

## XI. SIGNAL PROCESSING

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#### A. SIMULATOR OF AUDITORY LOCALIZATION CUES

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Preliminary experiments were conducted on a system for simulating auditory localization cues.<sup>1,2</sup> After a brief adaptation period, most listeners who were able to perceive good binaurally recorded images perceived the simulated sound source outside their head and were able to move the image in azimuth and elevation. A common report was that the image was broad and moved within 0.3 m of the head. The rear half of the hemisphere was usually simulated more realistically than the other half. A few listeners reported only a lateralized image (in-head) with spectral coloration changes.

Listening to the simulation of his own pinna, Subject B. T. perceived a good external image over the whole hemisphere, except for positions  $\pm 45^\circ$  in azimuth in the front. He was able to track the moving image on the horizontal plane from  $180^\circ$  to  $45^\circ$  in azimuth, at which point the image split into front and rear sources. Further forward movement of the joystick caused the rear image to dominate. This type of auditory spatial warping had been observed by the subject when he listened to binaural recordings from ears other than his own.

Subject C. L. S., after a brief adaptation period, also perceived an external image. Changes in elevation from  $0^\circ$  to  $45^\circ$  on the median plane were the hardest to sense, and again the rear half of the hemisphere was best simulated. The quality of the image was broad and close when in front of the subject. The errors of C. L. S. were mainly confusions between adjacent positions. For source positions in front, there was a bias toward  $45^\circ$  elevation, but there were very few front-rear mistakes, which indicated that the ambiguities of the cone of confusion were successfully resolved.

#### References

1. J. R. Boddie, "Simulation of Auditory Signals for Localization," Quarterly Progress Report No. 108, Research Laboratory of Electronics, M.I.T., January 15, 1973, p. 352.
2. J. R. Boddie, "A Real-Time Signal Processor for Simulating a Sound Source in Free Space," E. E. Thesis, Department of Electrical Engineering, M.I.T., September 1973.

