XX. congress of International BioAcoustic Council (IBAC)

Book of Abstracts

Edited by Tomi Trilar

XX. kongres Mednarodnega bioakustičnega združenja (IBAC)

Knjiga povzetkov

Uredil Tomi Trilar

Portorož, 15.-19. 9. 2005

Quantitative analysis of nonlinear phenomena in whines of the domestic dog (*Canis familiaris*)

Elena Volodina[1], Ilya Volodin[1,2], Olga Filatova[2]

[1] Scientific Research Department, Moscow Zoo, B. Gruzinskaya, 1, Moscow, 123242, Russia - E-mail: zoosci@cdt.ru

[2] Dept. of Vertebrate Zoology, Faculty of Biology, Lomonosov Moscow State University, Vorobievy Gory, Moscow, 119992, Russia - E-mail: volodinsvoc@yahoo.com

Nonlinear phenomena (biphonation, subharmonics, sidebands, deterministic chaos and frequency jumps) were found in calls of many taxa, but their functions are poorly understood. One hypothesis (Fitch et al., 2002, Anim. Behav., V. 63, P. 407-418) says that the phenomena serve to avoid habituation of a listener and to attract attention to a caller due to strong variability they introduce in vocal sequences. Here we study occurrence and individual preferences in use of nonlinear phenomena in frustrate whines of the domestic dog.

Whines from 9 dogs of different breeds aged from 3 months to 7 years and weighed from 1.5 to 70 kg were recorded from March 2000 to January 2004. Spectrograms of 2643 whines (first 300 high-quality whines per each of 8 dogs and 243 from the ninth dog) were analysed from display with Avisoft-SASLab Pro v. 4.3 (R. Specht). The whines could contain one or two fundamentals (with their harmonics), that could be produced both singly as separate vocalizations and simultaneously, creating biphonation. The lower frequency (ranged from 0.4 to 1.4 kHz), was either purely tonal or consisted deterministic chaos, subharmonics, or frequency jumps within it. The higher frequency (ranged from 3.1 to 11 kHz) was either pure or bored sidebands. Some whines showed frequency jumps from the higher to the lower frequency.

The pooled sample included 1125 (42.6%) whines with the lower-frequency only, 869 (32.9%) - the higher-frequency only, 430 (17.1%) - both (biphonation), and 198 (7.5%) - the lower after the higher (frequency jump). The analysis of individual samples revealed two dogs (toy dachshund-1 and Pekinese) that called nearly exclusively lower-frequency whines, and another dog (dachshund-1) with 68% calls of that sort. Three dogs: (dachshund-2, collie and riesenschnauzer) called primarily high-frequency whines (more 50% of calls), whereas in a Caucasian shepherd and in a mongrel dog more than 30% of calls were biphonic. The last dog (toy dachshund-2) used frequency jumps from the higher to the lower frequency more than any other dog (28% of calls).

Also, we counted percentages of nonlinearities separately for the higher and the lower frequencies. Among 1774 whines with the lower frequency, 1441 (81.2%) showed lack of nonlinearities, 173 (9.8%) contained subharmonics, 177 (10%) - deterministic chaos, and 81 (4.6%) - frequency jumps within the low frequency. Among 1518 whines with the higher frequency, 1476 (97.2%) showed lack of nonlinearities, and 42 (2.8%) contained sidebands. Being parts of biphonic calls, both the lower and the higher frequencies bored less nonlinear phenomena than when they occurred as separate vocalisations. So, among 1125 the lower-frequency whines, 27% bored the nonlinear phenomena, whereas as little as 4.5% of 649 biphonic calls bored the phenomena within the lower frequency. Similarly, among 869 high-frequency whines, nonlinear phenomena were registered in 4.4% calls versus only 0.6% of 649 biphonic calls (significant differences for both the cases, $p < 0.001$, White t-test).

Thus, dogs showed a great variability both in use of the higher or low frequencies, and in appearance of nonlinear phenomena in calls. Dogs used different ways to decrease monotony of vocal utters and attract attention: they either emitted calls with two frequencies or produced single-frequency calls bearing various nonlinear phenomena on an exploitable frequency.

Oral presentation