

## References

- Asano, F. Suzuki, Y. & Sone, T. (1990). Role of spectral cues in median plane localization. *Journal of the Acoustical Society of America*, **88**, 159-168.
- Batteau, D. W. (1968). Listening with the naked ear. In S. J. Freedman (Ed.), *The Neuropsychology of Spatially Oriented Behaviour*, Homewood IL: Dorsey Press, pp. 109-33.
- Blauert, J. (1969/70). Sound localization in the median plane. *Acustica*. **22**, 205-213.
- Blashfield, R. K. (1976). Mixture model tests of cluster analysis: Accuracy of four agglomerative hierarchical methods. *Psychological Bulletin*, **83**, 377-388.

## References

- Blauert, J. (1983). *Spatial Hearing: The psychophysics of human sound localization*. Cambridge, MA: MIT.
- Burger, J. F. (1958). Front-back discrimination of the hearing system. *Acustica*, **8**, 301-302.
- Butler, R. A. & Helwig, C. C. (1983). The spatial attributes of stimulus frequency in the median sagittal plane. *American Journal of Otolaryngology*, **4**, 165-173.
- Chandler, D. W., and Grantham, D. W. (1992). Minimum audible movement angle in the horizontal plane as a function of stimulus frequency and bandwidth, source azimuth, and velocity. *Journal of the Acoustical Society of America*, **91**, 1624-1636. .
- Fisher, H. G. & Freedman, A. J. (1968) The role of the pinna in auditory localization. *Journal of Auditory Research*, **8**, 15-26.
- Gardner (1973). Some monaural and binaural facets of median plane localization. *Journal of the Acoustical Society of America*, **54**, 1489-1495.
- Gilkey, R. H. & Anderson, T. R. (1995). The accuracy of absolute localization judgements for speech stimuli. *Journal of Vestibular research*, **5**, 487-497.

## References

- Harris, J. D. & Sergeant, R. L. (1971). Monaural/binaural minimum audible angle for a moving sound source. *Journal of Speech and Hearing Research*, **14**, 618-629.
- Hebrank, J. & Wright, D. (1974). Spectral cues used in the localization of sound sources on the median plane. *Journal of the Acoustical Society of America*, **56**, 1829-1834.
- Heffner, R. S. & Heffner, H. E. (1992). Visual factors in sound localization in mammals. *Journal of Comparative neurology*, **317**, 219-232.
- Jongkees, L. B. W. & van der Veer, R. A. (1958). On directional sound localization in unilateral deafness and its explanation. *Acta Oto-laryngol.* **49**, 119-131.
- Klumpp, R. G. and Eady, H. R. (1956). Some measurements of interaural time difference thresholds. *Journal of the Acoustical Society of America*, **28**, 859-60.
- Koenig, W. (1950). Subjective effects in binaural hearing. *Journal of the Acoustical Society of America*, **22**, 61-62.
- Kuhn, G. F. (1987). Physical acoustics and measurement pertaining to directional hearing. In W. A. Yost & G. Gourevitch (Eds.) *Directional hearing* (pp. 3-25). New York: Springer-Verlag.

## References

- Lishman, J. R. & Lee, D. N. (1973). The autonomy of visual kinaesthesia. *Perception*, **2**, 287-294.
- Middlebrooks, J. C. & Green, D. M. (1991). Sound localization by human listeners. *Annual Review of Psychology*, **42**, 135-159.
- Middlebrooks, J. C., Makous, J. C. & Green, D. M. (1989). Directional sensitivity of sound-pressure levels in the human ear canal. *Journal of the Acoustical Society of America*, **86**, 89-108.
- Mills, A. W. (1960). Lateralization of high-frequency tones. *Journal of the Acoustical Society of America*, **32**, 132-134.
- Mills, A. W. (1972). Auditory localization. In J. V. Tobias (Ed.), *Foundations of modern auditory theory* (pp. 303-348). New York: Academic Press.
- Musicant, A. D. & Butler, R. A. (1984). The influence of pinnae-based spectral cues on sound localization. *Journal of the Acoustical Society of America*, **75**, 1195-1200.
- Perrett, S. & Noble, W. (1995). Available response choices affect localization of sound. *Perception & Psychophysics*, **57**, 150-158.

## References

- Perrott, D. R. & Tucker, J. (1988). Minimum audible movement angle as a function of signal frequency and the velocity of the source. *Journal of the Acoustical Society of America*, **83**, 1522-1527.
- Perrott, D. R. & Musicant, A. D. (1977). Minimum auditory movement angle: Binaural localization of moving sound sources. *Journal of the Acoustical Society of America*, **62**, 1463-1466.
- Perrott, D. R., Saberi, K., Brown, K. and Strybel, T. Z. (1990). Auditory psychomotor coordination and visual search behaviour. *Perception and Psychophysics*, **48**, 214-226.
- Perrott, D. R., Buck, V., Waugh, W. and Strybel, T. Z. (1979). Dynamic auditory localization: Systematic replications of the auditory velocity function. *Journal of Auditory Research*, **19**, 277-285.
- Pollack, I. & Rose, M. (1967). Effect of head movement on the localization of sounds in the equatorial plane. *Perception & Psychophysics*, **2**, 591-596.
- Shaw, E. A. G. & Teranishi, R. (1968). Sound pressure generated in an external ear replica and real human ears by a nearby point source. *Journal of the Acoustical Society of America*, **44**, 240-249.
- Thompson, S. P. (1882). On the function of the two ears in the perception of space, *Philos Mag.* **13**, 406-416.

## References

- Thurlow, W. R. & Runge, P. S. (1967). Effect of induced head movements on localization of direction of sounds. *Journal of the Acoustical Society of America*, **42**, 480-488.
- Thurlow, W. R. & Mergener, J. R. (1970). Effect of stimulus duration on localization of direction of noise stimuli. *Journal of Speech and Hearing Research*, **13**, 826-838.
- Wallach, H. (1939). On sound localization. *Journal of the Acoustical Society of America*, **10**, 270-274.
- Wallach, H. (1940). The role of head movements and vestibular and visual cues in sound localization. *Journal of Experimental Psychology*, **27**, 339-368.
- Waugh, W., Strybel, T. Z. and Perrott, D. R. (1979). Perception of moving sounds: Velocity discrimination. *Journal of Auditory Research*, **19**, 103-110.
- Wightman, F. L. & Kistler, D. J. (1992). The dominant role of low-frequency interaural time differences in sound localization. *Journal of the Acoustical Society of America*, **91**, 1648-1661.
- Wightman, F. L. & Kistler, D. J. (1993). Sound localization. In W. Yost, A. Popper and R. Fay (Eds.), *Springer handbook of auditory research: Human psychophysics* (pp. 155-192). New York: Springer-Verlag.

## References

- Wightman, F. L. & Kistler, D. J. (1994). The importance of movements for localizing virtual auditory display objects. In G. Kramer (Ed.), *Proceedings of the 1994 international conference on auditory displays*. Santa Fe, NM.  
Available On-Line: <http://waisman.wisc.edu/hdrl/Spatial.htm>
- Wightman, F. L. & Kistler, D. J. (1997). Monaural sound localization revisited, *Journal of the Acoustical Society of America*, *101*, 1050-1063.
- Woodworth, R. S. and Schlosberg, H. (1954). *Experimental psychology* (Rev. ed.). London: Methuen.
- Yost, W. A. & Hafter, E. R. (1987). Lateralization. In W. A. Yost & G. Gourevitch (Eds.) *Directional hearing* (pp. 49-84). New York: Springer-Verlag.
- Young, P. T. (1928). Auditory localization with acoustical transposition of the ears. *Journal of Experimental Psychology*, *11*, 399-429.
- Young, P. T. (1931). The rôle of head movements in auditory localization. *Journal of Experimental Psychology*, *14*, 95-124.

## Appendix A: Data

Double-pole co-ordinates corresponding to each loudspeaker as identified by numbers used in data listing.

Loudspeaker	Azimuth	Elevation	
1	-90	0	LVP
2	-75	15	LVP
3	-60	30	LVP
4	-45	45	LVP
5	-30	60	LVP
6	-15	75	LVP
7	0	90	LVP
8	-75	0	Front
9	-60	0	Front
10	-45	0	Front
11	-30	0	Front
12	-15	0	Front
13	0	0	Front
14	-75	0	Back
15	-60	0	Back
16	-45	0	Back
17	-30	0	Back
18	-15	0	Back
19	0	0	Back
20	-75	-15	LVP
21	-60	-30	LVP
22	-45	-45	LVP
23	-30	-60	LVP
24	-15	-75	LVP
25	0	-90	LVP
27	0	30	Front
29	0	60	Front
32	0	60	Back
34	0	30	Back
37	0	-30	Back
39	0	-60	Back
42	0	-60	Front
44	0	-30	Front



## Appendix A: Data

**Front/back errors — Experiment 1****Rotate**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
8	0	0	0	0.00
9	0	0	0	0.00
10	0	0	0	0.00
11	0	0	0	0.00
12	0	0	0	0.00
13	0	0	0	0.00
14	0	0	0	0.00
15	0	0	0	0.00
16	0	0	0	0.00
17	0	0	0	0.00
18	0	0	0	0.00
19	0	0	0	0.00
Mean all speakers	0.00	0.00	0.00	0.00 Grand Mean

**Motionless**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
8	1	0	1	0.67
9	1	1	1	1.00
10	1	0	0	0.33
11	1	1	0	0.67
12	0	0	0	0.00
13	0	0	0	0.00
14	0	0	0	0.00
15	0	0	0	0.00
16	0	0	0	0.00
17	0	0	0	0.00
18	0	0	0	0.00
19	0	0	0	0.00
Mean all speakers	0.33	0.17	0.17	0.22 Grand Mean

**Pivot**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
8	1	0	0	0.33
9	0	0	0	0.00
10	1	0	0	0.33
11	0	0	0	0.00
12	0	0	0	0.00
13	0	0	0	0.00
14	0	0	0	0.00
15	0	0	0	0.00
16	0	0	0	0.00
17	0	0	0	0.00
18	0	0	0	0.00
19	0	0	0	0.00
Mean all speakers	0.17	0.00	0.00	0.06 Grand Mean

**Natural**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
8	0	0	0	0.00
9	0	0	0	0.00
10	0	0	0	0.00
11	0	0	0	0.00
12	0	0	0	0.00
13	0	0	0	0.00
14	0	0	0	0.00
15	0	0	0	0.00
16	0	0	0	0.00
17	0	0	0	0.00
18	0	0	0	0.00
19	0	0	0	0.00
Mean all speakers	0.00	0.00	0.00	0.00 Grand Mean

**Tip**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
8	1	0	0	0.33
9	1	0	0	0.33
10	1	1	0	0.67
11	0	1	0	0.33
12	0	1	0	0.33
13	0	1	0	0.33
14	0	0	0	0.00
15	0	0	0	0.00
16	0	0	0	0.00
17	0	0	0	0.00
18	0	0	0	0.00
19	0	0	0	0.00
Mean all speakers	0.25	0.33	0.00	0.19 Grand Mean

## Appendix A: Data

**Apparent elevation — Experiment 1****Rotate**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
1	0	0	15	5.00
2	0	0	30	10.00
3	0	15	15	10.00
4	0	30	0	10.00
5	0	30	45	25.00
6	0	75	15	30.00
7	0	60	90	50.00
8	0	0	0	0.00
9	0	0	30	10.00
10	0	0	0	0.00
11	0	15	0	5.00
12	0	30	15	15.00
13	0	30	0	10.00
14	0	0	0	0.00
15	0	0	15	5.00
16	0	-15	0	-5.00
17	0	0	0	0.00
18	0	0	15	5.00
19	0	0	15	5.00

**Tip**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
1	0	0	0	0.00
2	0	15	0	5.00
3	15	0	15	10.00
4	15	45	45	35.00
5	15	30	45	30.00
6	15	45	-15	15.00
7	0	30	-15	5.00
8	0	0	15	5.00
9	0	0	15	5.00
10	0	30	15	15.00
11	0	15	15	10.00
12	0	15	0	5.00
13	0	30	0	10.00
14	0	0	0	0.00
15	0	0	0	0.00
16	0	15	-15	0.00
17	0	15	-15	0.00
18	0	15	-30	-5.00
19	0	15	0	5.00

**Pivot**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
1	0	30	0	10.00
2	15	15	15	15.00
3	15	30	15	20.00
4	30	45	15	30.00
5	30	45	30	35.00
6	30	60	30	40.00
7	30	60	0	30.00
8	0	0	0	0.00
9	0	0	0	0.00
10	15	30	15	20.00
11	0	15	0	5.00
12	0	45	15	20.00
13	0	30	0	10.00
14	0	15	15	10.00
15	0	15	-15	0.00
16	0	30	-15	5.00
17	0	15	0	5.00
18	0	0	0	0.00
19	0	15	-15	0.00

**Motionless**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
1	0	0	15	5.00
2	15	0	0	5.00
3	15	15	30	20.00
4	15	30	15	20.00
5	15	45	-15	15.00
6	15	45	0	20.00
7	0	30	-15	5.00
8	0	0	0	0.00
9	0	-15	15	0.00
10	0	15	15	10.00
11	0	30	15	15.00
12	0	15	15	10.00
13	0	15	0	5.00
14	0	0	0	0.00
15	0	-15	0	-5.00
16	0	-15	0	-5.00
17	0	-15	0	-5.00
18	0	0	0	0.00
19	0	30	-15	5.00

Appendix A: Data

**Natural**

Loudspeaker	Listener			Mean all listeners
	1	2	3	
1	0	0	0	0.00
2	0	0	15	5.00
3	15	30	30	25.00
4	30	30	45	35.00
5	60	60	60	60.00
6	75	90	75	80.00
7	90	90	90	90.00
8	0	0	0	0.00
9	0	0	15	5.00
10	0	15	0	5.00
11	0	15	0	5.00
12	0	15	15	10.00
13	0	45	15	20.00
14	0	0	0	0.00
15	15	0	15	10.00
16	0	0	15	5.00
17	0	0	15	5.00
18	0	0	15	5.00
19	0	15	15	10.00
Mean all speakers				

**Pivot**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
8	0	0	0	0	0.00
9	0	0	0	0	0.00
10	0	0	0	0	0.00
11	0	0	0	0	0.00
12	0	0	0	0	0.00
13	0	0	0	0	0.00
14	0	0	0	0	0.00
15	0	0	0	0	0.00
16	0	0	0	0	0.00
17	0	0	0	0	0.00
18	0	0	0	0	0.00
19	1	0	0	0	0.25
Mean all speakers	0.08	0.00	0.00	0.00	0.02 Grand Mean

**Tip**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
8	0	0	1	0	0.25
9	0	1	1	0	0.50
10	0	1	1	0	0.50
11	0	1	1	0	0.50
12	1	1	0	0	0.50
13	0	0	0	0	0.00
14	0	0	0	0	0.00
15	0	0	0	0	0.00
16	0	0	0	0	0.00
17	0	0	0	0	0.00
18	0	0	0	0	0.00
19	1	0	0	1	0.50
Mean all speakers	0.17	0.33	0.33	0.08	0.23 Grand Mean

**Front Back errors — Experiment 2**

**Rotate**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
8	0	0	0	0	0.00
9	0	0	0	0	0.00
10	0	0	0	0	0.00
11	0	0	0	0	0.00
12	0	0	0	0	0.00
13	0	0	0	0	0.00
14	0	0	0	0	0.00
15	0	0	0	0	0.00
16	0	0	0	0	0.00
17	0	0	0	0	0.00
18	0	0	0	0	0.00
19	0	0	0	0	0.00
Mean all speakers	0.00	0.00	0.00	0.00	0.00 Grand Mean

**Motionless**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
8	0	0	1	0	0.25
9	0	0	1	0	0.25
10	0	0	1	0	0.25
11	0	1	1	0	0.50
12	0	0	1	0	0.25
13	0	0	1	0	0.25
14	0	0	0	0	0.00
15	0	0	0	1	0.25
16	0	0	0	1	0.25
17	0	0	0	0	0.00
18	0	0	0	0	0.00
19	0	0	0	1	0.25
Mean all speakers	0.00	0.08	0.50	0.25	0.21 Grand Mean

## Appendix A: Data

**Apparent elevation — Experiment 2****Rotate**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
1	0	0	0	0	0.00
2	15	0	0	15	7.50
3	0	0	0	30	7.50
4	30	30	15	45	30.00
5	30	15	0	60	26.25
6	45	15	0	15	18.75
7	0	15	15	45	18.75
8	0	15	0	0	3.75
9	0	0	0	15	3.75
10	0	15	0	15	7.50
11	0	15	0	15	7.50
12	0	30	0	0	7.50
13	0	15	0	0	3.75
14	0	0	0	15	3.75
15	0	15	0	0	3.75
16	0	15	0	15	7.50
17	0	0	0	15	3.75
18	0	0	0	0	0.00
19	0	15	0	15	7.50

**Tip**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
1	30	15	0	30	18.75
2	15	30	15	30	22.50
3	15	15	15	45	22.50
4	45	15	0	60	30.00
5	45	15	0	45	26.25
6	75	15	15	60	41.25
7	45	75	15	60	48.75
8	15	-15	0	30	7.50
9	30	0	15	45	22.50
10	30	0	0	30	15.00
11	60	-15	0	45	22.50
12	75	0	30	45	37.50
13	75	60	15	45	48.75
14	30	30	0	30	22.50
15	15	-15	0	15	3.75
16	15	15	0	45	18.75
17	30	0	0	75	26.25
18	45	0	0	15	15.00
19	60	-15	0	45	22.50

**Pivot**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
1	0	0	0	0	0.00
2	0	0	15	15	7.50
3	15	15	30	30	22.50
4	0	15	30	60	26.25
5	30	15	30	75	37.50
6	60	0	15	90	41.25
7	15	0	45	90	37.50
8	0	0	0	0	0.00
9	0	-15	0	0	-3.75
10	0	0	0	0	0.00
11	0	0	15	0	3.75
12	0	15	0	0	3.75
13	0	0	0	0	0.00
14	0	0	0	0	0.00
15	0	0	0	0	0.00
16	0	15	15	15	11.25
17	15	15	15	0	11.25
18	15	-15	15	0	3.75
19	30	-15	15	0	7.50

**Motionless**

Loudspeaker	Listener				Mean all listeners
	1	2	3	4	
1	0	0	0	0	0.00
2	15	0	0	0	3.75
3	30	15	30	15	22.50
4	30	-15	30	45	22.50
5	45	30	30	45	37.50
6	45	0	15	30	22.50
7	15	0	0	0	3.75
8	0	0	15	15	7.50
9	0	30	15	15	15.00
10	0	30	30	15	18.75
11	15	-15	30	15	11.25
12	15	0	0	30	11.25
13	15	15	0	0	7.50
14	0	0	0	0	0.00
15	0	-15	0	15	0.00
16	0	0	0	15	3.75
17	0	0	15	0	3.75
18	-15	0	0	0	-3.75
19	75	0	0	30	26.25

## Appendix A: Data

**Source-head-response (SHR) angle — Experiment 3****500-ms Rotate**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	15.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	45.00	8.33
2	0.00	15.00	30.00	21.09	15.00	15.00	15.00	0.00	25.38	15.16
3	33.23	15.00	15.00	15.00	30.00	30.00	30.00	0.00	38.13	22.93
4	0.00	15.00	0.00	30.00	60.00	46.92	46.92	60.00	37.31	32.91
5	30.42	30.00	77.94	0.00	69.30	61.12	38.13	82.56	30.00	46.61
6	56.64	15.00	91.48	21.09	93.84	82.56	25.38	93.84	21.09	55.66
7	60.00	15.00	0.00	0.00	90.00	90.00	90.00	75.00	30.00	50.00
8	0.00	0.00	0.00	18.69	15.00	0.00	0.00	0.00	31.42	7.24
9	0.00	19.71	30.42	15.00	0.00	0.00	15.00	15.44	32.20	14.20
10	15.14	15.14	15.14	45.00	0.00	0.00	0.00	15.14	31.40	15.22
11	117.76	15.04	0.00	0.00	0.00	0.00	0.00	15.04	20.72	18.73
12	61.12	15.01	15.01	33.23	15.01	0.00	21.09	55.35	15.00	25.65
13	30.00	48.85	30.00	15.00	0.00	0.00	0.00	15.00	75.00	23.76
14	21.09	0.00	0.00	21.09	15.00	15.00	15.00	15.00	15.00	13.02
15	0.00	0.00	15.44	0.00	15.00	15.00	0.00	15.44	19.71	8.96
16	15.14	0.00	0.00	15.00	0.00	0.00	0.00	31.40	20.29	9.09
17	0.00	22.57	0.00	45.00	0.00	0.00	0.00	15.00	30.00	12.51
18	0.00	15.01	0.00	79.45	15.00	0.00	0.00	15.01	60.00	20.50
19	0.00	0.00	0.00	15.00	0.00	15.00	0.00	0.00	45.00	8.33
Mean all loudspeakers	23.97	13.49	16.86	20.51	22.80	19.51	15.61	28.12	32.77	21.52 Grand Mean

**3-s Rotate**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	30.00	5.00
2	15.00	15.00	15.00	15.00	0.00	15.00	15.00	21.09	25.38	15.16
3	0.00	15.00	33.23	30.00	30.00	30.00	30.00	15.00	15.00	22.03
4	15.00	30.00	60.00	15.00	30.00	45.00	46.92	15.00	31.40	32.04
5	0.00	45.00	105.00	15.00	30.00	61.12	61.12	64.34	0.00	42.40
6	0.00	15.00	91.48	69.30	0.00	61.70	48.24	48.24	25.38	39.93
7	15.00	15.00	135.00	30.00	15.00	60.00	30.00	0.00	15.00	35.00
8	0.00	0.00	18.69	61.12	0.00	0.00	0.00	18.69	31.42	14.44
9	15.44	0.00	0.00	15.44	0.00	0.00	0.00	0.00	19.71	5.62
10	15.14	0.00	15.14	15.14	15.14	0.00	0.00	0.00	20.29	8.98
11	30.42	15.04	15.04	30.42	30.42	0.00	0.00	32.31	32.31	20.66
12	15.01	15.00	0.00	21.92	15.01	0.00	0.00	55.35	15.00	15.25
13	45.00	0.00	0.00	30.00	21.47	15.00	0.00	15.00	60.00	20.72
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	15.00	3.33
15	15.44	15.44	0.00	0.00	15.44	0.00	0.00	15.00	15.00	8.48
16	0.00	0.00	0.00	20.29	0.00	0.00	0.00	15.14	15.00	5.60
17	0.00	0.00	0.00	15.04	0.00	0.00	0.00	0.00	15.00	3.34
18	15.00	15.01	15.00	0.00	21.09	0.00	0.00	0.00	60.00	14.01
19	0.00	0.00	15.00	15.00	15.00	15.00	0.00	21.47	21.47	11.44
Mean all loudspeakers	10.34	10.29	28.08	20.98	12.56	15.94	12.17	18.51	24.34	17.02 Grand Mean

## Appendix A: Data

## 3-s Natural

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	0.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00	15.00	5.00
2	15.00	15.00	45.00	30.00	0.00	15.00	15.00	25.38	21.09	20.16
3	15.00	15.00	30.00	15.00	0.00	30.00	0.00	0.00	0.00	11.67
4	15.00	15.00	60.00	0.00	0.00	0.00	30.00	15.00	31.40	18.49
5	15.00	15.00	45.00	0.00	45.00	61.12	30.00	15.00	15.00	26.79
6	25.38	15.00	120.00	0.00	45.00	0.00	0.00	21.09	21.09	27.51
7	15.00	0.00	0.00	0.00	30.00	0.00	90.00	15.00	30.00	20.00
8	0.00	0.00	0.00	0.00	46.92	0.00	0.00	15.00	35.67	10.84
9	30.42	0.00	0.00	15.44	15.44	0.00	0.00	0.00	19.71	9.00
10	45.00	0.00	0.00	45.00	31.40	15.14	0.00	20.29	20.29	19.68
11	60.01	0.00	15.04	82.56	30.42	15.04	15.04	15.04	45.63	30.98
12	33.70	15.01	0.00	61.12	30.09	15.01	0.00	61.12	43.00	28.78
13	30.00	0.00	0.00	15.00	30.00	15.00	0.00	30.00	48.85	18.76
14	0.00	0.00	0.00	0.00	18.69	0.00	0.00	21.09	15.00	6.09
15	15.44	0.00	0.00	0.00	15.44	0.00	0.00	15.00	15.00	6.76
16	0.00	0.00	15.14	0.00	15.14	0.00	0.00	23.81	15.00	7.68
17	15.04	0.00	15.04	0.00	15.04	0.00	15.04	15.00	15.00	10.02
18	15.01	0.00	15.01	15.01	15.01	0.00	0.00	21.92	21.92	11.54
19	0.00	0.00	15.00	15.00	30.00	0.00	0.00	0.00	0.00	6.67
Mean	18.16	4.74	19.75	15.48	23.35	8.75	10.27	17.36	22.56	15.60
all loudspeakers										Grand Mean

## 500-ms Rotate

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	60.00	8.33
2	15.00	15.00	15.00	30.00	15.00	15.00	15.00	15.00	25.38	17.82
3	15.00	15.00	30.00	30.00	33.23	30.00	15.00	15.00	30.00	23.69
4	15.00	15.00	75.00	0.00	46.92	46.92	46.92	37.31	46.92	36.67
5	28.43	0.00	75.00	0.00	15.00	61.12	48.92	46.92	46.92	35.81
6	45.00	15.00	97.44	0.00	30.00	61.70	48.24	90.00	39.69	47.45
7	45.00	0.00	90.00	0.00	45.00	15.00	90.00	75.00	75.00	48.33
8	0.00	0.00	0.00	18.69	15.00	0.00	0.00	15.00	35.67	9.37
9	15.00	0.00	15.44	30.42	15.44	15.00	15.00	0.00	19.71	14.00
10	45.00	0.00	15.14	31.40	20.29	0.00	15.00	15.14	60.00	22.44
11	32.31	0.00	0.00	45.63	15.04	0.00	20.72	0.00	32.31	16.22
12	46.92	15.00	0.00	33.23	30.09	0.00	15.01	55.35	33.23	25.42
13	48.85	0.00	0.00	60.00	30.00	15.00	15.00	34.26	45.00	27.57
14	0.00	0.00	0.00	0.00	0.00	0.00	15.00	21.09	21.09	6.35
15	0.00	15.00	0.00	15.44	0.00	15.44	15.00	0.00	15.44	8.48
16	0.00	15.00	15.00	15.00	0.00	15.00	0.00	15.00	15.00	10.00
17	0.00	15.00	15.04	15.04	15.00	0.00	0.00	125.90	20.72	22.97
18	0.00	15.00	21.92	0.00	0.00	15.00	15.00	15.01	0.00	9.10
19	15.00	30.00	15.00	34.26	15.00	15.00	15.00	0.00	21.47	17.86
Mean	19.29	8.68	26.05	18.90	17.95	16.85	21.31	30.31	33.87	21.47
all loudspeakers										Grand Mean

## Appendix A: Data

**500-ms Motionless**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	15.00	15.00	15.00	15.00	15.00	0.00	0.00	15.00	30.00	13.33
2	0.00	15.00	21.09	21.09	21.09	21.09	0.00	0.00	15.00	12.71
3	0.00	0.00	28.43	0.00	41.41	15.00	30.00	28.43	0.00	15.92
4	0.00	0.00	15.00	15.00	57.55	30.00	31.40	31.40	30.00	23.37
5	55.78	0.00	30.00	0.00	75.52	38.13	38.13	38.13	42.12	35.31
6	41.41	0.00	96.93	41.41	71.52	45.00	25.38	67.70	21.09	45.60
7	60.00	90.00	120.00	90.00	75.00	90.00	90.00	75.00	45.00	81.67
8	15.00	18.69	15.00	21.09	15.00	21.09	15.00	21.09	18.69	17.85
9	15.44	15.44	57.58	30.00	73.54	0.00	0.00	33.23	19.71	27.22
10	71.95	15.14	15.14	71.95	88.01	31.40	0.00	15.14	60.00	40.97
11	117.76	30.42	15.04	100.55	120.00	15.04	0.00	45.63	38.13	53.62
12	146.30	30.09	15.01	86.16	158.91	30.09	61.12	33.23	61.12	69.11
13	30.00	0.00	15.00	165.00	165.00	0.00	15.00	60.00	60.00	56.67
14	0.00	0.00	21.09	0.00	0.00	15.00	15.00	15.00	21.09	9.69
15	33.23	0.00	30.00	15.44	0.00	33.23	45.00	15.00	15.00	20.77
16	15.14	0.00	23.81	15.14	15.14	46.92	0.00	0.00	23.81	15.55
17	15.04	0.00	38.13	0.00	0.00	86.42	0.00	15.00	15.04	18.85
18	0.00	0.00	110.70	15.00	0.00	21.92	0.00	164.99	21.09	37.08
19	21.47	165.00	145.74	15.00	15.00	0.00	30.00	150.00	48.85	65.67
Mean all loudspeakers	34.40	20.78	43.62	37.78	53.04	28.44	20.84	43.37	30.83	34.79 Grand Mean

**Front-back errors — Experiment 3****500-ms Rotate**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	NM	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean all loudspeakers	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 Grand Mean

Note: NM indicates trial involving front back error but data discounted because listener failed to move.

Appendix A: Data

**3-s Rotate**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
all loudspeakers	Grand Mean									

**3-s Natural**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
all loudspeakers	Grand Mean									

**500-ms Rotate**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	NM	0.00	0.11
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
all loudspeakers	Grand Mean									

Note: NM indicates trial involving front back error but data discounted because listener failed to move.



## Appendix A: Data

**500-ms Motionless**

Loudspeaker	Listener									Mean all listeners	
	1	2	3	4	5	6	7	8	9		
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.22
10	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.33
11	1.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.33
12	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.22
13	0.00	0.00	0.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00	0.22
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.11
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.11
18	0.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.22
19	0.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.33
Mean all loudspeakers	0.25	0.08	0.25	0.25	0.42	0.08	0.08	0.17	0.00		0.18 Grand Mean

**Apparent elevation — Experiment 3****500-ms Rotate (1)**

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	15.00	0.00	0.00	0.00	0.00	0.00	0.00	-15.00	45.00	5.00
2	15.00	0.00	-15.00	0.00	0.00	0.00	0.00	15.00	15.00	3.33
3	0.00	15.00	15.00	45.00	0.00	0.00	0.00	30.00	45.00	16.67
4	45.00	30.00	45.00	15.00	0.00	0.00	0.00	0.00	15.00	16.67
5	45.00	30.00	-15.00	60.00	0.00	0.00	30.00	-15.00	90.00	25.00
6	30.00	90.00	-15.00	75.00	0.00	0.00	60.00	-15.00	75.00	33.33
7	30.00	75.00	90.00	90.00	0.00	0.00	0.00	15.00	60.00	40.00
8	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	15.00	3.33
9	0.00	15.00	-30.00	0.00	0.00	0.00	0.00	15.00	15.00	1.67
10	15.00	15.00	15.00	45.00	0.00	0.00	0.00	15.00	30.00	15.00
11	-15.00	15.00	0.00	0.00	0.00	0.00	0.00	15.00	15.00	3.33
12	60.00	15.00	15.00	30.00	15.00	0.00	15.00	-45.00	0.00	11.67
13	30.00	45.00	30.00	15.00	0.00	0.00	0.00	15.00	75.00	23.33
14	15.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	3.33
15	0.00	0.00	15.00	0.00	0.00	0.00	0.00	-15.00	15.00	1.67
16	-15.00	0.00	0.00	0.00	0.00	0.00	0.00	-30.00	15.00	-3.33
17	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.67
18	0.00	15.00	0.00	45.00	0.00	0.00	0.00	15.00	0.00	8.33
19	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	30.00	5.00

## Appendix A: Data

## 3-s Rotate

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	0.00	0.00	-15.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00
2	0.00	0.00	0.00	30.00	15.00	0.00	0.00	0.00	15.00	6.67
3	30.00	15.00	0.00	0.00	0.00	0.00	0.00	15.00	15.00	8.33
4	30.00	15.00	-15.00	60.00	15.00	0.00	0.00	30.00	45.00	20.00
5	60.00	15.00	-45.00	75.00	30.00	0.00	0.00	0.00	60.00	21.67
6	75.00	60.00	-15.00	30.00	75.00	15.00	30.00	30.00	60.00	40.00
7	75.00	75.00	-45.00	60.00	75.00	30.00	60.00	90.00	75.00	55.00
8	0.00	0.00	-15.00	60.00	0.00	0.00	0.00	-15.00	15.00	5.00
9	15.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	15.00	5.00
10	15.00	0.00	-15.00	15.00	15.00	0.00	0.00	0.00	15.00	5.00
11	30.00	15.00	-15.00	30.00	30.00	0.00	0.00	30.00	30.00	16.67
12	15.00	0.00	0.00	15.00	15.00	0.00	0.00	-45.00	0.00	0.00
13	45.00	0.00	0.00	30.00	15.00	0.00	0.00	15.00	30.00	15.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	15.00	15.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	5.00
16	0.00	0.00	0.00	-15.00	0.00	0.00	0.00	15.00	0.00	0.00
17	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	1.67
18	0.00	15.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	3.33
19	0.00	0.00	0.00	-15.00	15.00	0.00	0.00	15.00	15.00	3.33

## 3-s Natural

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	0.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00	0.00	3.33
2	30.00	0.00	-30.00	-15.00	15.00	0.00	0.00	15.00	0.00	1.67
3	45.00	15.00	0.00	15.00	30.00	0.00	30.00	30.00	30.00	21.67
4	60.00	30.00	-15.00	45.00	45.00	45.00	15.00	60.00	30.00	35.00
5	75.00	75.00	15.00	60.00	75.00	0.00	30.00	75.00	75.00	53.33
6	60.00	90.00	-45.00	75.00	60.00	75.00	75.00	75.00	75.00	60.00
7	75.00	90.00	90.00	90.00	60.00	90.00	0.00	75.00	60.00	70.00
8	0.00	0.00	0.00	0.00	45.00	0.00	0.00	0.00	30.00	8.33
9	30.00	0.00	0.00	15.00	15.00	0.00	0.00	0.00	15.00	8.33
10	45.00	0.00	0.00	45.00	30.00	15.00	0.00	15.00	15.00	18.33
11	60.00	0.00	-15.00	75.00	30.00	15.00	15.00	15.00	45.00	26.67
12	-15.00	15.00	0.00	60.00	30.00	15.00	0.00	60.00	30.00	21.67
13	30.00	0.00	0.00	15.00	30.00	15.00	0.00	30.00	45.00	18.33
14	0.00	0.00	0.00	0.00	15.00	0.00	0.00	15.00	0.00	3.33
15	15.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	3.33
16	0.00	0.00	-15.00	0.00	15.00	0.00	0.00	15.00	0.00	1.67
17	15.00	0.00	-15.00	0.00	15.00	0.00	-15.00	0.00	0.00	0.00
18	15.00	0.00	-15.00	15.00	15.00	0.00	0.00	15.00	15.00	6.67
19	0.00	0.00	-15.00	15.00	30.00	0.00	0.00	0.00	0.00	3.33

## Appendix A: Data

## 500-ms Rotate (2)

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.00	6.67
2	0.00	0.00	0.00	-15.00	0.00	0.00	0.00	0.00	15.00	0.00
3	15.00	15.00	0.00	0.00	0.00	0.00	15.00	15.00	0.00	6.67
4	60.00	30.00	-30.00	45.00	0.00	0.00	0.00	15.00	15.00	15.00
5	60.00	60.00	-15.00	60.00	45.00	0.00	15.00	30.00	30.00	31.67
6	60.00	60.00	0.00	75.00	75.00	15.00	30.00	0.00	60.00	41.67
7	45.00	90.00	0.00	90.00	45.00	75.00	0.00	15.00	15.00	41.67
8	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	30.00	5.00
9	0.00	0.00	-15.00	30.00	15.00	0.00	0.00	0.00	15.00	5.00
10	45.00	0.00	-15.00	30.00	15.00	0.00	0.00	15.00	45.00	15.00
11	30.00	0.00	0.00	45.00	15.00	0.00	15.00	0.00	30.00	15.00
12	45.00	0.00	0.00	30.00	30.00	0.00	15.00	-45.00	30.00	11.67
13	45.00	0.00	0.00	60.00	30.00	0.00	0.00	30.00	30.00	21.67
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	15.00	3.33
15	0.00	0.00	0.00	-15.00	0.00	15.00	0.00	0.00	15.00	1.67
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	-15.00	15.00	0.00	0.00	0.00	30.00	15.00	5.00
18	0.00	0.00	-15.00	0.00	0.00	0.00	0.00	-15.00	0.00	-3.33
19	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	15.00	3.33

## 500-ms Motionless

Loudspeaker	Listener									Mean all listeners
	1	2	3	4	5	6	7	8	9	
1	15.00	0.00	-15.00	15.00	0.00	0.00	0.00	15.00	15.00	5.00
2	15.00	0.00	0.00	0.00	0.00	0.00	15.00	15.00	0.00	5.00
3	30.00	30.00	15.00	30.00	0.00	15.00	0.00	15.00	30.00	18.33
4	45.00	45.00	30.00	30.00	15.00	15.00	30.00	45.00	15.00	30.00
5	30.00	60.00	30.00	60.00	0.00	30.00	30.00	30.00	45.00	35.00
6	45.00	75.00	-15.00	45.00	15.00	30.00	60.00	15.00	75.00	38.33
7	30.00	0.00	-30.00	0.00	15.00	0.00	0.00	15.00	45.00	8.33
8	0.00	15.00	0.00	-15.00	0.00	-15.00	0.00	15.00	15.00	1.67
9	15.00	15.00	15.00	0.00	15.00	0.00	0.00	15.00	15.00	10.00
10	15.00	15.00	-15.00	15.00	15.00	30.00	0.00	15.00	45.00	15.00
11	15.00	30.00	15.00	45.00	0.00	15.00	0.00	45.00	30.00	21.67
12	15.00	30.00	-15.00	75.00	15.00	30.00	60.00	30.00	60.00	33.33
13	30.00	0.00	15.00	15.00	15.00	0.00	0.00	60.00	30.00	18.33
14	0.00	0.00	-15.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00
15	15.00	0.00	0.00	15.00	0.00	15.00	0.00	0.00	0.00	5.00
16	15.00	0.00	-15.00	-15.00	15.00	15.00	0.00	0.00	15.00	3.33
17	15.00	0.00	-30.00	0.00	0.00	15.00	0.00	0.00	15.00	1.67
18	0.00	0.00	-45.00	0.00	0.00	15.00	0.00	15.00	15.00	0.00
19	15.00	0.00	-30.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00

**SHR angle — Experiment 4****3-s Natural**

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	3.33	0.89	2.27	1.60	1.50	1.81	3.76	6.95	1.24	7.10	4.68	10.09	3.77
2	13.21	21.05	13.26	12.27	12.08	12.79	15.65	13.29	13.65	20.57	8.69	9.80	13.86
3	27.73	28.68	17.21	21.18	23.80	28.05	31.62	24.74	24.05	36.48	8.51	33.33	25.45
4	9.07	34.95	4.33	40.98	10.51	42.79	67.70	37.78	10.84	29.15	10.21	26.57	27.07
5	34.76	5.82	37.24	57.05	20.13	57.54	87.99	31.22	22.20	68.77	10.54	15.55	37.40
6	29.74	12.15	59.49	13.85	39.27	80.29	98.39	17.24	35.20	63.66	23.21	16.42	40.74
7	59.85	11.43	18.20	5.06	63.04	89.82	42.61	48.57	32.96	86.90	14.63	16.36	40.79
8	4.28	9.06	4.03	1.78	3.47	3.94	14.24	2.38	4.01	11.41	17.95	2.60	6.60
9	4.10	8.84	4.22	1.64	5.39	3.72	5.00	2.99	3.35	0.53	18.35	8.49	5.55
10	11.82	3.86	11.87	8.65	1.42	0.98	18.04	2.56	15.26	28.69	29.86	0.98	11.17
11	19.76	1.86	9.76	1.30	2.05	1.20	9.42	1.45	14.62	13.59	21.93	0.93	8.16
12	28.92	1.44	21.01	14.56	1.59	0.23	8.15	6.14	2.15	14.53	16.02	7.63	10.20
13	20.14	2.83	11.30	22.27	3.81	0.20	35.78	2.89	21.40	28.88	15.97	1.48	13.91
14	4.57	2.45	8.00	9.76	4.58	2.67	7.94	11.97	5.01	15.25	8.42	3.33	7.00
15	1.67	1.16	7.69	4.18	4.38	5.15	13.99	10.10	2.83	12.93	6.59	1.47	6.01
16	3.10	3.04	2.28	12.09	0.77	5.79	4.51	12.33	1.88	13.71	9.04	0.73	5.77
17	5.11	2.04	4.78	1.39	1.81	3.90	16.17	10.49	4.33	5.64	11.35	0.88	5.66
18	2.13	2.38	2.45	1.86	2.05	5.71	18.65	14.12	2.57	22.88	10.13	1.32	7.19
19	10.12	3.09	2.94	1.96	3.92	179.74	8.80	12.25	3.95	13.73	11.91	2.13	21.21
20	14.06	8.72	17.45	13.04	16.67	17.15	7.19	8.74	13.91	1.25	18.95	12.06	12.43
21	30.00	1.80	19.78	12.84	10.40	32.03	7.14	11.21	5.49	14.17	31.68	26.77	16.94
22	7.63	8.49	5.38	5.11	25.27	46.92	5.12	11.01	5.51	3.28	60.17	3.19	15.59
23	32.36	3.76	13.78	10.75	2.32	60.29	14.09	4.74	20.84	3.00	49.16	36.48	20.96
24	100.38	15.46	140.36	74.45	46.78	76.91	23.05	23.59	86.44	91.13	131.40	94.77	75.39
25	109.60	163.03	105.36	49.63	97.55	90.23	135.51	94.61	117.96	155.91	151.77	104.95	114.68
Mean	23.50	14.33	21.78	15.97	16.18	33.99	28.02	16.93	18.87	30.53	28.04	17.53	22.14
All loudspeakers													Grand Mean

## 0.5-s Natural

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	1.90	2.54	8.69	1.77	2.06	2.49	4.64	14.88	5.29	11.99	4.43	1.06	5.15
2	13.62	16.59	11.47	6.67	9.60	19.81	18.01	16.57	15.93	20.92	9.39	13.26	14.32
3	30.10	30.99	6.78	23.11	20.76	26.01	36.76	29.46	27.25	20.00	23.08	17.20	24.29
4	46.10	32.17	14.54	27.76	23.93	53.88	70.62	40.95	43.47	23.39	29.94	38.99	37.15
5	71.96	13.85	21.80	64.61	49.14	84.64	103.53	82.88	63.81	52.11	49.48	48.73	58.88
6	82.69	53.87	51.72	86.21	74.97	88.53	117.58	103.14	87.96	64.45	44.77	58.44	76.19
7	94.21	17.57	62.74	103.52	70.25	89.79	109.97	96.46	76.34	62.91	31.27	58.93	72.83
8	0.93	23.04	23.05	14.84	11.40	2.04	8.90	14.87	6.05	14.79	14.88	8.72	11.96
9	3.16	21.59	29.91	32.66	3.99	2.47	27.99	55.86	1.71	9.90	20.39	5.09	17.89
10	5.42	38.71	49.36	62.02	7.23	0.68	45.52	85.19	17.36	14.50	37.56	8.26	30.98
11	4.36	7.57	48.85	100.85	3.85	12.70	17.97	67.55	11.10	13.22	19.96	4.34	26.03
12	1.98	26.98	28.90	128.64	10.44	1.32	22.08	125.42	13.20	15.71	57.00	7.41	36.59
13	1.28	22.18	28.20	170.33	8.19	0.36	24.72	77.92	13.60	19.00	25.57	9.89	33.44
14	9.24	10.60	27.30	20.71	14.15	28.95	19.42	12.63	15.96	9.09	18.02	8.76	16.24
15	13.43	6.53	50.30	7.60	22.51	21.54	30.36	10.18	5.33	5.83	11.55	5.78	15.91
16	11.48	9.13	62.34	23.93	28.54	7.26	45.92	18.98	9.35	30.60	13.47	11.02	22.67
17	7.87	12.65	14.85	11.04	16.43	6.57	26.84	15.63	9.99	63.58	11.61	6.03	16.92
18	3.24	61.71	29.67	4.38	23.11	150.72	18.53	18.11	12.66	60.32	69.41	11.43	38.61
19	87.15	5.68	23.93	13.92	89.68	170.03	139.07	36.54	167.46	35.83	167.00	11.75	79.00
20	14.94	3.10	11.91	50.01	12.76	27.20	7.64	20.52	3.34	10.40	23.10	15.54	16.71
21	30.89	12.65	24.26	17.97	19.04	41.28	19.02	27.48	2.38	18.47	42.78	27.70	23.66
22	47.73	2.57	11.72	30.11	22.11	37.66	9.32	27.55	15.98	16.11	51.00	19.31	24.26
23	62.72	3.15	6.20	47.03	32.67	60.05	38.20	50.62	39.20	19.92	73.69	42.12	39.63
24	77.43	17.02	142.74	67.68	92.96	98.94	33.38	53.70	73.04	127.28	126.59	90.10	83.41
25	86.88	101.55	131.09	64.86	96.41	90.27	52.13	51.95	77.85	144.32	124.49	108.41	94.18
Mean	32.43	22.16	36.89	47.29	30.65	45.01	41.92	46.20	32.62	35.39	44.02	25.53	36.68
All loudspeakers													Grand Mean

## 3-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	1.59	8.85	2.58	9.28	3.03	2.10	5.03	2.58	1.26	7.11	5.34	3.09	4.32
2	15.55	24.06	14.20	15.71	10.35	16.75	11.01	18.48	14.06	20.47	3.94	14.85	14.95
3	29.60	44.15	30.04	30.26	11.24	32.21	27.78	29.30	27.46	43.34	28.88	32.68	30.58
4	43.71	51.50	21.04	47.65	12.64	44.97	43.39	70.35	25.42	49.76	4.67	46.62	38.48
5	97.24	59.38	9.76	63.72	25.60	63.11	40.32	109.21	51.04	110.03	23.84	65.13	59.87
6	65.68	11.93	6.92	16.79	72.33	75.73	35.23	92.54	48.98	14.62	12.38	30.85	40.33
7	89.48	19.95	9.97	12.10	73.31	89.33	3.94	117.04	59.52	24.15	45.86	97.51	53.51
8	1.68	17.74	6.13	7.99	10.03	7.48	6.08	3.24	2.24	9.37	4.78	1.25	6.50
9	2.46	18.65	5.29	8.78	4.84	1.48	10.23	17.07	5.47	6.99	12.33	4.85	8.20
10	1.54	11.88	11.24	6.24	4.75	0.90	3.69	9.43	11.69	15.30	25.37	0.66	8.56
11	1.78	2.53	4.67	3.02	1.43	1.13	6.63	2.14	12.32	21.12	23.06	0.51	6.70
12	2.19	3.73	2.91	6.82	2.64	0.93	19.69	2.58	12.23	22.28	18.04	1.33	7.95
13	7.26	2.01	7.86	11.57	5.33	0.38	33.66	1.92	10.30	14.49	12.01	1.67	9.04
14	5.94	11.75	5.99	13.59	10.05	14.84	8.10	10.48	7.98	8.88	9.50	15.14	10.19
15	2.73	17.63	3.72	12.01	8.37	2.27	8.40	15.07	2.26	18.13	10.10	2.59	8.61
16	4.66	8.40	7.39	14.17	9.99	2.31	14.32	12.06	4.14	11.46	10.48	1.50	8.41
17	2.60	1.65	10.23	25.85	12.98	15.58	11.22	10.06	12.60	18.23	7.50	7.51	11.33
18	7.76	15.01	17.58	9.79	17.06	16.21	19.98	23.24	25.65	16.73	5.17	7.80	15.17
19	15.10	27.95	13.01	35.82	13.36	14.60	20.24	32.20	19.15	40.49	13.50	11.54	21.41
20	8.20	12.86	13.43	15.13	16.11	22.52	16.58	10.26	6.36	7.60	20.51	14.56	13.68
21	23.31	12.30	16.02	13.93	24.83	34.08	30.30	5.93	4.87	17.31	41.34	30.05	21.19
22	37.63	5.34	4.07	13.14	22.24	48.36	31.41	10.04	5.89	5.22	31.41	39.11	21.16
23	20.37	12.61	5.63	26.90	45.63	63.91	19.40	7.04	24.18	23.03	67.75	42.04	29.87
24	66.53	21.26	122.51	27.35	75.34	78.23	119.14	34.84	70.22	86.05	131.51	83.76	76.40
25	93.10	102.10	171.55	168.54	103.98	90.63	150.74	67.73	105.62	139.90	102.21	116.81	117.74
Mean	25.91	21.01	20.95	24.65	23.90	29.60	27.86	28.59	22.84	30.08	26.86	26.94	25.77
All loudspeakers													Grand Mean



## 3-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.74	4.96	2.08	8.48	7.46	14.29	2.32	7.00	1.60	8.40	14.71	3.28	6.28
2	14.03	12.95	13.93	13.03	8.98	25.54	29.71	17.07	15.21	10.86	10.11	14.87	15.52
3	30.35	17.04	18.38	31.37	12.98	46.08	26.29	22.59	12.91	13.72	17.30	22.19	22.60
4	62.14	27.86	16.49	29.71	21.65	59.28	67.54	30.49	24.38	18.39	13.81	51.07	35.23
5	67.70	41.57	22.13	37.42	47.22	75.74	107.80	55.15	60.09	40.96	11.07	67.60	52.87
6	69.63	35.58	48.95	55.11	80.83	85.92	84.53	69.66	82.94	44.88	41.85	81.67	65.13
7	92.33	64.85	68.71	98.38	74.36	89.84	32.66	96.78	79.66	37.55	36.86	95.67	72.30
8	12.84	16.11	17.58	12.74	17.59	13.45	7.85	18.80	10.02	10.41	17.07	11.69	13.85
9	16.27	55.55	40.76	29.33	39.38	7.67	26.77	52.49	52.27	30.21	23.10	22.92	33.06
10	3.06	88.16	76.91	41.96	23.42	16.07	35.46	83.33	30.03	15.53	44.43	13.45	39.32
11	1.42	111.37	105.93	66.27	12.54	13.11	55.72	109.91	88.67	9.78	63.65	51.10	57.46
12	0.59	144.39	121.14	111.49	81.43	0.32	31.79	144.40	72.75	43.87	105.97	15.82	72.83
13	2.70	174.42	102.99	95.59	83.91	0.33	22.61	167.91	17.86	61.65	93.10	0.36	68.62
14	20.77	13.43	15.60	16.85	15.81	37.40	20.98	6.94	16.70	4.99	16.01	14.47	16.66
15	4.36	16.89	26.64	21.18	28.16	67.22	29.31	7.79	21.82	34.82	27.84	30.59	26.39
16	3.21	27.81	16.11	13.39	22.55	55.45	12.73	15.84	10.76	63.79	19.80	11.45	22.74
17	4.15	21.58	7.18	21.03	51.68	15.19	4.06	14.39	16.76	91.78	13.65	11.65	22.76
18	3.24	15.39	18.61	10.03	82.05	149.65	10.28	10.23	12.83	68.30	13.95	12.03	33.88
19	11.01	12.89	22.17	14.16	17.92	179.58	139.59	11.41	88.01	37.15	83.61	3.79	51.77
20	15.04	16.07	15.03	11.98	11.46	25.04	10.08	17.83	2.17	8.47	21.88	10.87	13.83
21	34.06	42.60	21.45	22.51	30.42	38.66	10.65	21.92	1.40	26.94	59.70	30.33	28.39
22	56.92	87.51	29.04	23.45	33.82	54.21	24.67	22.94	7.70	18.35	69.06	34.75	38.54
23	59.35	66.83	35.26	33.20	45.72	65.45	20.06	57.20	33.00	22.45	82.10	48.88	47.46
24	83.54	84.88	130.94	153.19	86.51	86.28	98.53	68.72	48.67	75.10	121.10	86.46	93.66
25	84.32	77.70	139.06	161.44	104.64	90.18	141.36	90.73	75.43	158.57	139.57	84.42	112.29
Mean	30.15	51.14	45.32	45.33	41.70	52.48	42.13	48.86	35.35	38.28	46.45	33.26	42.54
All loudspeakers													Grand Mean



## 0.5-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	1.74	8.38	8.16	7.18	1.68	23.45	3.03	17.43	2.60	15.67	9.00	1.86	8.35
2	14.13	17.57	13.78	3.95	6.13	30.81	15.90	5.02	15.40	19.26	10.93	11.93	13.73
3	28.51	22.26	22.92	32.78	18.54	56.00	43.38	21.83	39.25	36.33	26.02	7.03	29.57
4	44.60	5.58	74.67	39.82	28.90	68.39	75.49	34.67	59.05	26.71	14.47	31.83	42.02
5	64.93	21.71	14.91	67.70	54.48	79.11	96.84	56.07	67.32	37.73	18.52	55.47	52.90
6	86.77	30.14	135.41	71.28	76.19	89.64	105.59	69.35	87.79	39.59	50.83	97.09	78.31
7	90.20	56.99	114.83	90.65	83.86	89.55	118.98	97.11	73.74	32.59	46.56	109.93	83.75
8	5.26	13.44	14.32	16.73	15.00	16.00	16.82	23.30	1.42	22.96	21.71	13.96	15.08
9	8.45	22.16	28.23	30.37	4.36	9.96	28.08	18.70	3.00	39.57	43.84	25.66	21.87
10	1.41	66.95	31.24	50.92	8.98	8.18	53.90	53.14	32.46	52.24	45.53	52.98	38.16
11	4.19	68.90	59.51	92.67	1.82	14.37	21.84	61.99	54.34	31.80	65.58	35.55	42.71
12	3.91	161.39	36.90	132.63	1.70	0.81	27.15	137.68	69.94	16.80	34.64	43.86	55.62
13	1.80	1.77	43.39	174.96	9.90	0.34	22.58	174.71	15.66	11.18	28.39	22.79	42.29
14	11.90	15.35	27.39	19.65	14.52	53.28	10.46	14.73	15.57	9.54	17.01	16.67	18.84
15	20.43	7.98	64.67	18.37	28.32	73.92	22.43	5.96	19.09	30.33	4.06	12.80	25.70
16	21.76	2.40	89.80	17.14	36.05	59.72	29.80	48.11	15.88	50.01	8.76	27.93	33.95
17	1.49	9.72	65.89	20.63	13.87	2.05	19.91	12.77	14.59	51.04	19.70	14.35	20.50
18	3.26	20.06	124.78	3.66	10.53	162.71	21.89	82.28	15.38	63.57	25.84	9.15	45.26
19	6.76	3.92	36.42	11.27	170.26	175.68	99.13	5.51	97.91	43.30	141.97	26.04	68.18
20	13.01	15.63	19.46	14.18	15.97	35.09	14.02	16.36	2.56	17.98	28.38	14.74	17.28
21	34.99	16.82	23.42	6.89	18.86	47.77	14.82	46.61	3.33	56.99	32.11	29.61	27.69
22	41.72	8.88	29.84	24.11	42.18	54.33	14.00	49.33	19.86	23.93	58.59	38.81	33.80
23	53.43	22.43	12.32	44.56	14.04	69.88	36.49	62.36	38.46	51.14	66.07	44.67	42.99
24	79.51	100.55	116.65	79.83	84.52	84.31	31.42	69.74	62.34	145.77	122.80	63.92	86.78
25	86.33	114.97	74.95	60.84	95.83	90.49	56.85	67.58	85.05	146.28	129.66	96.46	92.11
Mean	29.22	33.44	51.35	45.31	34.26	55.83	40.03	50.09	36.48	42.89	42.84	36.20	41.50
All loudspeakers													Grand Mean

**Front/back errors — Experiment 4**  
**3-s Natural**

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.08
Mean	0.00	0.00	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	0.01
All loudspeakers													Grand Mean

## 0.5-s Natural

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
8	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.13
9	0.00	0.00	0.50	1.00	0.00	0.00	0.50	1.00	0.00	0.00	0.00	0.00	0.25
10	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.17
11	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.13
12	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.17
13	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.13
14	0.50	0.50	1.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	1.00	0.00	0.38
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.04
18	0.00	0.50	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.50	0.00	0.17
19	0.50	0.00	0.00	0.00	0.50	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.42
Mean	0.08	0.08	0.25	0.50	0.04	0.21	0.13	0.38	0.08	0.04	0.21	0.00	0.17
All loudspeakers													Grand Mean

## 3-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
8	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.13
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	0.00	0.04	0.00	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.01
All loudspeakers													Grand Mean

## 0.5-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
13	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
14	0.50	0.50	0.00	0.50	0.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	0.29
15	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean	0.04	0.08	0.00	0.08	0.00	0.08	0.04	0.00	0.00	0.00	0.04	0.00	0.03
All loudspeakers													Grand Mean

## 3-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
8	0.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	0.50	0.00	0.00	0.00	0.38
9	0.00	1.00	1.00	0.00	1.00	0.00	0.00	1.00	1.00	0.50	0.00	0.50	0.50
10	0.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.25
11	0.00	1.00	1.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.50	0.50	0.42
12	0.00	1.00	1.00	0.50	0.50	0.00	0.00	1.00	0.50	0.00	1.00	0.00	0.46
13	0.00	1.00	0.50	0.50	0.50	0.00	0.00	1.00	0.00	0.50	0.50	0.00	0.38
14	0.50	0.00	0.00	1.00	0.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.46
15	0.00	0.00	0.00	0.00	0.50	1.00	0.00	0.00	0.00	0.50	0.00	0.50	0.21
16	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.50	0.00	0.00	0.08
17	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.13
18	0.00	0.00	0.00	0.00	0.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.13
19	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	0.50	0.00	0.50	0.00	0.25
Mean	0.04	0.50	0.46	0.17	0.38	0.38	0.17	0.50	0.38	0.25	0.29	0.13	0.30
All loudspeakers													Grand Mean

## 0.5-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
8	0.00	0.00	0.50	0.50	0.50	0.00	0.50	0.50	0.00	0.50	0.50	0.00	0.29
9	0.00	0.50	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.50	0.50	0.29
10	0.00	0.00	0.00	1.00	0.00	0.00	0.50	0.50	0.00	1.00	0.00	0.50	0.29
11	0.00	0.50	0.50	1.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.25
12	0.00	1.00	0.00	1.00	0.00	0.00	0.00	1.00	0.50	0.00	0.00	0.00	0.29
13	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.17
14	0.00	0.50	1.00	0.50	0.00	1.00	0.00	0.50	0.00	0.00	0.50	1.00	0.42
15	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17
16	0.00	0.00	1.00	0.00	0.00	0.50	0.00	0.50	0.00	0.00	0.00	0.00	0.17
17	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04
18	0.00	0.00	1.00	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.21
19	0.00	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.50	0.00	1.00	0.00	0.33
Mean	0.00	0.21	0.46	0.50	0.13	0.38	0.13	0.42	0.13	0.21	0.21	0.17	0.24
All loudspeakers													Grand Mean

**Absolute elevation error — Experiment 4****3-s Natural**

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.73	0.84	2.24	0.84	1.30	1.80	2.49	6.18	1.16	6.72	3.63	9.71	3.14
2	12.93	21.05	13.22	12.27	12.04	12.78	15.23	13.19	13.58	20.56	7.25	9.68	13.65
3	27.60	28.68	17.20	21.14	23.68	28.05	30.72	24.71	24.01	36.46	6.29	33.31	25.15
4	8.29	34.89	2.84	40.97	9.92	42.79	65.32	37.58	10.72	28.88	10.15	26.53	26.57
5	33.16	5.57	37.07	57.05	20.12	57.54	86.35	31.03	21.93	68.67	10.24	15.51	37.02
6	27.14	8.04	59.45	12.64	38.26	74.43	96.01	16.25	27.20	62.91	22.64	16.27	38.44
7	59.85	11.43	18.20	5.06	63.04	89.82	42.61	48.57	32.96	86.90	14.63	16.36	40.79
8	3.64	8.63	2.48	0.95	2.97	3.92	14.14	1.51	3.92	11.38	17.80	2.35	6.14
9	3.42	8.40	3.92	1.51	5.35	3.72	5.00	2.38	3.23	0.42	18.34	8.46	5.35
10	11.54	3.24	11.79	8.63	0.75	0.97	17.82	2.43	14.96	28.45	29.85	0.09	10.88
11	19.74	0.21	9.75	1.28	1.86	1.00	8.54	1.33	14.57	13.54	21.86	0.26	7.83
12	28.89	0.43	20.85	14.49	1.32	0.02	4.21	5.85	2.03	14.45	16.02	7.04	9.63
13	20.07	2.83	11.30	22.26	3.77	0.18	35.64	0.43	21.38	28.87	15.95	1.45	13.68
14	4.18	1.88	6.60	9.48	4.26	2.54	1.73	11.63	1.07	15.04	7.89	1.90	5.68
15	0.32	0.26	7.40	4.00	4.25	5.12	12.51	9.94	2.33	12.89	6.31	1.43	5.56
16	2.03	1.84	2.10	11.92	0.36	5.75	3.17	12.20	1.74	12.94	8.93	0.26	5.27
17	4.33	1.49	4.78	1.13	1.77	3.81	16.14	10.44	4.31	5.59	11.13	0.52	5.45
18	1.25	1.51	2.42	1.72	2.03	5.67	17.37	13.95	2.35	22.12	10.11	1.07	6.80
19	4.18	2.81	1.48	1.32	3.81	0.25	2.67	12.25	0.63	8.32	11.63	1.93	4.27
20	13.75	7.61	17.20	12.64	16.61	17.12	6.60	8.63	13.81	1.20	18.92	12.01	12.18
21	29.98	1.47	19.14	12.50	10.37	32.02	3.12	11.17	5.24	13.18	31.68	26.77	16.39
22	7.58	8.45	5.28	3.08	24.93	46.92	2.47	10.95	4.92	1.36	60.02	1.24	14.77
23	32.23	3.41	13.76	10.06	1.82	60.29	11.13	1.15	20.81	0.38	48.92	35.73	19.97
24	100.03	15.32	137.65	74.40	46.63	76.90	21.45	23.36	84.94	88.83	130.94	94.18	74.55
25	109.60	163.03	105.36	49.63	97.55	90.23	135.51	94.61	117.96	155.91	151.77	104.95	114.68
Mean	22.66	13.73	21.34	15.64	15.95	26.55	26.32	16.47	18.07	29.84	27.72	17.16	20.95
All loudspeakers													Grand Mean



## 0.5-s Natural

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.98	1.68	8.68	1.73	0.41	2.42	0.84	3.16	3.55	4.24	2.33	0.22	2.52
2	13.43	14.78	11.29	5.10	9.10	12.43	16.86	16.46	15.91	14.40	8.98	13.23	12.66
3	30.01	26.23	1.42	23.11	20.74	23.12	35.17	27.37	23.94	15.74	17.10	17.15	21.76
4	41.68	28.74	10.51	27.62	21.64	37.55	61.29	34.21	39.24	8.76	28.30	34.43	31.16
5	57.99	13.69	21.67	59.47	41.66	71.31	98.60	77.24	56.65	35.46	35.92	43.23	51.07
6	74.17	40.64	40.41	79.12	67.55	78.46	110.44	95.22	80.51	50.58	34.41	42.48	66.17
7	94.21	17.57	62.74	103.52	70.25	89.79	109.97	96.46	76.34	62.91	31.27	58.93	72.83
8	0.10	19.00	12.30	2.43	2.45	1.36	3.35	0.61	3.86	2.12	7.37	1.26	4.68
9	3.01	17.05	1.23	7.74	2.64	2.46	10.31	14.38	0.74	9.42	10.65	3.49	6.93
10	0.31	33.58	45.72	5.07	6.13	0.59	36.98	13.32	2.76	12.92	34.01	8.11	16.63
11	1.41	7.46	34.66	9.75	3.45	2.93	15.72	3.60	5.11	13.10	19.49	2.78	9.96
12	0.93	26.42	28.87	17.25	10.26	1.28	19.73	14.96	8.95	15.63	56.72	7.26	17.36
13	1.16	21.73	26.03	8.60	8.16	0.34	24.55	14.21	13.22	12.96	23.77	9.64	13.70
14	0.59	2.76	20.85	7.55	2.90	2.91	19.13	8.35	8.48	4.23	2.39	0.98	6.76
15	1.53	0.68	49.38	6.28	2.94	15.28	26.07	9.96	5.21	5.56	11.53	5.75	11.68
16	0.70	3.28	38.50	15.54	1.24	1.99	37.50	18.61	8.76	29.64	12.93	7.68	14.70
17	0.19	1.64	9.58	4.83	4.43	6.10	25.28	15.36	2.53	19.46	10.43	5.69	8.79
18	2.69	34.63	25.43	3.47	3.03	2.56	17.88	11.07	11.82	52.84	29.00	10.46	17.07
19	2.85	5.43	22.15	13.47	15.53	0.45	40.88	34.71	12.53	31.42	11.60	8.64	16.64
20	14.80	2.37	11.87	12.37	12.59	16.96	7.54	8.68	3.32	9.62	22.10	15.51	11.48
21	29.06	9.63	18.16	16.49	17.72	30.03	18.15	7.06	1.50	11.94	38.42	25.84	18.67
22	45.84	1.97	5.09	21.93	19.06	29.65	8.51	4.30	15.39	9.40	45.84	18.71	18.81
23	59.11	3.05	0.58	38.81	26.89	50.38	27.96	35.73	31.94	14.60	60.26	41.56	32.57
24	76.05	16.86	136.79	55.17	88.12	90.21	31.83	41.58	65.44	119.79	124.14	78.99	77.08
25	86.88	101.55	131.09	64.86	96.41	90.27	52.13	51.95	77.85	144.32	124.49	108.41	94.18
<b>Mean</b>	25.59	18.10	31.00	24.45	22.21	26.43	34.27	26.34	23.02	28.44	32.14	22.82	26.23
All loudspeakers													Grand Mean





## 3-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.63	4.88	1.03	6.61	7.19	0.77	2.32	0.58	1.21	4.74	14.13	3.15	3.94
2	13.99	12.92	13.90	12.20	8.84	13.65	29.69	15.93	15.21	5.60	8.69	14.72	13.78
3	30.30	8.10	14.75	25.27	12.54	29.26	19.93	22.36	12.11	6.99	17.24	20.60	18.29
4	48.43	4.72	1.64	25.06	17.27	44.15	52.93	21.55	21.49	17.58	7.36	43.43	25.47
5	55.42	18.98	10.37	26.90	36.65	59.95	105.92	43.53	50.46	33.47	7.89	55.68	42.10
6	61.77	20.07	35.49	49.22	72.88	75.06	75.63	62.10	73.63	36.50	30.93	71.08	55.36
7	92.33	64.85	68.71	98.38	74.36	89.84	32.66	96.78	79.66	37.55	36.86	95.67	72.30
8	0.45	2.16	2.23	0.11	4.93	0.72	1.96	2.69	2.55	8.21	11.03	2.31	3.28
9	2.26	21.32	7.21	7.75	9.99	1.10	8.32	7.46	2.87	7.89	9.51	0.52	7.18
10	3.03	23.50	26.52	22.48	0.66	0.60	10.78	8.77	4.42	10.23	39.22	5.76	13.00
11	1.28	23.01	24.63	60.32	8.28	0.17	41.87	21.88	2.49	9.76	50.07	4.73	20.71
12	0.28	21.59	50.04	42.40	19.74	0.27	30.62	14.64	7.22	43.34	51.76	2.51	23.70
13	2.64	5.29	50.09	9.93	24.44	0.31	22.51	11.51	17.72	44.96	13.91	0.29	16.97
14	1.68	12.88	6.13	0.68	6.48	0.97	1.53	2.04	1.16	4.81	2.37	0.97	3.48
15	3.22	15.56	24.56	4.38	7.12	0.76	26.02	5.01	7.68	15.93	27.80	0.03	11.51
16	2.40	26.42	15.95	9.61	2.85	1.10	10.34	15.12	10.66	26.98	12.81	8.23	11.87
17	1.60	21.17	5.68	6.39	6.54	1.23	2.38	13.37	2.73	55.56	10.49	6.21	11.11
18	2.41	15.21	17.02	1.77	15.88	0.41	9.98	6.19	12.63	63.74	8.43	7.03	13.39
19	2.08	7.61	16.34	14.11	15.16	0.36	32.91	10.12	10.89	37.09	54.42	3.28	17.03
20	14.85	15.87	14.10	9.12	10.26	16.43	9.85	14.78	1.89	8.21	21.61	10.87	12.32
21	17.33	35.03	20.25	22.12	30.40	31.43	9.21	8.93	1.09	25.64	55.15	27.86	23.70
22	45.25	78.98	22.18	21.30	30.33	45.97	15.59	7.79	6.47	18.08	62.56	33.84	32.36
23	50.72	58.08	29.70	27.14	43.29	60.82	14.56	46.66	22.40	20.35	76.12	44.16	41.17
24	76.59	77.65	129.33	149.36	85.58	75.24	94.15	59.73	44.08	72.36	114.94	78.84	88.15
25	84.32	77.70	139.06	161.44	104.64	90.18	141.36	90.73	75.43	158.57	139.57	84.42	112.29
Mean	24.61	26.94	29.88	32.56	26.25	25.63	32.12	24.41	19.53	30.97	35.39	25.05	27.78
All loudspeakers													Grand Mean



**Apparent elevation — Experiment 4**  
**3-s Natural**

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.73	0.84	2.24	0.57	1.30	1.80	-2.49	-3.15	0.49	-6.58	3.63	9.71	0.76
2	2.07	-6.05	1.78	2.73	2.96	2.23	-0.23	1.81	1.42	-5.56	8.53	5.32	1.42
3	2.40	1.32	12.80	8.86	6.32	1.94	-0.72	5.29	5.99	-6.46	23.71	-3.31	4.85
4	36.71	10.11	47.84	4.03	35.08	2.21	-20.32	7.42	34.28	16.13	34.85	18.47	18.90
5	26.84	65.57	22.93	2.95	39.89	2.47	-26.36	28.97	38.07	-8.66	49.76	44.49	23.91
6	47.86	83.04	15.55	71.22	36.74	0.57	-21.01	58.75	47.80	12.09	52.36	58.73	38.64
7	30.15	78.58	71.80	84.94	26.96	0.19	47.40	41.43	57.05	3.11	75.37	73.64	49.22
8	3.64	4.85	2.48	0.95	2.97	3.92	-14.14	1.51	3.92	11.38	17.80	-2.35	3.08
9	3.42	-8.40	3.92	1.51	5.35	3.72	-5.00	0.51	2.60	-0.42	18.34	-8.46	1.42
10	11.54	-3.24	11.79	8.63	-0.61	0.97	-17.82	-1.63	14.96	28.45	29.85	0.09	6.92
11	19.74	-0.07	9.75	1.28	-1.07	1.00	-8.54	-0.18	14.57	13.54	21.86	0.26	6.01
12	28.89	-0.43	20.85	14.49	-1.32	-0.02	-0.03	-2.69	2.03	14.45	16.02	7.04	8.27
13	20.07	2.83	11.30	22.26	3.77	0.18	-2.45	-0.43	21.38	-28.87	15.95	0.49	5.54
14	4.18	1.88	1.17	9.48	4.26	2.54	-1.73	-11.63	1.07	-15.04	7.89	1.53	0.47
15	0.25	0.24	2.18	4.00	4.25	5.12	-12.51	-9.94	2.33	-5.23	0.50	-0.20	-0.75
16	2.03	1.84	-2.10	11.92	0.36	5.75	-3.17	-12.20	1.74	-12.13	8.93	0.26	0.27
17	4.33	-0.47	4.78	1.13	1.77	3.81	-16.14	-10.44	4.31	-5.59	11.13	-0.35	-0.14
18	-1.25	0.89	1.71	1.72	2.03	5.67	-11.51	-13.95	2.35	8.68	10.11	1.07	0.63
19	-4.18	-2.81	1.48	-0.97	3.81	0.25	2.67	-12.25	0.56	8.32	11.63	-1.93	0.55
20	-1.25	-7.39	2.19	-2.37	1.61	2.12	-21.60	-6.37	-1.19	-13.80	3.92	-2.99	-3.93
21	-0.02	-28.57	-10.86	-17.50	-19.63	2.02	-33.12	-41.16	-24.76	-16.83	1.68	-3.23	-16.00
22	-37.42	-53.45	-50.28	-41.92	-20.07	1.93	-45.54	-55.95	-40.09	-45.98	15.02	-43.76	-34.79
23	-27.76	-60.00	-46.23	-49.95	-58.18	0.29	-48.87	-58.85	-39.19	-59.62	-11.08	-24.27	-40.31
24	25.02	-59.68	62.65	-0.61	-28.37	1.90	-53.54	-51.65	9.94	13.83	55.93	19.18	-0.45
25	19.61	73.03	15.36	-40.37	7.55	0.23	45.51	4.61	27.96	65.91	61.77	14.95	24.68

## 0.5-s Natural

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.98	0.04	8.68	1.73	0.41	2.42	0.56	-1.75	-3.55	-4.24	2.33	0.07	0.64
2	1.58	0.22	3.71	11.25	5.90	2.57	-1.86	-1.46	-0.90	0.60	6.03	1.77	2.45
3	-0.01	3.78	30.58	6.90	9.26	6.88	-5.17	2.64	6.06	14.26	12.90	12.85	8.41
4	3.31	16.26	55.51	17.38	23.36	7.45	-16.29	10.79	5.76	36.24	16.71	10.57	15.59
5	2.01	46.31	38.34	0.53	18.35	-11.31	-38.60	-17.24	3.35	24.54	24.08	16.77	8.93
6	0.83	34.36	34.59	-4.12	7.45	-3.46	-35.43	-20.22	-5.50	24.43	40.60	32.52	8.84
7	-4.21	72.43	27.26	-13.52	19.75	0.22	-19.96	-6.46	13.67	27.09	58.73	31.07	17.17
8	-0.10	-19.00	12.30	2.43	2.45	1.36	-3.35	-0.24	-3.86	2.12	7.37	-0.69	0.07
9	-1.02	-17.05	1.23	-5.98	2.64	2.46	-10.31	-14.38	0.74	-9.42	10.65	-3.49	-3.66
10	-0.11	-33.58	9.52	1.78	-6.13	0.59	-36.98	-13.32	2.76	-8.58	34.01	1.26	-4.07
11	1.41	3.04	3.45	-9.10	-3.45	-2.08	-15.72	3.60	5.11	13.10	19.49	-2.78	1.34
12	0.93	-26.42	28.87	-4.93	10.26	1.28	-14.46	-14.96	8.95	13.49	56.72	-6.89	4.40
13	0.85	-21.20	26.03	-4.73	8.16	0.34	-24.55	-14.21	13.22	-12.96	23.77	9.59	0.36
14	0.59	-2.76	-20.85	-7.55	2.90	2.91	-19.13	-5.49	-8.48	0.61	2.39	-0.98	-4.65
15	0.26	-0.68	-49.38	-6.28	2.94	-10.86	-26.07	-9.96	-5.21	-5.56	11.53	-5.75	-8.75
16	0.70	-3.28	-38.50	-15.54	1.24	1.99	-37.50	-18.61	-8.76	-29.64	12.93	-7.68	-11.89
17	0.00	-1.64	1.45	-4.83	4.43	-4.76	-25.28	-15.36	0.02	7.49	10.43	-5.69	-2.81
18	-2.69	34.08	-25.43	3.47	3.03	-1.82	-17.88	-9.74	-11.82	52.84	29.00	-10.46	3.55
19	-1.91	-5.43	22.15	-13.47	15.53	0.45	-40.88	-34.71	12.53	31.42	11.60	-8.64	-0.95
20	-0.20	-14.29	-3.14	-2.63	-2.41	1.97	-7.47	-6.33	-11.68	-5.39	7.10	0.51	-3.66
21	-0.94	-20.36	-11.84	-13.51	-12.28	0.03	-11.85	-22.94	-28.51	-18.07	8.43	-4.16	-11.33
22	0.84	-46.97	-42.03	-23.07	-25.94	-15.36	-36.48	-43.12	-29.61	-35.60	0.84	-26.29	-26.90
23	-0.90	-56.96	-59.42	-21.19	-33.11	-9.62	-32.05	-24.27	-28.06	-45.41	0.26	-18.44	-27.43
24	1.05	-58.14	61.79	-19.83	13.12	15.21	-43.17	-33.42	-9.57	44.79	49.14	3.99	2.08
25	-3.13	11.55	41.09	-25.14	6.41	0.26	-37.88	-38.05	-12.15	54.32	34.49	18.41	4.18

## 3-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.35	-6.01	2.47	1.05	2.60	2.04	4.93	2.01	1.18	-3.46	-2.23	0.53	0.46
2	-0.16	-4.73	1.09	3.90	4.88	1.14	4.93	-3.34	0.94	-4.91	15.74	0.14	1.64
3	1.38	-13.90	1.63	1.64	19.68	1.07	3.66	1.72	4.30	-11.63	1.13	-2.14	0.71
4	2.26	7.64	40.13	23.53	33.29	1.81	2.01	-25.34	19.59	-4.42	40.63	0.21	11.78
5	-36.76	4.65	63.88	2.11	35.38	0.96	21.60	-49.07	11.12	-49.96	37.93	-3.95	3.16
6	15.38	74.99	77.31	82.88	4.17	1.23	56.36	-16.82	28.27	70.68	65.29	46.16	42.16
7	0.52	70.05	80.03	77.90	16.69	0.68	86.07	-27.04	30.49	65.85	44.14	-7.51	36.49
8	-1.09	-16.93	6.00	-0.77	3.04	1.44	-4.19	0.44	2.15	-0.25	2.86	-0.49	-0.65
9	0.38	-17.72	-3.13	-8.34	4.78	1.43	-9.16	-16.55	5.20	-6.18	12.15	-4.83	-3.50
10	1.53	-11.49	11.22	6.09	4.74	0.86	-2.42	-6.29	11.63	14.76	25.28	0.45	4.70
11	0.36	1.69	4.64	1.84	1.25	0.92	3.90	-1.64	12.24	16.08	22.14	-0.32	5.26
12	1.16	2.15	2.17	6.56	2.17	0.68	18.60	-0.13	12.08	22.08	17.54	-0.28	7.07
13	5.00	0.69	7.75	11.55	5.08	0.29	33.52	-1.06	10.23	14.48	12.01	-1.40	8.18
14	-0.14	-2.28	0.89	2.13	6.29	1.82	7.06	-4.54	2.23	1.71	6.69	0.31	1.85
15	1.75	-7.61	3.44	3.32	3.77	2.19	7.12	-14.52	0.73	-0.11	9.70	-1.60	0.68
16	1.57	-1.33	-6.34	10.71	4.60	2.01	12.70	-5.71	-4.00	10.49	10.40	-0.53	2.88
17	0.45	0.47	4.75	-7.79	4.35	2.56	8.98	-9.57	0.13	5.55	3.63	-1.44	1.01
18	-1.43	-13.65	-16.02	-0.11	-1.23	2.38	13.55	-22.41	-9.33	-5.12	4.71	-6.33	-4.58
19	-0.91	-27.27	-9.39	-24.28	1.40	0.89	13.38	-32.14	-11.61	38.35	12.80	-4.94	-3.64
20	-8.24	-2.15	-1.57	-3.37	1.09	1.81	1.26	-12.42	-14.75	-17.40	5.21	-1.32	-4.32
21	-7.38	-19.14	-14.39	-22.17	-6.14	1.36	-0.10	-26.02	-25.44	-21.82	9.35	-0.48	-11.03
22	-7.60	-43.32	-43.43	-36.51	-23.40	1.74	-15.80	-53.78	-39.91	-40.60	-15.15	-6.99	-27.06
23	-40.66	-48.22	-55.68	-38.26	-16.53	1.36	-41.58	-58.82	-36.30	-38.96	6.02	-18.90	-32.21
24	-9.54	-54.76	47.16	-51.90	-0.68	1.46	43.57	-43.45	-5.39	8.40	54.28	6.94	-0.33
25	3.10	12.10	81.56	78.54	13.98	0.63	60.74	-22.27	15.62	49.90	12.21	26.81	27.74



## 0.5-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	2.22	-12.43	1.14	5.43	2.36	1.95	-1.05	-1.90	-0.61	-13.57	6.77	0.93	-0.73
2	1.88	-0.16	6.80	7.16	4.35	3.18	0.67	2.03	-0.40	-10.51	2.19	1.44	1.55
3	4.32	-5.88	22.15	1.60	11.23	6.21	-1.06	1.53	-1.50	-5.74	15.92	5.61	4.53
4	-6.82	46.93	50.32	-10.25	18.85	1.37	-15.45	13.82	3.48	-2.97	34.82	22.21	13.03
5	-23.04	5.54	6.12	5.76	6.24	1.32	-39.72	0.79	-3.69	-0.39	32.75	-4.92	-1.10
6	2.34	55.76	55.38	26.96	11.50	-4.94	-4.36	22.61	-2.40	-54.28	57.03	-0.28	13.78
7	-6.29	51.71	-10.91	15.95	7.15	0.76	-2.28	-5.20	1.16	14.97	46.02	26.49	11.63
8	2.67	-4.96	2.64	1.97	3.90	3.91	-8.34	-4.86	-2.40	-8.23	4.29	-0.07	-0.79
9	2.74	-17.65	12.34	-3.85	1.74	1.23	-15.47	2.75	-1.18	-13.01	27.58	0.66	-0.18
10	0.64	-7.02	17.56	1.73	1.12	0.72	-16.71	2.66	8.44	-12.28	20.91	1.47	1.60
11	0.94	-0.02	2.37	1.11	1.15	0.68	-25.38	2.73	13.39	11.84	42.73	-0.10	4.29
12	0.72	0.07	3.51	12.27	2.35	0.41	-18.17	0.64	14.74	-13.14	24.00	-0.15	2.27
13	0.86	-30.01	8.18	13.37	3.48	0.35	-1.77	1.09	12.57	14.54	59.86	4.13	7.22
14	1.60	-0.59	-3.63	1.95	4.63	3.40	-5.91	-4.72	-1.03	-4.06	10.79	4.54	0.58
15	1.47	-6.46	-8.99	1.09	6.53	3.06	-2.98	-6.13	-6.63	-15.57	7.60	0.67	-2.20
16	1.84	-6.93	-8.23	3.58	1.50	1.81	-8.21	-12.69	-11.06	-12.04	9.93	-0.88	-3.45
17	-0.67	-28.61	-5.19	1.65	0.63	2.26	-11.82	-15.06	-12.53	-18.01	13.56	0.68	-6.09
18	-0.36	-30.31	-12.24	-15.57	-4.79	2.28	-16.68	-15.48	-12.85	9.55	10.12	-0.32	-7.22
19	-0.57	1.06	-6.11	-5.58	4.23	1.11	-7.07	-14.63	-9.57	54.34	21.13	-1.43	3.08
20	0.72	-20.96	-12.55	0.43	-12.27	3.35	-8.49	-3.48	-13.29	-10.95	2.83	0.52	-6.18
21	2.31	-24.21	-21.88	-13.62	-13.18	4.69	-17.34	-18.58	-24.48	-13.63	12.06	-0.50	-10.70
22	-23.87	-44.64	-46.55	-31.36	-7.50	-4.18	-33.67	-41.62	-31.44	-34.38	6.29	-9.94	-25.24
23	-31.35	-54.39	-49.60	-26.64	-19.32	3.75	-36.06	-24.14	-39.54	-43.55	28.18	-15.22	-25.66
24	-21.38	-57.02	51.19	-28.79	5.49	3.32	-44.99	-30.54	-18.27	-1.95	52.38	-0.29	-7.57
25	-8.29	42.30	34.52	13.55	5.68	1.80	-14.01	-26.97	-5.31	47.36	42.77	32.32	13.81

3-s  
Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.41	4.88	1.03	6.61	7.19	0.77	0.91	0.24	1.21	4.74	14.13	3.15	3.77
2	1.01	2.08	1.10	2.80	6.16	1.35	-14.69	-0.93	-0.20	11.58	23.69	0.27	2.85
3	-0.30	38.10	15.25	4.73	17.46	0.74	10.07	7.65	17.89	23.16	12.76	9.40	13.08
4	-3.43	44.35	46.64	19.95	27.74	0.85	-7.93	23.46	23.51	27.42	37.64	1.58	20.15
5	4.58	41.02	49.63	33.10	23.35	0.05	-45.92	16.47	9.54	26.54	52.12	4.32	17.90
6	13.22	54.93	39.51	25.78	2.13	-0.06	-0.63	12.90	1.38	38.50	44.07	3.92	19.64
7	-2.33	25.15	21.30	-8.38	15.64	0.16	57.34	-6.78	10.34	52.46	53.14	-5.67	17.70
8	0.17	2.16	2.11	0.11	4.93	0.72	-1.96	1.87	0.56	-5.32	11.03	-2.31	1.17
9	2.26	21.32	0.66	-7.75	9.99	1.10	-7.14	-7.46	-2.87	-5.44	9.51	0.52	1.23
10	-0.72	23.50	26.52	-22.48	0.66	-0.09	-10.78	8.77	4.42	-10.23	39.22	-5.76	4.42
11	1.28	-10.40	24.63	60.32	-5.27	-0.17	-41.87	-21.88	-2.15	3.35	50.07	-4.73	4.43
12	0.19	21.59	50.04	28.25	19.74	-0.27	-30.62	-1.31	4.63	43.34	51.76	-0.78	15.55
13	2.64	5.29	50.09	5.95	24.44	0.31	-2.55	2.75	17.72	44.96	13.91	0.29	13.82
14	1.52	12.88	-5.71	-0.68	6.48	0.97	1.53	-0.34	1.16	-4.81	2.37	0.97	1.36
15	0.01	-1.23	-24.56	-4.38	1.13	0.76	-26.02	-5.01	-7.68	-15.93	27.80	0.00	-4.59
16	-2.06	26.42	-15.95	1.00	-2.85	1.10	-2.97	-15.12	-10.66	0.13	12.81	-8.23	-1.37
17	-1.60	-13.68	5.68	-6.39	6.54	1.23	1.39	-13.37	-2.73	24.86	10.49	-6.21	0.52
18	-2.00	-4.14	17.02	0.02	-15.88	-0.41	-9.98	-6.19	-12.63	63.74	3.99	-7.03	2.21
19	-0.72	7.61	16.34	14.11	15.16	0.36	32.91	-3.98	7.11	37.09	54.42	1.57	15.17
20	-0.14	0.87	-0.91	-5.88	-4.74	1.43	-13.51	-0.22	-16.29	-6.79	6.61	-4.13	-3.64
21	-12.67	2.51	-9.75	-7.89	0.41	1.43	-21.65	-21.07	-28.90	-4.36	25.15	-2.13	-6.58
22	0.25	33.98	-22.82	-23.70	-14.68	0.98	-29.41	-37.21	-38.53	-26.92	17.56	-11.17	-12.64
23	-9.29	-1.92	-30.30	-32.85	-16.71	0.82	-45.45	-13.34	-37.60	-39.65	16.11	-15.85	-18.84
24	1.59	2.65	54.33	74.36	10.58	0.25	19.15	-15.26	-30.93	-2.63	39.93	3.84	13.16
25	-5.68	-12.31	49.06	71.43	14.63	0.18	51.36	0.73	-14.57	68.58	49.57	-5.58	22.28

## 0.5-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	0.26	-1.58	7.61	7.09	1.17	3.73	0.20	3.15	-2.44	-4.53	4.93	-0.56	1.59
2	0.96	0.65	1.57	11.26	10.13	3.87	0.11	10.10	-0.40	-3.35	17.18	3.08	4.60
3	3.58	16.60	33.46	-2.76	12.70	1.95	-13.08	16.54	-6.07	6.10	4.71	23.92	8.14
4	5.47	42.46	-19.24	5.38	20.50	0.60	-22.31	17.04	-13.17	39.22	38.47	19.33	11.15
5	5.55	67.20	53.82	-0.76	11.30	0.29	-31.10	10.07	-0.43	39.74	44.37	13.07	17.76
6	-1.05	64.26	-53.86	8.01	7.20	0.39	-23.54	13.52	-5.75	52.43	40.99	-11.15	7.62
7	-0.20	33.01	-24.82	-0.64	6.14	0.45	-28.99	-7.11	16.26	57.42	43.44	-19.92	6.25
8	4.86	-0.71	2.08	7.16	2.06	3.57	-0.87	-1.51	0.13	-8.01	16.83	-1.21	2.03
9	2.71	-13.00	27.67	1.19	4.11	2.72	-15.73	14.42	2.49	3.04	29.67	-5.93	4.45
10	0.59	-59.21	-8.29	-0.13	0.31	0.47	-35.34	2.98	-6.07	14.57	35.02	-15.03	-5.84
11	4.04	-54.39	19.98	-0.69	-0.45	0.61	-19.26	12.41	3.04	27.91	51.54	-10.07	2.89
12	3.35	-2.44	-36.21	-0.66	1.55	0.67	-26.18	8.20	5.22	3.56	34.03	-31.55	-3.37
13	0.33	1.13	-3.84	-0.38	9.88	0.32	-22.54	3.94	15.59	-0.74	27.18	-22.79	0.67
14	0.30	-0.09	-10.91	-13.64	7.47	2.22	-3.81	2.36	-3.86	0.92	13.96	4.92	-0.01
15	-0.32	-1.02	-38.20	-8.15	-1.05	-0.66	-21.28	-5.33	-17.05	-27.14	2.72	-12.65	-10.84
16	2.22	-2.21	-44.36	-6.69	-5.84	0.75	-27.10	-7.90	-14.51	44.57	7.12	-26.39	-6.70
17	-0.33	-1.56	-15.69	-6.92	0.76	1.38	-18.96	-3.01	-9.14	47.20	11.11	-12.71	-0.66
18	-3.21	-14.68	-54.07	-2.28	-0.44	0.51	-21.18	4.69	-10.57	60.05	22.40	-8.77	-2.30
19	-6.53	1.81	-2.85	-11.18	7.81	0.33	-35.66	4.67	4.24	41.91	37.80	-26.02	1.36
20	-4.46	0.62	3.25	-0.92	0.90	3.30	-5.45	0.78	-12.64	-0.16	11.57	-0.62	-0.32
21	2.12	-13.25	-18.40	-25.52	-15.48	1.80	-16.38	5.32	-26.93	15.34	2.08	-3.16	-7.71
22	-9.88	-53.52	-32.17	-23.27	-7.87	-1.51	-34.57	-2.11	-31.58	-35.36	3.71	-13.88	-20.17
23	-10.77	-44.50	-52.52	-18.11	-47.67	1.36	-35.04	-13.95	-26.32	-25.37	-4.05	-27.43	-25.36
24	0.61	12.02	40.55	1.56	3.63	0.25	-43.62	-15.90	-18.65	58.89	42.95	-21.14	5.10
25	-3.67	24.96	-15.05	-29.16	5.82	0.49	-33.15	-22.42	-4.95	56.28	39.66	6.46	2.11

**Test orders in Experiment 4**

Listener	Order of conditions		Cluster
	Session 1	Session 2	
1	3-s N R M	0.5-s N R M	1
2	3-s M N R	0.5-s M N R	2
3	0.5-s M N R	3-s M N R	2
4	0.5-s N M R	3-s N M R	2
5	3-s M R N	0.5-s M R N	2
6	0.5-s N R M	3-s N R M	1
7	3-s R N M	0.5-s R N M	3
8	0.5-s M R N	3-s M R N	1
9	3-s N M R	0.5-s N M R	1
10	3-s R N M	0.5-s R N M	3
11	0.5-s R N M	3-s R N M	3
12	0.5-s R M N	3-s R M N	1

Note: N = Natural, R = Rotation, M = Motionless



## 0.5-s Natural

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	1.55	1.70	NM	0.48	2.02	0.04	4.42	NM	3.73	11.20	3.77	1.03	2.99
8	0.92	12.24	NM/FBE	14.88	11.11	0.89	9.67	14.50	4.64	14.64	11.94	4.57	9.09
9	0.94	13.81	NM	FBE/NM	2.74	0.20	19.96	FBE/NM	1.54	2.40	15.65	2.94	6.69
10	5.41	20.81	18.28	NM/FBE	1.64	0.34	28.90	NM	17.15	6.72	16.99	1.41	11.76
11	4.13	1.31	NM	NM	1.44	12.27	2.03	NM/FBE	9.89	1.71	1.24	2.04	4.01
12	2.01	6.23	NM	NM	2.82	0.12	NM	NM	6.82	2.53	6.79	0.93	3.53
13	NM	1.33	NM	NM	0.60	0.13	NM	NM	NM	18.43	NM	NM	5.12
14	1.83	1.13	NM	NM	13.79	13.39	1.47	8.25	13.46	7.25	FBE	8.59	7.68
15	13.33	6.47	NM	4.22	22.33	15.39	8.06	NM	1.03	1.48	0.47	0.50	7.33
16	11.46	8.48	NM	NM	28.51	6.86	NM	4.85	2.42	10.09	0.34	7.95	8.99
17	7.86	12.52	NM	17.77	14.84	1.47	NM	2.63	9.38	3.80	NM	0.88	7.90
18	1.79	12.41	NM	1.72	22.93	NM	NM	NM	4.01	35.27	NM	4.54	11.81
19	NM	0.83	NM	NM	16.24	NM	NM	NM	NM	17.24	NM	6.63	10.24
Mean	4.66	7.63	18.28	7.81	10.85	4.65	10.64	7.56	6.73	10.21	7.15	3.50	7.47
All loudspeakers													Grand Mean

## 3-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	1.05	3.30	0.63	9.15	1.54	0.48	0.96	1.26	0.38	3.84	3.12	3.04	2.39
8	0.84	5.18	1.25	7.90	2.86	6.67	2.33	2.45	0.60	6.54	3.72	1.15	3.46
9	2.40	5.95	0.57	1.72	0.79	0.27	4.32	4.08	1.66	2.40	1.82	0.41	2.20
10	0.11	3.05	0.52	0.82	0.35	0.24	2.12	5.39	1.16	3.62	2.14	0.37	1.66
11	1.66	1.58	0.43	2.39	0.70	0.56	5.35	1.31	1.09	11.52	6.57	0.39	2.79
12	1.68	2.99	1.07	1.91	1.49	0.57	6.49	2.57	1.88	3.13	4.27	1.31	2.44
13	5.23	0.91	1.19	0.83	1.59	0.19	3.28	0.99	1.23	0.53	0.33	0.85	1.43
14	0.78	5.14	3.61	11.03	5.24	14.73	3.90	9.05	7.34	7.18	2.36	14.38	7.06
15	2.03	3.52	0.95	11.50	6.99	0.50	4.27	3.56	1.80	15.85	2.59	1.79	4.61
16	4.21	8.14	3.08	13.64	8.34	1.13	6.50	10.00	0.69	1.10	0.86	1.37	4.92
17	2.55	1.58	8.75	24.75	11.92	15.36	6.35	2.47	12.56	17.02	6.48	7.37	9.76
18	7.44	6.40	6.80	9.75	16.71	16.03	14.32	4.98	22.99	15.44	2.02	4.46	10.61
19	15.02	5.57	8.89	13.74	13.29	14.57	11.00	2.06	15.30	9.00	3.08	10.42	10.16
Mean	3.46	4.10	2.90	8.39	5.52	5.48	5.47	3.86	5.28	7.47	3.03	3.64	4.88
All loudspeakers													Grand Mean

## 0.5-s Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	2.31	4.50	0.74	10.33	1.54	22.12	4.93	4.26	0.70	2.50	6.41	0.45	5.06
8	10.61	10.63	8.69	1.65	3.63	7.99	4.59	2.55	2.94	6.90	10.29	11.21	6.81
9	2.07	4.75	10.10	3.73	0.86	11.92	3.51	2.61	7.70	5.86	4.03	1.89	4.92
10	0.32	2.40	6.21	7.18	1.10	7.13	11.97	5.54	18.29	5.31	3.34	3.99	6.06
11	2.12	6.31	8.75	6.38	0.24	7.73	9.91	5.13	2.84	13.70	5.14	0.26	5.71
12	1.65	7.93	4.73	7.08	0.46	9.18	5.52	3.52	0.35	15.17	6.76	0.59	5.24
13	2.15	0.64	1.87	0.68	0.73	0.04	7.47	2.73	0.79	10.27	9.41	1.36	3.18
14	11.42	14.00	11.81	14.81	12.43	FBE	7.21	15.76	12.55	1.18	11.70	4.41	10.66
15	8.80	17.31	1.66	15.71	17.15	0.89	8.43	9.62	1.47	5.24	7.96	0.85	7.92
16	13.66	5.98	0.25	17.34	22.38	9.42	4.99	8.25	7.91	5.27	15.99	8.12	9.96
17	8.93	14.13	6.48	17.82	31.40	12.98	7.85	4.33	5.35	3.93	7.04	16.09	11.36
18	11.40	20.47	7.73	17.39	21.30	8.07	5.85	6.45	15.58	8.81	4.00	30.16	13.10
19	15.26	0.38	6.71	22.00	22.24	16.47	13.56	0.75	24.58	15.56	11.73	16.01	13.77
Mean	6.97	8.42	5.82	10.93	10.42	9.49	7.37	5.50	7.77	7.67	7.98	7.34	7.98
All loudspeakers													Grand Mean





## 0.5-s Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
1	1.72	6.95	0.53	1.14	0.91	23.17	1.54	17.15	0.82	12.90	7.54	1.15	6.29
8	1.93	13.38	12.73	13.34	14.45	15.56	12.79	13.94	1.11	14.05	9.87	13.80	11.41
9	7.44	3.04	4.39	FBE	1.23	7.93	20.26	9.68	0.92	FBE	25.52	17.50	9.79
10	1.03	40.06	20.93	FBE	7.10	7.94	15.85	17.50	29.30	FBE	30.42	36.49	20.66
11	1.09	38.04	7.42	FBE	1.28	14.36	10.45	32.44	30.68	13.79	47.67	33.91	21.01
12	2.01	FBE	7.68	FBE	0.34	0.44	7.03	FBE	16.30	3.48	6.97	31.09	8.37
13	1.77	0.87	1.20	FBE	0.36	0.06	1.07	FBE	1.36	1.05	8.51	0.50	1.67
14	11.77	14.35	FBE	5.99	12.41	FBE	9.14	13.85	14.77	7.78	0.07	FBE	10.01
15	20.43	6.43	FBE	16.46	28.11	FBE	6.32	2.61	8.72	14.30	1.62	1.90	10.69
16	21.62	0.88	FBE	15.77	33.78	1.81	10.60	7.27	5.99	25.56	4.19	8.05	12.32
17	1.45	8.55	3.37	17.40	13.85	1.39	4.22	7.24	9.30	20.83	12.19	5.64	8.78
18	0.55	6.12	FBE	2.86	9.18	FBE	3.90	1.89	10.20	25.86	10.27	2.55	7.34
19	1.66	3.45	32.78	1.38	FBE	FBE	58.81	2.58	30.81	11.03	FBE	1.02	15.95
Mean	5.73	11.84	10.11	9.29	10.25	8.07	12.46	11.47	12.33	13.69	13.74	12.80	11.10
All loudspeakers													Grand Mean

**Front-back errors — Experiment 4****5 kHz pure tone, Motionless**

loudspeaker	Listener												Mean All listeners
	1	2	3	4	5	6	7	8	9	10	11	12	
10	0	1	0	0	1	0	0	1	0	0	0	1	0.33
11	1	0	0	0	1	1	0	0	0	0	0	1	0.33
12	0	1	0	0	1	0	0	0	0	0	0	1	0.25
13	1	1	0	0	0	0	0	0	0	1	0	0	0.25
16	0	1	1	1	0	0	1	1	1	0	1	1	0.67
17	1	0	0	1	0	1	0	1	1	0	1	0	0.50
18	0	0	1	1	0	1	1	1	1	0	1	1	0.67
19	1	0	0	1	0	0	0	1	0	0	1	1	0.42
Mean	0.50	0.50	0.25	0.50	0.38	0.38	0.25	0.63	0.38	0.13	0.50	0.75	0.43
All loudspeakers													Grand Mean

**1.5 kHz pure tone, Motionless**

loudspeaker	Listener												Mean All listeners
	1	2	3	4	5	6	7	8	9	10	11	12	
10	0	1	1	0	1	0	1	1	0	0	0	1	0.50
11	0	1	1	0	0	0	1	1	1	0	0	1	0.50
12	1	1	1	0	0	0	0	0	1	0	0	1	0.42
13	0	1	1	0	0	0	1	0	1	0	0	1	0.42
16	1	0	0	1	1	1	0	0	1	1	1	0	0.58
17	1	0	1	1	1	1	0	0	0	1	1	0	0.58
18	1	0	1	1	1	1	0	0	0	1	1	1	0.67
19	1	0	1	1	1	1	1	1	1	1	1	0	0.83
Mean	0.63	0.50	0.88	0.50	0.63	0.50	0.50	0.38	0.63	0.50	0.50	0.63	0.56
All loudspeakers													Grand Mean

## 500 Hz pure tone, Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	1	1	0	0	1	1	0	0	0	0	1	0.42
11	0	1	1	0	0	0	1	0	1	0	0	1	0.42
12	0	1	1	0	0	1	1	0	1	0	0	1	0.50
13	0	1	0	0	0	0	1	0	1	0	0	0	0.25
16	1	0	0	0	1	1	1	0	1	1	0	0	0.50
17	0	0	0	1	0	0	0	0	0	1	1	0	0.25
18	0	0	0	0	0	1	1	0	0	1	1	0	0.33
19	1	0	1	1	1	1	0	1	0	1	1	1	0.75
Mean	0.25	0.50	0.50	0.25	0.25	0.63	0.75	0.13	0.50	0.50	0.38	0.50	0.43
All loudspeakers													Grand Mean

## 2 kHz low-pass noise, Motionless

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	1	1	1	1	1	1	0	1	0	0	1	0.67
11	0	1	1	0	0	1	1	1	1	0	0	1	0.58
12	0	1	1	0	1	1	1	1	0	0	0	1	0.58
13	0	1	1	1	0	0	0	1	0	0	0	0	0.33
16	1	0	0	0	0	1	0	0	0	1	0	0	0.25
17	1	0	0	0	0	0	0	1	0	1	0	0	0.25
18	1	0	0	0	0	0	0	0	0	1	0	0	0.17
19	1	0	0	0	0	0	0	0	0	1	1	1	0.33
Mean	0.50	0.50	0.50	0.25	0.25	0.50	0.38	0.50	0.25	0.50	0.13	0.50	0.40
All loudspeakers													Grand Mean

## 5 kHz pure tone, 4 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	1	0	0	1	1	0	0	0	1	0	1	0.42
11	0	1	0	1	1	0	0	0	0	0	0	1	0.33
12	1	1	0	0	1	0	0	0	0	0	0	1	0.33
13	0	1	0	0	0	0	0	0	0	1	0	0	0.17
16	1	0	0	1	0	1	0	1	1	0	1	0	0.50
17	1	0	1	0	0	1	0	1	0	1	1	0	0.50
18	1	0	1	0	0	0	1	1	0	0	0	0	0.33
19	1	0	0	1	0	0	1	1	0	0	1	0	0.42
Mean	0.63	0.50	0.25	0.38	0.38	0.38	0.25	0.50	0.13	0.38	0.38	0.38	0.38
All loudspeakers													Grand Mean

## 1.5 kHz pure tone, 4 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	1	1	0	0	1	1	1	1	0	1	1	0.67
11	1	1	1	0	0	0	1	1	1	0	1	1	0.67
12	0	1	0	0	0	1	1	0	0	0	0	1	0.33
13	0	1	0	0	0	0	1	1	1	1	1	1	0.58
16	0	0	1	1	1	0	0	0	0	1	0	0	0.33
17	0	0	0	1	0	1	0	0	1	1	0	0	0.33
18	0	0	0	1	1	1	0	1	1	1	0	0	0.50
19	0	0	0	1	1	0	0	0	0	1	1	0	0.33
Mean	0.13	0.50	0.38	0.50	0.38	0.50	0.50	0.50	0.63	0.63	0.50	0.50	0.47
All loudspeakers													Grand Mean

## 500 Hz pure tone, 4 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	1	1	1	1	0	0	1	0	1	0	0	1	0.58
11	0	1	1	1	0	0	1	1	1	0	1	1	0.67
12	0	1	0	0	0	1	1	0	0	0	0	1	0.33
13	0	1	0	0	0	1	0	1	1	0	0	1	0.42
16	0	0	0	0	1	1	0	0	0	1	1	0	0.33
17	0	0	0	0	0	1	0	0	0	0	1	0	0.17
18	0	0	0	0	1	1	0	0	0	0	1	0	0.25
19	0	0	0	0	1	1	0	1	0	0	0	0	0.25
Mean	0.13	0.50	0.25	0.25	0.38	0.75	0.38	0.38	0.38	0.13	0.50	0.50	0.38
All loudspeakers													Grand Mean

## 2 kHz low-pass noise, 4 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	1	1	1	0	1	0	1	1	1	0	0	1	0.67
11	0	1	1	0	1	1	1	1	1	0	0	1	0.67
12	0	1	0	0	1	1	0	1	1	0	0	1	0.50
13	0	1	1	1	0	1	0	0	1	0	0	1	0.50
16	1	0	0	0	0	1	0	0	0	1	0	0	0.25
17	1	0	0	0	0	0	0	0	0	0	0	0	0.08
18	1	0	0	0	0	0	0	0	0	0	0	0	0.08
19	0	0	0	0	0	0	0	0	0	0	0	0	0.00
Mean	0.50	0.50	0.38	0.13	0.38	0.50	0.25	0.38	0.50	0.13	0.00	0.50	0.34
All loudspeakers													Grand Mean

## 5 kHz pure tone, 8 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	0	1	0	1	1	1	0	0	1	0	1	0.50
11	0	0	0	0	1	0	0	0	0	1	1	1	0.33
12	0	0	0	0	0	0	1	0	0	1	0	0	0.17
13	0	0	0	0	0	0	0	0	0	1	0	0	0.08
16	1	1	1	0	1	0	1	1	0	0	1	1	0.67
17	1	1	1	1	0	0	0	1	1	0	1	0	0.58
18	1	0	0	1	0	1	1	1	0	0	1	0	0.50
19	1	0	1	1	0	0	1	1	1	0	1	0	0.58
Mean	0.50	0.25	0.50	0.38	0.38	0.25	0.63	0.50	0.25	0.50	0.63	0.38	0.43
All loudspeakers													Grand Mean

## 1.5 kHz pure tone, 8 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	0	1	0	1	0	1	0	1	0	0	0	0.33
11	0	1	0	0	0	0	0	0	1	0	0	1	0.25
12	0	0	0	0	0	1	0	0	1	0	0	1	0.25
13	1	1	1	0	0	0	0	0	1	0	0	1	0.42
16	1	1	0	1	1	1	0	0	0	0	0	0	0.42
17	1	0	0	1	1	1	0	0	1	0	0	0	0.42
18	1	0	1	0	1	0	0	0	0	1	0	0	0.33
19	1	0	0	0	1	1	0	0	1	0	0	0	0.33
Mean	0.63	0.38	0.38	0.25	0.63	0.50	0.13	0.00	0.75	0.13	0.00	0.38	0.34
All loudspeakers													Grand Mean

## 500 Hz pure tone, 8 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	0	1	1	0	0	1	0	0	0	0	1	0.33
11	0	0	1	1	0	1	1	0	1	0	0	1	0.50
12	0	0	0	0	0	0	0	0	0	0	0	0	0.00
13	0	1	0	0	0	0	0	0	0	0	0	0	0.08
16	1	0	0	0	0	1	0	0	0	0	1	0	0.25
17	1	0	1	0	1	1	0	1	0	0	0	0	0.42
18	1	0	1	0	1	0	0	0	0	0	0	0	0.25
19	0	0	0	0	1	0	0	0	0	0	1	0	0.17
Mean	0.38	0.13	0.50	0.25	0.38	0.38	0.25	0.13	0.13	0.00	0.25	0.25	0.25
All loudspeakers													Grand Mean

## 2 kHz low-pass noise, 8 degrees Rotation

loudspeaker	Listener												Mean
	1	2	3	4	5	6	7	8	9	10	11	12	All listeners
10	0	1	0	0	0	0	1	0	1	0	0	0	0.25
11	0	0	0	0	0	0	0	1	1	0	0	0	0.17
12	0	0	0	0	0	0	0	0	1	0	0	0	0.08
13	0	0	0	0	0	0	0	0	0	0	0	0	0.00
16	0	0	0	0	0	0	0	0	0	0	0	0	0.00
17	0	0	0	0	0	0	0	0	0	0	0	0	0.00
18	1	0	0	0	0	0	0	0	0	0	0	0	0.08
19	1	0	0	0	0	0	0	0	0	0	0	0	0.08
Mean	0.25	0.13	0.00	0.00	0.00	0.00	0.13	0.13	0.38	0.00	0.00	0.00	0.08
All loudspeakers													Grand Mean



**Front-back — Experiment 6****1 kHz low-pass noise, Normal, Motionless**

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.13
19	0	1	0	0	1	1	0	0	1	1	0	1	1	0	0	1	0.50
27	1	0	0	0	0	0	1	1	0	0	0	1	0	0	1	0	0.31
29	1	0	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0.38
32	0	1	0	0	1	1	1	0	1	1	0	0	1	1	0	1	0.56
34	0	1	0	0	1	1	0	0	0	1	0	1	1	0	0	1	0.44
Mean all loudspeakers	0.5	0.5	0	0	0.5	0.5	0.333	0.5	0.5	0.5	0.167	0.667	0.5	0.167	0.333	0.5	0.39 Grand Mean

**2 kHz low-pass noise, Normal, Motionless**

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	1	0	1	0	0	0	0	1	1	0	0	1	0	0	1	0	0.38
19	0	1	0	0	1	0	0	0	1	1	0	0	1	0	0	1	0.38
27	1	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0.19
29	1	0	1	0	0	0	0	1	0	0	0	1	0	0	1	0	0.31
32	0	1	0	1	1	1	0	0	0	1	0	0	1	0	0	1	0.44
34	0	1	0	0	1	1	1	0	0	1	0	0	1	0	0	1	0.44
Mean all loudspeakers	0.5	0.5	0.333	0.167	0.5	0.5	0.167	0.5	0.333	0.5	0	0.333	0.5	0	0.333	0.5	0.35 Grand Mean

## 4 kHz low-pass noise, Normal, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.13
19	0	1	0	0	1	1	1	0	0	1	0	0	1	0	0	0	0.38
27	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0.25
29	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	0.25
32	0	1	0	0	1	1	1	0	1	1	0	0	1	1	1	0	0.56
34	0	1	0	0	1	0	0	0	0	1	0	0	1	0	0	0	0.25
Mean all loudspeakers	0.5	0.5	0	0	0.5	0.667	0.333	0.5	0.167	0.5	0	0.333	0.5	0.167	0.167	0	0.30 Grand Mean

## Broadband noise, Normal, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.06
19	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0.13
27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
29	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0.19
32	0	1	0	0	1	1	0	0	1	0	0	0	1	1	0	0	0.38
34	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0.13
Mean all loudspeakers	0.333	0.167	0	0	0.167	0.5	0	0.333	0.167	0	0	0.167	0.5	0.167	0	0	0.16 Grand Mean

## 1 kHz high-pass noise, Normal, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0.13
27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
29	1	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0.19
32	0	0	0	0	0	1	1	0	1	1	0	0	1	0	0	0	0.31
34	0	1	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0.19
Mean all loudspeakers	0.333	0.167	0	0	0	0.5	0.167	0.167	0.167	0.167	0	0.167	0.5	0	0	0	0.15 Grand Mean

## 2 kHz high-pass noise, Normal, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	1	1	0	0	1	0	1	0	0	0	1	1	0	1	1	0.50
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
29	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.13
32	0	1	1	1	1	1	1	1	1	1	0	0	1	1	0	0	0.69
34	0	1	1	0	0	1	0	1	1	0	0	0	1	0	0	0	0.38
Mean all loudspeakers	0.167	0.5	0.5	0.167	0.167	0.5	0.167	0.5	0.333	0.167	0	0.333	0.5	0.167	0.167	0.167	0.28 Grand Mean

## 4 kHz high-pass noise, Normal, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.00
19	0	1	1	0	0	1	0	0	1	0	0	1	1	1	0	0	0.44
27	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.06
29	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0.13
32	0	1	1	0	0	1	1	0	1	1	0	0	1	1	1	0	0.56
34	0	1	1	0	0	1	0	0	0	0	0	0	1	0	0	0	0.25
Mean all loudspeakers	0.333	0.5	0.5	0	0	0.5	0.167	0	0.333	0.167	0	0.333	0.5	0.333	0.167	0	0.24 Grand Mean

## 1 kHz low-pass noise, Distorted, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0.25
19	0	1	0	0	1	1	1	0	1	0	0	0	1	0	0	1	0.44
27	1	0	0	0	0	0	0	1	0	0	0	1	0	0	1	0	0.25
29	1	0	0	1	0	0	0	1	1	0	1	1	0	0	1	0	0.44
32	0	1	0	0	1	0	0	0	0	1	0	0	1	1	0	1	0.38
34	0	1	0	0	1	1	0	0	1	1	0	1	1	0	0	1	0.50
Mean all loudspeakers	0.5	0.5	0	0.167	0.5	0.333	0.167	0.5	0.5	0.333	0.167	0.667	0.5	0.167	0.5	0.5	0.38 Grand Mean

## 2 kHz low-pass noise, Distorted, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0.19
19	0	1	0	0	1	0	1	0	0	0	0	0	1	0	0	1	0.31
27	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0.19
29	1	0	0	1	0	1	0	1	0	0	1	1	0	1	1	0	0.50
32	0	1	0	0	1	1	0	0	0	1	0	0	1	0	0	1	0.38
34	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0.25
Mean all loudspeakers	0.5	0.5	0	0.167	0.5	0.333	0.167	0.5	0	0.167	0.167	0.167	0.5	0.167	0.5	0.5	0.30 Grand Mean

## 4 kHz low-pass noise, Distorted, Motionless

Loudspeaker	Listener																Mean all listeners
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	
13	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0.13
19	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0.19
27	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0.06
29	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0.13
32	0	1	0	0	1	0	0	0	1	0	0	0	1	1	0	1	0.38
34	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	0.19
Mean all loudspeakers	0	0.167	0	0.167	0.5	0	0	0.5	0.167	0	0	0.167	0.5	0.167	0	0.5	0.18 Grand Mean