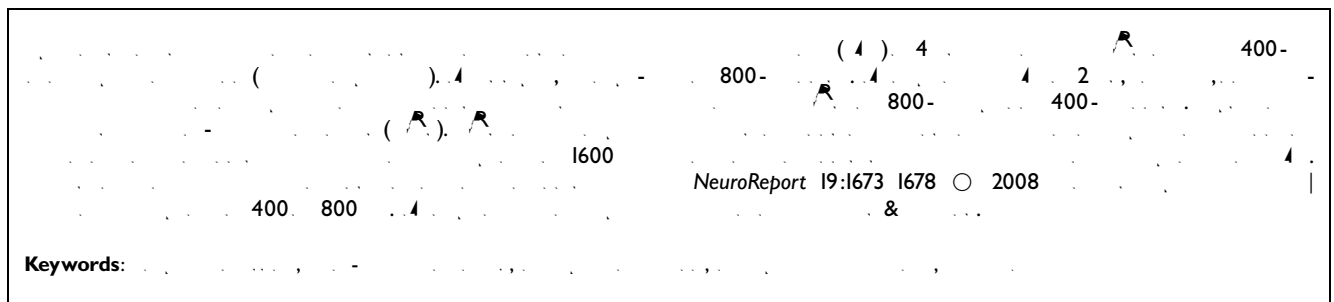


# Both frequency and interaural delay affect event-related potential responses to binaural gap

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## Introduction

The human brain is able to detect and respond to temporal discontinuities in sound. The binaural gap response (BGR) is an event-related potential (ERP) component that is elicited by a binaural gap in a sound stimulus. The BGR is thought to be generated by the auditory brainstem and is sensitive to the frequency and duration of the gap. In this study, we investigated the effects of frequency and interaural delay on the BGR. We found that the BGR amplitude is significantly affected by both frequency and interaural delay. The BGR amplitude is larger for higher frequencies and shorter interaural delays. These findings suggest that the BGR is a sensitive indicator of the temporal structure of sound and may play a role in the processing of speech and music.

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## Methods

Twenty healthy subjects (18 men and 2 women) participated in the study. The subjects were seated in a sound-attenuated chamber and listened to binaural stimuli through headphones. The stimuli consisted of a 100 ms tone burst followed by a 100 ms gap, followed by another 100 ms tone burst. The frequency of the tone bursts was either 400 Hz or 800 Hz, and the interaural delay was either 400 ms or 800 ms. The amplitude of the BGR was measured at 100 ms, 200 ms, and 300 ms after the end of the second tone burst.

15 B 125 8000H  
 A  
 T  
 12  
 G 1 E 1 2  
 H 2 T C P  
 P A S D P  
 C P U  
 G  
 2000 ( 30- / )  
 MATLAB (T M I N M  
 USA) 48 H 16-  
 T  
 200-  
 2 N  
 (SPL)  
 T G  
 512- FIR 10 H  
 512- FIR 400,  
 800, 1600H ( =1/3 ) T  
 C S  
 B (C SB A 2 S, C T S L,  
 S )  
 56 B SPL.  
 T  
 ERP 10,  
 200-  
 T  
 ERP  
 I E 1,  
 400, 800, 1600H  
 S ITD  
 0 E  
 160  
 32 T 768  
 16 I  
 10 T  
 1000  
 I E 2,  
 400H  
 800H T  
 ITD 0, 2, 4  
 T 12 E  
 2 E ( )  
 ITD )  
 120 T 864  
 24 T I

10  
 T  
 1000  
 E  
 (EMI S A E  
 A S S ) 64-  
 N S S A (C L V  
 A ) P  
 D ( : 0.05 40 H ;  
 : 1000 H )  
 F  
 F ERP  
 11 N  
 S (C L V A ) D  
 ERP 1500-  
 100- D  
 ERP 2400-  
 100- T  
 ( ± 100 mV )  
 F ERP  
 A ERP  
 20 H  
 T  
 E 1 ITD E 2,  
 N1 ( )  
 100 210  
 ) P2 ( 210 350 )  
 (F1, F2, FC1, FC2, C1, C2)

Results

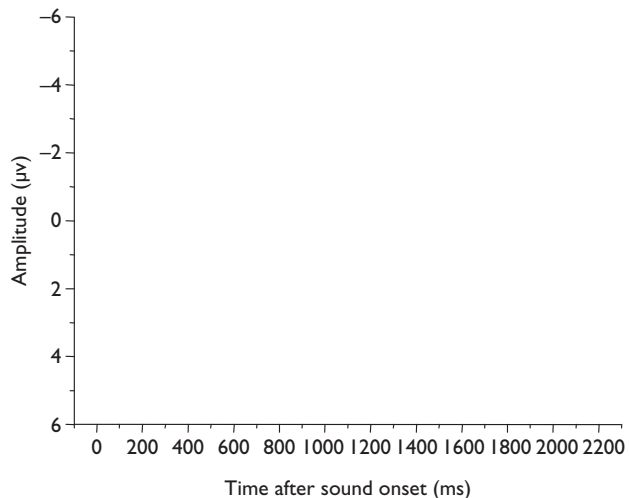
T 96.88% (SE=1.04%) E  
 1 98.59% (SE=0.50%) E 2 T  
 ERP I

Experiment 1

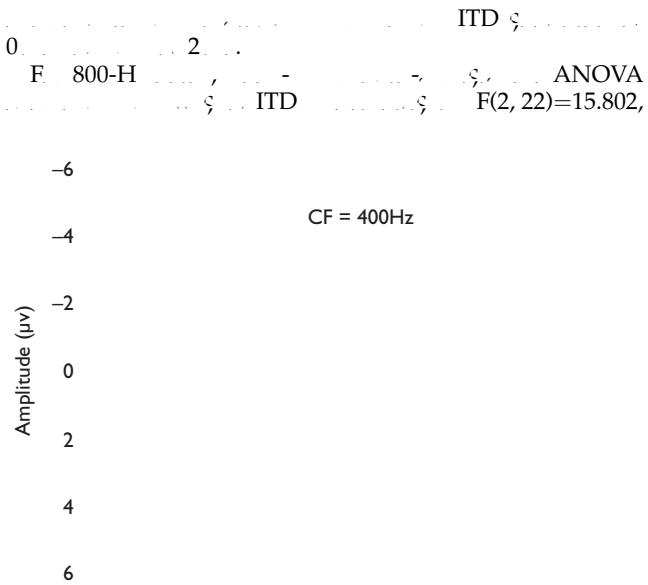
F 1 ERP  
 FC ITD 0 C  
 N1-P2 F ERP  
 N1-P2 ERP  
 F  
 (ANOVA) N1-P2  
 F(3,33)=18.883, P<0.001 . P ERP  
 t

( $P < 0.01$ ). N  
 ( $P < 0.05$ ). T F . 2  
 F 1 ERP  
 N1-P2  
 T ERP  
 1600-H

ANOVA  
 F(3,33)=8.998,  
 $P < 0.001$ . P  
 N1-P2 1600-H  
 400-H  
 ( $P < 0.001$ )  
 800-H  
 ( $P = 0.001$ ). T ERP  
 800-H 400-H  
 ( $P < 0.05$ ) ( F 2).



**Experiment 2**  
 I E 2, ERP 400-  
 H 800-H ITD  
 A  
 ITD.  
 F 3 ERP  
 FC 400-H  
 ( ) 800-H  
 ( ) ITD 0, 2,  
 4 C, ERP  
 ITD. P ITD 0 4  
 N1-P2  
 F 4 N1-P2  
 400-H ( ) 800-H  
 ( ) ITD. A ( )  
 (ITD) ANOVA  
 F(2, 22)=18.187,  $P < 0.001$ .  
 F 400-H ANOVA  
 ITD F(2, 22)=30.257,  
 $P < 0.001$ . P  
 N1-P2 ITD 4  
 ITD 0 ITD  
 2 ( $P < 0.001$ ). N



ITD 0 ITD 2 ITD 4  
 ERP 400-H 800-H  
 (t<sub>11</sub>=0.102, P=0.920)  
 ERP 400-H 800-H  
 (t<sub>11</sub>=5.707, P < 0.001)  
 ERP 400-H 800-H  
 (t<sub>11</sub>=-0.239, P=0.816)

### Discussion

I N1-P2 ERP  
 A  
 ERP  
 2,3 O  
 N1-P2  
 ERP T, ERP  
 T  
 SPL  
 ERP T  
 N1-P2 1600-H  
 400-H 800-H T  
 1600-H  
 400-H 800-H A  
 T  
 S 2  
 250 2000 H T  
 12

13. H, 2, ERP, ITD, M, S, 400-H, ITD, 4, ERP, 800-H, 2, 4, ERP, ITD, 400-H, 800-H, ITD, 14, T, ERP, I, ITD, 4, A, J, 15, O, A, ITD, 4, ERP, I, A, ERP, I, A, ERP, M, 21, ERP, M

ITD, N1, P2, 22,23, T, I, ERP, ITD, T, ( )

**Acknowledgements**

T, N, N, S, F, C, (30670704; 30711120563; 60605016; 60535030; 60435010) 985' P, U

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