

Classification of discomfort-related ultrasonic calls in pup and adult fat-tailed gerbils *Pachyuromys duprasi*



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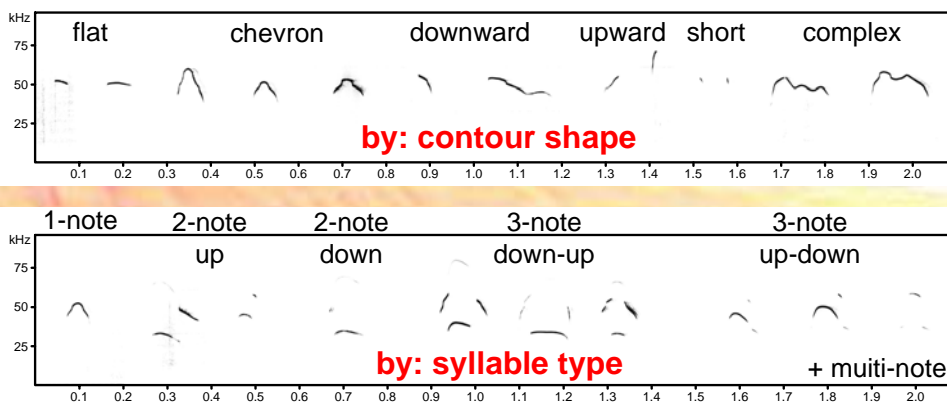
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Classification of discomfort-related ultrasonic calls (US) is an important prerequisite for their applicability as indicators of emotional arousal in laboratory rodents. **Aim:** To develop the classification of the fat-tailed gerbil US and to compare the US acoustics between pups and adults.

Classification of ultrasonic calls:



Laboratory colony of Moscow Zoo.

40 pups (17 male, 23 female) from 11 litters.

20 adults (10 male, 10 female).

420-s isolation-and-handling tests.

As ultrasound emerges in fat-tailed gerbils at 6th day of life (Zaytseva et al. 2016), we used recordings of 6, 8 and 10-day-old pups. The UCs were provided by 22 of 40 pups (**782 calls in total**) and by 7 (3 male, 4 female) of 20 adults (**248 calls in total**).



Isolation stage Handling stage

This variation resulted in the total of **36 US call types**.

Comparison US calls between pups and adults:

Occurrence

Pups	—	∧	∨	∕	-	∩	Total
1-note	299	193	87	6	9	6	600
2-note up	7	16	7	0	0	0	30
2-note down	11	16	0	3	0	0	30
3-note down-up	0	96	0	0	0	0	96
3-note up-down	1	17	4	0	0	0	22
multi-note	0	2	1	1	0	0	4
Total	318	340	99	10	9	6	782

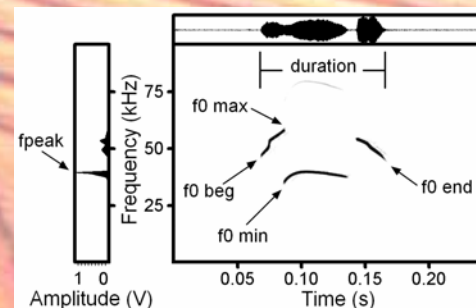
In pups, most frequent were 1-note USs (600 of 782 calls), with either Flat (299 calls) or Chevron (193 calls) contour. Another widespread call type was the 3-note down-up US (in total 96 calls) with Chevron contour.

Adults

Adults	—	∧	∨	∕	-	∩	Total
1-note	40	57	25	28	35	8	193
2-note up	2	11	2	2	0	0	17
2-note down	6	3	3	3	0	3	18
3-note down-up	0	2	1	0	0	2	5
3-note up-down	1	4	0	0	0	1	6
multi-note	0	5	2	0	0	2	9
Total	49	82	33	33	35	16	248

In adults, as in pups, most USs were 1-note (193 of 243 calls) with contours Chevron (57 calls), Flat (40 calls), or Short (35 calls).

Acoustics



FFT-length 1024;
frame 50%,
overlap 93.75%,
Hamming window

Pups

Adults

Duration	50.0±30.9 ms	>	28.1±97.1 ms
fpeak	47.8±5.8 kHz	<	58.8±8.7 kHz
f0 max	52.0±4.8 kHz	<	64.2±11.0 kHz
f0 min	41.8±6.4 kHz	<	50.9±8.8 kHz

Compared to adult USs, the pup USs were longer and lower in frequency. Consistent differences between pups and adults were found also for most widespread single-note Flat and single-note Chevron USs, taken separately from other call types.

Ontogenetic pathway of fat-tailed gerbils USs (towards shorter and higher-frequency calls) resembles those of domestic mice and bats.

