Perception of the missing fundamental by cats*

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Two cats were tested on their ability to perceive the missing fundamental through the use of an avoidance technique. The animals were trained to discriminate between rising and falling pitch sequences first with single and then with multiple tones. They were then tested by presenting them with tone triads known to produce the perception of the missing fundamental in humans. In these traids the pitch of the frequencies composing the triad either remained the same or shifted in the direction opposite the shift of the missing fundamental. The results show that the animals' response to these triads was not in conformity with that expected from the direction of change of the component frequencies, but could be accounted for if it were assumed that the cats were responding on the basis of the missing fundamental. A further test given one of the cats indicated that this phenomenon declined progressively as the center frequency was raised, until at 6 kHz it was apparently completely absent. A similar decline in the strength of the fundamental pitch occurs over the same range in humans. Thus, there is reason to believe that cats perceive the missing fundamental.

Subject Classification: [43]65.75, [43]65.56, [43]65.54; [43]80.50.

INTRODUCTION

The phenomenon of the missing fundamental can be demonstrated with a complex tone made up of sinusoids

present it with the above stimulus situation on the hypothesis that its response will depend on whether it is assigning pitch on the basis of the harmonics or of the

TABLE I. Stimuli used in the missing fundamental test.

	Oscillators				Direction of Change	
	A	B	Frequency	Missing fundamental	Frequency	Missing fundamental
(a)	342	···	342	None	Down	···
	400	···	400	None	Standard	···
	458	···	458	None	Up	···
(b)	342	1942	1600, 1942, 2284	342	Down	Down
	400	2000	1600, 2000, 2400	400	Standard	Standard
	458	2058	1600, 2058, 2516	458	Up	Up
(c)	342	2058	1716, 2058, 2400	342	Up	Down
	400	2000	1600, 2000, 2400	400	Standard	Standard
	458	1942	1484, 1942, 2400	458	Down	Up

independent oscillators and a balanced modulator. To

followed by a “comparison” stimulus of either higher

In this case, the frequencies of the triads and the missing fundamental produced by the triads change in the

opposite direction relative to the standard. Thus, for example, a person who perceived the missing fundamental would say that the comparison tone of the pair

“warning” stimulus came on and thus were usually able to avoid the shock. The warning stimulus was pre-

sented at random intervals varying in 15-sec blocks from 45 to 180 sec following the previous warning signal. Thus, there were generally 10 intervals in which

that the animal does not switch to using the component

frequencies when the fundamental cue disappears.

III. DISCUSSION

fundamental declines in man. A more realistic

sion is that the animals were not able to use

The discovery that cats may be able to perceive the