Skyline: Final Report

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May 25th, 2007

1 CONCEPT AND APPROACH

The conceptual and ethical and phenomenological research for Skyline, which lasted for the initial five months of the development period, was an investigation of how the contemporary configuration of the "network" as storage, retrieval and dissemination mechanism affects the political economy of music and by extension both the experience and the idea of lived time. The initial concept for the work comes from Jacques Attali's 1975 book "Noise: the Political Economy of Music" where he describes the development of capitalism through the organization of use-values in the conception of "Music". Attali maps this development historically, starting at a point where music is tied to the rituals of enclosing the time of its performance to a point in twentieth century Western European Culture where music is stockpiled essentially outside of time. Under this configuration, stockpiling and reproduction are not only rules for the "dissemination" of music as a commodity (which is a fairly recent idea) but fundamental value conditions for the conception of what music is. Attali projects a configuration in the future wherein the production and consumption of music are locked together and the conception of music becomes connected with the instrumentality of its mode of dissemination, where music's production and consumption are essentially the same process so that the conception of use-value as such implodes. I'd like to propose that the current configuration is a kind of intensification of the mode of stockpiling, wherein the logic of repetition and replication has become even more refined. If the value conditions for repetition are the propensity of the musical event for stockpiling and replication, a third value has been added in the past fifteen years: temporal reduction. Compression and reduction has become the norm, the ideal point of which, in engineering terms, is the point whereby the smallest possible amount of data can be retained from which as much "imperceptible" data as possible has been subtracted. The goal of compression serves only the network so here the network is a primary medium. But, at least for the economy of music, the network only serves to make stockpiling possible to a greater extent than ever. "Fidelity" of representation is now completely undermined, in favour of an increase in both production and consumption. The retention of the materiality of the mediated musical event under these conditions is fundamentally different from the materiality of the mediated musical event under any other historical or cultural configuration.

Skyline is an attempt to draw out the "lines" of the network under these terms. Everyone in design has seen these very slick-looking "network maps" which are attempts to represent networks as spatially conceivable and temporally fixed phenomena. But these representations are primarily metaphorical. The network does not have any "visual" component so the ascription of colour and space values is always arbitrary. Even more arbitrary are the spatial metaphors, since the function of the "network" does not depend on geographical space. In fact the network needs to erase space. When you talk the space of the internet you're talking about virtual space, which is by definition not space. What the network does need is time, so the primary use-value under this medium, the grease for its gears and the condition for its recognition of data of “meaningful information”, is the pressing of data into smaller and smaller amounts of time.

Skyline is both a phenomenological investigation of this process and an ironic attempt at the reversal of this process. As mp3 files are downloaded the data is compressed to a point of absurdity (16 32bit floating-point values for each file). These values are accumulated over time and used in two ways in the audio/visual composition. First as what might be called “turbulence”, meaning a set of almost inconceivably minute deviations which are applied to the frequencies of the sine waves and add a level of fluctuation to the psycho-acoustic poly-rhythms which provide its primary rhythmic structure. The second is that these values are accumulated in the piece to stretch its duration towards theoretical infinity. The composition starts with a harmonic period of twenty minutes, which is divided into two minute sub-periods. After each full period, the captured values from one file are added to the full period so that gradually the period accumulates more and more duration, thus exposing, on an exponentially larger and larger scale, the amount of time actually being dealt with in the virtual immediacy of the network.

I am not dealing with the encoded "music" being downloaded as such because I want to investigate the medium, which for these purposes means "bracketing" the "cultural" information in order to focus on the ways the medium transmits such information. An attempt at a critical investigation of a technology should not need to address the content it transmits (which for one thing is far too large a set to even imagine). My ethical position here is similar: the content of the network is not the network. When McLuhan said "the medium is the message" on a certain level he was probably being facetious. I think Kittler and Luhmann have been very important in clarifying the relationships at play: A "message" is an operative closure: if not it would have no real identity. A "medium" is also an operative closure. The relationship between the two is not deterministic, but involves a kind of irreducible structural coupling analogous to that observed in “living systems”. (cf. Maturana and Varela) The medium cannot have a deterministic relationship with its messages. Its set of possible messages is probably infinite.

1.1 TITLE

The working title for the piece was “Spider”, after the software mechanism used for the gathering of raw data and the projected interaction mechanism. After the original interaction model was dropped from the piece in January 2007, the title was changed. The current title is a reference to a 1967 project of the same name by the German conceptual artist Hans Haacke, which consisted of a nylon string suspended in the air by a series of one hundred white helium balloons. Just as Haacke's work attempted to articulate the behaviour of natural and living systems using simple, reproducible, low-cost materials, Skyline is an attempt to articulate the behaviour of a file-sharing network using a similarly minimalistic framework. I am also suggesting that a file-sharing network's behaviour could be considered both natural and in a metaphorical sense “living”.

1.2 INTERACTION MODEL

The idea of structural coupling also provides a conceptual framework for the organization of the different elements of Skyline's construction. The audio-visual system and the network spider system are independent operative closures. The “interaction” model is also a reflection of this framework. The visitor to Skyline (also an operative closure) has no role in the generation of content in the piece but does have agency in that her perception of the sound and video is determined by

her movement in the room and the amount of time she spends there. The use of psychoacoustic effects and *trompe-oeil* means that each visitor has a literally unique experience. The model of interaction which I have developed on an experimental level in Skyline will continue to be developed in future research and creation.

1.3 INTELLECTUAL PROPERTY

The raw material for Skyline is copyright material and gathered using techniques normally labeled “piracy”. Since the copyright material is compressed to a point where it is absurdly unrecognizable and its accumulation is essentially symbolic, I believe that its use of this material falls within acceptable limits prescribed under modern copyright law and that no legal action should result from exhibiting the work. Moreover, the work is engaged on a critical level with the debate around media networking to a sufficient extent that its construction should speak for itself as a positive argument to any legal or ethical objections.

The software engine for Skyline is free to use, reproduce and modify under the terms of the GNU General Public License, version 2. Anyone with sufficient hardware and space can download the software and present the piece at will, so long as the license and credit for the piece remains the same.

The experience of Skyline is entirely dependent on external factors. There is no saleable object.

2 INSTALLATION

The installation of Skyline requires a completely dark space with a hard floor, two networked computers (one with high speed Internet connection, another with high quality video card and at least four channels of analogue audio output), a single video projector with secure rigging to be hung from the ceiling, and four powered loudspeakers (minimum 80 watts each).

The floor dimensions of the room where Skyline is installed should have a ratio of 4:3 like the frame of the projection. The original installation happened in a space of roughly 4 square meters with a ceiling height of about 3 meters. A larger room could accommodate more visitors, but would require larger speakers and a much higher ceiling from which to hang the projector. If necessary, a section of a larger room can be separated using blackout curtains. There should be no light leakage from windows or doors.

The video projector is suspended securely from the ceiling such that its beam is focused on the centre of the floor of the room. The four corners of the projection should lie on imaginary diagonal lines between the centre of the room and its corners. This arrangement requires a room with particularly high ceilings so that the projection covers as much of the floor as possible. The colour contrast is quite high (the only colours in the projection are black, white and yellow). Unfinished concrete floors should prove to be ideal for the projection and also produce an interesting prism effect with the white. Wood floors or floors with coloured surfaces may need to be covered with white sheets or painted. Carpeted floors should be avoided.

Sound is diffused over 4 independent channels using four loudspeakers positioned in the corners of the space and raised on plinths roughly to the ear level of a standing observer (150-180cm, depending on the size of the loudspeaker). Sound volume level will be relative to the overall sonic isolation of the room. The volume should be set sufficiently high to mask outside noise, but low enough to allow observers to stay in the room for a long time without experiencing pain and speak to each other in a normal voice. A higher intensity of sound will accentuate the psychoacoustic effects being explored in the composition. At a sufficient intensity, the small range of frequencies used in the piece should at certain points mask some frequencies of the observers' voices such that if they speak to each other their voices seem to be modulated by rapidly shifting sine waves, as in a vocoder.

3 SOFTWARE

Skyline consists of two separate and independent software modules, preferably running on separate computers which communicate either via a simple local area network connection or remotely over the Internet, should firewall restrictions prevent communication with file-sharing networks in the installation space. The first computer gathers and processes raw material and the second computer generates the audio and video environment.

Skyline should run on any Unix-like operating system (Linux, BSD, Mac OS X) with the following basic software requirements: Pure-Data 0.38 with Gem 0.9.0, Python 2.3, and Mutella 0.4.5. The audio-visual module should be run on a computer with a high-quality sound card with a minimum of 4 analogue output channels and a high quality video card with hardware-accelerated 3d rendering.

3.1 SPIDER MODULE

The first module is an automated "spider" system written in the Python scripting language, which finds and gathers mp3 compressed audio files from the Gnutella file-sharing network. After the spider has connected to the network, it runs a search every ten minutes choosing a query string using a crude word-association algorithm. The initial search looks for files matching the keyword string "skyline". All of the filenames that match the initial search string are filtered into a list of words from which the next search string will be chosen by a pseudo-random number generator. For each new search this list of words is overwritten. In practice, this algorithm is not "intelligent" but it can appear to draw semantic lines between consecutive filenames. An initial search for "skyline" might hit the song "Nashville Skyline Rag" by Bob Dylan. If all of the words on the title and the artist's name appear in the filename, the following search could be "nashville", "skyline", "rag", "bob" or "dylan". Thus the second search term, chosen from this list, would appear to bear a semantic relationship with the first. The spider contains filters to remove common punctuation marks, but no filter for non-european characters. Thus the spider is not limited to American popular music.

As the spider finds files it attempts to download them asynchronously. Downloads which stall or for which no hosts are found are aborted. Successful downloads are handled by a separate asynchronous algorithm which averages the data in the file in order to compress it into a list of sixteen 32-bit floating point values. This absurdly low-resolution representation of the file is written to a score file to be used by the second software module, the audio-visual engine. In all other senses, the activity of the spider system is intended to be fully transparent in terms of the actual experience of the

observer of the piece.

3.2 AUDIO-VISUAL ENGINE

The audio-visual engine for Skyline, by which the majority of the perceptible content of the piece is generated, is a closed independent composition written in Pure Data and GEM running asynchronously from the spider system, preferably on a separate computer connected by local area network. The framework provided by this closed system is intended to perpetuate a sense of aesthetic unity and an illusion of long-term stasis. The guiding principle in its construction is the generation of a maximum of experienced content with minimal and hyper-compressed source material. In order to focus attention on the harmonic relationships being suggested and subverted in the composition, and to simplify the perceived rhythmic activity, the sonic material is reduced to a set of 32 sine wave voices. Each sine wave voice is mapped literally to a white wire-frame cuboid object generated in Gem. The z-axis dimension (depth) of each cuboid pulses at the same frequency as its synesthetic counterpart. A straight line dividing the projection length-wise pulses alternately white or yellow at the same rate as the basic clock of the engine.

The structure of the audio-visual composition is periodic. Frequency material is organized into a series of ten phase structures which are sequenced in a uni-directional loop which runs for the entire duration of the installation. The first iteration of the loop lasts twenty minutes. For each file downloaded by the spider, the loop's duration is increased by a 32-bit floating-point number representing the average value of all of the data in one individual mp3 file (this value is usually in the range of tens of milliseconds). So, the second iteration of the loop has a duration of twenty minutes plus the average value of the first file, the third loop lasts the duration of the second loop plus the average value of the second file, and so on towards theoretical infinity. Over the course of the installation the compositional period gradually accumulates duration, getting longer and longer until the installation is closed.

Each loop presents ten transformations of a "nucleus" series of frequencies. This nucleus consists of the first eight partials in a harmonic series with its fundamental frequency at 201hz, that is: 201hz, 402hz, 603hz, 804hz, 1005hz, 1206hz, 1407hz, 1608hz. A harmonic series of this size contains a few "dissonant" interval relationships, and moreover maintains a sense of unity by doubling the fundamental at three higher octaves.

Each subsection of the loop describes a transformation of the eight frequencies of the nucleus series using a modulus frequency, such that each frequency heard is the remainder of the division of the original frequency by the modulus frequency. Thus, for each subsection the frequency values of the nucleus series are wrapped to a bandwidth of one octave with its lower cutoff point at a frequency within a few hertz of having a simple integer-ratio relationship with the fundamental of the nucleus. The slightly off ratio relationships between the modulus frequencies and the fundamental of the nucleus series forces the wrapped values into intervals which express either a triad or tetrad with frequency doublings that sound slightly out of tune, accentuating an effect of both rhythmic and harmonic "beating". (cf. Plomp) Modulus frequencies were chosen intuitively for euphony and are presented in ascending sequence in the composition: 67hz, 135hz, 168.5hz, 205hz, 268hz, 300hz, 339hz, 403hz, 500hz, and 598hz.

Since there are 32 voices and only 8 frequencies for each subsection, a certain amount of doubling would occur in the composition if it were not connected to the Spider module. For each file downloaded by the Spider a list of 16 floating-point values is written to a score file. For each iteration of the composition's loop, one set of these sixteen values (representing one mp3 file) is used to offset the audible frequencies by a small amount so that in practice even the sine waves which are supposed to be playing the same frequency will always sound at slightly different frequencies. This means that for each iteration of the compositional loop the poly-rhythms generated by the "beating" effect will be slightly different although the perceived pitch relationships will remain the same.

A visual analogue to the beating effect is provided by the illusion of interference and movement patterns in the video projection on the floor. Depending on the frequency relationships in each transformation, the rectangular white boxes appear to flow in waves with no defined direction, spread out towards the walls of the room, or slip rapidly into an implied hole in the centre of the room.

4 RECEPTION

The first installation of Skyline happened at the EV building at Concordia University in Montreal beginning at 12pm on Monday, April 30th and ending at 6pm on Sunday, May 6th, 2007. Since the spider software had to be run remotely due to firewall restrictions on the Concordia campus, the spider module was started approximately one hour before the audio-visual engine.

Visitor reaction ranged from mild annoyance at the loud slowly changing sine waves to a sense of hypnosis after spending a long time in the room. These reactions roughly corresponded to the amount of time spent in the installation. Some visitors would enter the room for around 10 seconds but not pass the curtains. Their reaction usually included questions about what was happening. Visitors who passed the curtains into the range of the projection would usually spend several minutes and reported a sense of hypnosis and an audible "after-image". The fact that the projector could not be mounted high enough for the frame to fill the entire floor generated a particularly interesting interaction. Many visitors tended to walk around the borders of the video frame rather than enter into it. Movement around the sides of the space while staring into the middle of the floor increased the perception of change in the beating effect and led to a distinct sense of vertigo. Visitors who stayed for longer periods often sat in the middle of the projection to watch the play of light on the surfaces of the clothing and bodies.

The acoustic characteristics of the building's architecture (highly reflective concrete construction, large open atriums connecting several floors, minimal sound-proofing) meant that the sound from Skyline could be heard distinctly over a large area, fading in and out of perception and often barely distinguishable from the constant and pervasive drone of the building's ventilation system.

5 FINAL BUDGET

MOTU 828 MKII Audio Interface (CIAM Concordia)	April 10 – May 8:	$80.00
PowerMac G4 (CIAM Concordia)	April 16 – May 8:	$320.00
Sanyo Video Projector (CIAM Concordia)	April 16 – May 8:	$600.00
4 Yorkville YSM1P Monitors (CIAM UQAM)	April 18 – May 8:	$64.00
4 Speaker Stands (Hexagram Concordia)	April 26 – May 7:	$0.00
Misc. Audio cables (Hexagram Concordia)	April 26 – May 7:	$0.00
4 Blackout curtains (IMCA Concordia)	April 26 – May 7:	$0.00
12" DVI cable (IMCA Concordia)	April 26 – May 7:	$0.00
Home-made projector mounting brace		$0.00
	TOTAL:	$1064.00

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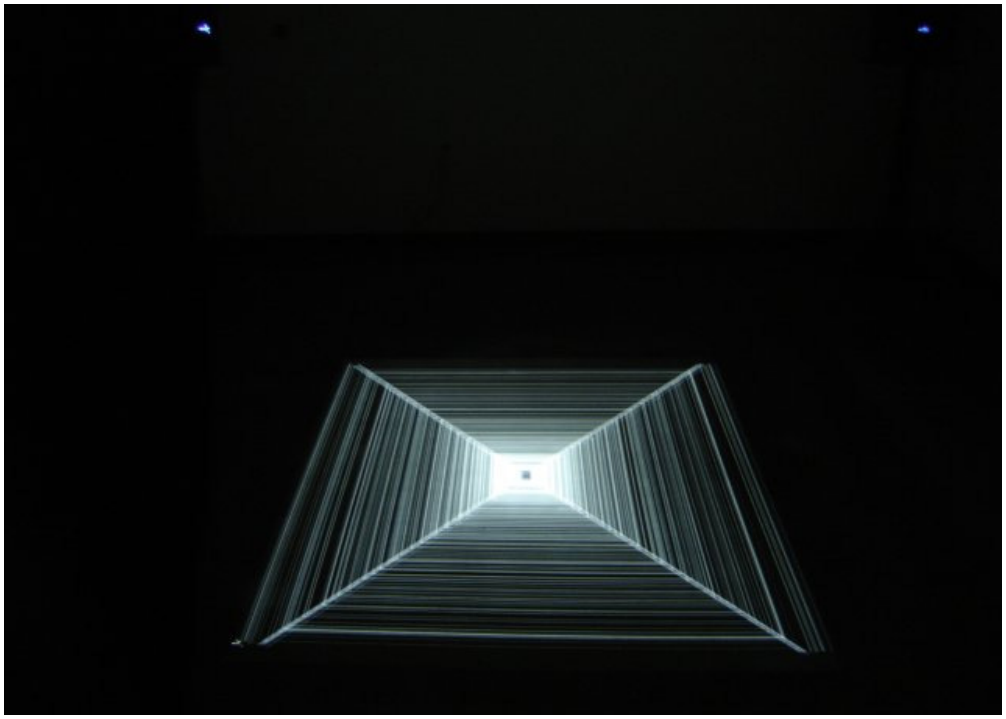

Figure 1: Skyline installation, view from entrance

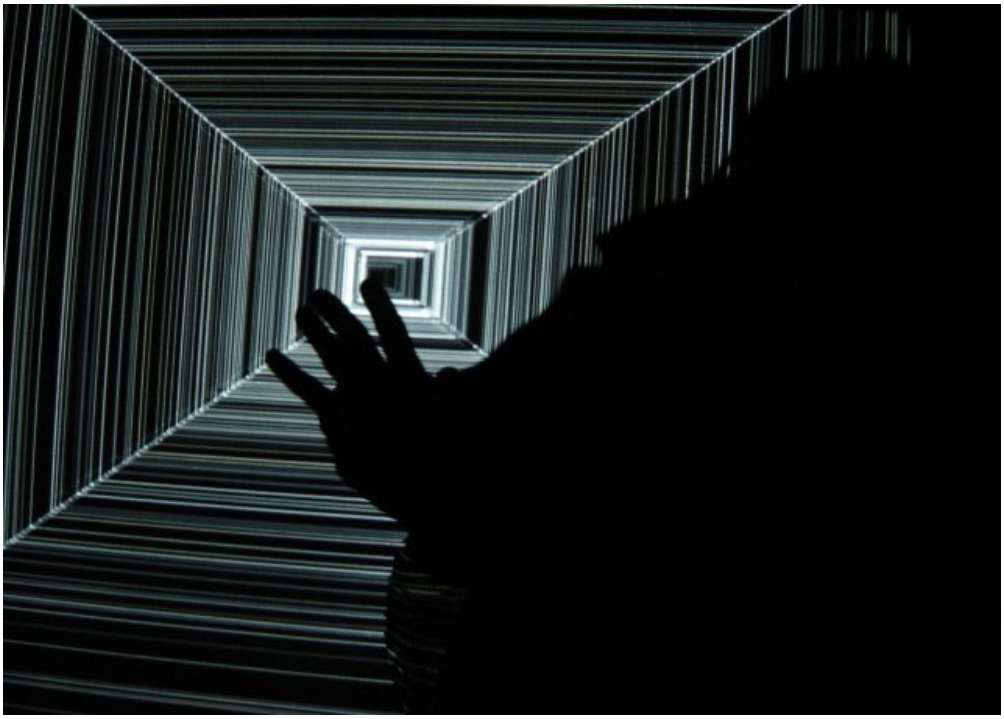

Figure 2: Skyline installation detail

Figure 3: Skyline installation detail

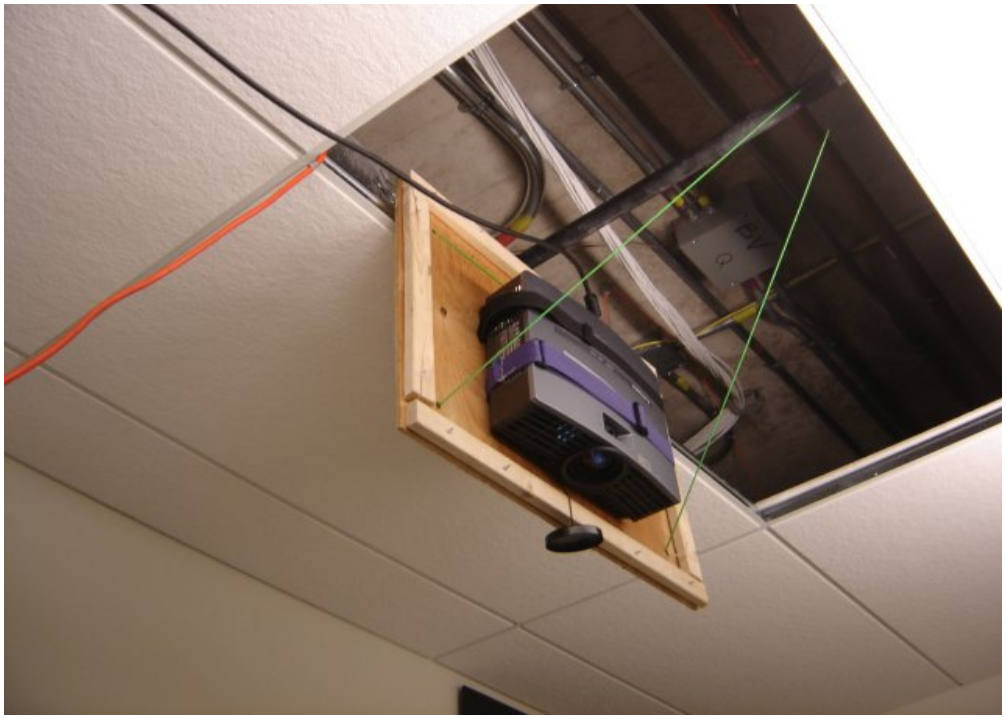

Figure 4: Projector suspension

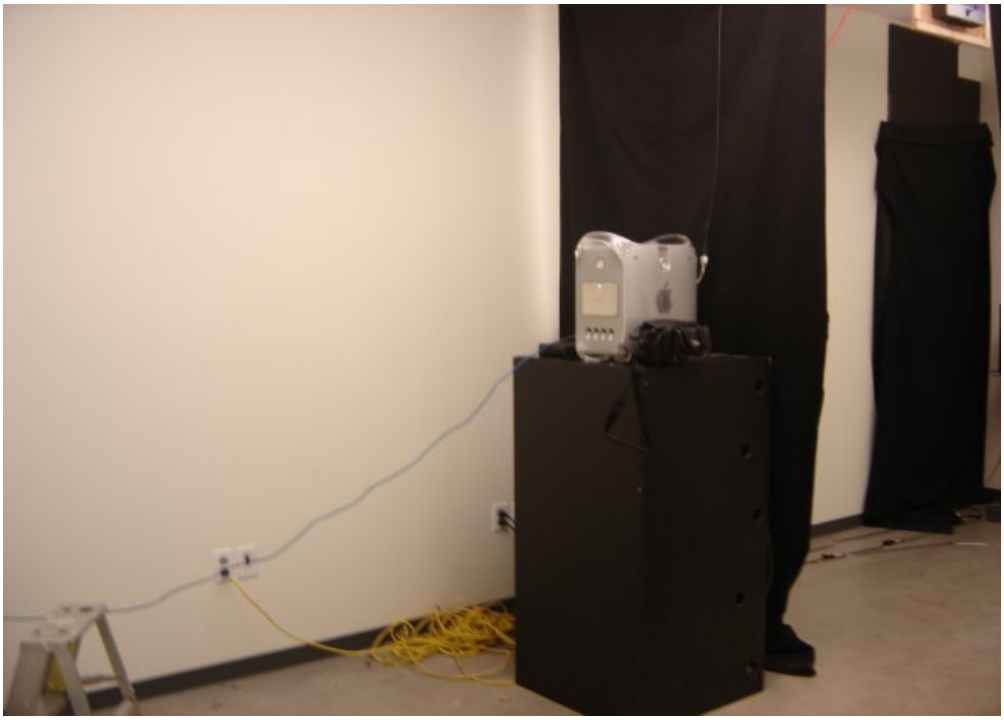

Figure 5: Projector, workstation and blackout curtains

Figure 6: Detail with projector, speaker and floor projection