# Current thoughts regarding multi-channel loudspeaker configurations; their compositional implications, and associated concerns

Scott Miller asked me to write this article to address current thinking for the composition and performance of multi-channel electro-acoustic music, more specifically 8-channel systems, and I am happy to offer the following. I do not consider myself an expert on this topic, yet I have actively worked with and composed for multi-channel systems since 1970. I am including comments from numerous colleagues who were consulted in an effort to broaden the perspective of the information presented here. As you are probably aware, there are numerous configurations used with multi-channel presentations, and this article will focus primarily on 8-channel systems as this remains a viable and popular delivery system for performance spaces used for many of our festivals and conferences, but with some incompatibilities that have caused conflict and debate.

At least two different perspectives have emerged based upon live diffusion and fixed media presentation. Often the loudspeaker configuration for these performances are quite different causing the composers, presenters, and engineers undue stress since these configurations do not allow for equal compatibility.

I would like to begin with a review of the historical development of multi-channel audio for both the entertainment industry, as well as the art music community even though I am certain many of you are fully aware of the timeline, advancements, and thought processes behind some of the developments. I am presenting this because I think some of the information is valuable insight into the choices behind the progression of format standards.

On-going research by Alan Blumlein in Great Britain in 1931 and by Harvey Fletcher and Art Keller at Bell Labs in 1932 led to the first known two-channel stereo recording by Leopold Stokowski and the Philadelphia Orchestra (Scriabin's *Poem of Fire*). Within a year of this recording, Bell labs experimented with recorded stereo sound that utilized three-channels (left, center, right) to produce the first full stereophonic recording without having the very noticeable center hole effect.

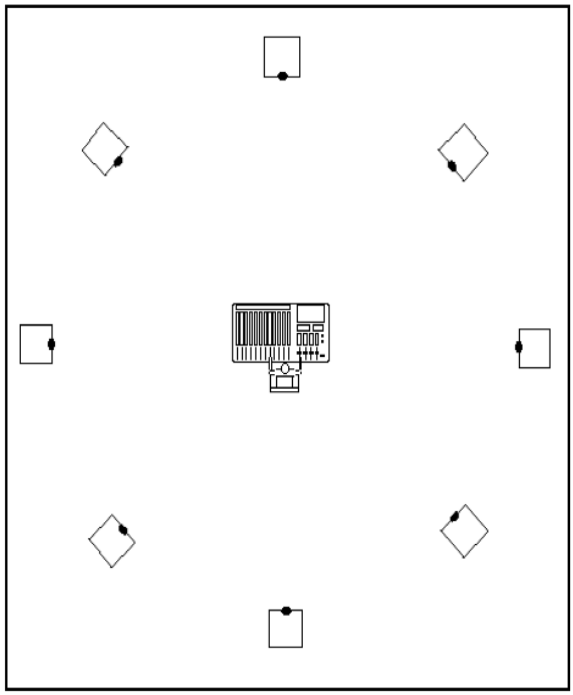
While numerous developments continued, Disney audio engineer, William Garity began serious efforts to explore what was being labeled three-dimensional sound as one of the many proposals in support for the pioneering animation film *Fantasia*, in 1939 once again featuring Leopold Stokowski conducting the *L'apprenti sorcier* by composer Paul Dukas. The original system (one of at least ten versions) had speakers being positioned front left, center, right and two speakers positioned in the back of the theater behind the audience, and it incorporated two audio channels; one for the center screen speaker, with the second audio channel being used to move sound to the remaining speakers by means of a manual panpot. The manual panpot was soon replaced by a tone control track thus automating the audio movement from one speaker to the next while also adding additional sidewall speakers and a ceiling mounted speaker. Soon a third audio channel

was added to the system for further sound movement and more impressive audio positioning effects. Fantasound soon proved to be too complex and too expensive even for Disney, especially with the impending world war at this time. Individual installations cost an average of $85,000 for full systems, and $45,000 for reduced channel and speaker versions. - Wm. E. Garity and J.N.A. Hawkins, Fantasound, Journal of the Society of Motion Picture Engineers, August, 1941

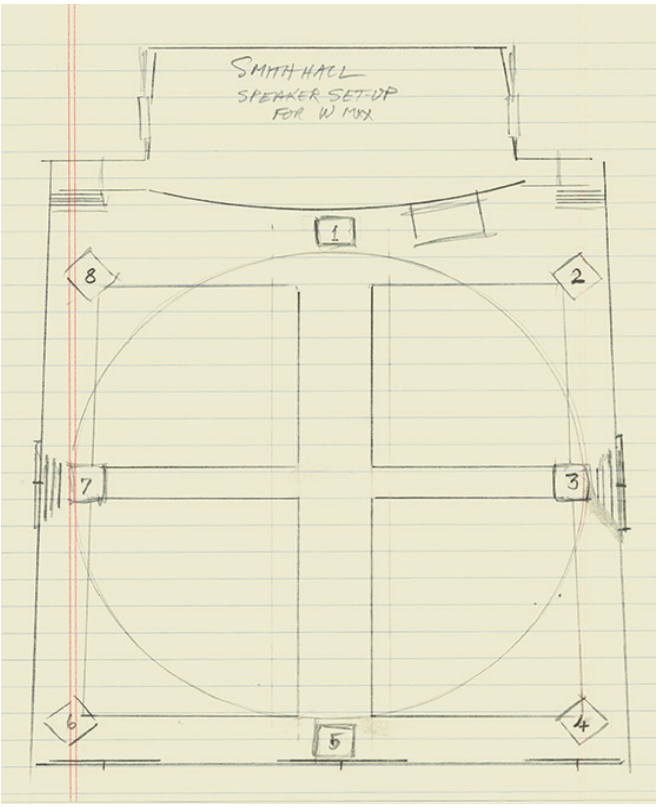
With the 1950's development of new widescreen film formats (Cinerama and CinemaScope), multiple audio channels were required to fill the expanded front screen area utilizing 4 to 7 channels of audio for both a more realistic stereo field delivery (left, center, right; avoiding the center hole effect), as well as the incorporation of one or more additional audio channels with speakers positioned behind the audience and/or along the sides of the theater considered desirable for ambient effects. Yet once again the expense of this technology was seen as too expensive for theater owners further reducing the surround sound reality.

With respect to the use of eight channel systems used within the art music community, there are numerous loudspeaker configurations being used – often due to on-going aesthetic and technical preferences. Some of these configurations include:

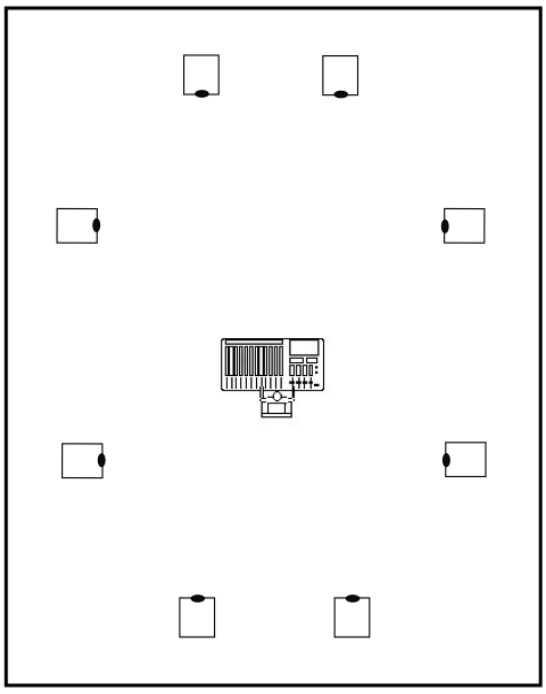
1. Circular / Octophonic



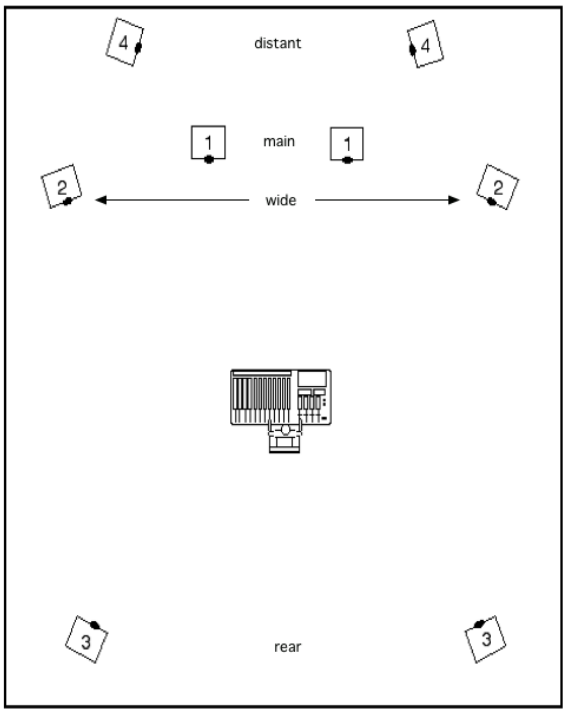
1A. Circular / Octophonic (based upon Cage's Williams Mix notes)



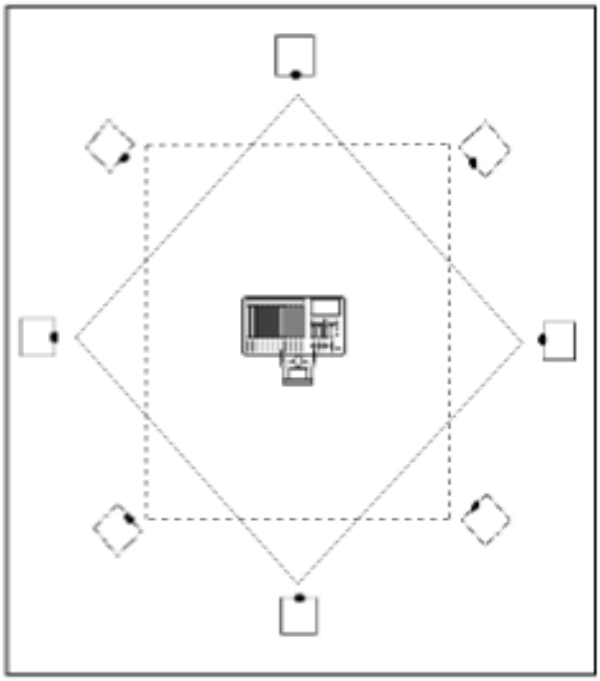

2. Circular – 4 stereo pair – Oval



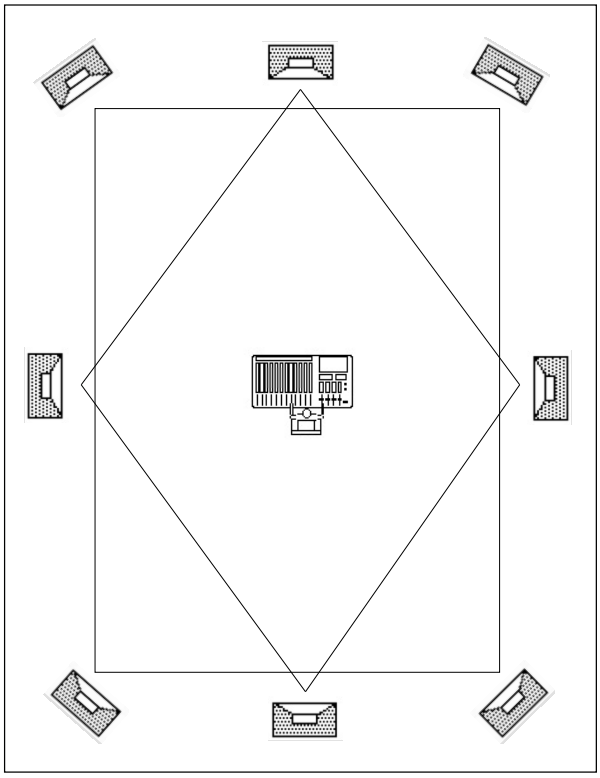
3. Acousmatique 4 stereo pair – Jonty Harison's 8-channel verision of the much larger Birmingham ElectroAcoustic Sound Theatre (BEAST) system




4. Double diamond



5. Discrete Eight (a version of the double diamond)



*the Discrete Eight (D-8) System*
*(a rectangular double diamond)*

I elect to work with 8-channel fixed media presentations – utilizing the Discrete Eight (D-8) speaker configuration. My reasons for working with fixed media presentation rather than live diffusion include:

- the lack of sufficient rehearsal time at conferences and festivals

- my preference to work with many more planned juxtapositions and a variety of translations other than primarily longitudinal rolls, different stereo pair balances, and combinations

- the D-8 system permits stereo longitudinal rolls and a variety of stereo pair balances, as well as permitting the challenging use of the center channels (I consider this a positive compositional and performance element)

- the D-8 system allows for compatibility with commercial industry's multi-channel configurations of 5.1, 7.1, 8.1, etc.

From the very beginning of the stereo recording experiments, the value of a center channel was rapidly recognized. Harvey Fletcher, PhD in physics from University of Chicago, who became Director of Research at Bell Labs – overseeing research in sound, hearing, transmission, and sound reproduction, has been called the father of stereo recording. He worked closely with Leopold Stokowski in developing stereo recordings of the Philadelphia Orchestra in 1931-32, yet while both were thrilled with the newly

created stereophonic image of the orchestra, Stokowski and Fletcher immediately complained of a center hole within the stereophonic image.

This led to the April 27, 1933 experiment with capturing the orchestra with three microphones spaced across the front of the orchestra in Philadelphia - and transmitted by three higher speed telephone lines to Constitution Hall in Washington, DC where three amplified loudspeakers reproduced the orchestra sound, controlled by Stokowski and Fletcher in Constitution Hall.

The success of this experiment, and the more realistic image created by the center channel, led to Stokowski's insistence of the center channel being included during the 1939 creation of Disney's Fantasound in support of the music tracks for Fantasia - also performed by the Philadelphia Orchestra conducted by Stokowski. This begins the realized importance of a center channel in support of stereophonic reproduction for film, and the industry's insistence of the center channel for multi-channel formats.

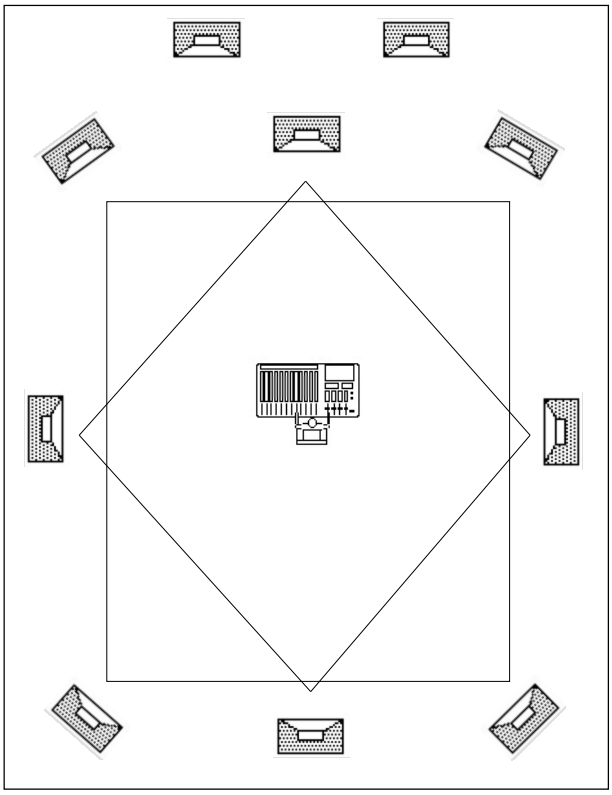
The fact remains that diffusion preferences with respect to loudspeaker configuration create significant problems for those composers working with fixed media (utilizing a different loudspeaker configuration) and vice versa. Budgetary constraints often prevent a festival or conference setting-up two different concert halls having an ideal loudspeaker configuration for eight-channel diffusion and an ideal configuration for eight-channel fixed media performance.

Trying to create a phantom center or phantom side channels just does not work, and so dictating one specific loudspeaker configuration for a festival or conference is problematic at best

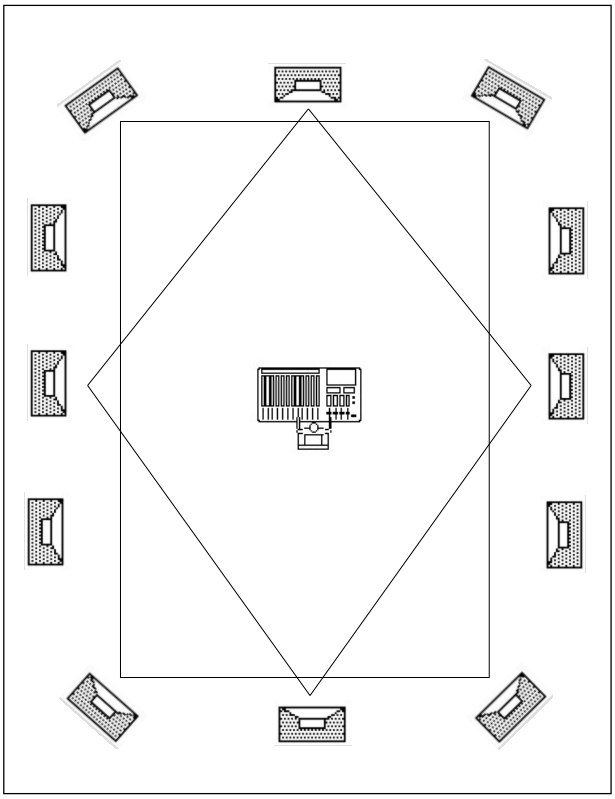
Since many composers feel standardization of a single loudspeaker configuration is undesirable, we are confronted with the task of looking for viable and affordable solutions. Remixing channels once on-site is undesirable.

Possible solutions include:

- having loudspeakers on casters or on speaker dollys, and organizing the concert selections into loudspeaker configuration categories, thus presenting pieces designed for possibly 8 stereo pairs, reconfiguration of the loudspeakers, then presenting pieces designed for double diamond would be a fairly cost effective approach.
- should sufficient equipment exist, adoption of a 10-channel system or a 12-channel system would permit satisfactory delivery for most diffusion and fixed media approaches.



*10-channel system that includes 4 stereo pairs*



*12-channel system that includes 5 stereo pairs*