SOE 17: Social Systems, Opinion and Group Dynamics

Time: Thursday 9:30–11:15 Location: MA 001

SOE 17.1 Thu 9:30 MA 001

Bag-of-calls analysis reveals group-specific vocal repertoire in long-finned pilot whales — •Sarah Hallerberg[1], Heike Vester[2], Kurt Hammerschmidt[3], and Marc Timme[1] — [1]Network Dynamics, Max Planck Institute for Dynamics and Self-Organization, 37077 Göttingen — [2]Ocean Sounds, Sauoya 01, 8312 Henningsvaer, Norway — [3]Cognitive Ethology Lab, German Primate Center, Kellnerweg 4, 37077 Göttingen

Besides humans, a large number of marine mammal species exhibit fundamental prerequisites to evolve language: cognitive abilities, flexibility in vocal production and advanced social interactions. Group specific communication is key to understanding potential vocal learning and thus vocal cultures. Here, we analyse the vocal repertoires and their group-specificity for long-finned pilot whales (Globicephalus melas) recorded in Northern Norway, by observer-based single-call sorting and a bag-of-calls approach we newly develop. The observer based analysis shows a complex vocal repertoire with 140 different call types, call sequences, call repetitions and group specific differences in the usage of call types. The bag-of-calls approach reveals that groups of pilot whales can be distinguished by properties of the ensembles of the vocalisations they produce. Comparing inter- and intra-group differences quantifies group specificity in a statistical significant way, indicates that pilot-whales have group-specific vocal cultures.

SOE 17.2 Thu 9:45 MA 001

Sequences of pilot whale calls — •Florencia Noriega[1], Heike Vester[1], Kurt Hammerschmidt[2], Sarah Hallerberg[1], and Marc Timme[1] — [1]Network Dynamics, Max Planck Institute for Dynamics and Self-Organization (MPIDS), 37077 Göttingen — [2]Deutsches Primatenzentrum, 37077 Göttingen

Vocal communication is highly evolved in social marine mammals such as killer whales, pilot whales or other dolphins. Their vocal repertoires consist of a variety of sounds ranging from noisy (like clicks and buzzes) to tonal signals (like calls and whistles). There is evidence that at least two or three sounds are sometimes used by killer whales in systematic combination and that they communicate by exchanging vocal signals. However, the way these vocal signals are combined and used by the animals is largely unknown. In this study we investigate the bigram structure observed in sequences of pilot whale calls recorded from six different groups of animals. We are specially interested in whether combinations of calls such as bigrams occur more often than expected when the calls are assumed to be independent. Apart from group specific results, we encounter common properties in the usage of calls across groups. Particularly, we find a tendency to produce sequences of repeated calls and similar distributions of time intervals between consecutive calls.

SOE 17.3 Thu 10:00 MA 001

Cluster formation in king penguin chicks — •Richard Gerum[1], Ben Fabry[1], Claus Metzner[1], Céline Le Bohec[2,3], Francesco Bonadonna[4], Anna Nesterova[4], and Daniel Zitterbart[1,5] — [1]University of Erlangen-Nürnberg, Germany — [2]CNRS/UdS, Strasbourg, France — [3]CSM LIA-647 BioSensib, Monaco — [4]CEFE-CNRS, Montpellier, France — [5]AWI, Bremerhaven, Germany

Several penguin species display complex and not well understood group dynamics such as cluster formation. We hypothesize that cluster formation can be driven by predators (short-term) or environmental factors (long-term). A preliminary analysis of video recordings of king penguin (*Aptenodytes patagonicus*) colonies on the sub-Antarctic Possession and Kerguelen Islands, obtained during 2011-2014, reveals that chicks can dynamically form irregular-shaped clusters of several hundreds or thousands of individuals. In this study, we focus on short-term arrangements induced by predation events. Isolated or loosely grouped king penguin chicks are an easy target for giant petrels (*Macronectes* spp.). When chicks are attacked by petrels, they flee away and try to maintain a safety distance from the predator. Using a computer simulation of the attack and flight behavior, we demonstrate that randomly attacking predators can lead to the formation of chick clusters that closely resemble those observed in our video recordings. The shape and size of the clusters strongly depend on the safety radius around the predator that triggers a flight response. Our results suggest that the escape behavior of king penguin chicks in response to predator attacks can lead to the emergence of large and dense clusters for protection.

SOE 17.4 Thu 10:15 MA 001

How relevant is the grading of soccer matches by experts and algorithms? An objective view — •Andreas Heuer[1] and Jens Smiatek[2] — [1]Institute for Physical Chemistry, University of Münster, Germany — [2]Institute for Computational Physics, University of Stuttgart, Germany

The grading of soccer players, e.g., by sports magazines is common usage to evaluate their performance. Often these grades are important parameters for player transfers and internet manager games.

In this talk we answer the question about the quality of the grades on a team level. We analyze grades, formulated by experts, and grades, determined on an algorithmic basis using match-data.

Via a specifically designed statistical analysis we can identify on an objective basis to which degree the grades indeed reflect the strengths of the individual teams or whether they are just a mirror-image of the random effects, inherently present in soccer matches or follow from the prejudices of experts. Interestingly, it turns out that the quality of both types of grading systems is relatively poor.

SOE 17.5 Thu 10:30 MA 001

A conceptual statistical framework to compare different sports and its application in basketball, handball and soccer — •Jens Smiatek[1], Dennis Riedl[2,3], and Andreas Heuer[2] — [1]Institut für Computerphysik, Universität Stuttgart, Allmandring 3, 70569 Stuttgart, Germany — [2]Institut für Physikalische Chemie, Universität Münster, Corrensstrasse 28/30, 48149 Münster, Germany — [3]Institut für Sportwissenschaft, Universität Münster, Horstmarer Landweg 62 b, 48149 Münster, Germany

We present a statistical framework to analyze the main properties of soccer, handball and basketball. Our approach is based on time series analysis and statistical mathematics without model parameters. The framework allows us to elucidate stochastic contributions as well as team strengths and their persistence in time. We compare the importance of offense and defense ability in team sports and investigate the underlying differences. Our findings indicate significant deviations as well as similarities between the considered leagues and sports. The outcomes of our analysis can be of interest for a deeper understanding of the characteristics of popular sports games and the prediction of match results in relation to stochastic contributions.

SOE 17.6 Thu 10:45 MA 001

Analysis of correlations in the temporal distribution of public loudspeaker announcements — •Hubert Ceeh — Technische Universität München, Physik Department, Lehrstuhl E21, James-Franck-Straße, D-85748 Garching, Germany

Announcements over public loudspeakers serve the purpose of delivering urgent messages, warning signals and alarms. They are usually preluded by a distinct major triad so that loud activities and thinking processes can be interrupted and full attention is paid to the content of the announcement. This work aims to investigate the time structure of announcements and especially addresses the question if one announcement triggers another one within a short time frame. For this purpose announcements were detected by a real-time Fourier analysis of the ambient noise in a common open space office. In the analysis, correlations between the time tags of the announcements are sought and the temporal distribution is modelled by multi-exponential distributions based on Poisson statistics.

- 15 min break -