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WHAT THE PAPER SAYS · WHAT IT DOESN'T · WHY IT MATTERS

Zebra finches calls akka categories meaning qabanitti ilaalu — garuu kun language waliin tokko miti

Science study tokko zebra finches calls adda adda dhaga'u qofa moo vocal repertoire ofii behavioral meaning qabu categories keessatti organize godhu jedhu test godhe. Laboratory discrimination tasks keessatti birds 11 call-types hunda baratan, categories new vocalizers irratti generalize godhan, calls contexts wal-fakkaataa keessatti fayyadaman acoustic similarity qofa irraa predicted caalaa systematic errors godhan. Kun categorical perception fi operational kind of meaning'f evidence cimaa dha. Finches human-like language, syntax, open-ended words yookaan humans waliin conversation channel qabu jechuun evidence miti.

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Jechi “meaning” as keessatti hojii of-eeggannoo qaba

Zebra finches hawaasummaa jireenya qabaachuuf hayyama keenya hin barbaadan. Yeroo beela’an, adda ba’an, courtship keessa jiran, soda/alarma keessa jiran, partner waliin wal qunnamanii yookaan conflict keessa jiran sagalee baasu. Ethologists sounds kana **call-types** keessatti qoodu danda’u: gareewwan hojiirra oolu akka alarm calls, contact calls yookaan begging calls, sound shape fi simbirroo yeroo call sana fayyadamu maal gochaa akka jiru irratti defined. Gaaffiin ulfaataan: simbirroota ofii isaanii calls sana akkasuma qoodu moo?

Saayinsii barruu tokko himannaa dhiphaa garuu barbaachisaa godha: adult zebra finches call-types vocal repertoire ofii isaanii gareetti qooduu danda’u; mistakes isaanii immoo behaviorally related calls simbirroota’ perceptual space keessatti acoustics qofa irraa eegamu ta’e caalaa walitti dhiyaachuu agarsiisu.

Asitti jechi **semantic** barruu keessa seena. Simbirroota namaa sense keessatti jechoota qabu jechuu miti. Syntax, conversation, yookaan dictionary finch sammuu keessatti dhokate jechuu miti. Asitti “meaning” operational dha: calls lama hawaasummaa haalawwan wal-fakkaataa keessatti fayyadamu, simbirroota acoustics qofa irraa eegamu caalaa yeroo baay’ee yoo walitti makaman, amalaa garee perception boca kennuuf gumaachaa jiraachuu mala.

ibsa ifaa “simbirroota afaan qabu” miti. Inni: zebra finches calls ofii isaanii hojii-qabeessa gareewwan akka ta’etti ilaalu fakkaatu, gareewwan tokko tokko yaalii keessatti limited, testable sense ta’een meaning qabu fakkaatu.

Zebra finches (*Taeniopygia guttata*) hawaasummaa songbirds baay'ee, calls repertoire bal'aa qabu; kanaaf animals vocal mallattoolee akkamitti gareetti qoodan qorachuuf moodeela faayidaa qabu dha.

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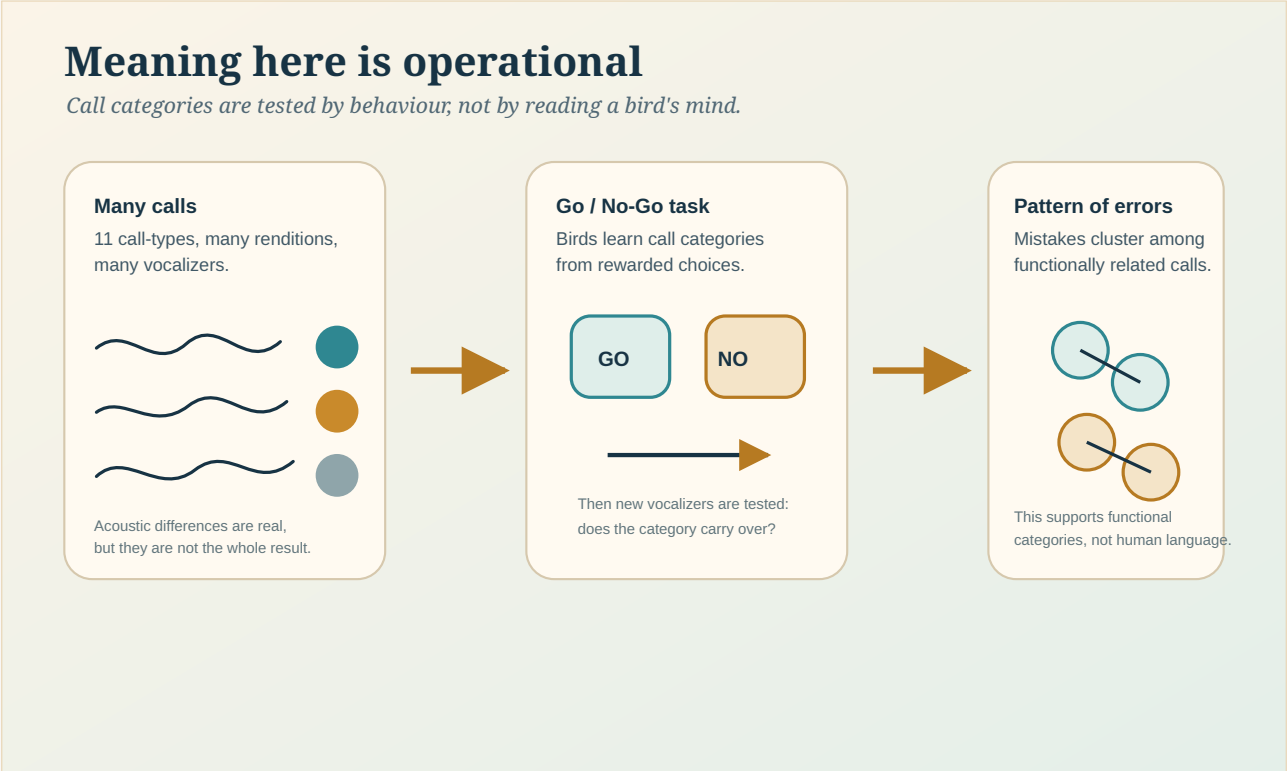

Draft evidence-chain slide: 11 call-types renditions hedduun Go/No-Go discrimination hojii seenu; key bu'aa simbirroota gareewwan vocalizers haaraatti haalawwan biraattis hojii irra oolchu fi dogoggorawwan call function'n cluster ta'u, acoustic similarity qofa miti.

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Barreessitoonni maal qoran

Barreessitoonni jiru ethological kaartaa zebra finch repertoire irraa jalqaban. Species kun **ethogram-based call-types naannoo 11** qaba: contact, pair bonding/nest amala, alarm, aggression/non-affiliative amala, begging fi male song waliin wal-qabatan.

Classification kun humans'n godhame. Acoustic amaloota, haala sound itti produced, fi hawaasummaa jireenya keessatti function isaa walitti fida. Garuu namaa ethogram automatically mental kaartaa animal miti. Qorannoo gaaffii walitti hidhatan sadii gaafata.

Tokkoffaa, zebra finches call-types hunda adda baasu danda'u?

Lammaffaa, nama dhuunfaa fakkeenyonni memorize godhu qofa osoo hin taane call-type garee vocalizers kanaan dura hin dhageenye irratti haalawwan biraattis hojii irra oolchu?

Sadaffaa, mistakes yeroo godhan acoustic similarity qofa hordofu moo amalaa meaning callotaa illee hordofu?

Qabxii ijoo: yaalii simbirroo akka call maal jedhu ibsu hin gaafatu. To'atame hojii keessatti amala simbirroo gareewwan fi meaning istaatistikii footprint qaba moo jechuun gaafata.

Yaalii akkamitti hojjetu

Terms sadii barruu kana keessatti ulfaataa dha.

Call-type zebra finch sound garee dha. Barruu **ethogram-based** call-types fayyadama, jechuun gareewwan amalaa catalogue irraa: sound acoustically akkam fakkaata, simbirroota yeroo kam uumu, hawaasummaa situation kam keessa. **Vocalizer** simbirroo nama dhuunfaa galmeeffame call sana uume qofa. **Acoustic shape** measurable sound akkaataa dha; **amalaa function** call'n yeroo baay'ee maalif fayyadamu.

Call-types 11 barruu keessatti qoraman labels abstract miti; repertoire simbirroota adda baasu qaban:

- **Contact calls:** fageenya call (DC), Tet (Te), long-tonal call (LT).
- **Pair-bonding fi nest amala:** whine call (Wh), nest call (Ne).
- **Alarm calls:** Tuck (Tu), Thuk (Th).
- **Non-affiliative calls:** distress call (Di), aggressive call (Ag).
- **Begging:** begging call (Be).
- **Courtship:** male song (So).

The 11 call-types are concrete categories

The paper asks whether zebra finches sort these calls the way ethologists do.

Contact calls
- DC — distance call
- Te — Tet
- LT — long-tonal call

Pair-bonding / nest
- Wh — whine call
- Ne — nest call

Alarm calls
- Tu — Tuck
- Th — Thuk

Non-affiliative
- Di — distress call
- Ag — aggressive call

Begging
- Be — begging call

Courtship
- So — male song

These are ethogram-based labels: categories from sound shape plus social context, not human words.

Call-types 11 barruu keessatti qoraman, broad hawaasummaa function'n grouped. Labels madda barruu ethogram-based gareewwan dha; "jechoota" miti, garuu repertoire ifa ta'e simbirroota adda baasu qaban agarsiisu.

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Ijoo hojii **Go/No-Go auditory discrimination** ture. Simbirroo key ifaa peck godhee playback seconds jaha jalqaba. Rewarded call irratti move sirrii wait gochuu: sound xumuramu booda food hopper ol ba'a, simbirroo seed argata. Non-rewarded call irratti wait homaa hin kennu; move efficient playback keessa deebi'ee peck godhee sound interrupt, yaalii haaraa jalqabu. Kanaaf interruptions simbirroota sounds kam "rewarded garee miti" akka ta'etti ilaalu agarsiisu.

Qormaata tokkoon tokkoon keessatti call-type tokko rewarded, kanneen biroo kudhan miti rewarded. Achii rewarded call-type jijjiiranii repertoire guutuu keessa darban. Renditions hedduu vocalizers hedduu irraa, sirrii repeats muraasa fayyadaman. Kun barbaachisaa: simbirroo recording tokko memorize qofa hin danda'u. Gaariitti hojjachuuf call-type maal akka ta'e voices simbirroota adda addaa fi fakkeenyonni adda addaa keessatti barachuu qaba.

Boodaa "perceptual space" sammuu scan yookaan kaartaa literal animal keessa jiru miti. Mistakes irraa inferred kaartaa dha. Call-types lama yeroo baay'ee yoo walitti makaman amalaa kaartaa keessatti walitti dhiyaatanii kaa'amu. Barreessitoonni kana acoustic kaartaa sound amaloota qofa irraa built waliin wal bira qaban. Himannaa hiika qabu ta'a simbirroota' dogoggora kaartaa call function garaatti pulled ta'e yoo ta'e, similar sound qofa miti.

Maal argatan

Simbirroota guutuu repertoire adda baasu danda'an. Adult zebra finches 12, males jaha fi females jaha, call-types 11 irratti qoraman. Jechuun ni danda'ama qormaatawwan hundi successful: **127 of 131** call-type discrimination qormaatawwan hiika qabu turan. Failures muraasni simbirroota/call-types addaa irratti; waliigalaan akkaataa call-type hundi chance ol adda baasu.

Kun barbaachisaa, sababni repertoire isolated beeps sirrii miti. Call-types tokko tokko acoustically cluster, kanneen biroo gradation qabu. Simbirroota ammallee gareewwan baratan.

Gareewwan vocalizers haaraatti haalawwan biraattis hojii irra oolchu. Yaalii lammaffaa keessatti simbirroota call-types lama xiqqaa set vocalizers irraa discriminate baratan. Guyyaa itti aanu haaraa vocalizers reward rule wal-fakkaataa waliin dabalaman. Simbirroota calls haaraa jalqabaa qormaata keessatti sirriitti classify godhan, reward feedback'n fakkeenya haaraa hunda barachuu dura. Kun categorical perception call-type deeggara, nama dhuunfaa sounds memorization qofa miti.

Garee reward rule haaraa override gochuu danda'e. Cimaa amalaa trick incongruent hojii yeroo ta'e. Calls haaraa vocalizers irraa opposite reward contingency call-type baratan irraa assign ta'e. Simbirroota haaraa acoustic fakkeenyonni qofa hordofan taanaan immediately adapt godhu qabu. Garuu jalqabaa deebiiwwan previously learned call-type garee hordofanii systematically wrong reward decisions uuman. Guyyaa keessa suuta arbitrary rule haaraa baratan. Kun natural call-type garee dhugaa enough ta'ee interfere godhu eegamu akkaataa dha.

Mistakes acoustic qofa hin turre. Barreessitoonni acoustic space classifier confusions call sounds irraa ijaarame fi perceptual space amalaa dogoggorawwan simbirroota irraa ijaarame wal bira qaban. Lamaan related turan: sound ammallee mattered. Garuu wal-fakkaataa amalaa/semantic hyper-category keessa call-types, simbirroota' perceptual space keessatti acoustic space caalaa

walitti dhiyaatan. Barruu kun **semantic magnet dhiibbaa** jedha.

Lakkoofsota keessatti grouping semantic hyper-category perceptual kaartaa keessatti acoustic kaartaa caalaa naannoo **2.43 yeroowwan stronger** ture. Afaan salphaan: mistakes simbirroota hojii-qabeessa meaning garaatti pulled ta'an, similar sound qofa irraa miti.

"Semantic" as keessatti maal jechuudha

Kutaan kun kunuunsa guddaa barbaada. Afaan guyyaa guyyaa keessatti "semantic" saffisaan "jechoota" ta'a. Barruu kun kana hin mirkaneessu.

Qorannoo "semantic" amalaa/comparative-cognition sense keessatti fayyadama. Call-type putative meaning qaba sababni hawaasummaa function waliin associated: alarm, contact, begging, aggression, pair bonding, courtship. Simbirroota call-types broad hawaasummaa garee wal-fakkaataa keessaa acoustic tilmaama caalaa yeroo baay'ee yoo walitti makaman, perceptual space isaanii hojii-qabeessa garee sanaan shape ta'a.

Kun serious bu'aa dha. Simbirroo spectrogram qofa hin dhageenye jechuun hint. Simbirroo gosa sanaaf addaa calls behaviorally organized gareewwan akka ta'etti ilaalaa jira.

Garuu al-kallattii dha. Barreessitoonni mind animal dubbisuu hin danda'an, akkasumas jedhu. Keessaa bakka-bu'insa amala irraa irraa hubatu: discrimination, generalization, systematic dogoggorawwan.

Analogy faayidaa qabu "finch jechoota" miti. Kana caalaa: auditory sirna simbirroo fageenya callota gidduu jiru maalif calls sun fayyadaman irratti hundaa'ee warp godhu fakkaata.

Kun maal *hin* mirkaneessu

- nama-fakkaataa afaan hin agarsiisu. Syntax, grammar, compositional meaning, banaa-ended vocabulary hin jiru.
- Zebra finches "jechoota" qabu hin agarsiisu. Call-types gosa sanaaf addaa vocal gareewwan amalaa haalawwan waliin linked, freely recombined symbolic labels miti.
- Humans waliin conversation yookaan decoded channel simbirroo waliin haasa'u hin agarsiisu.
- Mental haalawwan kallattii hin access. Meaning hojii amala fi dogoggora caasaa irraa inferred, mind simbirroo keessa hin mul'anne.
- Simbirroota meanings haaraa understood ta'an hin agarsiisu. Generalization haaraa vocalizers call-type garee adda individuals sounds irratti haalawwan biraattis hojii irra oolchu dha.
- Gareewwan kun akkamitti develop ta'an hin settle. Adult simbirroota qoran; saaxilamuu/development semantic magnet dhiibbaa akkam shape godhu fuuldura hojii dha.

Ragaan hammam cimaa dha?

Categorical perception call-types irratti ragaa cimaa dha. Qophii simbirroota guutuu repertoire adda baasu gaafata, renditions/vocalizers hedduu fayyadama, generalization qormaata haaraa vocalizers call-type'n classify godhaman qaba. Incongruent reward haala keessumaa faayidaa qabu: garee arbitrary rule haaraa interfere gochuu danda'a agarsiisa.

Operational semantic perception irratti ragaa gaarii garuu inferential caalaa. Semantic magnet dhiibbaa metaphor qofa miti: barreessitoonni acoustic fi amalaa fageenya kaartawwan wal bira qabanii behaviorally related call-types perception keessatti acoustics caalaa cimaa cluster ta'uu argan. Kun call function perception shape gochuu deeggara.

nama-fakkaataa meaning irratti ragaa hin jiru — barbaachisus miti. Barruu addaa ta'ee yoo dhiifne caalaatti interesting. Animal communication namaa speech fakkaatee qofa valuable ta'u hin qabu.

Maaliif barbaachisaa dha

Ummataaf banaa temptation ifaadha. Simbirroo call hiika qabu akka dhaga'u yoo jedhu, mata-duree itti aanu animal afaan decode gochaa jirra jechuu barbaada. Leap kun saayinsii hard kutaa bira darbu.

Bu'aa careful caalaatti gaarii: researchers "meaning" animal mind translate fakkeessuu malee akkam qorachuu akka danda'an agarsiisa. Animals namaa ethologists gareewwan waliin agree godhu moo? Haaraa fakkeenyonni garee'n sort godhu moo? Dogoggorawwan acoustic similarity yookaan hawaasummaa function hordofu moo? Gaaffii durii — animal calls animals'f meaning qabu moo? — experimentally sharper godha.

Discussion namaa afaan fi everything else noise jedhu false ladder irraa illee sochoosa. Zebra finches xiqqaa gosa sanaaf addaa vocal repertoire qabu. Repertoire sana keessatti simbirroota structured gareewwan hawaasummaa fayyadama waliin tied ta'an perceive godhu fakkaata. Kun afaan keenya miti. Communication sirna isaanii, terms ofii isaatiin qorame dha.

Cuunfaa gabaabaa

Saayinsii qorannoo adult zebra finches vocal repertoire isaanii call-types 11 irratti qore. Auditory Go/No-Go hojiiwwan keessatti simbirroota call-types hunda adda baasu, learned gareewwan haaraa vocalizers calls irratti haalawwan biraattis hojii irra oolchu, incongruent haala keessatti call-type gareewwan hordofanii jalqaba wrong reward decisions illee godhan. Barreessitoonni acoustic similarity amalaa dogoggorawwan waliin wal bira qabanii call-types hawaasummaa haalawwan wal-fakkaataa keessatti fayyadaman simbirroota' perceptual space keessatti acoustic space caalaa cimaa cluster ta'uu argan. Kun categorical perception fi operational semantic perception deeggara: simbirroota calls ofii hojii-qabeessa gareewwan'n organize godhu fakkaatu, sound qofa miti. nama-

fakkaataa afaan, syntax, jechoota, kallattii mental haalawwan access yookaan simbirroota waliin conversation hin agarsiisu.

Sakatta'a ifaa

barruun maal agarsiisa: Adult zebra finches 11 ethogram-based call-types repertoire discriminate gochu danda'u; gareewwan haaraa vocalizers irratti haalawwan biraattis hojii irra oolchu; systematic dogoggorawwan amalaa/semantic gareewwan'n acoustic similarity qofa caalaa shape ta'u.

Waan amansiisaa ta'e garuu hin mirkanoofne: Zebra finches keessaa bakka-bu'insawwan call meaning qabaachuu; neural kaartawwan similar amalaa "semantic magnet" dhiibbaa jala jiraachuu; development/saaxilamuu gareewwan kana learned perceptual gareewwan biroo fakkaataniin shape gochuu.

Waan hin agarsiifne: nama-fakkaataa afaan; grammar; banaa-ended jechoota; symbolic wabii namaa sense; subjective mental haalawwan kallattii ragaa; humans zebra finches waliin haasa'u karaa.

Daangaawwan ijoo: Laaboraatoorii operant hojiiwwan **adult simbirroota 12** waliin, natural damee interactions miti; "semantic" amala/dogoggora caasaa irraa inferred; development banaa; dhaabbataa gosa sanaaf addaa repertoire irratti, flexible compositional afaan miti.

Dubbisaan waliigalaa amanamummaa hammam qabaachuu qaba? Zebra finches hojii kana keessatti call-types categorize/adda baasu irratti ol-aanaa. Dogoggorawwan hojii-qabeessa gareewwan, acoustic similarity qofa miti, reflect gochuu irratti gaarii. Namaa sense simbirroo afaan ragaa ta'uu irratti gadi-aanaa. Stance sirrii: hiika qabu vocal gareewwan irratti animal-cognition bu'aa cimaa, Dolittle yeroo miti.

Maddoota

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