Book of Abstracts

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Linguistic and Cognitive Science Meet Diversity

Language and cognitive diversity and global wellbeing: the Behemoth Language Bias

Damián Blasi
Pompeu Fabra University

It is now a textbook fact that our understanding of humans has been hampered by an extremely narrow focus on a few populations, specially WEIRD societies endowed with a spoken European language (most notably, English). The theoretical consequences of this historical bias have been spelled out numerous times as well: humans are shaped differentially by culture, so our ability to predict human behavior and cognition is bounded by its capacity to plastically change us. In spite of how commonplace these ideas have become, their real-world consequences for technology, medicine, education, and beyond remain only parsimoniously explored. In this presentation I will provide evidence across numerous fields of this societal challenge, including health communication, educational testing, neurodegenerative disease diagnosis, and communication technologies. In particular, I will explore the idea that there exists a pervasive "Behemoth Language Bias", a tendency towards developing and testing technologies and techniques in a handful of large and influential languages and then transferring those to less resourced languages with little adaptation. This results in sizable and measurable consequences in the wellbeing and quality of life for the roughly 60% of the world's population not using any of the Behemoth Languages. I will finalize by discussing ideas and strategies on how to improve this state of affairs.

Examining global patterns of universality through an explicitly diachronic lens

Hannah Haynie (presenter)
University of Colorado, Boulder

Co-authors: Annemarie Verkerk, Olena Shcherbakova, Hedvig Skirgård, Simon J. Greenhill, Quentin D. Atkinson, Russell D. Gray

Linguistic universals have been an enduring concept in the study of global grammatical diversity from Greenberg (1963) onward. Implicational universals, in particular, have been a focal point in exploring grammatical variation and investigating functional pressures that may influence the dynamics of language change and thus shape synchronic patterns of linguistic diversity (e.g. Greenberg 1969, Lehmann 1973, Hawkins 1983, Dryer 1992). However, the extent to which proposed universals are truly universal has been challenged (e.g. Evans & Levinson 2009) and the handling of language diversity in linguistic universals research is known to have influenced the development of many universal hypotheses (e.g. Eurasian bias in language samples, Dryer 1988). This talk presents a collaborative re-evaluation of implicational universals that uses morphosyntactic information from Grambank (Skirgård et al. 2023) to assess the universality of morphosyntactic implicational universals in the Konstanz Universals Archive (Plank & Filimonova 2000) in a diverse global sample of languages. The large sample of languages used in this study, combined with methods that account for genealogical and geographic relationships, avoids some of the limitations and biases that have influenced earlier work to identify universals. By adopting an explicitly diachronic approach we are also able to examine theoretical explanations for universals that invoke constraints on language that may cause patterns (universals) to emerge as languages evolve (cf. Croft 2002). Ultimately this work considers how interactions between practical considerations, linguistic theory, and empirical evidence have influenced our understanding of trends in grammatical diversity and presents new evidence regarding what associations appear to be universal and why.

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The evolution of gender-differentiated kinship terms

Olena Shcherbakova
Max Planck Institute for Evolutionary Anthropology

Recent studies testing hypotheses about cultural variables, like marriage organization, residence and descent patterns, shaping kinship terminology demonstrate that kinship terms have evolved independently from these factors (Passmore & Jordan 2020). So far, alternative explanations of the variation in kinship system have received less attention (but see Kemp et al. 2018).

One alternative explanation involves general linguistic principles. Greenberg (1980) suggests the following implicational hierarchy: siblings = children > grandparents > grandchildren, meaning that gender distinctions in grandchildren arise after other terms already marking gender. Greenberg (1990: 322) also points out the potential influence of sex-based gender systems on gender-differentiated kinship terms.

We test Greenberg's hierarchy of kinship terms and explore the potential effect of sex-based gender systems on a sample of 303 languages. We map the kinship term data from Kinbank (Passmore et al. 2023) and the sex-based gender data from Grambank (Skirgård et al. 2023) onto the global EDGE tree Bouckaert et al. (2022). We fit Bayesian mixed models using the brms package (Bürkner 2017) to establish whether the results support or deviate from Greenberg's predictions.

We find partial support for Greenberg's hierarchy: distinctions in grandparents are positively correlated with distinctions in children, but not in siblings, and distinctions in grandchildren are positively correlated with distinctions in grandparents, children, and siblings. This suggests that (1) general linguistic principles proposed by Greenberg can partially account for the variation in the kinship lexicon and (2) gender distinctions in kinship terms (with the exception of children) evolve independently from gender systems.

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How to make general claims about language acquisition and cognitive processes in the light of linguistic diversity?

Sabine Stoll
University of Zurich

The communication system of humans stands out in being a dynamic adaptive system. Human languages vary extremely from group to group and change constantly resulting in a huge number of varieties. This variation is critically sustained by mechanisms of ritualization, transmission and ultimately learning.

To uncover these mechanisms at the species level rather than for specific languages, we must embrace this diversity head on. This is important because evidence suggests that language structure can influence learning or processing. Yet, addressing this diversity is challenging, because we risk biasing our results when selecting our language sample. I argue that systematic sampling is key for making progress in discovering species specific processes of language learning and processing. I present an extension of the Maximum-Diversity approach as developed by Stoll & Bickel (2013) for studying language acquisition to address psycho- and neurolinguistic questions more generally. The Maximum-Diversity approach simulates global linguistic diversity of linguistic systems. This allows us to generalize about language learning and neuro- and psycholinguistic topics beyond individual systems. To study general mechanisms of language acquisition we implemented this approach in a database of longitudinal acquisition studies (Moran et al. 2016). The approach has been applied to a wide range of questions of language acquisition. In this talk I present evidence for input universals children encounter and similarities in the acquisition process of grammatical systems.

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A multimodal approach to linguistic diversity and cognition

Aslı Özyürek
Max Planck Institute for Psycholinguistics

One of the core features of human language is its diversity. Not only that languages vary in their sound structures, words, semantics and syntax but also in the type of modality they are expressed in. A key component of human language is therefore its expressibility in multiple modalities, that is not only through vocal /auditory but also visual/spatial modality.

There is growing consensus in language studies that language, in its primary face-to-face context is multimodal (e.g., Perniss, 2018; Holler & Levinson, 2019; Hagoort and Özyürek, 2024). All spoken languages of the world have visual expressions related to the linguistic forms they accompany in the spoken channel, that is cospeech gestures produced by the hands, face, head movements. Furthermore, when speech is not accessible due to deafness, deaf communities in the world can invent sign languages in a short amount of time that can express all core linguistic components in the visual modality (i.e., face, body, hands) (e.g., Senghas et al., 2004; Özyürek, & Woll, 2019; Perniss, Özyürek, & Morgan, 2015; Kita & Emmorey, 2023). However, uncovering the range and limits of diversity of structures specific to affordances of visual modality (i.e, due to iconicity, pointing and simultaneity) and its integration with speech, when appropriate, is still in its beginning stages. In this talk I will talk about how modality specific aspects of visual modality contribute to our understanding of linguistic diversity when they are used with speech (i.e., as in cospeech gestures) and when they are used on their own (i.e, as in sign languages). Finally, I will discuss consequences of considering multimodality and crosslingusitic diversity together for language processing and cognition — leveraging on studies in different signed and spoken languages.

Universal biases in Algonquian-specific contexts

Christopher Hammerly
University of British Columbia

In this talk I will survey previous and ongoing work to document and understand the relationship between grammatical person and voice in my ancestral language Ojibwe (Central Algonquian). One typologically uncommon hallmark of Algonquian languages is obviation, which is a partially grammaticalized discourse spotlighting system that marks animate third persons within a discourse as either "in the spotlight" (proximate) or "out of the spotlight" (obviative). In transitive clauses, obviation interacts with direct/inverse voice (akin, but not identical, to the active/passive distinction in English), where direct voice must be used in contexts where the proximate noun is the prototypical agent, while inverse voice is used when the proximate noun is the prototypical patient.

To current knowledge, few if any languages outside of Algonquian have a similarly robust system of obviation, let alone one which interacts so profoundly with grammatical voice. This raises a question: Are the properties of this system unique to Algonquian, or are there broader connections to other related phenomena?

I show evidence from eye tracking and traditional interview-based elicitation methods that obviation and voice in Ojibwe conforms to well-established universal grammatical and processing biases. Namely, biases for more "prominent" nouns to be subjects and agents, as well as biases to create less complex dependencies. This has implications for how we understand typologically uncommon phenomenon in general, and informs how teachers and learners of Ojibwe should approach these often difficult to understand aspects of the language.

Field cognitive sciences in Peruvian Amazonia: current research, challenges and opportunities

Roberto Zariquiey
Chana Research Station for Language Sciences and Intercultural Studies,
Pontificia Universidad Católica del Perú

In this talk, I report on work in progress that is currently being conducted at the Chana Research Station for Language Sciences and Intercultural studies (Ucayali, Peru). I first present the preliminary results of an ambituous psycholinguistic study on language processing, led by Caroline Andrews (U Zurich), which focuses on various aspects associated with the processing of ergativity in Shipibo-Konibo, a Pano language with strong ergative morphology, with very few instances of splits. This research provides interesting insights on the nature of these splits and shows interesting differences regarding how ergativity is planned by speakers of Shipibo-Konibo and speakers of other languages with ergativity, like Hindi (Zafar and Husain 2022)

Then I also report on second study, in collaboration with Rafael Nuñez (U San Diego), which uses language documentation techniques to explore number cognition among speakers of Pano languages from the Yurua-Purus area. I show how data from language documentation may contribute to the understanding of some fundamental issues about the use of numerals and quantifiers, and the nature of quantity-related thinking in the Amazonian context. This is particularly interesting since Amazonian languages have been claimed to either exhibit small numeral systems or lack numbers altogether (Dixon & Aikhenvald 1999; Hammarström 2010; Epps, 2006; Epps & Salavona 2013 Epps et al. 2012), and have been the focus of seminal scholarship on numerical cognition (Gordon 2004; Pica et al. 2004; Frank et al. 2008; Everett & Madora 2012; Núñez, 2017).

Finally, I also discuss the challenges and opportunities for field cognitive sciences in Peruvian Amazonia, in the context of the recent launching of the Chana Research Station for Language Sciences and Intercultural studies, a joint initiative by PUCP, MPI-EVA and U Zurich, which creates a unique environment for the production of groundbreaking interdisciplinary research in fundamental topics related to human language and cognition in a cross-cultural perspective, supported by a strong ethical commitment to the education of local indigenous communities.

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Cognitive diversity in abstract thought: Cultural differences in event construal and analogical reasoning

Amritpal Singh
Cornell University

How do minds differ across cultures? According to a long-standing perspective in the social sciences, people from non-Western cultures, specifically China, think less abstractly than Western people. We tested this claim by administering two measures of abstract thinking to Chinese and US individuals. In our first series of studies, participants completed the Behavioral Identification Form (Vallacher & Wegner, 1989): participants chose whether events were best described abstractly or concretely. Across six independent national samples (total N = 1,797), Chinese participants were more likely than Americans to construe events abstractly. In another comparison (n = 965), participants from a more context-sensitive Chinese subculture were more likely to construe events abstractly than those from a less context-sensitive subculture. In the second series of studies, participants attempted to solve analogical reasoning problems from Raven's Standard Progressive Matrices (Raven, 2003). Across four independent national samples (total N = 677), Chinese participants were more likely than Americans to solve the matrix problems correctly (Singh et al., submitted). We predicted this difference on the basis of previously documented cross-cultural differences in East Asians' and Westerners' attention to their physical and social context. These studies challenge the belief that Westerners think more abstractly than Chinese people and support the proposal that context-sensitivity may be an engine of abstract thought.

Cognitive diversity in context: US-China differences in children's reasoning, visual attention, and social cognition

Alexandra Carstensen
Arizona State University

I will discuss research investigating cross-cultural variation in the phenomenon of the "relational shift," in which early learners shift from an initial focus on concrete object features to abstract relations. Previous work suggests that this view of cognition reflects a sampling bias in existing research, and shows that the development of abstract reasoning follows qualitatively different trajectories in the US and China, depending upon the learning context (Carstensen et al., 2019). The causal mechanisms for these differences are unknown, but a range of accounts have been proposed. These accounts implicate several potential factors that differ between the US and China, including language, executive function, visual attention, and social reasoning. While there is extensive work documenting US-China differences in language and executive function, less is known about the development of cross-cultural variation in visual attention and social reasoning.

This project begins to address this empirical gap by measuring performance on tasks of visual attention and social reasoning over a broad developmental window in children from the US and China. We document abstract reasoning about relations (Ambiguous cRMTS, Carstensen et al., 2019) alongside the potential moderating factors of visual attention (Free Description, Imada et al., 2013) and social reasoning (Causal Attribution, Seiver et al., 2013; Uniqueness Preference, Kim & Markus, 1999) in a cross-sectional sample of 3-12-year-olds, with 120 children in the US and 120 in China. We observe cross-cultural differences in three of the four tasks and describe the distinct developmental trajectory that each task follows throughout early and middle childhood.

Letter shapes phonology: Feature economy and informativeness in 43 writing systems

Yoolim Kim
Wellesley College

Marc Allassonnière-Tang
Centre national de la recherche scientifique

Helena Miton
Stanford University

Olivier Morin (presenter)
Centre national de la recherche scientifique

Differentiating letter shapes accurately is an increasingly indispensable competence. Are letters as distinctive as they could be? We used a unique dataset of crowdsourced letter descriptions across 43 writing systems to produce a comprehensive typology of letter shapes for these diverse scripts. We built the gaming applet glyph.shh.mpg.de to allow thousands of participants to play with letter shapes. We extracted from 19,591 letter classifications, contributed by 1,683 participants, enough features to provide a unique description of all letters in each system. We show that scripts, compared to phoneme inventories, are feature-extensive: they use additional features to do what could be done with a lower number of features, used more efficiently. Compared to 516 phoneme inventories from the P-base dataset, our 43 scripts have lower feature economy (fewer symbols for a given number of features) and lower feature informativeness (a less balanced distribution of feature values). Letter shapes, having more degrees of freedom than speech sounds, use features in a more wasteful way.

Inter-individual and cross-linguistic diversity meet the color lexicon

Dan Dediu
University of Barcelona

The way humans perceive colors, and the way languages name them seem, at first sight, so obvious and self-evident that studying them might seem like a waste of researcher time (and taxpayer money). However, I will argue here that color is, in fact, a fascinating case allowing us to understand how an a priori physically continuous and uniform phenomenon maps into a discrete linguistic domain that shows both universal tendencies and vast amounts of variation. After briefly reviewing the bases of "normal" color perception in humans, I will focus on two broad types of abnormal color perception, the first rooted in the genetics of color-sensitive cones and the other in the putative effects of ultraviolet radiation. I will then discuss how such types of abnormal color perception might help explain the way the perceptual color space is divided between discrete color categories across languages, focusing on the 'blue'/'green' distinction that some languages make while other don't, as well as some mathematical and computer models that have been used to study the emergence of color categories. The main point that I will try to convey is that inter-individual variation sometimes plays a crucial role in shaping cross-linguistic variation, which, far from being some sort of "noise" blurring "crisp", platonic universals, is the natural outcome and source of (biological and) cultural evolution, and allows the emergence of some of the observed cross-linguistic universal tendencies.

Cognitive diversity and the practice of bilingualism: Some methodological concerns and a theoretical proposal

Ramesh Kumar Mishra
University of Hyderabad

It is now well recognized as a research framework with its own epistemological rational that no theory is universal, and such an aspiration is bound to fail in making us understand the diverse world we inhabit. Linguists who found out that people from different cultures use language differently as a reflection of their unique cognition (Evans & Levinson, 2009), offered a new direction to the study of mind, language and society at large. A similar motive is now seen in more empirical areas such as cognitive science and cognitive psychology (Majid, 2021; Weissmark, 2020) However, inspite of much discourse and marshalling of facts from various disciplines, the operational definition of 'diversity' remains somewhat blurred. Some scholars link it to unique cultural endowments of individuals who act on the world in unique ways validated by evolutionary laws. Some others think of it as differences in manifesting verbal and non-verbal cognition as a function of habits, belief structures and socio-political constraints. In this lecture, I argue for a special type of diversity, which we see in bilingual language experience and everyday cognition, from the perspective of cognitive psychological theories, seen particularly in India. The argument is: historically diverse cultures and multilingual, multiethnic environments create far greater cognitive challenges, thereby inducing unique neuroplasticity in people, in comparison to cultures where bilingualism is narrower and more confined to social classes and constraints of economics, as is found in some western countries (Mishra, 2018). Comprehensively, multilingual contexts modulate core aspects of cognition such as social cognition, selective attention, reciprocity, and decision-making differently than environments that are less flexible, rigid and stratified (Barrett, 2020). I provide data from bilingualism research from India and also cross-cultural contexts to substantiate these conjectures, where at the moment very minimal research is being done. Bi-multilingualism, being an evolutionarily adaptive social mechanism that allows humans to interact with one another cognitively using multiple symbolic systems, plays a very serious role in modulating everyday cognition uniquely in different domains. I will also posit the general theory that naturally diverse linguistic contexts, in addition to cultural and ethnic practices, foster greater cognitive challenges than more constrained contexts and therefore lead to different cognitive outputs measured in laboratory experiments in humans. Bilingualism is used as a unique model of mind's engagements with multiple mental and cognitive states, with well-known psycho-neural mechanisms, that reflects our ability to adapt to environmental contingencies with more resilience and cognitive control (Mishra, 2018).

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Native language and modality shapes structural connectivity in the brain

Alfred Anwander
Max Planck Institute for Human Cognitive and Brain Sciences

World languages exhibit significant diversity in sound encoding, syntax, and semantics. In the brain, language is processed in a network connecting specialized cortical areas across different lobes via white matter connections. The infant brain adapts to the linguistic demands of the mother tongue and its modality (spoken or signed), indicating that lifelong language experience shapes neuronal connectivity. To investigate this, we analyzed two large cohorts of native speakers proficient in distinct languages: German, an Indo-European language with complex syntax, and Arabic, a Semitic root-based language. Using diffusion-weighted MRI and tractography, we assessed structural connectivity within language and speech production networks. German speakers demonstrated increased connectivity in frontal-parietal/temporal areas involved in syntax processing, whereas Arabic speakers exhibited stronger interhemispheric connectivity via the posterior corpus callosum, linking bilateral superior temporal and inferior parietal regions. Additionally, they showed stronger connections between regions associated with semantic processing, particularly within the left temporo-parietal network (Wei, Neuroimage, 2023). Similarly, distinct variations were observed in the white matter connectivity patterns among speakers of English (with fixed word order), German (featuring grammatical marking), and Chinese (a tonal language) (Goucha, bioRxiv, 2022). Employing machine learning, we classified individuals' mother tongues based on their unique connectivity profiles, revealing pertinent processing characteristics of each language. Moreover, when comparing different language modalities, we identified systematic differences in brain wiring between signers and speakers of German (Finkl, Cereb Cortex, 2020). Our findings suggest that environmental factors, including linguistic processing demands of the native language, modulate the structural connectivity and wiring of the brain.

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Language-like efficiency and structure in house finch song

Mason Youngblood
Stony Brook University

Communication needs to be complex enough to be functional while minimizing learning and production costs (Gruber et al., 2021). Recent work suggests that the vocalizations and gestures of some songbirds, cetaceans, and great apes may conform to linguistic laws that reflect this trade-off between efficiency and complexity (James et al., 2021). In studies of non-human communication, though, clustering signals into types cannot be done a priori, and decisions about the appropriate grain of analysis may affect statistical signals in the data. The aim of this study was to assess the evidence for language-like efficiency and structure in house finch (Haemorhous mexicanus) song across three levels of granularity in syllable clustering. The results show strong evidence for Zipf's rank-frequency law, Zipf's law of abbreviation, and Menzerath's law. Additional analyses show that house finch songs have small-world structure, thought to reflect systematic structure in syntax, and the mutual information decay of sequences is consistent with a combination of Markovian and hierarchical processes. These statistical patterns are robust across three levels of granularity in syllable clustering, pointing to a limited form of scale invariance. In sum, it appears that house finch song has been shaped by pressure for efficiency, possibly to offset the costs of female preferences for complexity.

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Mapping cross-cultural internal-representations in audition and music

Nori Jacoby
Max Planck Institute for Empirical Aesthetics

How can we overcome the sampling constraint that is entailed by traditional psychology experiments, which recruit participants with access to computer technology from industrialized societies? We apply computational methods and analysis to data obtained in field research with diverse populations around the world in order to investigate whether the similarities we find between participants stem either from biological mechanisms or from comparable exposure. In the first part of the talk I describe how techniques that reduce the reliance on linguistic instruction can be applied to test rhythm perception and production. I will discuss work in which we measured a signature of mental representations of rhythm in 923 participants from 39 participant groups in 15 countries across 5 continents, spanning urban societies and indigenous populations. Integer ratio categories were universally present in rhythm, although their relative importance varied across groups, often reflecting local musical systems. In the second part of the talk I will describe how we use singing to study pitch representations, and specifically results that indicate that octave equivalence is culturally contingent. Finally I will share our recent efforts to extend these lab-based studies to online cohorts. These results demonstrate the exciting possibilities that emerge when we combine computational methods and cross-cultural research to the study of music perception both in the field and online.

Chimpanzees use social information to acquire a skill they fail to innovate

Edwin J. C. van Leeuwen (presenter)
Utrecht University, Max Planck Institute for Evolutionary Anthropology, Royal Zoological Society of Antwerp

Sarah E. DeTroy
Max Planck Institute for Evolutionary Anthropology

Daniel B. M. Haun
Max Planck Institute for Evolutionary Anthropology

Josep Call
University of St. Andrews

Cumulative cultural evolution (CCE) refers to the iterative process through which incremental modifications to a cultural trait result in enhanced functional performance[1]. It is widely recognized as a distinguishing feature of the human species[2–4] and claimed to be pivotal to the biological success of our species[3,5]. For CCE to emerge, high-fidelity social learning of know-how has been posited as a key mechanism, where social learning is defined as the acquisition of environmental information through observation or interaction with conspecifics or their products[6,7]. Some recent studies suggest that animal culture contains cumulative elements and that their behaviour implies know-how copying[8–11]. This assertion, however, remains untested. Moreover, past inferences in terms of animal culture have been questioned after showing that naïve individuals can come up with the respective "culture" by themselves, i.e., without social input of know-how[12,13]. Here, we show that chimpanzees can use social learning to acquire a skill they do not independently innovate. By teaching chimpanzees how to solve a sequential task (one chimpanzee in each of the five tested groups, N=110), and using Network-Based Diffusion Analysis, we find that 28 naive chimpanzees learned the skill that had remained impossible to acquire individually during the preceding three months of exposure to all necessary materials. Moreover, we find interesting differences in learning opportunities and patterns of information transmission across the groups, revealing a possibly valuable source of group-level variation for natural selection to act upon. In conjunction, we substantiate recent studies on CCE in animals and present evidence for the hitherto untested hypothesis that social learning in chimpanzees is necessary and sufficient to acquire a new, complex skill after the initial innovation.

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A goat is a goat is a goat? Taking farm animal diversity into account to strengthen policy recommendations for animal welfare regulations

Christian Nawroth
"Animal Behaviour and Welfare" Working Group, Research Institute for Farm Animal Biology

Policy recommendations to improve farm animal welfare require rigorous and robust studies. However, research on farm animal behaviour and welfare is often based on underpowered studies conducted on single breeds and sites, making the data and its interpretation susceptible to idiosyncrasies. Our own research indicates substantial differences in learning/problem-solving performance (Rosenberger et al., 2021; Nawroth et al., 2022) and human-animal interactions (Rosenberger et al., 2022) between goat breeds, and considerable variation in task performance between two research sites. A multi-site, multi-breed approach is imperative to increase the generalisability of study results. To achieve this, employing Big Team Science approaches in animal welfare research is essential (Alessandroni et al., in press). We have therefore launched the ManyGoats initiative (https://themanygoatsproject.com/), which brings together an international team of experts in goat behaviour and welfare. The initiative aims to increase the external validity and robustness of findings by using identical experimental protocols to test a large number of individual goats across diverse facilities and husbandry contexts around the world. By using such a collaborative and multidisciplinary approach, we hope to pave the way for more effective policies to improve farm animal welfare at scale.

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Beyond WEIRD dogs - Cultural differences in dog-human interactions

Juliane Bräuer
Max Planck Institute of Geoanthropology

Angela Chira
Max Planck Institute for Evolutionary Anthropology

Dogs show an extraordinaire capacity to understand, communicate, and cooperate with us. However, what we know about the social-cognitive skills of dogs comes from observations and experiments performed in WEIRD societies. Around the world though, dogs are kept for various functions, they are perceived and treated differently, suggesting cross-cultural diversity in the strength of dog-human relationships. In our project about Cultural Differences in Dog Human Interactions we take two distinctive approaches to address this issue, hypothesizing that dog-human relationships will be closer in societies where dog functions require intense cooperation between dogs and humans.

First, we collected data on the function and perception of dogs in 124 globally distributed societies using the eHRAF cross-cultural database. We found that the number of functions dogs perform associates with closer dog-human relationships, and keeping hunting dogs is linked with higher odds of dogs being treated akin to a person.

Second, we investigate how dogs' cognitive skills and dog-human interactions vary cross-culturally comparing dog-owner interactions in Germany and in four non-western cultures. We developed a test battery with short tests on the following aspects of dog-owner interaction: education, communication, visual perspective-taking, social referencing, and physical cognition. From this ongoing study, we will present data from Vanuatu, Mongolia, Madagascar and Germany. The results of this project do not only contribute to a better understanding of the dog-human relationship, but also of the relationship between cultural evolution and domestication, i.e. how cultural and evolutionary processes influence each other.