Notes

1. For example, those described by Deutsch (1975a).
2. From Guzman (1969).
3. Bregman and Rudnicky (1975).
4. Treisman and Schmidt (1982).
5. Julesz and Hirsh (1972).
6. Forms of this effect have been described by Vicario (1965, 1982) and Bregman and Achim (1973).
7. See discussion in van Noorden (1975). A more elaborate form of Körte's law in audition has been offered by Jones (1976).
8. Ogasawara (1936), Corbin (1942), and Attneave and Block (1973).
9. Bregman and Mills (1982).
10. See review in Warren (1982).
11. Bregman and Pinker (1978).
12. Cutting (1976).
13. Anstis and Saida (1985).
14. Shepard (1981).
15. Demany (1982).
16. This computer was kindly supplied by Martin Levine of the McGill University Department of Electrical Engineering.
17. Warren, Obusek, Farmer, and Warren (1969).
18. Bregman and Campbell (1971).
19. Miller (1947).
20. Miller and Heise (1950).
21. Researchers who seem to have independently rediscovered the extreme dissociation of streams in rapid sequences of alternating high and low pitched tones include Bozzi and Vicario (1960), Warren (1968), Bregman and Campbell (1971), van Noorden (1975).
22. Bozzi and Vicario (1960). The phenomenon of the splitting of streams the Gestalt approach to explaining it can also be found in Vicario (1965, 1982).
23. Jones, Kidd, and Wetzel (1981).
24. van Noorden (1975, 1977).
25. Bregman (1971).
26. Anstis and Saida (1985).
27. van Noorden (1975).
28. Jones (1976).
29. van Noorden (1975) p. 53.
30. Dannenbring and Bregman (1976a).
31. The importance of onset-to-onset time in controlling the amount of stream segregation was also apparent in a different experiment by the same authors

(Dannenbring and Bregman, 1976b). There was no effect of the silent gap between tones when onset-to-onset time was held constant.
32. van Noorden (1975) p. 56.
33. Vos and Rasch (1981).
34. Tuller and Fowler (1980).
35. Hirsh (1959) and Hirsh and Sherrick (1961).
36. Hirsh (1959).
37. Broadbent and Ladefoged (1959).
38. Warren (1982), Ch. 5.
39. For example, Hirsh (1974).
40. Royer and Robin (1986).
41. van Noorden (1975).
42. Royer and Robin (1986).
43. Ideas related to this notion of hierarchy have been discussed by Jones (1976), but her view of temporal units is tied to the notion of perceptual rhythms that result from oscillators in the auditory system becoming entrained to periodicities of different length in the signal. In the view that I am presenting here, the notion of a unit does not rely on the existence of periodicities.
44. Steiger and Bregman (1981).
45. Shepard (1981).
46. The evidence involves the time taken to imagine visual transformations of different sizes, (Cooper and Shepard, 1973a, 1973b; Shepard and Metzler, 1971) or the time required to shift one's attention across different distances in two-dimensional space (Tsal, 1983; Shulman, Remington and McLean, 1979) and in three-dimensional space (Downing and Pinker, 1985). Evidence for analog tactile representation comes from experiments by Carpenter and Eisenberg (1978) and Marmor and Zaback (1976).
47. Rhodes (1985).
48. This has been found in birds (Knudsen 1982, 1984) and mammals (Drager and Hubel, 1975, Palmer and King, 1982)
49. I am indebted to Michael Cohen for finding this interpretation of the experiment.
50. Examples of signal-processing approaches to the separation of signals by their spatial location include Mitchell, Ross, and Yates (1971) and Strube (1981). There have been two attempts that I know of to use other sorts of cues, by Parsons (1976) and Weintraub (1984). A number of approaches to the separation of speech from interfering noise are described in Lim (1983).
51. Norman (1966).
52. van Noorden (1975) p. 22.
53. Deutsch (1975).
54. Judd (1977).
55. Deutsch (1979).
56. Butler (1979a, 1979b).
57. Cherry and Taylor (1954).
58. Broadbent (1954).
59. Schubert and Taylor (1956).
60. Axelrod and Guzy, (1968), Axelrod, Guzy, and Diamond (1968), Axelrod and Powazek (1972), Guzy and Axelrod (1971, 1972).
61. Huggins (1974).
62. ten Hoopen (1982), ten Hoopen and Akerboom (1982), ten Hoopen, Vos and Dispa (1982), and ten Hoopen, van Meurs and Akerboom (1982).

63. ten Hoopen, Akerboom and Boelaarts (1985).
64. Deutsch (1979), Judd (1977), and Schubert and Parker (1956).
65. See Moore (1982), Ch. 4, for a review of pitch phenomena.
66. van Noorden (1975).
67. Bregman, Pinker (1978).
68. A result of spectral position on segregation of tones in the absence of a difference between them in (missing) fundamental frequency was also found by Kinney (1961). The segregation affected the listener's ability to judge the duration of a gap between the tones.
69. Bregman and Levitan (1983). See also Singh (1987).
70. Bregman and Liao (1984).
71. Bregman and Levitan (1983).
72. van Noorden (1975).
73. Darwin and Bethell-Fox (1977).
74. Dannenbring and Bregman (1976).
75. American Standards Association (1960).
76. Smith, Hausfeld, Power, and Gorta (1982).
77. Warren, Obusek, Farmer and Warren (1969).
78. See also the review of the research relating to this phenomenon in Warren (1982), Ch. 5.
79. McNally and Handel (1977).
80. The matching in frequency was studied by Bregman and Pinker (1978) and the density of the simultaneous components by Vicario (1982).
81. Steiger (1980).
82. Wessel (1979).
83. The role of the higher harmonics in increasing the brightness of a tone was described by Helmholtz (1859), p. 62.
84. Risset and Wessel (1982) caution that the estimate of brightness would also have to take into account the masking of one partial by another, and the fact that the loudness of any group of harmonics depends upon whether its components are in the same critical band or in different ones.
85. Kinney (1961), Bregman and Levitan (1983), Bregman and Liao (1984), and van Noorden (1975).
86. Green and Kidd (1983), Green, Kidd, and Mason (1983), Green, Kidd, and Picardi (1983), Green and Mason (1983), Green and Mason (1985), and Green, Mason, and Kidd (1984).
87. van Noorden (1975).
88. McAdams and Bregman (1979).
89. Halpern (1977).
90. Tougas and Bregman (1985a).
91. Plomp and Steenecken (1971).
92. Described by Plomp (1976), pp. 107–109.
93. Dannenbring and Bregman (1976).
94. Plomp (1976), p. 97.
95. Warren and Verbrugge (1984).
96. For example, Grey (1977).
97. Steiger and Bregman (1981).
98. The notion of pitch movement detectors has been supported by evidence from psychophysical observations (Regan and Tansley, 1979). Kay and Matthews (1972), Green and Kay (1973), and Gardner and Wilson (1979) have found that the auditory system can be habituated to particular kinds of frequency

sweeps without at the same time being habituated to different orientations or rates of frequency modulation. Pollack (1968) has also found psychophysical evidence for channels in the auditory system sensitive to particular directions of frequency change. Physiological measurement on bats (Suga 1965a, 1965b) shows FM-sensitive auditory neurons. Other physiological observations have been reported by Evans and Whitfield (1964) and Vartanian (1974).
99. Steiger and Bregman (1981).
100. Steiger (1980).
101. Grey (1977), Grey and Gordon (1978), and Grey and Moorer, (1977).
102. Cutting and Rosner (1976).
103. Butler (1979b), Wessel (1979).
104. van Noorden (1975).
105. Erickson (1974).
106. E.g., Zucker (1977, 1985a, 1985b).
107. Julesz (1981a, 1981b) and Pomerantz (1981).
108. Warren and Verbrugge (1984).
109. Gabor (1947), p. 591.
110. Bastiaans (1980).
111. Julesz (1981a, 1981b) and Julesz and Bergen (1983).
112. I would like to express my thanks to Bela Julesz for discussing the topic of auditory texture with me and helping me to clarify my thinking on the topic.
113. Roads (1985), p. 156.
114. See chapter 3.
115. Ciocca and Bregman (1987).
116. Goldstein (1980), pp. 116–119.
117. Shepard (1962).
118. Reviewed in Plomp (1976), ch.6.
119. von Bismarck (1974).
120. Grey (1977). See also Grey (1975), Grey and Gordon (1978), Gordon and Grey (1978), Grey and Moorer (1977), Wessel (1978, 1979).
121. The actual analyses in experiments by Grey and his colleagues used an algorithm called INDSCAL that takes individual differences between listeners into account (Carroll and Chang, 1970).
122. van Noorden (1975).
123. van Noorden (1975).
124. Bregman (1978a).
125. Anstis and Saida (1985).
126. Bregman (1978a), pp. 386–387.
127. For example, Ladefoged (1959), Ladefoged and Broadbent (1960), and Fodor and Bever (1965).
128. For example, Kinney (1961), Perrott and Williams (1970), Divenyi (1971), Williams and Perrott (1971), Divenyi and Hirsh (1972), Collyer (1974), Williams and Elfner (1976), Williams, Elfner and Howse (1979), Fitzgibbons, Pollatsek, and Thomas (1974), Divenyi and Danner (1977), and Divenyi and Sachs (1978).
129. Anstis and Saida (1985).
130. van Noorden (1975).
131. Bregman and Rudnicky (1975).
132. Bregman (1978a), p. 386.
133. Jones, Kidd, and Wetzel (1981).
134. Also see the preliminary observations made by Bregman and Rudnicky on simultaneous cycles of tones with different tone repetition rates (reported in

chapter 3). It took a little while for the sense of two distinct streams to build up despite the fact that the listener was not trying to follow a sequence that was alternating between frequency ranges.
135. Bregman and Dannenbring (1973).
136. A related experiment was performed for a "ramped" condition by Anstis and Saida (1985). Despite using a different methodology and a different type of ramp (sinusoidal), they obtained similar results.
137. Heise and Miller (1951).
138. Jones (1976).
139. Bregman and Campbell (1971).
140. Bregman and Campbell (1971).
141. Dowling (1973).
142. See also Warren (1968).
143. Bregman and Rudnicky (1975).
144. Ortmann (1926), Divenyi and Hirsh (1975), Watson, Kelly, and Wroton (1976), Watson, Wroton, Kelly, and Benbasset (1975), Idson and Massaro (1976), and Divenyi and Hirsh (1978).
145. Divenyi and Hirsh (1975).
146. Divenyi and Hirsh (1978).
147. Massaro (1970, 1975).
148. Idson and Massaro (1976).
149. Sparks (1976).
150. Holding, Loeb, and Yoder (1972) and Sparks (1976).
151. Dannenbring and Bregman (1976b).
152. Woods (1979).
153. Massaro (1977).
154. Warren, Obusek, Farmer, and Warren (1969).
155. Hirsh (1959).
156. See also Thomas and Fitzgibbons (1971) who reported that successive tones within recycled sequences of four items all have to be within half an octave for accurate identification of order at the limiting value of 125 msec per item.
157. Similar cases of grouping similar items together in the report were found by McNally and Handel (1977) and by Bregman (1972).
158. Bregman and Campbell (1971).
159. Broadbent and Ladefoged (1959).
160. Norman (1966), p. 4. See also Norman (1967).
161. Vicario (1973), pp. 64–72.
162. McNally and Handel (1977).
163. Nickerson and Freeman (1974) and Warren and Byrnes (1975).
164. Warren and Obusek (1972) and Warren and Ackroff (1976).
165. Wilcox, Neisser, and Roberts (1972), Watson (1976), Watson, Wroton, Kelly, and Benbasset (1975), Watson, Kelly, and Wroton (1976), and Warren (1974).
166. Warren and Obusek (1972).
167. Warren (1982), p. 125.
168. Nickerson and Freeman (1974).
169. Neisser (1971, 1972) and Neisser and Hirst (1974).
170. For example, Warren (1974).
171. Broadbent and Ladefoged (1959).
172. Warren (1982), p. 132.
173. Hirsh (1959), Hirsh and Sherrick (1961), Kinney (1961), and Fay (1966).

174. Patterson and Green (1970), Yund and Efron (1974), and Wier and Green (1975).
175. Neisser (1972).
176. Neisser and Hirst (1974).
177. Warren and Byrnes (1975).
178. For example, Warren (1982), p. 129.
179. Warren (1982), p. 123–125, reviews many of these studies, including those of Warren, Obusek, Farmer and Warren (1969), Thomas, Hill, Carroll, and Garcia (1970), Thomas, Cetti, and Chase (1971), and Dorman, Cutting, and Raphael (1975).
180. Neisser (1971).
181. Cole and Scott (1973).
182. Neisser and Hirst (1974).
183. Ortmann (1926), Warren (1972, 1974), Watson, Kelly, and Wroton (1975), Watson, Wroton, Kelly, and Benbasset (1975), and Divenyi and Hirsh (1978).
184. Bregman (1978a) and Anstis and Saida (1985).
185. This term was used by Neisser (1967). It has also been called "precategorical acoustic store" by Crowder and Morton (1969). See also Darwin, Turvey, and Crowder (1972).
186. Divenyi and Hirsh (1978).
187. For example, Bregman (1978b) and Handel, Weaver, and Lawson (1983).
188. For example, Neisser and Hirst (1974) and Barsz (1988).
189. Warren and Ackroff (1976) employed this method.
190. Warren (1982).
191. van Noorden (1975).
192. Norman and Bobrow (1977).
193. Hirsh (1959).
194. See Warren (1982), pp. 120–139.
195. van Noorden (1975).
196. Bregman (1978b).
197. van Noorden (1975), p. 56.
198. See experiments reviewed by Handel (1984) and studies by Klapp, Hill, Tyler, Martin, Jagacinski, and Jones (1985) and Beauvillain (1983).
199. Dannenbring and Bregman (1976b). This was a more carefully controlled study based on an earlier pilot study by Bregman (1972b).
200. Kinney (1961).
201. Fitzgibbons, Pollatsek, and Thomas (1974).
202. van Noorden (1975), p. 47.
203. For example, Perrott and Williams (1970), Divenyi (1971), Williams and Perrott (1971), Divenyi and Hirsh (1972), Collyer (1974), Williams and Elfner (1976), Williams, Elfner and Howse (1979), Divenyi and Danner (1977), and Divenyi and Sachs (1978).
204. Neff, Jesteadt and Brown (1982).
205. Bregman and Liao (1984).
206. Dowling (1973).
207. Warren and Ackroff (1976).
208. ten Hoopen, van Meurs, and Akerboom (1982) and ten Hoopen, Akerboom and Boelaarts (1985).
209. Bregman and Rudnicky (1975).
210. van Noorden (1975), pp. 46–48; see also Norman (1967).
211. Bregman (1978b).

212. McNally and Handel (1977) p. 455.
213. Idson and Massaro (1976).
214. For a discussion of recognition masking see Massaro (1975); other related articles are Massaro (1970, 1970, 1972).
215. Bregman and Rudnicky (1975).
216. Bregman and Levitan (1983) and Bregman and Liao (1984).
217. Smith, Hausfeld, Power and Gorta (1982); the scale illusion is described in the earlier section of the present volume on the effect of spatial factors on stream segregation and in Deutsch (1975b, 1982).
218. Bregman and Pinker (1978).
219. Among them, in chronological order: Ortmann (1926), Koffka (1935), Fox (1948), Miller and Heise (1950), Heise and Miller (1951), Bozzi and Vicario (1960), Vicario (1965), Bregman and Campbell (1971), Julesz and Hirsh (1972), Bregman and Achim (1973), Vicario (1973), van Noorden (1975), Deutsch (1975a), Divenyi and Hirsh (1978), Bregman (1978b), Kubovy (1981), Vicario (1982), Deutsch (1982), Handel, Weaver, and Lawson (1983), and Anstis and Saida (1985),
220. For example, Helmholtz (1862) and Koffka (1935), p. 435.
221. Divenyi and Hirsh (1971) and Bregman and Achim (1973).
222. This account is given by van Noorden (1975, p. 50).
223. Kolers (1964) and Anstis, Giaschi and Cogan (1985).
224. Bregman and Achim (1973).
225. Vicario (1965).
226. Tougas and Bregman (1985a).
227. Ramachandran and Anstis (1984).
228. Ramachandran and Anstis (1983).
229. Körte (1915).
230. The notion of pitch movement detectors has been supported by evidence from psychophysical observations (Regan and Tansley, 1979). Kay and Matthews (1972), Green and Kay (1973), and Gardner and Wilson (1979) have found that the auditory system can be habituated to particular kinds of frequency sweeps without at the same time being habituated to different orientations or rates of frequency modulation. Pollack (1968) has also found psychophysical evidence for direction-specific channels in the auditory system. Physiological measurement on bats (Suga 1965a, 1965b) shows FM-sensitive auditory neurons. Other physiological observations have been reported by Evans and Whitfield (1964) and Vartanian (1974).
231. van Noorden (1975), Anstis and Saida (1985).
232. Bregman and Dannenbring (1973).
233. Anstis, Giaschi, and Cogan (1985).
234. van Noorden (1975).
235. Bregman and Dannenbring (1973).
236. Burke (1952); see also Wertheimer (1912) and Knops (1947).
237. But see Sigman and Rock (1974), who showed that if the screen is shown, its own properties (for example, whether it is seen as being in motion itself) can change the perceived motion of the events going on behind it.
238. Spelke and Cortelyou (1981); see also Spelke (1979).
239. Dodd (1979).
240. O'Leary (1981), p. 7.
241. O'Leary and Rhodes (1984).
242. Gilbert (1939).

243. Staal and Donderi (1983).
244. Radeau and Bertelson (1976) and Bertelson and Radeau (1981). See also Hay, Pick, and Ikeda (1965), Jackson (1953), Thomas (1941), Witkin, Wapner, and Leventhal (1952), and Jack and Thurlow (1973).
245. This is supported by experiments done by Dodd (1977, 1980).
246. McGurk and MacDonald (1976).
247. van Noorden (1975).
248. Judd (1977), Deutsch (1979).
249. Bregman and Liao (1984).
250. van Noorden (1975) and Anstis and Saida (1985).
251. For a list of some of the research on cortical detectors see my earlier discussion on the sequential grouping of frequency glides, and my discussion of the research of Anstis and Saida (1985).
252. van Noorden (1975), p. 41.
253. Bregman and Rudnicky (1975).
254. Bregman and Pinker (1978); a similar sort of capturing was demonstrated by van Noorden (1975).
255. Pattison, Gardner and Darwin (1986).
256. Bregman and Rudnicky (1975).
257. van Noorden (1975).
258. Norman (1967).
259. Anstis and Saida (1985).
260. Idson and Massaro (1976), p. 173.
261. Bregman and Rudnicky (1975).
262. Bregman (1978a).
263. Bregman (1981b).
264. Jones (1976).
265. Jones, Maser and Kidd (1978).
266. van Noorden (1975).
267. Bregman (1978a).
268. Bregman and Rudnicky (1975).
269. See Bregman (1981a).
270. Tougas and Bregman (1985a).
271. Gottschaldt (1926).
272. Demany (1982).
273. Bregman (1984), Deutsch (1982), Fox (1948), Handel (1985), Julesz and Hirsh (1972), Vicario (1965, 1973, 1980, 1982).
274. I thank Meg Withgott for pointing this out.
275. Witkin and Tenenbaum (1983).
276. Rock (1985), Bregman (1977).
277. Steiger (1980).
278. Discussions of hierarchies in the representation of temporal patterns are presented by Handel and Todd (1981), Jones (1976, 1978), Jones, Boltz, and Kidd (1982), Jones, Kidd, and Wetzel (1981), and Jones, Maser, and Kidd (1978); it is discussed specifically in relation to music by Jackendoff and Lehrdahl (1981).
279. Norman (1966), Jones (1976).
280. Jones, Maser and Kidd (1978).
281. Bregman and Rudnicky (1975). This experiment is discussed in detail elsewhere in this volume.
282. Summarized in Warren (1982), pp. 185–186.
283. Carried out by von Wright, Anderson, and Stenman (1975).

284. Bregman and Pinker (1978).
285. van Noorden (1975).
286. Helmholtz (1859), p. 50.
287. van Noorden (1975), p. 88.
288. Steiger and Bregman (1981).
289. Helmholtz (1859), pp. 59–60.
290. Helmholtz (1859), p. 50.
291. van Noorden (1975), pp. 23, 87–89.
292. The experiment was carried out by Warren, Obusek, and Ackroff (1972) and is described in Warren (1982), p. 141.
293. Bregman (1977).
294. For example, in Shepard (1981).
295. van Noorden (1975).
296. For example, Helmholtz (1859) and Plomp (1964).
297. Moore (1982), Ch. 1.
298. This explanation for the unequal ability of different harmonics to resist being captured out of the complex tone was offered by van Noorden (1975).
299. Vicario (1982).
300. This assumption was required to explain certain results in the experiments of Bregman, Abramson, Doehring, and Darwin (1985). An unpublished result by Margo Taylor at McGill also produced confirming evidence.
301. Bregman and Pinker (1978).
302. Plomp's studies of the hearing out of partials are reported in Plomp (1964, 1976), and Plomp and Mimpen (1968).
303. Dannenbring and Bregman (1978).
304. Moore (1982), Ch.3.
305. van Noorden (1975), p. 87.
306. Dannenbring and Bregman (1978).
307. Denes and Pinson (1963).
308. Martens (1984) and Moore, Peters, and Glasberg (1985).
309. See McAdams (1984), pp. 41–43.
310. One of the best of these is by Moore (1982).
311. McAdams (1984), p. 41.
312. See Moore (1982), Ch. 4, for a review of the phenomena associated with shifting a harmonic series.
313. Goldstein (1973).
314. Theories of this type are reviewed in Moore (1982), pp. 123–127.
315. The perceptual qualities of sounds with "stretched partials" were reported by Slaymaker (1970), Cohen (1979, 1980a, 1980b), and Mathews and Pierce (1980).
316. Personal communication, 1982.
317. Houtsma (1985) and Weintraub (1985).
318. Martens (1984) showed that a 7 percent mistuning of the third harmonic increased its audibility as much as adding 23 dB to its intensity did.
319. Moore, Glasberg, and Peters (1985a), p. 13. See also Moore, Glasberg, and Peters (1985b) and Moore, Peters, and Glasberg (1985).
320. This notion has been proposed as an extension of the pitch model of Goldstein (1973) by Duifhius, Willems, and Sluyter (1982), Scheffers (1983), and Grandori (1984). "According to this idea, a partial will only be accepted by the pitch mechanism as part of a given harmonic series if its estimated frequency falls within a pre-set range around each harmonic frequency . . . about 2–3 for com-

plex tones 410 ms in duration" (Moore, Glasberg, and Peters, 1985a).
321. This argument can be read in more detail in Moore (1982), p. 154.
322. Plomp (1964).
323. Bregman and Doehring (1984).
324. Summerfield, Haggard, Foster, and Gray (1984).
325. It was discovered by Summerfield and his co-workers before 1985 but had not been published as of the writing of this chapter.
326. A case that we will not consider here is one where one of the tones is harmonic and the other inharmonic. There can be more than a fifty percent overlap in such a case. However, we will probably find that there is only one dominant global pitch and a number of partial pitches, as in the case of mixed inharmonic partials.
327. Stumpf (1890).
328. Vicario (1982).
329. This idea has, in effect, been proposed by Rasch (1978).
330. Houtsma (1983).
331. While there are certain nonlinearities in acoustic systems that cause violations of this principle, it remains, on the whole, a valid one.
332. Chowning (1980).
333. McAdams (1984).
334. McAdams (1984). He actually used a mixture of two different kinds of modulation functions to generate the FM. The first (called vibrato) was a 6.5-Hz sinusoid, the second (called jitter) was an irregular function containing frequency components from 0 to 150 Hz with the amplitude falling off greatly for the higher frequency components.
335. McAdams (1984), p. 106.
336. McAdams (1984), p. 193.
337. Thurlow and Small (1955) and Plomp (1976).
338. McAdams (1984), p. 200.
339. The sound was used in the 1983 composition "Archipelago" by Roger Reynolds and was made with the assistance of Thierry Lancino.
340. This was reported in Bregman, McAdams, and Halpern (1978) and in McAdams and Bregman (1979), and was an undergraduate project at McGill University. Replications and extensions were done subsequently with the assistance of Magda Halikia (also spelled Chalikia).
341. Bregman and Doehring (1984).
342. Bregman and Pinker (1978).
343. Vicario (1973).
344. Dannenbring and Bregman (1978).
345. Rasch (1978).
346. See Kubovy (1981), pp. 66–69.
347. Kubovy and Jordan (1979).
348. They pointed out that if the waveform is subject to a compressive nonlinearity, such as a cubic root transformation, at some peripheral stage of processing, it can be shown that there is a peak in the power spectrum at precisely the frequency of the shifted component.
349. Cohen (1979, 1980).
350. Risset and Mathews (1969).
351. Some of these are given by McAdams (1984), p. 50.
352. Bacon and Viemeister (1985a, 1985b).
353. Malsburg and Schneider (1986).

354. Schubert and Nixon (1970), cited in McAdams (1984), p. 57.
355. Broadbent and Ladefoged (1957).
356. Hall, Haggard, and Fernandes (1984), p. 56.
357. The computations underlying the cochleagram are described by Lyon (1982, 1983).
358. Broadbent and Ladefoged (1957) have argued that "the key to the fusion of sounds which stimulate different parts of the basilar membrane is the envelope of the waveform of these sounds" (p. 709).
359. Moore (1982), pp. 140–144.
360. Moore (1982), p. 133.
361. Warren (1982), p. 101.
362. Halikia (1985). See also Chalikia and Bregman (1989).
363. Moore (1982).
364. Moore (1982), p. 193.
365. Bregman, Abramson, Doehring, and Darwin (1985).
366. Bregman, Levitan, and Liao (1990). Experiments 1A and 1B.
367. Bregman, Levitan, and Liao (1990). Experiments 2A and 2B.
368. See experiment 2 of Bregman, Abramson, Doehring, and Darwin (1985).
369. Warren (1982), p. 79–80 and Warren and Bashford (1981).
370. Békésy (1963).
371. Reviewed in Deutsch (1982a).
372. Bregman and Abdel Ahad (1985).
373. See Moore (1982), p. 104.
374. Bertelson and Radeau (1981), Hay, Pick, and Ikeda (1965), Jack and Thurlow (1973), Jackson (1953), Radeau and Bertelson (1976), Thomas (1941), and Witkin, Wapner, and Leventhal (1952).
375. Dodd (1979), Spelke (1979), and Spelke and Cortelyou (1981).
376. O'Leary and Rhodes (1984).
377. See, for example, Dodd (1977, 1980).
378. For example, McGurk and MacDonald (1976).
379. Cherry (1953).
380. Kubovy (1981).
381. See chapter 7, the section entitled *How Unusual is the Sharing of Evidence?*
382. Jenkins and Merzenich (1984).
383. Perrott and Barry (1969).
384. Kubovy and Howard (1976).
385. This pattern was created by Roger Reynolds and Thierry Lancino at the Institut de Recherche et Coordination Acoustique/Musique (Institute for Research and Coordination in Acoustics and Music, abbreviated IRCAM) in Paris, for Reynolds' composition, *Archipelago*. It was reported by McAdams (1984), p. 55.
386. This description is based on an experiment by Cramer and Huggins (1958).
387. Meyer (1978).
388. Green and Kidd (1983).
389. For reviews, see Broadbent (1958, 1971), Kahneman (1973), Norman (1976), Underwood (1976), and Moray (1970).
390. Efron, Crandall, Koss, Divenyi, and Yund (1983).
391. Strube (1981).
392. Mitchell, Ross, and Yates (1971).
393. Strube (1981).
394. Lyon (1983).

395. The model is described in Lyon (1983).
396. Steiger and Bregman (1982).
397. van den Brink, Sintnicolaas, and van Stam (1976).
398. Cutting (1976).
399. Deutsch (1974, 1975a, 1982).
400. Bertelson and Radeau (1981), Hay, Pick, and Ikeda (1965), Jack and Thurlow (1973), Jackson (1953), Radeau and Bertelson (1976), Thomas (1941), and Witkin, Wapner, and Leventhal (1952). A recent general review of the effects of discrepancies between the senses is given by Welch and Warren (1980).
401. It has been noted in experiments on discrepancy between information derived from different senses that the subject's awareness that a discrepancy has been experimentally induced can affect the interaction (Welch and Warren, 1980). For example, Miller (1972), experiment 3, found in studying how sight and touch interact in the perception of the shape of an object that only when the observer believes that the visual and touch cues are from the same object does vision correct the shape perception derived from touching.
402. Jack and Thurlow (1973).
403. Bregman and Steiger (1980).
404. Pratt (1930).
405. Butler (1969), Roffler (1968), and Searle, Braida, Cuddy, and Davis (1975).
406. Broadbent and Ladefoged (1957).
407. For example, Julesz (1981a).
408. Helmholtz (1859), p. 62.
409. The effect of harmonicity on masking was shown by Moore, Peters, and Glasberg (1985) and the effect on perceptual isolation by Moore, Glasberg, and Peters (1986).
410. Rasch (1978).
411. Kubovy (1976) described in Kubovy (1981), pp. 66–69.
412. Scheffers (1983a).
413. Dannenbring and Bregman (1978).
414. Rasch (1979).
415. Bacon and Viemeister (1985b).
416. Hall, Haggard, and Fernandes (1984) and Hall (1986). Closely related research has been done by Buus (1985), Haggard, Harvey, and Carlyon (1985), and Hall, Haggard, and Harvey (1984).
417. The noise was amplitude modulated by a 0–50 Hz noise band.
418. Hall, Haggard, and Fernandes (1984), p. 56.
419. See Buus (1985).
420. Schooneveldt and Moore (1988). However, other research by Hall and Grose (1988) shows that multiple cues may be involved in the release from masking.
421. This argument has been made by Moore (1982).
422. Bronkhorst and Plomp (1987) and Plomp and Mimpen (1981).
423. Kock (1950), Schubert (1956), Carhart, Tillman, and Johnson (1967), and Levitt and Rabiner (1967).
424. A more complete discussion of the binaural masking level difference and related effects is given by Moore (1982), Ch. 5.
425. de Laat and Plomp (1985).
426. McAdams (1984), p. 176.
427. Thurlow and Small (1955) and Plomp (1976).
428. Houtsma and Goldstein (1972).

429. Green and Kidd (1983).
430. Stern (1972).
431. Treisman and Schmidt (1982), p. 119.
432. Helmholtz (1859), pp. 60–61.
433. Attneave (1974).
434. van Noorden (1975).
435. Bregman (1977).
436. Bregman and Tougas (1989).
437. This will be discussed under the topic of duplex perception of speech in the section on speech.
438. Winston (1975), Ch.3.
439. Waltz (1975).
440. Zucker (1977).
441. For example, van Noorden (1975). The sequence-integrating theory of Mari Riess Jones, which sees the integrative process as the action of a single sequence building process, would have the same problems; see Jones (1976), Jones, Boltz, and Kidd (1982), and Jones, Kidd, and Wetzel (1981).
442. Warren (1982).
443. Dannenbring (1976).
444. See Warren and Bashford (1976).
445. Warren (1982).
446. For example, Vicario (1960).
447. Warren, Obusek, and Ackroff (1972).
448. Elfner and Caskey (1965) and Houtgast (1972).
449. Bregman and Dannenbring (1977).
450. Plomp (1982).
451. Houtgast (1972), cited by Warren (1982).
452. Elfner and Caskey (1965) and Elfner and Homick (1966, 1967).
453. Warren, Obusek, and Ackroff (1972).
454. Warren, Obusek, and Ackroff (1972).
455. Verschuure, personal communication in 1974, cited by van Noorden (1975).
456. Moore (1982), pp. 97–105.
457. Ciocca (1985) and Dannenbring (1976).
458. This perceptual result is predictable from unpublished experiments done by Yves Tougas in my laboratory.
459. Layton (1975) and Samuel (1981).
460. Warren (1982), p. 151.
461. Zwicker, Flottorp, and Stevens, (1957).
462. Houtgast (1972).
463. Houtgast (1974).
464. Steiger (1980).
465. Tougas and Bregman (1985b).
466. Ciocca (1985) and Ciocca and Bregman (1987).
467. A mild deception in the name of science.
468. Steiger and Bregman (1981), for example, found that it did not.
469. Vicario (1973).
470. Warren, Sherman (1974).
471. Warren, Warren (1970).
472. Warren, Obusek, and Ackroff (1972).
473. Thurlow (1957), Thurlow and Elfner (1959), and Warren, Obusek, Ackroff (1972).

474. Bregman and Dannenbring (1973).
475. Vicario (1960, 1982) and Sasaki (1980), cited in Warren (1982). Musical scale restoration has also been observed in unpublished research by Gary Dannenbring.
476. Warren (1982), Ch.6.
477. Warren, Obusek, and Ackroff (1972) and Warren (1982), p. 141.
478. Warren, Obusek, and Ackroff (1972) and van Noorden (1975).
479. Miller and Licklider (1950).
480. Vicario (1960). The visual tunnel effect was studied by Wertheimer (1912), Knops (1947), and Burke (1952).
481. Bashford and Warren (1986).
482. Thurlow (1957); see also subsequent research by Elfner (1969, 1971), Elfner and Caskey (1965), Elfner and Homick (1966, 1967), Thurlow and Elfner (1959), Thurlow and Marten (1962), and Thurlow and Erschul (1978).
483. Dannenbring (1976).
484. Ciocca (1985) and Ciocca and Bregman (1987).
485. Vicario (1982).
486. Miller and Licklider (1950); this result was also found by Dirks and Bower (1970).
487. Cherry and Wiley (1967), Holloway (1970), Powers and Wilcox (1977), and Verschuure and Brocaar (1983).
488. This was first proposed by Huggins (1964) and later by Powers and Wilcox (1977).
489. This suggestion was first made by Cherry and Wiley (1967).
490. The research on the different types of spoken material was done by Bashford and Warren (1979) and on the different rates of speaking by Bashford, Meyers, Brubaker, and Warren (1988).
491. Warren (1970), Warren and Obusek (1971), Obusek and Warren (1973), and Warren and Sherman (1974).
492. Warren and Obusek (1971).
493. Warren and Sherman (1974).
494. Layton (1975), Samuel (1981), and Samuel and Ressler (1986). This finding has been confirmed using the method of periodic interruption of running speech by Bashford and Warren (1986).
495. Wrightson and Warren (1981), described in Warren (1982); the tone was 70 dB at 1,000 Hz; the narrow band was 80 dB, centered at 1,000 Hz.
496. I am indebted to John Pierce for this story.
497. Warren, Obusek, and Ackroff (1972).
498. van Noorden (1975).
499. van Noorden (1975), pp. 31–36.
500. The speech-noise case was reported by Egan (1948), and the tone-tone case by Thurlow and Elfner (1959).
501. Butler and Naunton (1962, 1964).
502. Warren and Bashford (1976).
503. Steiger and Bregman (1982a).
504. Steiger (1983).
505. Deutsch (1979).
506. For example, Warren (1982), Ch.6.
507. Bregman and Pinker (1978).
508. Rasch (1978).

509. Helmholtz (1859).
510. Nordmark (1970).
511. Scheffers (1979, 1982, 1983a).
512. Cutting (1976).
513. Cutting (1975), Darwin (1979, 1981), Isenberg and Liberman (1979), Liberman, Isenberg, and Rakerd (1981), Mann (1980), Mann, Madden, Russell, and Liberman (1981), Mattingly, Liberman, Syrdal, and Halwes (1971), Mattingly and Liberman (1989), Liberman and Mattingly (1985), Rand (1974), and Repp (1984).
514. Cherry (1953), Broadbent (1958).
515. Bregman (1971).
516. Dowling (1973).
517. DeWitt and Samuels (1986).
518. "Schema," or actually "scheme," was the term employed by Jean Piaget. A good general outline of his work on the analysis of certain mental capacities is found in Flavell (1963). "Frame" is a term introduced in the field of artificial intelligence by Minsky (1975). The term "ideal" was used by Bregman (1977).
519. Watson, Wroton, Kelly, and Benbasset (1975).
520. Watson, Kelly, and Wroton (1976).
521. Spiegel and Watson (1981).
522. McBride (1986).
523. Leek and Colleran (1984).
524. Demany (1982).
525. van Noorden (1975).
526. For a discussion of the concept of the critical band, see Zwislocki (1978) and Moore (1982), Ch. 3.
527. Dowling (1973).
528. Deutsch (1972).
529. Warren and Warren (1970).
530. Anstis and Saida (1985).
531. Dowling (1973).
532. Jones (1976).
533. van Noorden (1975).
534. Jones, Maser, and Kidd (1978).
535. Jones, Maser, and Kidd (1978) required listeners to write down a description of the sequence while Jones, Boltz, and Kidd (1982) and Kidd, Boltz, and Jones (1984) used a sequence-comparison task.
536. van Noorden (1975), p. 41.
537. This phenomenon was first described by van Noorden (1975), p. 76.
538. Deutsch (1975a).
539. Tougas and Bregman (1985a).
540. Smith, Hausfeld, Power, and Gorta (1982) also promoted the crossing of streams in a more complex situation in which tones were also being alternated between ears in the manner of the Deutsch (1975) scale illusion. They isolated the streams on the basis of timbre by having a synthesized piano play one stream and a synthesized saxophone the other. Again the effect cannot be interpreted as showing the existence of a trajectory principle.
541. Steiger and Bregman (1981).
542. Ciocca and Bregman (1987).
543. Dannenbring (1976).
544. Bregman and Rudnicky (1975).

545. Pattison, Gardner, and Darwin (1986) and Darwin and Gardner (1986), p. 16.
546. Bregman and Dannenbring (1973).
547. Ciocca and Bregman (1987).
548. Dannenbring (1976).
549. Heise and Miller (1951).
550. Nickerson and Freeman (1974).
551. Warren and Byrnes (1975).
552. van Noorden (1975), p. 15.
553. McNally and Handel (1977).
554. Handel, Weaver, and Lawson (1983).
555. Divenyi and Hirsh (1974, 1975).
556. Idson and Massaro (1976).
557. Bregman (1978c).
558. van Noorden (1975), pp. 77–78.
559. Guilford and Hilton (1933) and Guilford and Nelson (1936); cited by Heise and Miller (1951), p. 69.
560. Scott (1971) and Scott and Cole (1972).
561. Cole and Scott (1973).
562. Warren and Warren (1970) and Warren and Sherman (1974).
563. Ciocca and Bregman (1987).
564. Bregman and Achim (1973).
565. Ramachandran and Anstis (1983); see also Ramachandran and Anstis (1981).
566. Shepard (1981).
567. Martin (1972).
568. Jones (1976).
569. Jones, Kidd, and Wetzel (1981), quotations from pp. 1060 and 1071.
570. Jones, Kidd, and Wetzel (1981).
571. Jones, Kidd, and Wetzel (1981), p. 1071.
572. Jones, Boltz, and Kidd (1982).
573. Dowling (1973).
574. Handel, Weaver, and Lawson (1983).
575. This is observable, for example, in the results of Bregman and Campbell (1971) and in those of Handel, Weaver, and Lawson (1983).
576. Tougas and Bregman (1985a).
577. French-St. George and Bregman (1989).
578. Bregman (1978a) and Anstis and Saida (1985).
579. Jones, Kidd, and Wetzel (1981).
580. Bregman and Rudnicky (1975).
581. Erickson (1982), p. 520.
582. I am not a musician. Fortunately, I have been privileged to associate with musicians and this chapter is the fruit of that contact. I particularly had the pleasure of a year-long dialogue with James Wright when I helped to supervise a Master's thesis that he submitted to the McGill University Faculty of Music. Many of the ideas that appear in this chapter are the result. Since the thesis and a subsequent paper by Wright and myself are not widely available, I have taken this opportunity to present many of our ideas. I have also had the benefit of discussions with composers at the Center for Computer Research in Music and Acoustics at Stanford who kept me honest in my statements about music. The citation for the thesis is Wright (1986) and for the article is Wright and Bregman (1987).
583. Boulez (1985).

584. The ideas of this chapter were evolved with little contact with the literature on music theory. They come from the ideas about scene analysis that have been the basis for the earlier parts of this book. They draw strongly upon the ideas of the Gestalt psychologists. In preparing this chapter it became obvious that music theorists have also been influenced by Gestalt theory. In particular, C. W. Fox in his 1948 article on modern counterpoint put forward a view of music based on Gestalt theory (Fox, 1948). He argued that a musical pattern was to be considered as a Gestalt (an integrated pattern) that had other smaller patterns such as melodic patterns, chords, and rhythmic patterns embedded within it. He pointed out the importance of frequency proximity and smooth continuity over time and pitch as factors that strengthened the melodic dimension of music. Similarity between the timbres of successive notes also strengthened the horizontal integration. He was aware of two factors in the integration of patterns, similarity and familiarity. These correspond roughly to what I have referred to, in chapter 4, as primitive and schema-based integration.
585. McAdams (1984).
586. Bregman and Levitan (1983), Bregman and Liao (1984), Noteboom, Brokx, and de Rooij (1978), Ortmann (1926), Singh (1987), Wessel (1979).
587. van Noorden (1975), p. 69.
588. Babbitt (1964).
589. Fraisse (1963), p. 89.
590. Winckel (1967), Warren (1982), p. 120.
591. Dowling (1973).
592. Ortmann (1926).
593. Fucks (1962).
594. Merriam (1964), cited by Dowling (1973).
595. Some of these terms can be found in the following sources: "compound melodic line" in Piston (1947), p. 23, "implied polyphony" in Bukofzer (1958), and "melodic segregation" in Fox (1948).
596. Erickson (1982), pp. 524–525.
597. Ortmann (1926), p. 7.
598. van Noorden (1975), p. 13.
599. Dowling (1973).
600. The research using cycles of unrelated sounds is extensively reviewed in chapter 2.
601. Dowling (1973, 1978) and Dowling and Fujitani (1971).
602. van Noorden (1975), p. 72.
603. Erickson (1975), p. 12.
604. Boulez (1985).
605. Webern (1935).
606. Bompiani (1987).
607. For example, Vicario (1982).
608. van Noorden (1975, 1977).
609. For example, Royer and Garner (1970) and Royer and Robin (1986).
610. Guilford and Nelson (1936); see also Guilford and Hilton (1933).
611. Bregman and Rudnicky (1975).
612. Bharucha (1984).
613. Sloboda (1985).
614. Vicario (1982), p. 272.
615. Vicario (1982), p. 270.
616. van Noorden (1975).

617. See Erickson (1975).
618. Boulez (1985).
619. Slawson (1968, 1981, 1985).
620. McAdams and Saariaho (1985) and Balzano (1986).
621. Cadoz (1985).
622. Balzano (1986) and Gibson (1966).
623. Huggins (1952).
624. Risset and Wessel (1982).
625. McAdams (1984), p. 18.
626. Boulez (1985).
627. Cited by Erickson (1982), p. 518.
628. Schoenberg (1911), p. 470f, introduced the term "klangfarbenmelodie". Robert Erickson (1974) has created an experimental composition called LOOPS to investigate the role of timbre contrasts, pitch sequence, and pitch range in the experience of klangfarbenmelodie.
629. Moore, Glasberg, and Peters (1985a). See also Moore, Peters, and Glasberg (1985) and Moore, Glasberg, and Peters (1985b).
630. Cutting (1976).
631. Sundberg (1977, 1978).
632. Rasch (1979) described the performance asynchronies and Rasch (1978) described their perceptual effects and the effects of vibrato.
633. Stern (1972).
634. Erickson (1982), p. 531.
635. These were codified by Fux (1725).
636. Fox (1948).
637. van Noorden (1975).
638. van Noorden (1975), p. 76, McAdams and Bregman (1979), and Tougas and Bregman (1985a); see also Deutsch's "scale illusion" (Deutsch, 1975a).
639. Wright (1986), pp. 106–108. The experiment was done in the Speech and Hearing Laboratory of the McGill University Psychology Department.
640. Erickson (1975).
641. Jeppesen (1939).
642. Brant (1967).
643. A psychological approach to musical dissonance is offered by Bharucha (1984).
644. Wright and Bregman (1987).
645. Roberts (1983).
646. Helmholtz (1859); See also Helmholtz' essay "On the physiological causes of harmony in music" in Warren and Warren (1976).
647. Stumpf (1890); see the description in Sadie (1980).
648. DeWitt and Crowder (1987).
649. Schenker (1925).
650. Zuckerkandl (1956).
651. Wright and Bregman (1987).
652. Fox (1948), p. 52.
653. The term "reckless counterpoint" is defined by the *Harvard Dictionary of Music* as "the modern type of counterpoint that takes little account of harmonic combination and euphony (Apel, 1972).
654. Bregman (1978a) and Anstis and Saida (1985).
655. This is another version of the illusion described by Galli and Zama (1931), illustrated in Vicario (1982).

656. Wright (1986).
657. Wright (1986).
658. See experiments reviewed by Handel (1984) and studies by Klapp, Hill, Tyler, Martin, Jagacinski, and Jones (1985), and Beauvillain (1983). Also Sachs (1953).
659. Piston (1978), p. 501.
660. Krumhansl and Schmuckler (1984).
661. Krumhansl and Shepard (1979) and Krumhansl and Kessler (1982).
662. Chowning (1970).
663. Chafe, Jaffe, Kashima, Mont-Reynaud, and Smith (1985) and Chafe and Jaffe (1985).
664. Moorer (1977).
665. Cherry (1953).
666. Speith, Curtis, and Webster (1954).
667. Darwin (1984), p. 1646.
668. Dorman, Raphael, and Liberman (1979); see also Price and Levitt (1983).
669. Warren (1982) Ch.5.
670. Orr, Friedman, and Williams (1965).
671. Foulke and Sticht (1969).
672. van Noorden (1975), p. 80.
673. See the research reviewed in chapter 2 of this volume and in chapter 5 of Warren (1982).
674. Hirsh (1959).
675. Warren (1968); see also Warren and Warren (1970), Warren, Obusek, Farmer and Warren (1969), and Warren (1982), Ch.5.
676. Thomas, Hill, Carroll, and Garcia (1970), Thomas, Cetti, and Chase (1971).
677. Cullinan, Erdos, Schaeffer, and Tekieli (1977).
678. Lackner and Goldstein (1974).
679. Noteboom, Brokx, and de Rooij (1978).
680. Treisman (1960).
681. Darwin (1975), the reported experiment was carried out in collaboration with Davina Simmonds.
682. Noteboom, Brokx, and de Rooij (1978).
683. Darwin and Bethell-Fox (1977).
684. Darwin and Bethell-Fox (1977).
685. Dorman, Raphael, and Liberman (1979); see also Price and Levitt (1983).
686. Ladefoged (1959); also reported by Ladefoged and Broadbent (1960) and Fodor and Bever (1965).
687. See reviews by Warren (1982) and by Bashford and Warren (1986).
688. Bregman and Dannenbring (1977).
689. Dorman, Cutting, and Raphael (1975).
690. Bregman and Dannenbring (1973).
691. Rakerd, Dechovitz, and Verbrugge (1982) and Verbrugge and Rakerd (1986).
692. Cole and Scott (1973).
693. Bregman and Dannenbring (1973).
694. Bregman and Dannenbring (1977).
695. Personal communication from Jared Bernstein.
696. Cherry and Taylor (1954).

697. Huggins (1964).
698. Cole and Scott (1973).
699. Liberman, Cooper, Shankweiler, and Studdert-Kennedy (1967); see also Liberman (1982), Liberman and Mattingly (1985), and Mattingly and Liberman (in press).
700. For example, Searle (1982), Yilmaz (1967, 1968), Stevens (1980), Blumstein and Stevens (1979), Stevens and Blumstein (1981), and Bladon (1982).
701. For example, Treisman (1964). For reviews, see Broadbent (1958, 1971), Kahneman (1973), Norman (1976), Underwood (1976), and Moray (1970).
702. Egan, Carterette, and Thwing (1954).
703. Brokx and Noteboom (1982).
704. The speech was subjected to LPC analysis and a subsequent formant analysis and then resynthesized with a digital speech synthesizer.
705. Scheffers (1979, 1982, 1983a). See also Zwicker (1984).
706. Scheffers (1983), p. 97. The formants were synthesized using a software serial five-formant synthesizer.
707. Duifhuis, Willems, and Sluyter (1982).
708. Darwin and Gardner (1986) and Moore, Glasberg and Peters (1985a).
709. Halikia (1985). See also Chalikia and Bregman (1989).
710. Broadbent (1955).
711. The filters attenuated at about 18 dB per octave above (or below) the cutoff frequency.
712. Broadbent and Ladefoged (1957).
713. Darwin, Howell, and Brady (1978).
714. Cutting (1976).
715. Darwin (1981); see also Darwin and Sutherland (1984), as well as unpublished research by Sally Gaskill described by Darwin and Gardner (1986).
716. Darwin and Gardner (1986). See also Roberts (1988).
717. Moore, Glasberg, and Peters (1985a).
718. Parsons (1976), Weintraub (1984, 1985, 1986).
719. Lyon (1982, 1983).
720. Darwin (1984), experiment 2.
721. Rodet (1983), cited by McAdams (1984), pp. 38–39. Also McAdams and Rodet (1988).
722. Chowning (1980).
723. McAdams (1984).
724. Marin (1987).
725. Halikia (1985) and Chalikia and Bregman (1989). (Halikia and Chalikia are alternate spellings).
726. Gardner and Darwin (1986).
727. McAdams (1984), experiment 6.
728. Dorman, Cutting, and Raphael (1975).
729. McAdams (1984), p. 200.
730. Warren, Obusek, and Ackroff (1972), van Noorden (1975), Bregman and Pinker (1978), and Dannenbring and Bregman (1978).
731. Scheffers (1983), p. 97.
732. Rasch (1978, 1979).
733. Kubovy (1976), described in Kubovy (1981).
734. Darwin (1981, 1983, 1984) and Darwin and Sutherland (1984).
735. Pattison, Gardner, and Darwin (1986) and Darwin and Gardner (1986), p. 16.

736. Dannenbring and Bregman (1978).
737. Darwin and Sutherland (1984).
738. Cutting (1976).
739. Darwin (1981), experiment 1.
740. Experiment 4 in Darwin (1981).
741. Weintraub (1984, 1985, 1986).
742. The early research was done by Cherry (1953) and Speith, Curtis and Webster (1954); reviews of the field are given by Broadbent (1958, 1971), Kahneman (1973), Norman (1976), Underwood (1976), and Moray (1970).
743. Schubert and Schultz (1962).
744. Broadbent (1955).
745. One signal was low-pass filtered at 450 Hz and the other was high-pass filtered at 2,000 Hz. The filters both attenuated at about 18 dB per octave and so that at the middle frequency (on a log-frequency scale) of about 950 Hz, there would have been some energy, attenuated by about 19 dB, that was common to the two ears.
746. Cutting (1976).
747. Darwin (1979).
748. Darwin (1981).
749. Scheffers (1983).
750. See, for example, Bregman (1978b), Bregman and Pinker (1978), Darwin (1983), Pattison, Gardner, and Darwin (1986), Steiger (1983), van Noorden (1975), and Vicario (1980).
751. For example, Liberman (1982); it has also been referred to as "spectral/temporal fusion" by Cutting (1976) and by Repp and Bentin (1984).
752. Rand (1974).
753. The example is taken from Liberman (1982).
754. Reviewed by Liberman (1982). See also Repp, Milburn, and Ashkenas (1983).
755. This research is reviewed by Liberman (1982). See also Mann, Madden, Russell, and Liberman (1981).
756. Liberman (1982) and Liberman and Mattingly (1985).
757. Rand (1974).
758. Cutting (1976).
759. Similar effects of asynchrony were found by Bentin and Mann (1983).
760. Broadbent and Ladefoged (1957) and Darwin (1981).
761. Darwin (1981).
762. Repp and Bentin (1984).
763. Repp and Bentin (1984), p. 528.
764. Liberman and Mattingly (1985), p. 16.
765. McAdams (1984), p. 27, has given a similar argument about the conflicts in duplex perception.
766. Liberman (1982).
767. Bregman (1981b, 1977) and Bregman and Mills (1982).
768. Mattingly and Liberman (in press).
769. Liberman and Studdert-Kennedy (1978).
770. Mattingly and Liberman (in press).
771. Broadbent and Ladefoged (1957).
772. Darwin (1981).
773. The experiment was carried out by Sally Gaskill and reported in Darwin and Gardner (1986).

774. Liberman and Mattingly (1985), p. 16.
775. Repp and Bentin (1984), p. 528.
776. Whalen and Liberman (1987).
777. McAdams (1984), p. 197.
778. This method, known as linear predictive coefficient (LPC) analysis and resynthesis, is described in the textbook by Rabiner and Schaffer (1978).
779. Pastore, Schmuckler, Rosenblum, and Szczesiul (1983).
780. Collins (1985).
781. See, for example, Liberman and Mattingly (1985), p. 16, and McAdams (1984), p. 27.
782. Pastore, Schmuckler, Rosenblum, and Szczesiul (1983), p. 470.
783. Fowler and Rosenblum (1988).
784. Hafter and Jeffress (1968) and Hafter and Carrier (1972).
785. Steiger (1983).
786. Bregman and Pinker (1978).
787. Ciocca and Bregman (1989).
788. Rand (1974), figure 5.
789. Scheffers (1983a).
790. Kanizsa (1955).
791. Beck (1975).
792. The method involves filtering the signal to the left and right ear so as to impose the same transfer function as measured on an artificial head for a signal arriving from the desired position in space. The filtering also takes the characteristics of the headphone into account. The method is described by Blauert (1983). Divenyi's laboratory is located at the Speech and Hearing Research Facility, Veterans Administration Hospital, Martinez, California.
793. Kubovy (1981).
794. Bailey, Dorman, and Summerfield (1977) and Remez, Rubin, Pisoni, and Carrell (1981).
795. See Bregman (1977).
796. Mill (1874), p. 592.
797. Hebb (1949).
798. A brief review is given in Cohen and Grossberg (1986); see also Grossberg (1986).
799. Bregman (1977).
800. Dowling (1973).
801. Liberman and Studdert-Kennedy (1978).

Auditory Scene Analysis

The Perceptual Organization of Sound

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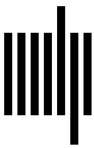

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