Saturday Citations: The sound of music, sneaky birds, better training for LLMs. Plus: Diversity improves research

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A male superb fairy wren brings food to a Horsfield's bronze cuckoo fledgling. Credit: Mark Lethlean

In the small fishing village where I grew up, we didn't have much. But

we helped our neighbors, raised our children to respect the sea, and embraced an inclusive scientific methodology with a cross section of sex, race and gender among study participants that enriched the results of our research.

This week, we reported on a study that upended previous brain research results by including both men and women. Scientists also report that cuckoos may have a more important ecological function than previously known. Plus a new training modality for LLMs and insights into how people distinguish music from speech.

Jerk birds increase biodiversity

Many cuckoos are brood parasites, laying their eggs in the nests of other birds; when they hatch, the cuckoo nestlings kick the other eggs out of the nest so their foster parents won't be distracted by their own young, feeding their baby parasite for weeks that they could have spent raising their own family.

Songbirds have adapted to reject weird-looking offspring, so bronze cuckoo nestlings have evolved to resemble their host parents. A new study by researchers at the University of Cambridge reports that this co-evolution drives the emergence of new cuckoo species and therefore biodiversity in general.

The researchers conducted a broad-scale analysis across all cuckoo species and found that lineages that are the most costly to their hosts in terms of resources and rearing time have adapted to look the most like their host birds. Dr. Clare Holleley at CSIRO says, "This finding is significant in evolutionary biology, showing that coevolution between interacting species increases biodiversity by driving speciation."

Including women helpful, scientists find

In terms of sex diversity, a lot of science research is stuck in the 1950s, with researchers predominantly recruiting men as subjects for studies and trials with the assumption that the findings are equally applicable to women. Now, Weill Cornell Medicine researchers report the first evidence that astrocyte receptors in the brain create opposite effects on cognitive function between male and female clinical models, suggesting that astrocytes are contributors to sex-specific brain mechanisms. Previous studies of astrocytes on cognitive function considered only males, leading to the widespread assumption that the mechanism was the same across sexes.

Many neurological conditions have known differences between sexes, including schizophrenia, stroke and dementia. Focusing on mGluR3, a glutamate receptor in astrocytes and a top altered gene in dementia, the research team selectively manipulated astrocytes in animal models to examine the effects of mGluR3 on learning, memory and cognitive and behavioral outcomes.

In females, increasing mGluR3 levels enhanced memory in older females, and reducing them impaired memory in younger females. In males, reducing mGluR3 enhanced memory and increasing levels had no effects. "Therapeutics influencing astrocytic receptors may cause sex-specific cognitive effects in part due to the divergent roles of astrocytes in males and females," said Dr. Anna Orr.

Better pedagogy for LLMs

By training LLMs with a new modality similar to language training in the human brain, researchers at Hong Kong Polytechnic University developed AI models that perform more like humans. Current LLM

training is designed around contextual word prediction. The researchers instead investigated next-sentence prediction tasks, simulating discourse-level comprehension in the human brain to evaluate the coherence of a pair of sentences.

They trained two models, one with NSP enhancement and one without. They were also trained on standard word prediction. The researchers compared patterns from the models with fMRI data collected from people reading either connected or disconnected sentences. The model with NSP training matched human brain activity more closely than the LLM with no NSP training. The researchers hope to create new training modalities for LLMs that do not solely rely on an enormous corpus of text to achieve intelligent results.

Music, speech distinguished

Humans are able to distinguish the sounds of music from speech and to focus closely on speech in an environment with music. An international team of researchers has mapped the process in a study that could enhance therapeutic programs that use music to help people with aphasia regain the ability to speak.

The researchers played audio noise clips for study participants, who were told they would be hearing noise-masked speech or music, and asked to distinguish them. As the participants sorted hundreds of clips, the researchers tracked the degree to which speed and regularity features influenced their judgments.

According to the researchers, the brain uses simple acoustic parameters to distinguish speech from music. They found that slower, steadier sound clips of random noise sound more like music, while fast, irregular clips sound more like speech. Specifically, speech is two to three times faster than most music. Additionally, changes in volume (or amplitude

modulation, if you're trying to impress a peer reviewer) is steady in music, while the volume of human speech changes frequently.

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