

Chapter 8

Resource Monitoring and Visualization

8.1 Monitoring of resource allocation

Tools for monitoring resource allocation [Herder, 1998] are described in Section 9.2.3. In this section, the allocation for one specific application, the Helical Keyboard [Herder and Cohen, 1996], is shown. A MIDI stream (Fugue from Bach) animates and triggers the animation. Each sound source in the scene corresponds to a note. The interesting parameters are the number of requests by the application for spatialization of sound sources (requested), the number of representative (virtual) sound sources generated through clustering, and the number of active (active) sound sources which are actually sent to the spatialization backend. Source which cannot be processed by the spatialization backend are mixed as ambient sound sources (ambient).

Figure 8.1 shows the resource allocation over a period of around 90s. Enough spatialization channels are available so that all requested mixels (sound sources) are granted. Virtual (representatives of a cluster) and ambient sources are not allocated. Up to five spatialization channels are requested in this example.

In the next three figures the number of spatialization channels is limited to two. Figure 8.2, shows that the clustering process starts after requests of more than two sound sources. Further, the clustering process can not always prevent the rendering of some sources ambiently. The maximum number of ambient sources is two in cases which the clustering cannot reduce the number of required spatialization channels.

Figure 8.2 shows a short time period (5s) of Figure 8.2. In this period, the maximum number of ambient sources is one. The number of clusters

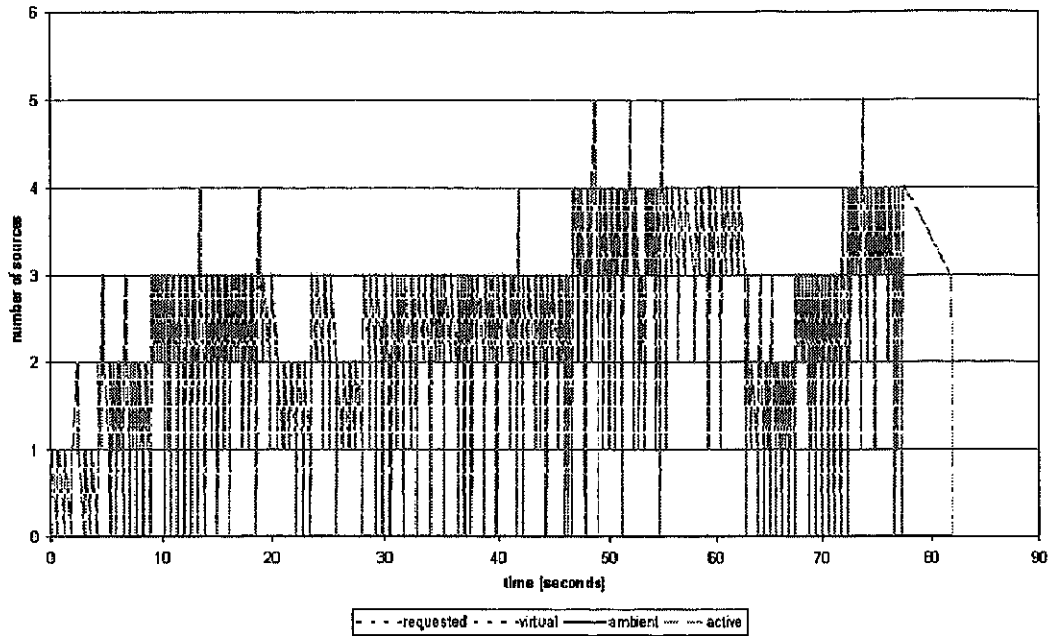


Figure 8.1: Resource allocation without reaching the limited number of spatialization channels

goes up to three, in which one cluster has to processed ambient.

Listener movement changes the parameters for the clustering. This is shown in Figure 8.4, for which listener position was steadily varied on smooth paths around the sound sources. Resource allocation changes more often because of the sound sink movement, but the frame rate is limited so as not to overload the spatialization backend.

8.2 Visualization of the clustering process

In this section the spatialization resource visualizer (described in Section 9.2.5) is used to visualize the clustering process. Again the application is the Helical Keyboard, but this time the sources are activated interactively. The number of spatialization channels is restricted to two. Figure 8.5 shows 88 inactive sound sources and one sound sink.

One sound source becomes active and is highlighted in Figure 8.6. The sound sink is presented with an up vector, a front vector, and a lateral axis, orthogonal to both vectors. This shows the orientation clearly. Additional labels L and R mark the left and right sides from the sink perspective.

Two sound sources are active and highlighted in Figure 8.7. The cluster-

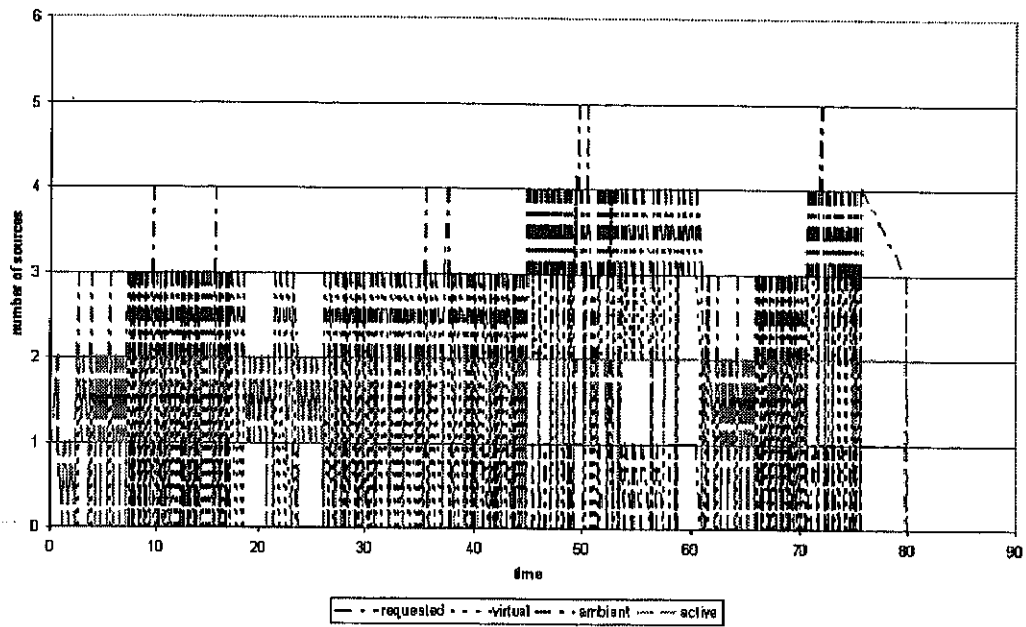


Figure 8.2: Only two spatialization channels are available; clustering process starts, along with source assignment to ambient channels

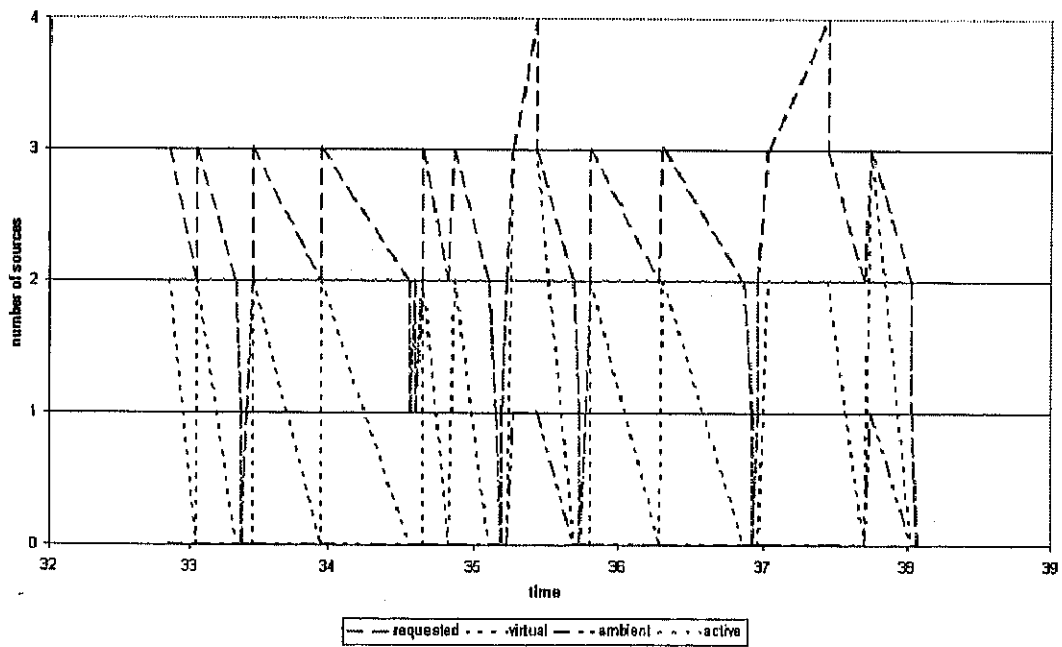


Figure 8.3: Enlargement of a section of Figure 8.2

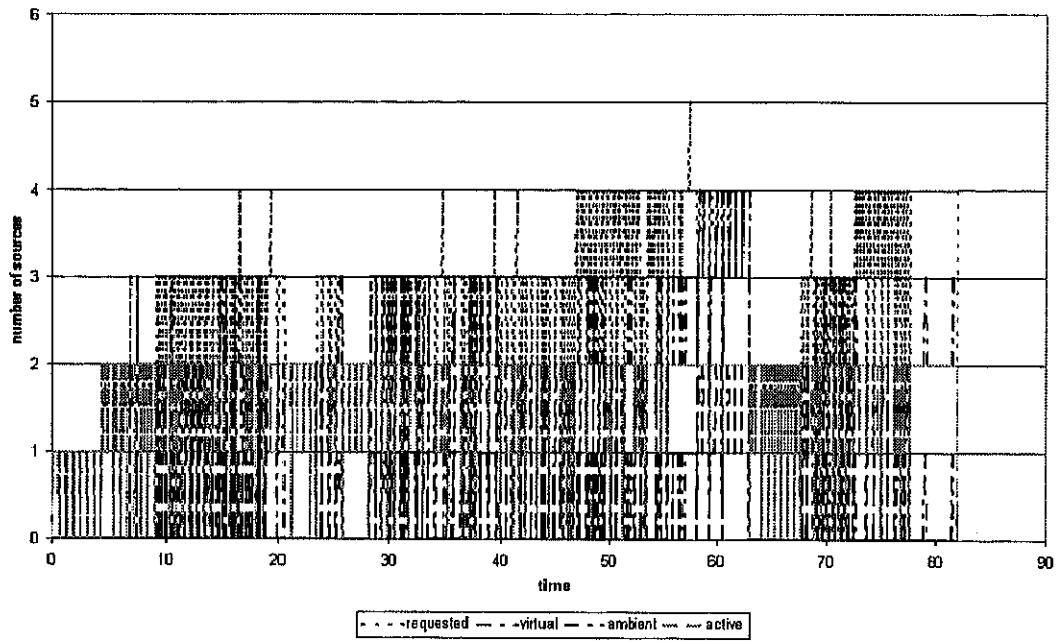


Figure 8.4: Listener movement changes clustering

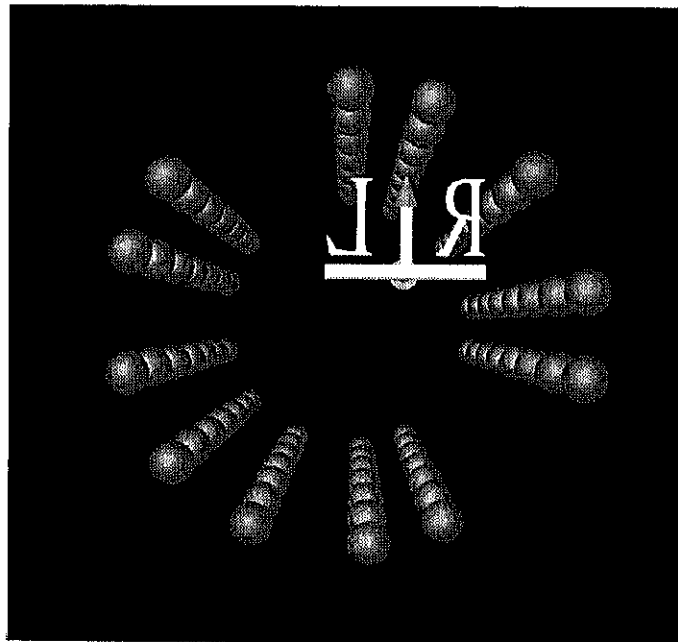


Figure 8.5: 88 inactive sound sources and one sound sink

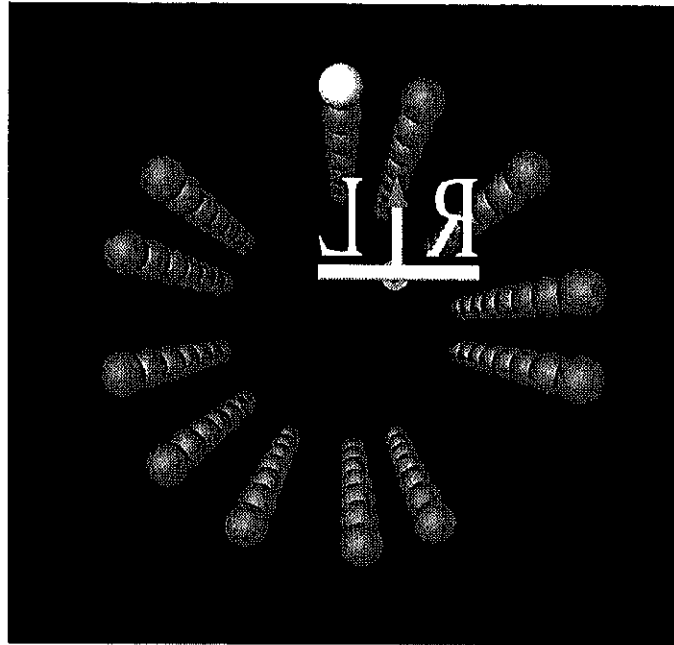


Figure 8.6: One sound source becomes active

ing process starts only when the limit of available spatialization channels is hit. As long enough resources are available, no clustering is required.

In Figure 8.8 three sound sources are requested. The clustering process starts, finding two clusters, one representing two sound sources. The other contains only one sound source. The representative sound sources of each cluster are highlighted. A small tether associates the sound sources in each cluster with their representative sound source.

Four sound sources are requested in Figure 8.9. Two clusters, each with two sound sources, are formed.

Rotation of the sound sink changes the cluster allocation, as shown in Figure 8.10, redistributing the four sources into a single cluster. The resolution cones are listener orientation-dependent. To the side of a listener, localization errors in elevation are lower and localization errors in azimuth higher (see Section 3.8.1).

Moving the sound sink closer to the sources in Figure 8.11 again changes the cluster distribution. Three sound sources on the left are in one cluster. Localization errors in azimuth to the front are small, so that the sound source in the upper front direction cannot be grouped with the other requested sound sources.

Figure 8.12 shows the resolution cones becoming smaller again. Moving

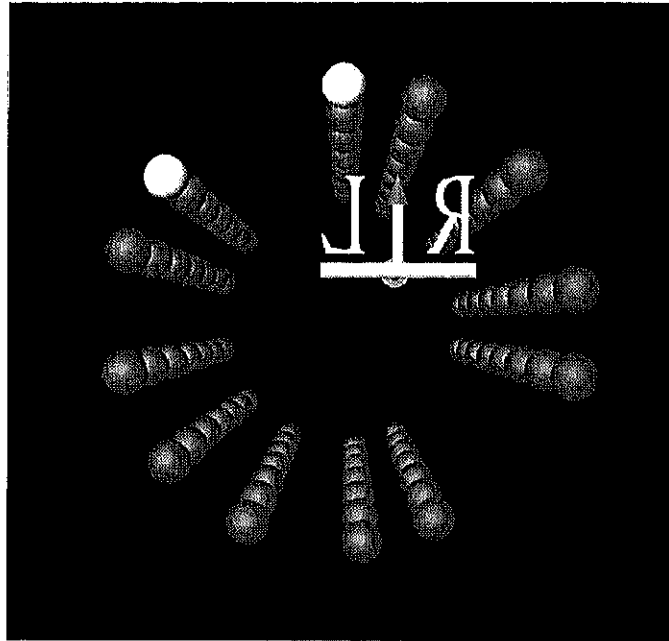


Figure 8.7: Two sound source are requested

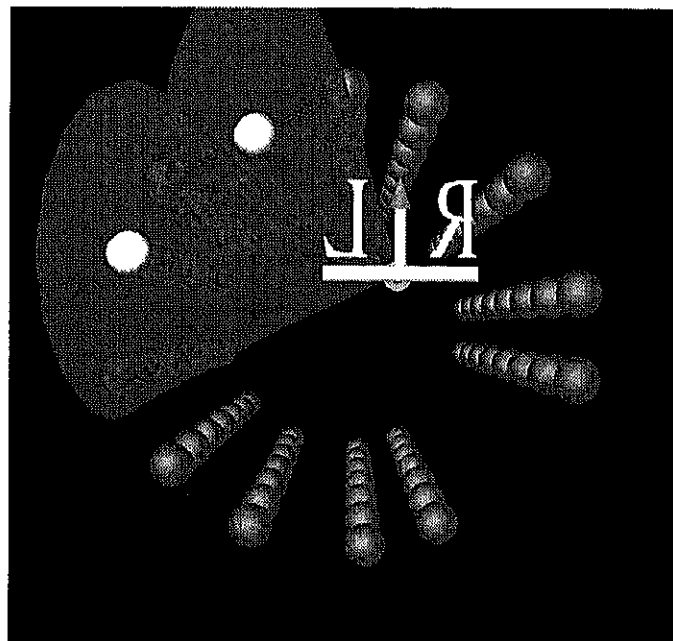


Figure 8.8: Three sound sources are requested; clustering algorithm becomes active

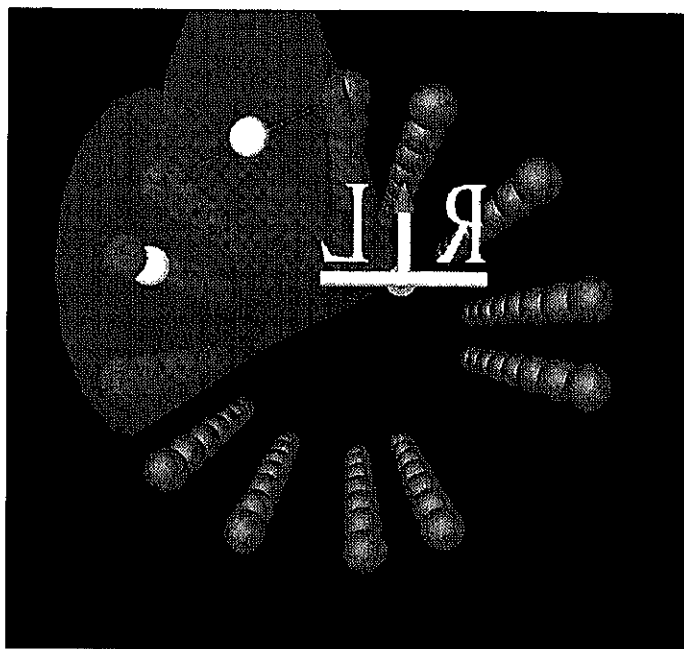


Figure 8.9: Four sound sources are requested

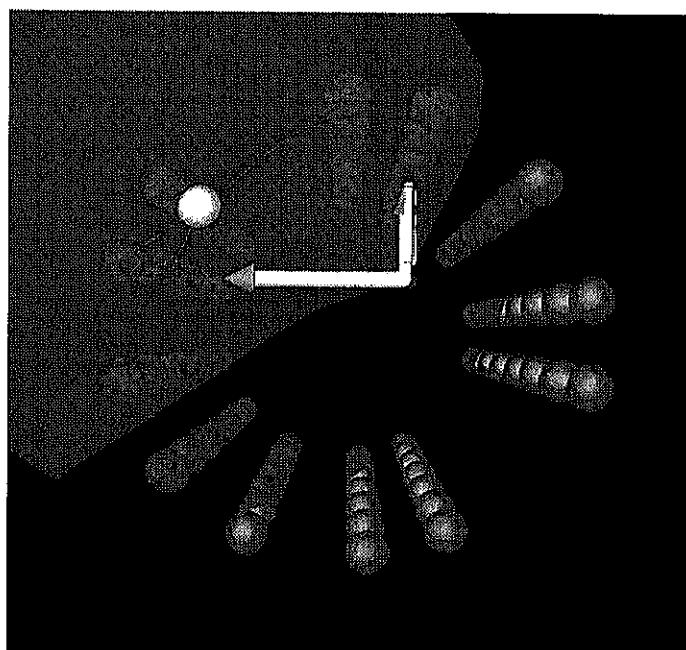


Figure 8.10: Rotation of the sound sink changes the cluster allocation

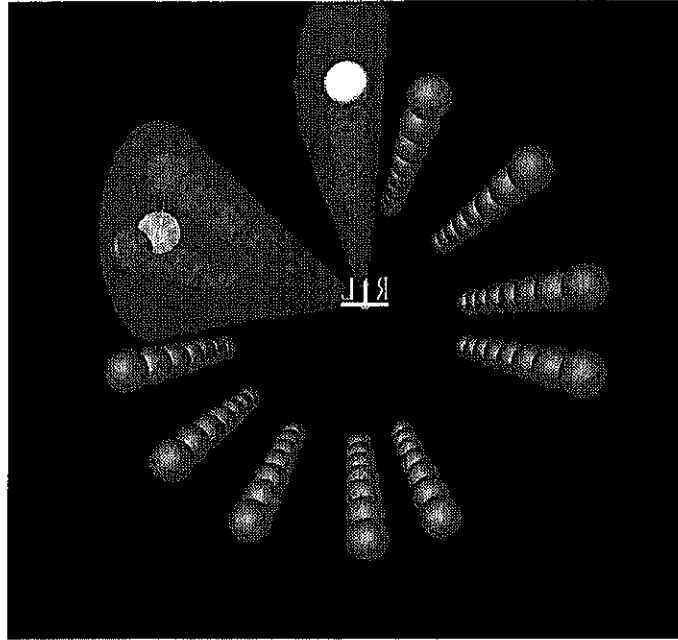


Figure 8.11: Moving closer with the sound sink to all sound sources

the sink closer to the sources changes the number of sound sources which can be clustered. This time three clusters are allocated. One cluster will be processed ambiently.

In Figure 8.13, the clusters get split up after further movement of the sink close to the sound sources. This shows that in the near field of the head, clustering does not reduce the number of required spatialization channels.

In Figure 8.14, three requested sound sources are passed. One active sound source is still in front of the sink. Two sound sources which are now in the back of the sink get clustered. One cluster must be processed ambiently.

The side view in Figure 8.15 shows that the resolution cones to the back of the listener are larger.

Bibliography

- [Herder and Cohen, 1996] Jens Herder and Michael Cohen. Design of a Helical Keyboard. In Steven P. Frysinger and Gregory Kramer, editors, *ICAD'96 — Int. Conf. on Auditory Display*, Palo Alto, CA; USA, November 1996.

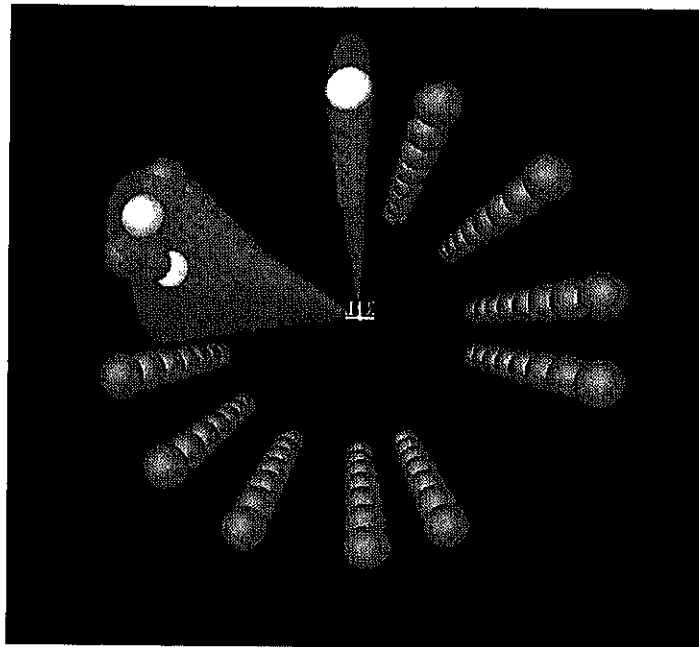


Figure 8.12: Moving closer again; cones become smaller

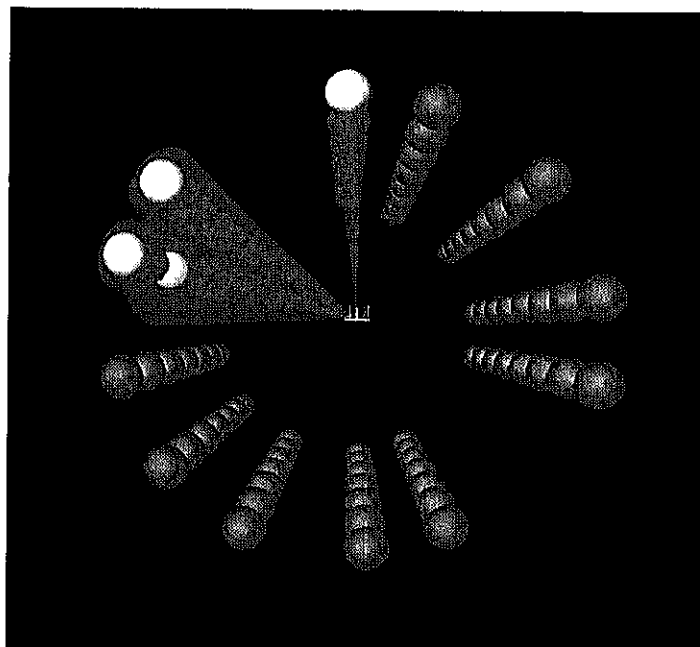


Figure 8.13: Moving closer again; cones become smaller; clusters get split up

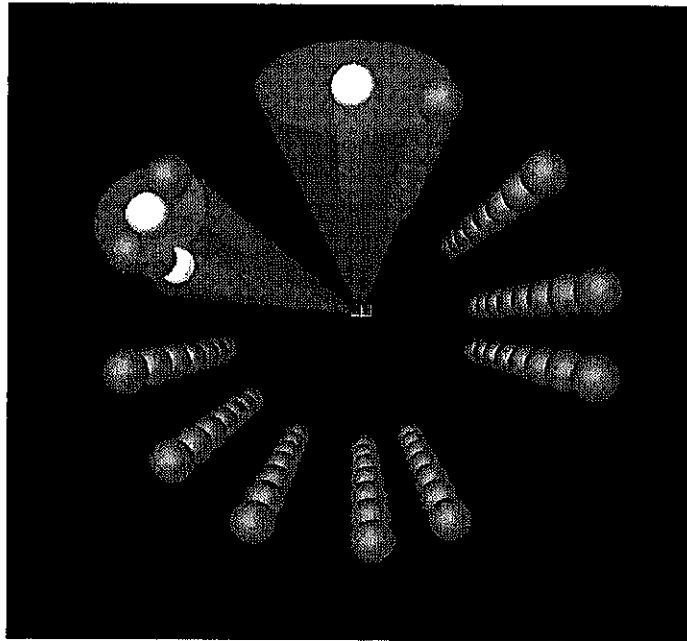


Figure 8.14: Besides on sound source, active sound sources are passed

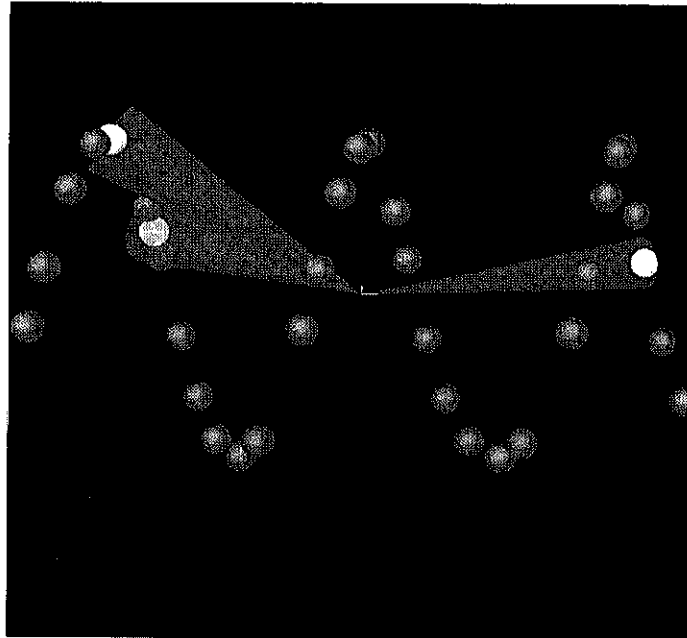


Figure 8.15: Side view shows that resolution cones to the back are larger

- [Herder, 1998] Jens Herder. Tools and Widgets for Spatial Sound Authoring. *Computer Networks & ISDN Systems*, 30(20-21):1933–1940, October 1998.