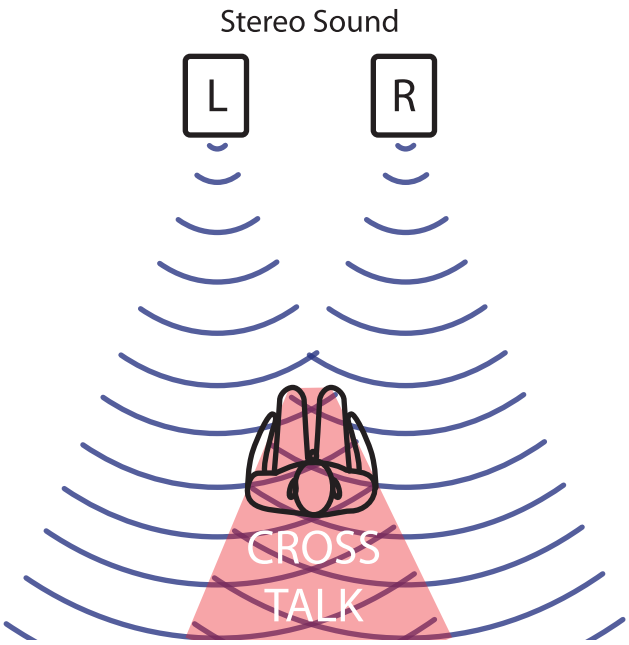
BACCH® 3D SOUND TECHNOLOGY

MASIS

A BESPOKE AUDIO EXPERIENCE

MASIS

THE PROBLEM
CONVENTIONAL STEREO IS POLLUTED



Stereo playback using two loudspeakers has been the standard configuration for music lovers worldwide for over 60 years.

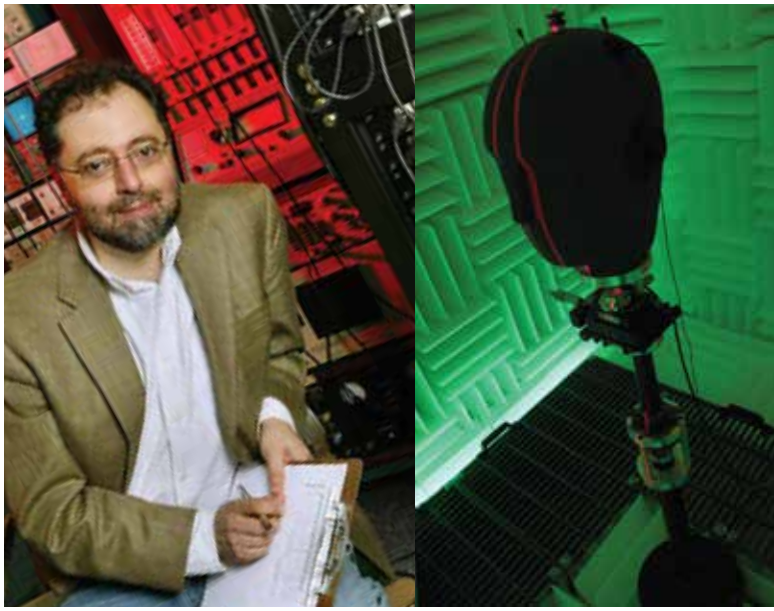
However, there is an inherent problem with conventional stereo playback - crosstalk. Crosstalk happens naturally as the sound from the left speaker goes into both the listener's left and right ears when the sound from the left speaker should only go to the left ear, and sound from the right speaker should only go to the right ear.

Crosstalk corrupts the stereo signal and destroys the spatial cues contained in a stereo recording. The brain no longer receives the correct cues and information to produce a spatially correct 3-D soundfield. Previous attempts required more than two loudspeakers and always suffer from severe spectral coloration, resulting in unnatural and unacceptable music playback.

Professor Edgar Choueiri began working on this crosstalk problem in 2002. As an expert in Plasma Physics, his research in 3D audio started out as a side hobby, until Princeton University's Project X Foundation funded his hobby and turned it into a proper lab for his research and development. The 3-D Audio and Applied Acoustics (3D3A) Laboratory at Princeton University was born.

BACCH® 3D Sound or ("BACCH® " for short) (Patent Pending: U.S. 61/379,891, and PCT/US2011/50181) is a recent breakthrough in audio technology (licensed by Princeton University) that yields unprecedented spatial realism in loudspeakers-based audio playback allowing the listener to hear, through only two loudspeakers, a truly 3D reproduction of a recorded sound-field with uncanny accuracy and detail, and with a level of high tonal and spatial fidelity that is simply unapproachable by even the most expensive and advanced existing high-end audio systems.

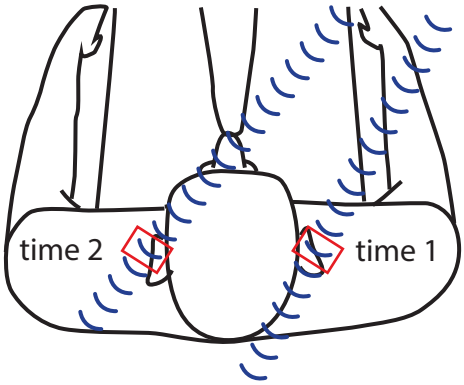
BACCH® is fully compatible with all existing stereo recordings and does not require any additional playback hardware aside from the single digital processor. BACCH® 3D Sound (like standard stereo) requires only a single pair of loudspeakers. Not only does BACCH® provide a shocking improvement to the spatial realism of sound reproduction, but the same digital filter used in BACCH® can also provide corrects, in both the frequency and time domains, most non-idealities in the playback chain (including loudspeaker coloration and resonances, listening room modes, spatial comb filtering, balance differences between channels, etc.) so that the frequency and impulse responses at the listener's ears are as close to ideal as possible for a given listening room and hi-fi system. This corrective property of BACCH®, which by itself is a highly desirable enhancement to the fidelity of any audio system, is only the secondary feature of BACCH® – the primary feature being 3D sound.



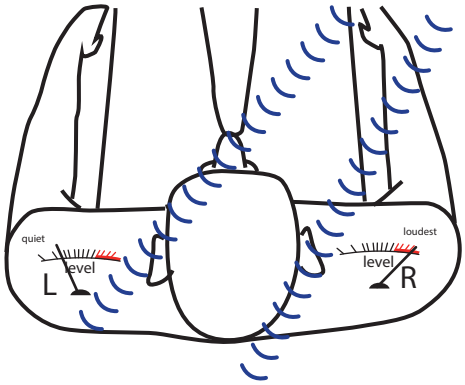
Professor Edgar Choueiri

THE TECHNOLOGY

BACCH™



Interaural Time Differences (ITDs)



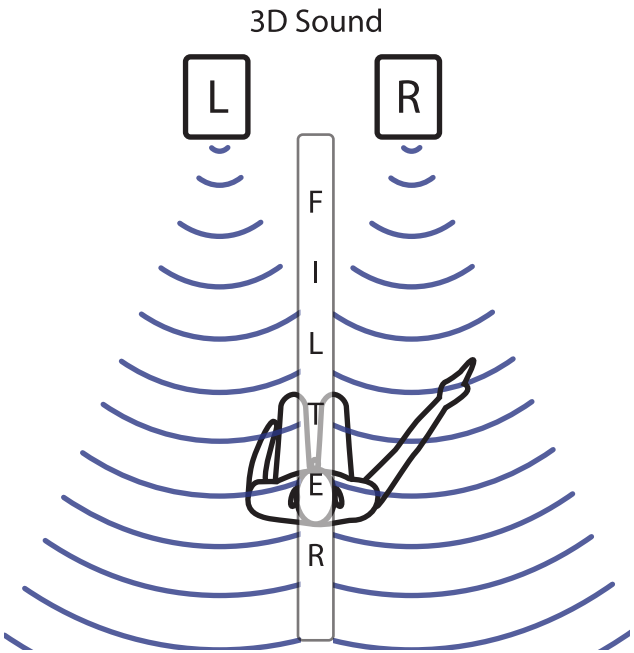
Interaural Level Differences (ILDs)

BACCH®

At the heart of BACCH® 3D Sound is a complex mathematical model. BACCH® stands for "Band Assembled Crosstalk Cancellation Hierarchy". The patent-pending BACCH® filters are optimized crosstalk cancellation filters that allow 3D audio reproduction over loudspeakers. They yield maximum crosstalk cancellation level without introducing any spectral coloration to the input signal.

An analogy could be made: listening to crosstalked-stereo is like watching 3D movies without 3D glasses. You get 'double images', just like the crosstalk pollution you get with two loudspeakers. BACCH® is like an invisible, mathematically constructed wall that separates the sound from your left and right speakers and creates a purified zone where crosstalk is minimized. The result is the restoration of the spatial cues from all your stereo recordings. Your brain relaxes, as it no longer needs to work hard trying to create a stereo illusion.

A technical paper is available for the inquisitive minds:
http://www.princeton.edu/3D3A/Publications/BACCHPaperV4d.pdf
A video posted by Princeton University on BACCH® can be found here:
http://youtu.be/SQmQD27uCt0?hd=1



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MASIS (Music As Is) is a by-invitation and by-direct-referrals only, bespoke service offer by Elpine Technologies Limited. We are proud to be appointed by the 3D3A Lab of Princeton University as the first BACCH® technology provider in the world. We provide consultation, measurements, and installation of the BACCH® technology for discerning music lovers and audiophiles. For more information, please contact *masis@elpinetech.com* or call *+852.2860.0985*

PROFESSOR
EDGAR Y. CHOUEIRI

Professor Choueiri at China Club, Hong Kong (August 2012)

Professor Edgar Choueiri, is a professor of Applied Physics at the Mechanical and Aerospace Engineering Department of Princeton University, and Associated Faculty at the Department of Astrophysical Sciences, Program in Plasma Physics. He is also Director of Princeton University's Engineering Physics Program and Chief Scientist at the University's Electric Propulsion and Plasma Dynamics Lab, a recognized center of excellence in research in the field of advanced spacecraft propulsion. He is also the Director of Princeton's 3D Audio and Applied Acoustics (3D3A) Lab.

Professor Choueiri is a world-renown leader in the field of plasma physics and plasma propulsion for spacecraft. He is the author of more than 145 scientific publications, and encyclopedia articles on plasma rockets, plasma physics, instabilities and turbulence in collisional plasmas, plasma accelerator modeling, space physics and applied mathematics. He has been the Principle Investigator (PI) on more than 25 competitively selected research projects (including two space experiments), funded by NASA, the US Air Force, the National Science Foundation, and other governmental and private institutions. He is a Fellow of the American Institute of Aeronautics and Astronautics and the recipient of many awards and honors including a knighthood.

An avid audiophile, acoustician and classical music recordist, his decades-long passion for perfecting the realism of music reproduction has led him to work on the difficult fundamental problem of designing advanced digital filters that allow the natural 3D audio to be extracted from stereo sound played through two loudspeakers, without adding any spectral coloration to the sound (i.e. without changing its tonal character). He was able to solve this problem mathematically by applying analytical and mathematical tools he uses in his plasma physics research.

3D3A

3-D AUDIO AND APPLIED ACOUSTICS LAB

BACH 3D SOUND Invented @ PRINCETON UNIVERSITY