About This Issue

Although the placement of sound at specific, multiple spatial locations has precedents in music history, computer technology brings spatial projection to a new level by enabling the creation of precisely specified virtual spaces. In computer music, space is available as a highly malleable parameter for compositional manipulation. This issue of *Computer Music Journal* examines some aesthetic and technical facets of the spatialization of sound.

The letters to the editor initiate our coverage of this topic. A controversy surrounds the decision to shut down the Cologne electronic music studio, which was made famous by Karlheinz Stockhausen's compositions in the 1950s. A director of the studio recently asserted in print that spatialization is a superficial attribute of tape music, which in turn is an obsolete genre. Leading figures in electronic music, including Mr. Stockhausen himself, wrote letters that passionately challenge such a view.

British composer Ambrose Field embraces the particular spatialization technique known as ambisonics, which allows specification of spatial locations independently of any particular arrangement of loudspeakers through which the piece might be heard. In an interview in this issue, Mr. Field explains his compositional interest in ambisonics. He also provides his views on hybrid systems that combine the ambisonics encoding with a ''loudspeaker orchestra'' approach in which the level of each speaker is controlled discretely.

David Malham, who, like Ambrose Field, is affiliated with the music department at the University of York, presents a technological overview of the state of the art in sound spatialization. He limits his discussion to systems that attempt to provide a close simulation of natural sound's spatial characteristics. Mr. Malham distinguishes among three types of simulation: ''one-to-one'' mapping, in which the sound is presented to only one listener; ''one-to-many,'' in which each audience member is presented with the same spatial parameters; and ''many-to-many,'' in which each audience member is given a unique location in virtual space. After reviewing the relevant psychoacoustics, the article examines two main categories of systems: those that use headphones (binaural systems) and those that use loudspeakers (wave field synthesis, holophony, and ambisonics).

Maja Trochimczyk of the University of Southern California offers a musicological approach to sound in space. Her article examines acoustic and electroacoustic compositions from the second half of the 20th century with respect to their spatial imagery. Ms. Trochimczyk classifies a composition's spatial design in terms of the acoustic environment in which the piece is presented, its virtuality (i.e., whether it has an electroacoustic component), and the fixity or mobility of the piece's performers and audience. She further adopts a geometrical paradigm for classifying spatial imagery in music, focusing on two geometries: the circle and the ''net'' or web. Each of these two carries semiotic and symbolic associations. For example, the circle frequently embodies an integrative, focused, spiritual function, whereas the net represents complexity, multidimensionality, egalitarianism, and chaos.

Corey Cheng and Gregory Wakefield explain how composers can employ binaural techniques, specifically Head-Related Transfer Functions (HRTFs), to simulate the motions of sounds through space. Of course, these techniques impose the constraint that the composition must be heard through headphones. The au-

Front cover. A collection of images from this issue's articles. Center: floor plan for Karlheinz Stockhausen's *Carré*, for four orchestras and choirs (1959–1960). Clockwise, from upper left: 1970s concert of tape music, Bourges; Ambrose Field; measuring HRTFs in an anechoic chamber; Christian Clozier at the Cybernéphone console.

Back cover. Spatial Frequency Response Surfaces (SFRSs) help visualize sound intensity at varying elevations, azimuths, and frequencies.

thors also introduce a technique for interpolating between HRTFs, using data from graphs called Spatial Frequency Response Surfaces. Sound examples are provided.

Over the last three decades, the Groupe de Musique Expérimentale de Bourges (GMEB) created a series of especially significant exemplars of the ''loudspeaker orchestra,'' each bearing the name ''Gmebaphone.'' Christian Clozier's article in this issue briefly traces the Gmebaphone's history and then gives a detailed description of the sixth version, dubbed the ''Cybernéphone'' for its cybernetic aspects. The Cybernéphone includes a computer-assisted, automatable, 76-channel mixer (with 8 master inputs and 16 master outputs) and an array of 50 or more loudspeakers. Mr. Clozier views the mixing console and network of loudspeakers as an instrument in its own right, and the performance of that instrument as having a special connection to the compositional process.

Three of this issue's articles (those by Mr. Malham, Ms. Trochimczyk, and Messrs. Cheng and Wakefield) have their origins in papers that were presented orally at the Sound in Space symposium held at the University of California, Santa Barbara (UCSB) in March 2000. Mr. Clozier's article was first printed in the proceedings of the Académie Bourges, but it deserves wider dissemination through *Computer Music Journal.*
We are grateful to Curtis Roads and Stephen Pope of UCSB for various suggestions that contributed to the formation of this issue.

Every winter, the print version of the *Journal* contains an audio compact disc that features not only sound examples corresponding to recent articles, but also compositions chosen by a curator. Beatriz Ferreyra, who was interviewed in the Fall issue, selected the compositions on this year's CD. Program notes can be found following the Products of Interest section.