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Perceptual Identification of Conspecific Calls by Budgerigars (*Melopsittacus undulatus*)

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Introduction

In the wild, budgerigars live as a colonial species. Calls are constantly being emitted and are often cut short by other vocalizations and natural interruptions such as noise. Therefore, it would be advantageous for budgerigars to have evolved a recognition system that does not require 100% of a call for accurate identification. Previous experiments have shown that budgerigars are able to identify calls emitted by conspecifics (Park & Dooling, 1985). However, the amount of information contained within a call that is required for accurate recognition, as well as the significance that each part of the call holds for the budgerigar, is unknown. Recently, European starlings were found to maintain accurate recognition of conspecific songs with as little as two motifs or 1-2 seconds of a presented song (Knudsen, Thompson, & Gentner, 2010).

In this study, we investigated how much vocal material was needed for accurate recognition of conspecific calls by budgerigars. Based on previous experiments, we hypothesized that recognition accuracy would increase with the amount of vocal material presented. We also predicted that temporal order would have an effect such that the beginning of a call would more easily incite accurate recognition than any other part of the call. This would be similar to what has been found in humans identifying speech (e.g., Marslen-Wilson, 1987). In humans, the beginning of a word is more easily recognized than the middle or end of the same word. If this effect is confirmed in the budgerigar, it would suggest that there is a cue present in the beginning of a call that may aid in accurate recognition.

Methods

Animals and Housing: Four adult budgerigars (two male and two female) were used in this experiment. All birds were housed individually at the University at Buffalo in a vivarium and were kept on a strict day/night cycle according to the season.

Experimental Chamber: The test cage (Fig. 1) contained a perch, an automatic food hopper, and two vertical response keys extending downwards in front of the bird. A loudspeaker, located behind the bird, presented the call stimuli. Birds were trained using operant conditioning procedures and an identification task to peck the left key to call A and to peck the right key for call B.

Call Stimuli: Isolated and combined call stimuli were created for each budgerigar call. The isolated call stimuli were created by cutting the whole call into quarters and labeling them by their serial position within the call (e.g., 0-25%=1st quarter, 25-50%=2nd quarter). The combined call stimuli were created by adding isolated stimuli in the forward direction starting with the first quarter (e.g., 1+2, 1+2+3), and in the reverse direction starting with the last quarter(e.g., 3+4, 2+3+4).

Testing: Once birds passed training criteria (85% correct identification on the whole calls), they were moved to the testing phase, where they continued to be presented with the whole budgerigar calls on 80% of trials. On the other 20% of trials, isolated and combined call stimuli were presented, and either response (call A or call B) was reinforced. There was a total of three sessions in this experiment, each consisting of two different calls.

Data Analysis: Data were analyzed using a two-way repeated measures ANOVA with between-subjects effects of call stimuli and within-subjects effects of session.

Fig. 1

Stimuli

Fig. 2

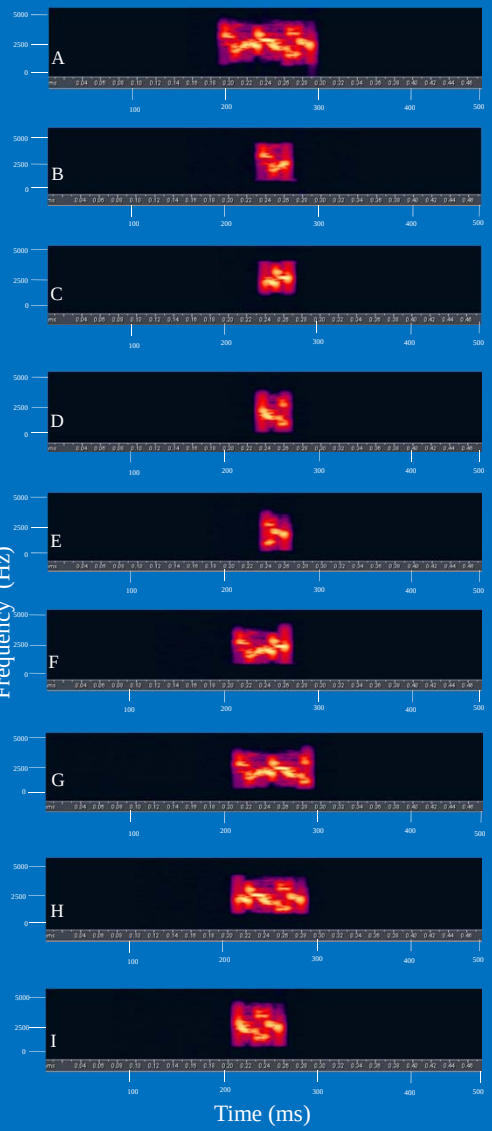

Figure 2. Spectrograms of the experimental stimuli. A) Complete call. B) Section 1 (0-25%). C) Section 2 (25-50%). D) Section 3 (50-75%). E) Section 4 (75-100%). F) Sections 1+2. G) Sections 1+2+3. H) Sections 2+3+4. I) Sections 3+4.

Fig. 3

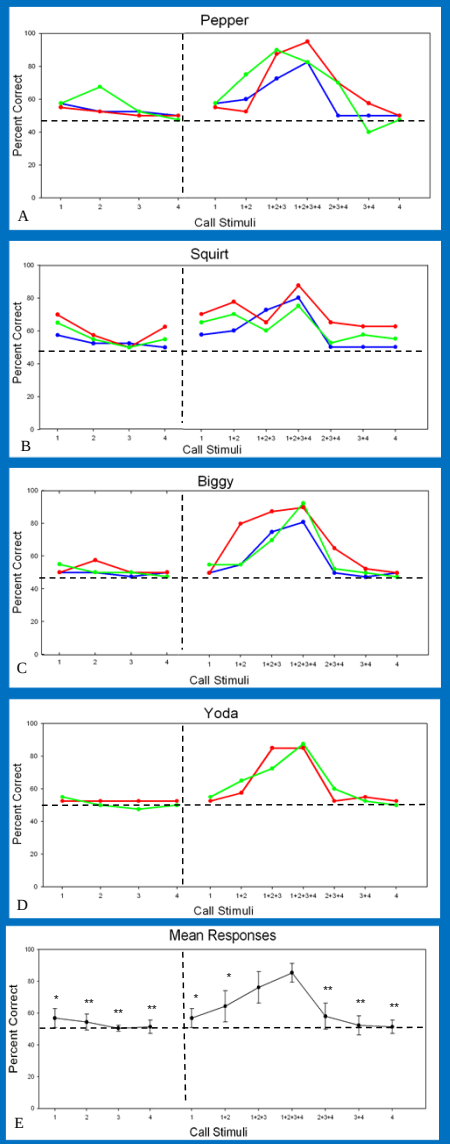

Figure 3. The different colors in the figures above represent different sessions, each consisting of two calls (i.e. Blue for session one, red for session two, green for session three). In the 'Mean Responses' figure, * = $p < 0.05$ and ** = $p < 0.01$ and represent significant difference from the whole call condition. Error bars represent between subjects standard deviations.

Results

A) Pepper was poor at identifying vocalizations when only 25% of the call was presented. When presented with 50-75% of vocal material in the forward direction, recognition accuracy dramatically increased.

B) Squirt was better in identifying vocalizations when only 25% was presented. Again, performance generally improved as more of the call was presented in the forward direction.

C) Biggy's accuracy at identifying only 25% of the vocalization was around chance and as more of the call was presented in the forward direction, recognition accuracy dramatically increased.

D) Yoda's performance was at chance with only 25% of vocal material. As more of the call was added in the forward direction, performance greatly improved.

E) On average, when 25% of vocal material was presented for the birds, recognition accuracy was at chance levels (50%). As more of a call was presented, recognition accuracy steadily increased, especially when the call was presented in the forward direction. Significant differences exist between the whole call and each isolated stimulus, as well as the reverse combined conditions. There were no significant differences between the whole call and the forward combined condition 1+2+3. Finally, there was no significant difference between any of the isolated stimuli.

Summary & Interpretations

- Budgerigars were generally poor at identifying vocalizations with only 25% of the material available.
- Recognition accuracy increased with the amount of vocal material presented .
- The beginning of the call appears to be more informative than the end of the call, suggesting that some cue at the beginning, not the end, aids in recognition.
- These results mimic findings with humans perceiving spoken words, and are another parallel between acoustic communication in humans and birds.

References and Acknowledgements

Knudsen, D., Thompson, J. V., & Gentner, T. Q. (2010). Distributed recognition of natural songs by European starlings. *Learning and Motivation* 41, 287-306.

Marslen-Wilson, W.D. Functional parallelism in spoken word-recognition. Cognition, 25, 71-102, 1987. (Reprinted in Psycholinguistics: Critical Concepts in Psychology, Vol.2, Altmann, G.T.M. (Ed.), New York: Routledge, 2002.)

Park, T. J., & Dooling, R. J. (1985). Perception of species-specific contact calls by budgerigars (*Melopsittacus undulatus*). *Journal of Comparative Psychology* 99, 391-402.

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