

number of chromosomes, and 5 were hyperhaploid. An older froglet (40 days) had 13 diploid and 22 haploid cells, as well as 7 with a hyper- and 6 with a hypohaploid chromosome number. Although the electrophoretic enzyme pattern of ovaries of frogs displaying both diploid and haploid nuclei showed the translation products of the *ridibunda* alleles dominating, a faint indication of heterozygosity was still noticeable (Fig. 2B). Usually by the time *R. esculenta* enter their first hibernation, the majority of oogonia have already been transformed into oocytes. Here, no univalents were seen in these primary oocytes (as one had expected due to the many haploid nuclei in late oogonia), but only bivalents in an approximately haploid number (Fig. 1C). Only the translation products of the *R. ridibunda* alleles are electrophoretically detectable in these primary oocytes (homozygous *ridibunda* allozyme pattern, Fig. 2C). These data give conclusive evidence that the chromosomes of *R. lessonae* are eliminated from the germ line of the hybrid taxon before the oogonia enter the prophase of the reduction division, and that the remaining *R. ridibunda* genome is apparently doubled by a premeiotic endoreduplication or restitutional mitosis resulting in the restoration of the diploid chromosome number from the haploid level. The mechanism of the elimination of the *R. lessonae* genome might be traced back to centromere differences found to exist between the chromosomes of *R. ridibunda* and *R. lessonae* [11].

The restoration of the diploid chromosome number enables an orderly meiosis to occur. The crossing over observed in lampbrush chromosomes [5, 12] is not relevant to recombination because bivalent chromosome pairs are identical copies. The occasional inclusion of a single *R. lessonae* chromosome in an oogonium and the loss of the *ridibunda* homologue during the premeiotic exclusion process would result in an ovum containing 12 chromosomes from *R. ridibunda* and one from *R. lessonae*. Thus the occasional recombination between the two parental sets of chromosomes, seen in *R. esculenta*, would also be caused by a premeiotic event. Those gametes with a somewhat recombined set of chromosomes must also be responsible for the observed low introgression rate of *R. ridibunda* genes into the genepool of *R. lessonae*.

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## Categorical Perception of Mouse Pup Ultrasound by Lactating Females

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In this paper we demonstrate categorical perception of an intraspecific communication call in the frequency domain by female house mice (*Mus musculus*, strain NMRI). As far as we know, it has not been shown before, except in studies of human speech perception, that mammals can perceive intra-specific vocalizations categorically. The criteria for categorical perception have been well described [1]: a) A subject has to label (or to identify) stimuli from an acoustic continuum as members of discrete classes; b) these classes are named categories if the subject is able to discriminate between stimuli drawn from different classes (inter-categorical discrimination) and not between stimuli drawn from the same class (intra-categorical non-discrimination).

Mouse pups in discomfort produce highly communicative ultrasonic whistles which release searching and retrieving behavior in their mothers [2, 3]. We show that lactating females respond (in a two-alternative choice test) not only to natural calls but also to model calls consisting of band-passed noise of variable bandwidth with noise energy in the frequency range of the natural calls (about 40–80 kHz). Data were collected under dim red light in a sound-proof and anechoic room (procedures and equipment are described elsewhere [4, 5]). A female together with her litter was placed in a nest depression in the middle

of a running board (110 × 8 cm) suspended between two identical ultrasonic speakers (flat ± 1 dB response from 15–100 kHz [6]). Sound pressure levels (SPLs) of stimuli were equalized at total 75 ± 2 dB (SPL re. 20 µPa) at the nest depression before a test. Pre-motivated females heard the test stimuli (A, B; 80 ms duration, 8 ms rise and fall time) alternatingly from the two speakers (a, b) in series (e.g. A<sub>a</sub>, B<sub>b</sub>, A<sub>a</sub>, B<sub>b</sub>, ...) until they made a choice by running toward one of the speakers. Stimuli were assigned randomly to the two speakers, each female had 5 runs, and a minimum of 50 runs per stimulus configuration were observed.

Table 1 shows the results: 1. The females identify natural ultrasound against a neutral 20 kHz tone indicated by their preference of the ultrasound (1st test). 2. They label narrow noise bands (17.5, 20, 22.5 kHz wide) with lower cutoff frequencies down to 37.5 kHz as relevant ultrasound models; broader noise bands with lower frequency cutoffs are not preferred (2nd test). A  $\chi^2$ -test indicates a significant preference for the three narrow noise bands (37:14,  $p < 0.01$ ; 35:17,  $p < 0.04$ ; 36:15,  $p < 0.02$ ) if compared with an expected equal distribution (25:25). 3. They discriminate between inter-categorical noise bands (narrow vs. broad), they do not discriminate, however, between intra-categorical noise bands (narrow vs. nar-

Table 1. Responses of lactating house mice in tests where they had to identify natural ultrasonic calls (natural USC) against a neutral (not occurring in the natural repertoire but being clearly audible) 20 kHz stimulus (1st test) and synthesized model calls (noise bands, 96 dB/octave slopes) against the 20 kHz stimulus (2nd test). In the 3rd test the ability to discriminate between different model calls (noise bands) was tested. Data were analyzed statistically with a two-tailed binominal test and the probability of the response distribution is indicated

Stimulus alternatives	Number of responses	Probability
natural USC: 20 kHz	1st test 35:17	0.018
noise band [kHz]	2nd test (identification)	
42.5-60:20	37:14	0.002
40 -60:20	35:17	0.018
37.5-60:20	36:15	0.005
36 -60:20	25:25	1.0
35 -60:20	28:22	0.478
30 -60:20	31:21	0.212
20 -60:20	21:31	0.212
inter-categorical [kHz]	3rd test (discrimination)	
37.5-60:35-60	40:14	0.0007
40 -60:35-60	33:18	0.05
42.5-60:30-60	37:16	0.006
intra-categorical [kHz]		
42.5-60:37.5-60	27:25	0.890
36 -60:30 -60	27:24	0.779
natural USC:40-60	22:29	0.401

row; broad vs. broad; 3rd test). 4. They do not discriminate between natural ultrasound and narrow noise bands (3rd test). We thus have shown that lactating female house mice perceive the ultrasonic calls of their pups categorically as sound energy in certain frequency bands and show phonotactic responses to appropriate bandwidths. Other characteristics of the natural ultrasonic calls like frequency sweeps and intensity variations are not necessary parameters for call perception and response release. The boundary between perception and non-perception (preference and non-preference to a stimulus) is defined by the bandwidth itself or by the lower cutoff frequency of the sound signal. These two parameters will be explored in further tests. Categorical perception of intra-specific sound signals is not restricted to human speech perception but is also present in mice and can be expected to be found in other mammals as well.

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## Effects of Differentially Shielded Lofts on Pigeon Homing

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In 1972 Papi et al. [1] put forward the hypothesis that wind-borne olfactory information reaching the loft was essential to the acquisition of the capacity to navigate in homing pigeons. On this view, wind-borne odours associated with the wind direction are used to build up the "map component" of the navigational mechanism. This hypothesis is supported by the fact that when lofts are completely shielded from winds, navigational capacity falls sharply [2]; in addition, pigeons raised in

lofts where wind direction is shifted or reversed display a correlated deviation or reversal of initial orientation [3]. In a recent paper, however, Wallraff [4] reports results which he does not consider to be in agreement with the olfactory hypothesis "as it stands so far". He has tested the navigational capacity of homing pigeons raised in two partly shielded lofts, one open to winds from the North and South, and the other open to winds from the West and East. These pigeons only showed a less

than significant worsening in navigational capacity when released from sites located on the axis along which loft-shielding had stopped winds reaching them.

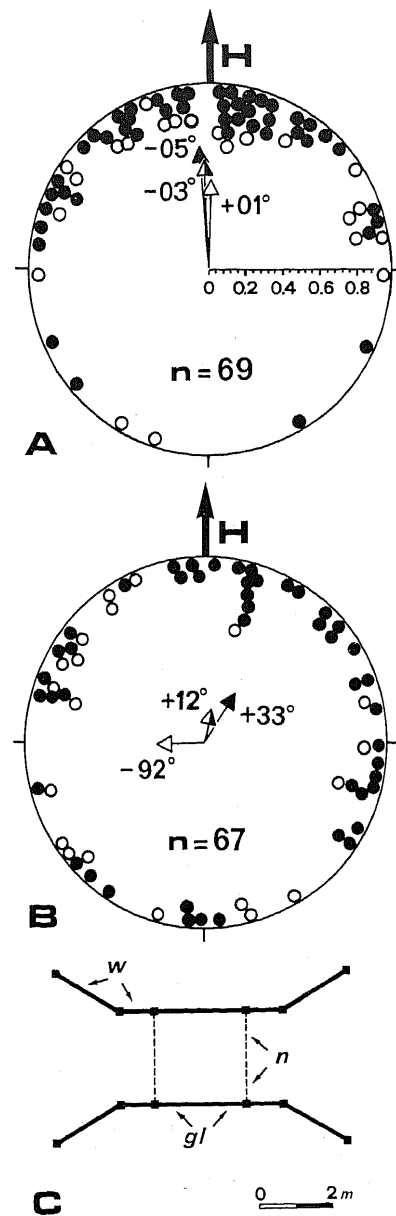


Fig. 1. Bearings of C-birds (A) and E-birds (B) have been pooled by setting home direction (H) to 0°. Each symbol on the periphery of the circles represents the vanishing bearing of one bird: filled dots refer to short-distance releases, open dots to long-distance releases; *n* is the number of bearings. The mean vectors corresponding to open dots, to filled dots and to the pooled distribution of both are indicated inside the circle (arrow with open, filled and half-filled head, respectively). The length of the vectors can be read according to the scale. In (C) an horizontal section of a corridor loft is shown: *gl* panes of glass; *n* wire netting; *w* wooden panels