several participants expressed interest in coordinating future efforts to improve the quality of current social learning pages.

20 Years of Social Learning, Senior Researchers' Panel Discussion

The Senior researchers' panel discussion drew attention towards the bigger picture in the field summarizing core developments and expressing the shared fascination for this diverse and growing field. Prof

Malinda Carpenter (St Andrews) described how the field changed during the mid 2000s, when developmental psychology recognised the importance of social aspects in imitation-based learning. This led to a new understanding of imitation as a precursor to the development of complex higher order social phenomena. Dr Luke Rendell (St Andrews) pointed out how moving the focus to non-human species triggered an explosion of studies on social learning and possibly culture in species across the animal kingdom. Here, human social learning has become one of many branches of social learning. Dr Monica Tamariz (Heriot-Watt University) pointed out major theoretical advances, such as dual inheritance, cultural attractor, and induction theory. The field is now moving to integrate and synthesise these different ideas into a unified science of social learning. Prof Andrew Whiten (St Andrews) further emphasized the historical significance of both the cognitive revolution spearheaded by Bruner and the focus on ethology by Tinbergen, endorsing to combine the rigour of experimental work with the methodological flexibility of the field work.

Poster Awards

During the open-door poster session participants exhibited the broad range of studies on animals, including fruit flies, bats, capuchin monkeys, and chimpanzees, as well as humans, with a broad range of questions, reaching from tool-use and corporate culture to pedagogy and innate learning biases. Some of the behavioural studies deployed advanced quantitative methods for data analysis, such as hierarchical Bayesian modelling and cross-recurrence quantification analysis. Some behavioural studies were augmented with other approaches, such as simulation models, meta-analyses, and phylogenetic approaches. The posters were judged by Dr Ellen Garland and Prof Andrew Whiten. Dr Sabine Nöbel's (Toulouse) finding of high conformity in the mate-copying behaviour of fruit flies, together with Murillo Pagnotta's (St Andrews) analysis of gaze coordination in a human social learning task, were awarded a prize for Best Poster, while a special mention was given to Julia Penndorf (Max Planck Institute for Ornithology) for her meta-analysis challenging the theory of age-dependent social learning.

The 3rd ESLR workshop will be in Leipzig, Germany, in June 2019. See ESLRsociety.org for updates.