

Supplementary material

Tolerant and intolerant macaques differ in the context specificity of their calls and how they 'comment' on interactions

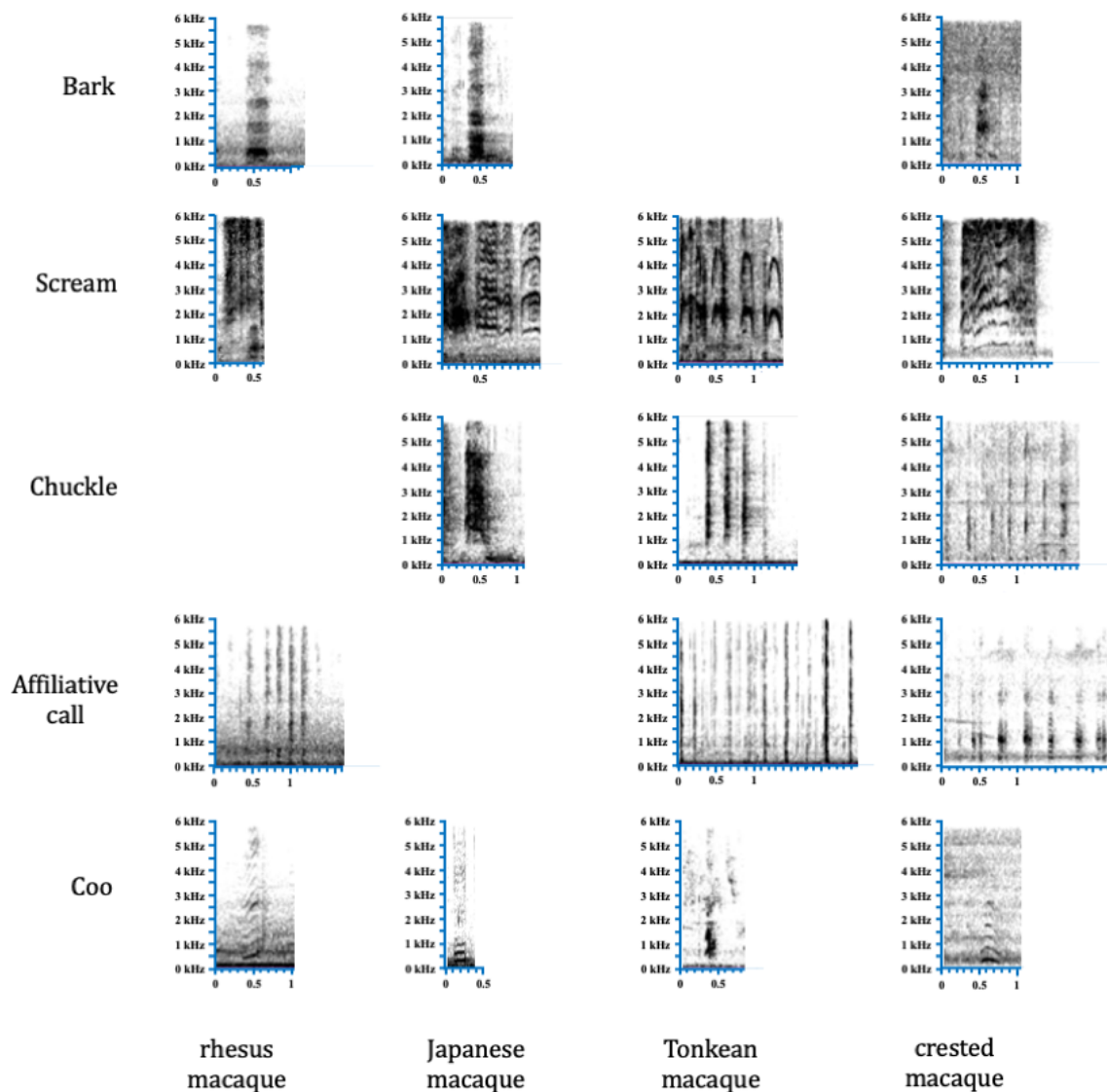
Behavioral Ecology and Sociobiology

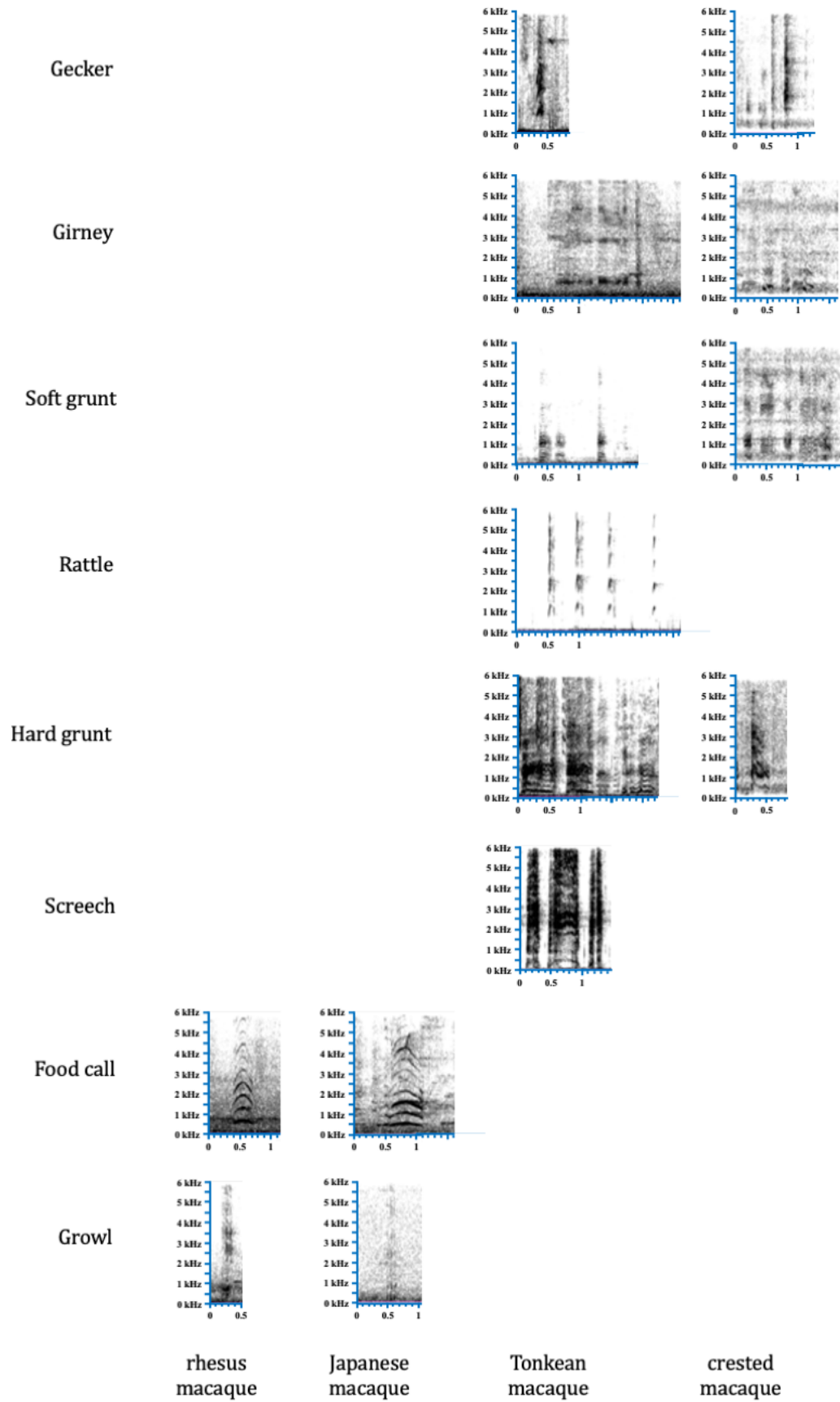
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Spectrograms of the main types of calls in rhesus, Japanese, Tonkean and crested macaques

The calls were labelled according to the main vocal types commonly recognized in macaques (Rowell & Hinde, 1962; Lindburg, 1971; Green, 1975; Peters, 1983; Lewis, 1985; Masataka & Thierry 1993; Panggur, 2013). The spectrograms were drawn with the software Raven Pro 1.4 (Center for Conservation Bioacoustics, 2011). They show the frequency (kHz) as a function of time (sec).





Calculation of the relative uncertainty index

The calculation of the relative uncertainty index is illustrated in Table 1. The application of the formula can be seen in the row General case. If a cluster is composed of calls from a single context, the uncertainty and the relative uncertainty are equal to 0 by convention (case 2). If a cluster is composed of calls from two contexts only, the uncertainty is calculated on these two contexts, which allows to avoid applying logarithms on null values, but still allows comparisons because thereafter the uncertainty value is divided by the logarithm of three (case 1).

Table 1 Examples of calculation for uncertainty (H) and relative uncertainty (h)

Figures are arbitrary, they are given for illustrative purposes

	Agonistic context	Affiliative context	Neutral context	Calculation
General case	0.5	0.25	0.25	$H = -0.5 \log 0.5 - 0.25 \log 0.25 - 0.25 \log 0.25 = 1.5$ $h = H / \log 3 = 0.95$
Case 1	0.6	0.4	0	$H = -0.6 \log 0.6 - 0.4 \log 0.4 = 0.97$ $h = H / \log 3 = 0.61$
Case 2	1	0	0	$H = 0$ $h = 0$

The diagrams in Figure 1 illustrates two extreme cases of clustering results. Each of the nine large circles represents a cluster. Each cluster consists of a group of calls (small circles) identified according to the acoustic structure of these calls. Calls are coloured according to their context of occurrence (three colours for three social contexts). In the case of a high relative uncertainty value (1), each context is distributed over a large number of clusters. In the case of a low relative uncertainty value (2), each context is limited to a small number of clusters, and each cluster consists mainly of one context. When relative uncertainty is low, knowing the cluster to which a call belongs provides reliable information about the context in which it was probably emitted. This is not true when the relative uncertainty is high.

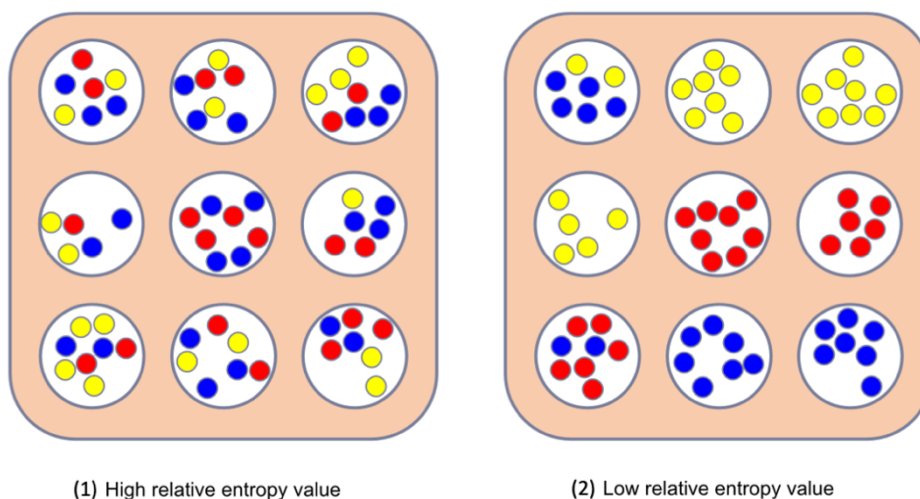


Fig. 1 Diagrams illustrating the method

References

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