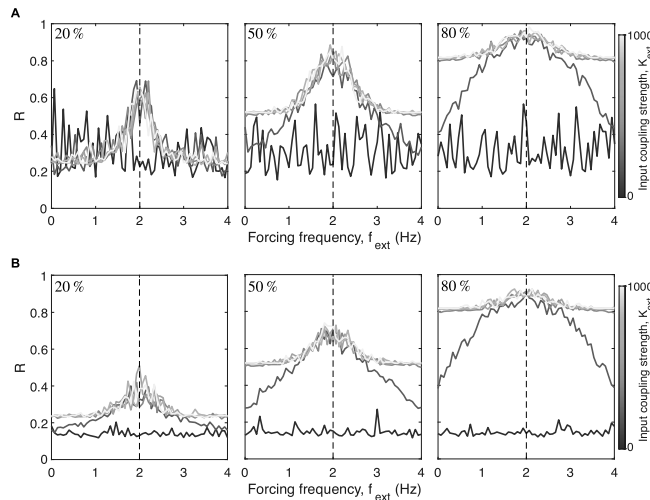


## Supporting Information: “A widespread animal communication tempo may resonate with the receiver’s brain”

### A. Extended neural resonance results

To check the robustness of our results in larger networks, we also perform simulations with  $N = 100$  with varying fractions of input neurons (Fig A in S1 Text); we observe similar resonance curves both with all-to-all and random binary networks.



**Supporting Fig. A. Resonance with a large network.** Resonance curves with  $N = 100$ . We vary the fraction of input neurons (with 20%, 50% and 80% in separate plots from left to right). Results obtained from 1 realization (initial seed). (A) All-to-all network. (B) A random binary network, with each node assigned 60 random connections to avoid sparsity. Data and code underlying this Figure can be found in <https://doi.org/10.5281/zenodo.19069908>.

### B. Extended graph topology results

When we attempt to ask what sets the “weaker” graph topologies apart from the others, we find that there are more reciprocal pairwise connections (i.e., if A is connected to B, B is also connected to A). In this 5-neuron example, the 10 lowest order cases have a mean of 5.38 reciprocal edges (i.e., graph reciprocity 0.54) as opposed to 5.08 in the 10 highest order cases (i.e., graph reciprocity 0.51): see Fig 4B of the main text for example graphs. The graphs also differed in degree of clustering, with a higher clustering coefficient in the lower order graphs (0.38 vs 0.32).

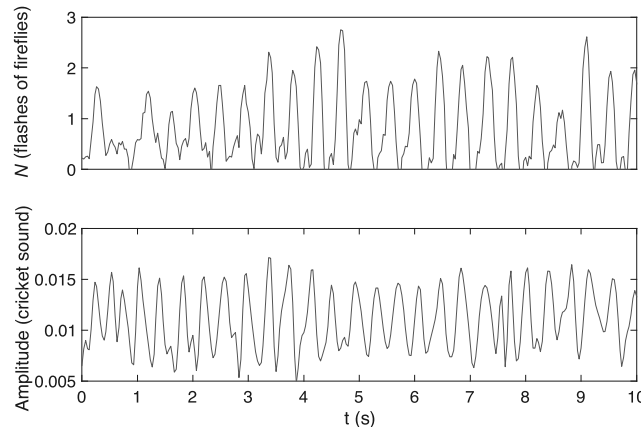
### C. Additional information on xeno-canto analysis

Assessment of isochronous frequency for each species in the xeno-canto database was performed manually by the authors. The process consisted of (1) randomly sampling a species (Matlab’s

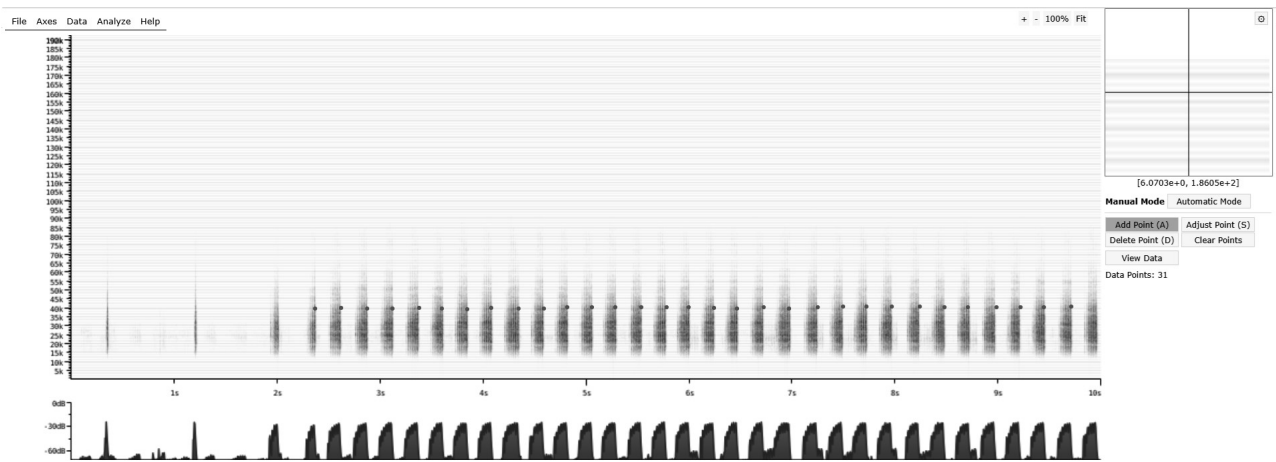
random number generator was used to select a page and line number from the listing of all recordings for a given category of animal), (2) looking at *xeno-canto*'s generated spectrogram for initial assessment, (3) downloading the spectrogram if plausible signs of isochronous signaling were present, (4) loading the spectrogram into an online plot digitizer tool (we used WebPlotDigitizer), (5) clicking on periodic points visible in the spectrogram and saving the coordinates of those points (see Fig C in S1 Text for an example), (6) analyzing the resulting data (extracting IOIs and their distribution) in Matlab.

In sampling randomly, we often ran into the problem that some species or genera are heavily overrepresented in the database. After a first recording from a specific genus was included in our analysis, we rejected any subsequent randomly selected recording that came from a species in that same genus. However, following a suggestion from an anonymous reviewer, we discarded lower quality (C or D rated) recordings when higher quality (A or B rated) recordings from the same species were available. This did not appreciably change our results.

In at least one case, two recordings from the same species represented different isochronous vocalizations (e.g., an alarm call vs. a mating call), but for consistency only one was included in our analysis. In some cases it was necessary to select only a part (frequency or time range) of the spectrogram representing the signal of interest, since the isochronous portion did not persist for the whole recording or there was apparently more than one species audible for all or part of the recording. Finally, unlike in our Fig 1 C, it was hard to judge whether the data included are truly representative of the indicated species, since these data are ultimately based on public citizen-science contributions rather than scholarly peer-reviewed publications. We expect that, for these reasons and more, automatically parsing the approximately one million recordings in *xeno-canto* will prove challenging (though valuable).



**Supporting Fig. B. Time-series of firefly and cricket measurements.** 10 s excerpts of the firefly summed flashing activity (top) and the sound of the cricket chirping (bottom). Data and code underlying this Figure can be found in <https://doi.org/10.5281/zenodo.19069908>.



**Supporting Fig. C. Example of xeno-canto data digitization.** Grayscale image is directly from xeno-canto's default spectrogram. Red points show locations where user has clicked to record the start/stop of an interval. Data from Vichet's Bush-cricket *Amedegnatiiana vicheti*, xeno-canto entry XC966674. Data and code underlying this Figure can be found in <https://doi.org/10.5281/zenodo.19069908>.

**Supporting Table A. Animal isochronous tempo data across species.** ID = Xeno-canto recording ID, N = number of intervals. \* = species possibly misidentified.

| ID                  | Common Name                      | Latin Name                           | Tempo | StdDev | StdDev% | N  |
|---------------------|----------------------------------|--------------------------------------|-------|--------|---------|----|
| <i>Birds</i>        |                                  |                                      |       |        |         |    |
| 871344              | Magellanic Snipe                 | <i>Gallinago magellanica</i>         | 3.69  | 0.21   | 5.6     | 16 |
| 36008               | Chestnut-backed Thornbird        | <i>Phacellodomus dorsalis</i>        | 3.34  | 0.41   | 12.3    | 21 |
| 102483              | Great Spotted Woodpecker         | <i>Dendrocopos major</i>             | 3.28  | 0.57   | 17.2    | 18 |
| 1063743             | House Sparrow                    | <i>Passer domesticus</i>             | 2.35  | 0.43   | 18.1    | 22 |
| 299606              | Magpie Tanager                   | <i>Cissopis leverianus</i>           | 0.56  | 0.04   | 7.3     | 5  |
| 623450              | Short-toed Treecreeper           | <i>Certhia brachydactyla</i>         | 4.21  | 0.65   | 15.5    | 8  |
| 748348              | Cassin's Vireo                   | <i>Vireo cassinii</i>                | 0.65  | 0.13   | 19.3    | 48 |
| 988523              | Fork-tailed Sunbird              | <i>Aethopyga christinae</i>          | 1.95  | 0.35   | 17.7    | 37 |
| 905313              | European Greenfinch              | <i>Chloris chloris</i>               | 12.28 | 0.75   | 6.1     | 5  |
| 906257              | Red-backed Shrike                | <i>Lanius collurio</i>               | 1.83  | 0.31   | 16.9    | 9  |
| <i>Frogs</i>        |                                  |                                      |       |        |         |    |
| 882740              | –                                | <i>Dendropsophus gaucheri</i>        | 1.24  | 0.05   | 4.3     | 10 |
| 961796              | Northern Cricket Frog            | <i>Acris crepitans</i>               | 3.82  | 0.16   | 4.3     | 52 |
| 891773              | –                                | <i>Bufoes pewzowi</i>                | 15.50 | 1.15   | 7.4     | 38 |
| 919363              | Black Leg Poison Dart Frog       | <i>Phyllobates bicolor</i>           | 4.36  | 0.56   | 12.9    | 6  |
| 928986              | –                                | <i>Chiasmocleis jacki</i>            | 5.58  | 0.42   | 7.5     | 11 |
| 949867              | Common Toad                      | <i>Bufo bufo</i>                     | 1.79  | 0.19   | 10.7    | 12 |
| 990053              | Lemon-Yellow Tree Frog           | <i>Hyla savignyi</i> *               | 2.18  | 0.27   | 12.3    | 18 |
| 1019185             | –                                | <i>Allobates granti</i>              | 4.14  | 0.37   | 9.0     | 16 |
| 1023333             | Agile Frog                       | <i>Rana dalmatina</i>                | 6.00  | 0.41   | 6.9     | 41 |
| 928972              | –                                | <i>Ameerega hahneli</i>              | 7.30  | 0.50   | 6.9     | 48 |
| <i>Grasshoppers</i> |                                  |                                      |       |        |         |    |
| 756241              | –                                | <i>Chorthippus vagans</i>            | 6.54  | 1.46   | 22.3    | 25 |
| 867517              | Ambitious Meadow Bush-cricket    | <i>Roeseliana ambitiosa</i>          | 3.90  | 0.58   | 14.8    | 25 |
| 873965              | Tinkling Leaf-runner             | <i>Homoeoxipha lycoides lycoides</i> | 3.46  | 0.32   | 9.1     | 13 |
| 923961              | –                                | <i>Platypleis intermedia</i>         | 3.33  | 0.25   | 7.6     | 33 |
| 820573              | –                                | <i>Gomphoceris sibiricus</i>         | 4.58  | 0.18   | 3.9     | 38 |
| 933574              | Dark Bush-cricket                | <i>Pholidoptera griseoptera</i>      | 0.94  | 0.13   | 13.4    | 61 |
| 944915              | –                                | <i>Borneopsis cryptosticta</i>       | 1.99  | 0.42   | 21.0    | 13 |
| 966674              | Vichet's Bush-cricket            | <i>Amedegnatianna vicheti</i>        | 4.09  | 0.28   | 6.8     | 30 |
| 966801              | Southern Saw-tailed Bush-cricket | <i>Barbitistes fischeri</i>          | 1.02  | 0.09   | 9.0     | 8  |
| 944562              | Rufous Grasshopper               | <i>Gomphocerippus rufus</i>          | 6.60  | 0.29   | 4.4     | 21 |
| <i>Land Mammals</i> |                                  |                                      |       |        |         |    |
| 43407               | Southern Gray Gibbon             | <i>Hylobates muelleri</i>            | 4.66  | 0.57   | 12.3    | 9  |
| 638479              | European Wildcat                 | <i>Felis silvestris</i>              | 0.56  | 0.10   | 18.0    | 6  |
| 760171              | Red Fox                          | <i>Vulpes vulpes</i>                 | 3.44  | 0.66   | 19.1    | 13 |
| 961817              | Eastern Chipmunk                 | <i>Tamias striatus</i>               | 1.80  | 0.20   | 11.0    | 23 |
| 1009337             | Toppin's Titi                    | <i>Plecturocebus toppini</i>         | 2.72  | 0.26   | 9.5     | 24 |
| 1016003             | Bearded Capuchin                 | <i>Sapajus libidinosus</i>           | 5.80  | 0.76   | 13.0    | 29 |
| 1025102             | Himalayan Striped Squirrel       | <i>Tamiops mccllellandii</i>         | 2.02  | 0.25   | 12.2    | 9  |
| 1025105             | Three-striped Ground Squirrel    | <i>Lariscus insignis</i>             | 0.13  | 0.00   | 3.8     | 4  |
| 1031607             | Northern Pygmy Marmoset          | <i>Cebuella pygmaea</i>              | 1.02  | 0.20   | 20.2    | 11 |
| 1037186             | Kenya Coast Dwarf Galago         | <i>Paragalago cocos</i>              | 1.56  | 0.23   | 14.8    | 6  |
| <i>Bats</i>         |                                  |                                      |       |        |         |    |
| 821717              | Seba's Short-tailed Bat          | <i>Carollia perspicillata</i>        | 11.01 | 1.07   | 9.7     | 15 |
| 1016870             | Eurasian Serotine                | <i>Eptesicus serotinus</i>           | 6.94  | 0.91   | 13.0    | 19 |
| 843529              | Common Butterfly Bat             | <i>Glauconycteris argentata</i>      | 4.41  | 0.40   | 9.0     | 9  |
| 822582              | Savi's Pipistrelle               | <i>Hypsugo savii</i>                 | 7.38  | 0.35   | 4.7     | 30 |
| 824785              | Schreibers's Long-fingered Bat   | <i>Miniopterus schreibersii</i>      | 2.72  | 0.59   | 21.7    | 6  |
| 822571              | Daubenton's Myotis               | <i>Myotis daubentonii</i>            | 6.91  | 0.56   | 8.1     | 10 |
| 934880              | Common Noctule                   | <i>Nyctalus noctula</i>              | 3.37  | 0.65   | 19.2    | 23 |
| 1023790             | Soprano Pipistrelle              | <i>Pipistrellus pygmaeus</i>         | 2.82  | 0.57   | 20.1    | 21 |
| 872807              | Brown Long-eared Bat             | <i>Plecotus auritus</i>              | 4.91  | 0.69   | 14.1    | 20 |
| 1038063             | Lesser Horseshoe Bat             | <i>Rhinolophus hipposideros</i>      | 11.38 | 1.22   | 10.7    | 19 |