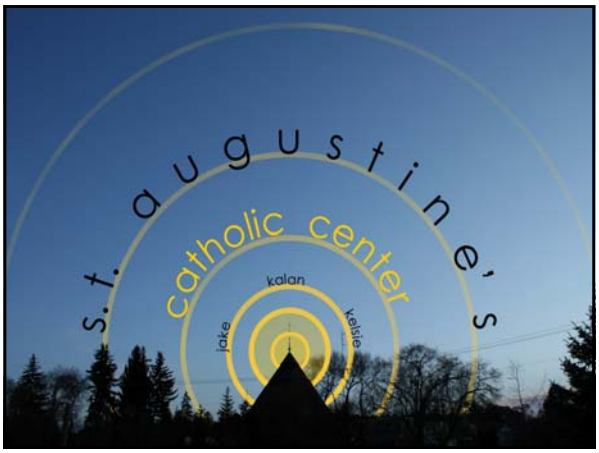
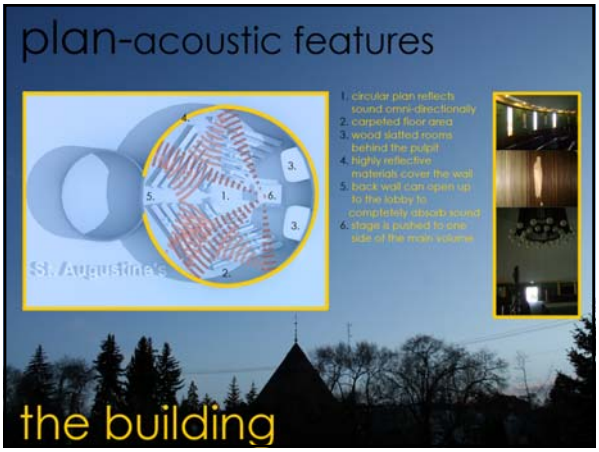
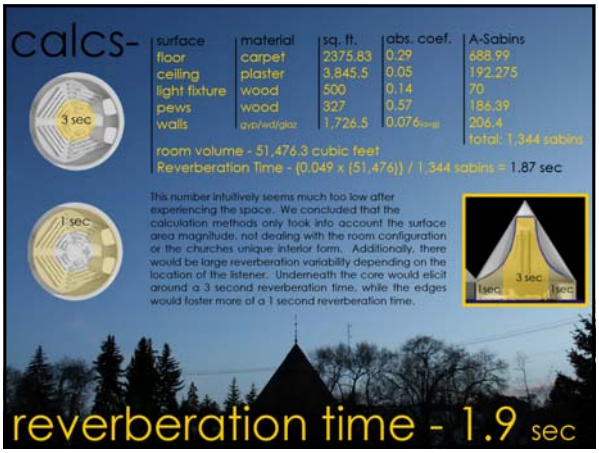
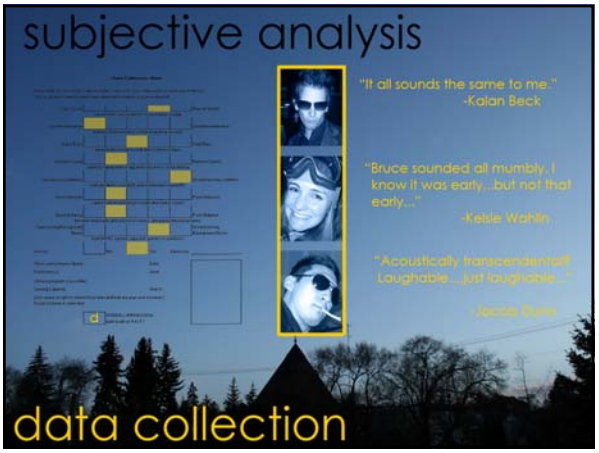

s.t. augustine's
catholic center
kalan
jake
kelsie

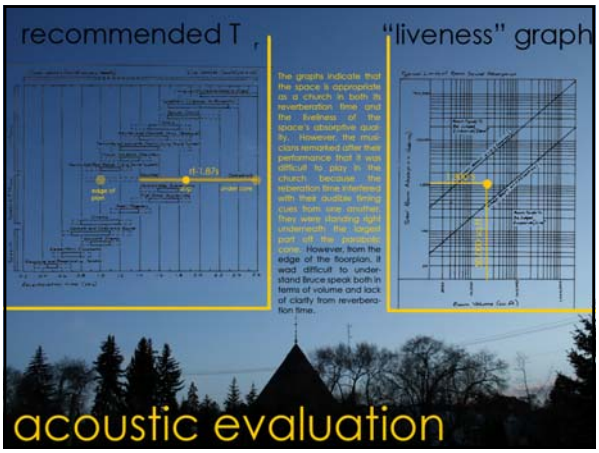

building: St. Augustine's Catholic Center
event: Bruce's "Acoustics Tour"
SUB
This building is located at the north eastern end of campus. The space was designed for church related activities including sermons, small scale musical performances, and worship. The building may look like a pyramidal cone from the outside, but the inside features a parabolic ceiling and an inspirational wood slatted chandelier that hangs from the center of the space.
description

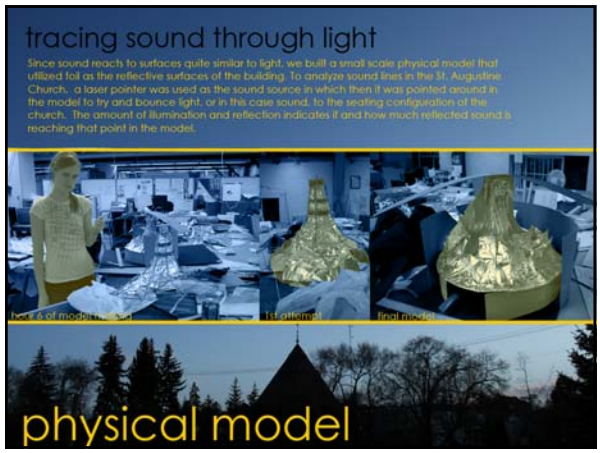

plan-acoustic features
1. circular plan reflects sound omni-directionally
2. carpeted floor area
3. wood slatted rooms behind the pulpit
4. highly reflective materials cover the wall
5. back wall can open up to the lobby to completely absorb sound
6. stage is pushed to one side of the main volume
St. Augustine's
the building

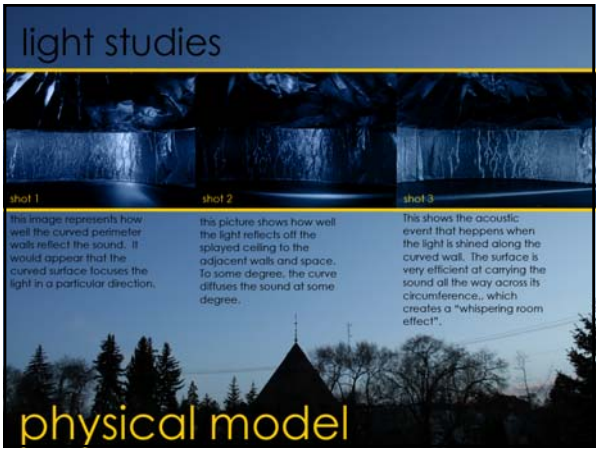

section-acoustic features
1. interior walls slope in a parabolic form to focus sound
2. splayed edges at the bottom of the curve reflect s ound to the entire congregation
3. the hanging chandelier attempts to diffuse sound that climbs up the walls of the parabolic cone.
the building


calcs-
surface | material | sq. ft. | abs. coef. | A-Sabins
floor | carpet | 2375.83 | 0.29 | 688.99
ceiling | plaster | 3,845.5 | 0.05 | 192.275
light fixture | wood | 500 | 0.14 | 70
pews | wood | 327 | 0.57 | 186.39
walls | (grp/wd/glaz | 1,726.5 | 0.076(ave)) | 206.4
total: 1,344 sabins
room volume - 51,476.3 cubic feet
Reverberation Time - (0.049 x (51,476)) / 1,344 sabins = 1.87 sec
3 sec
1 sec
This number intuitively seems much too low after experiencing the space. We concluded that the calculation methods only took into account the surface area magnitude, not dealing with the room configuration or the churches unique interior form. Additionally, there would be large reverberation variability depending on the location of the listener. Underneath the core would elicit around a 3 second reverberation time, while the edges would foster more of a 1 second reverberation time.
3 sec
1sec
1sec
reverberation time - 1.9 sec

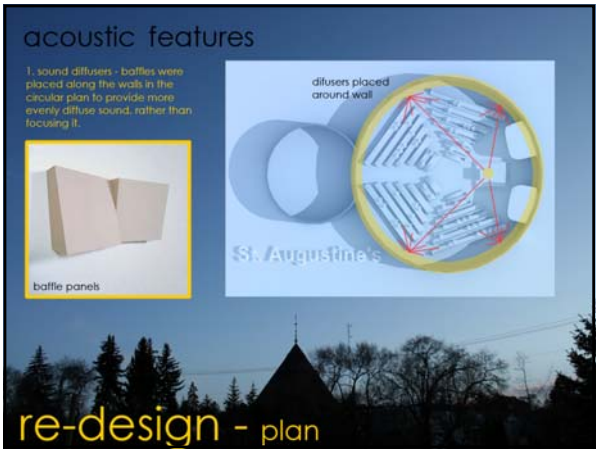

subjective analysis
"It all sounds the same to me."
-Kalan Beck
"Bruce sounded all mumbly. I know it was early...but not that early..."
-Kelsie Wahlin
"Acoustically transcendental? Laughable ...just laughable..."
Jacob Dunn
data collection

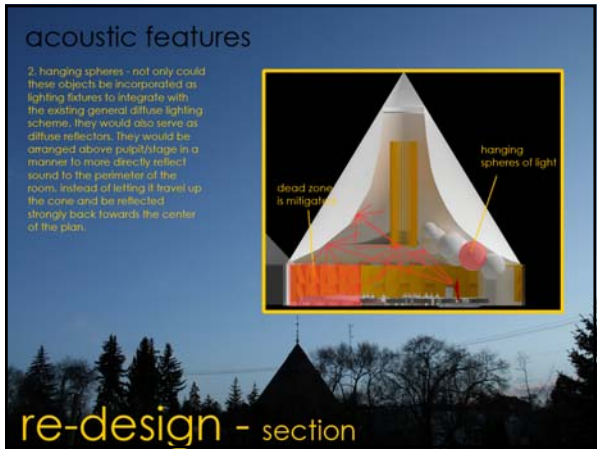

recommended T
"liveness" graph
The graphs indicate that the space is appropriate as a church in both its reverberation time and the liveliness of the space's absorptive quality. However, the musicians remarked after their performance that it was difficult to play in the church because the reberation time interfered with their auditor timing cues from one another. They were standing right underneath the largest part of the parabolic cone. However, from the edge of the floorplan, it was difficult to understand Bruce speak both in terms of volume and lack of clarity from reverberation time.
acoustic evaluation

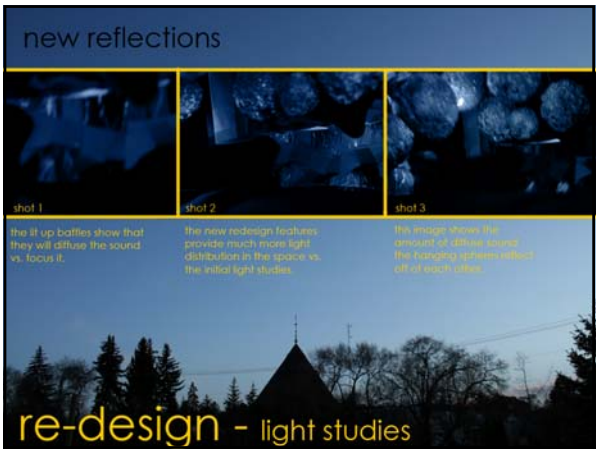

tracing sound through light
Since sound reacts to surfaces quite similar to light, we built a small scale physical model that utilized foil as the reflective surfaces of the building. To analyze sound lines in the St. Augustine Church, a laser pointer was used as the sound source in which then it was pointed around in the model to try and bounce light, or in this case sound, to the seating configuration of the church. The amount of illumination and reflection indicates if and how much reflected sound is reaching that point in the model.
1st attempt
final model
physical model

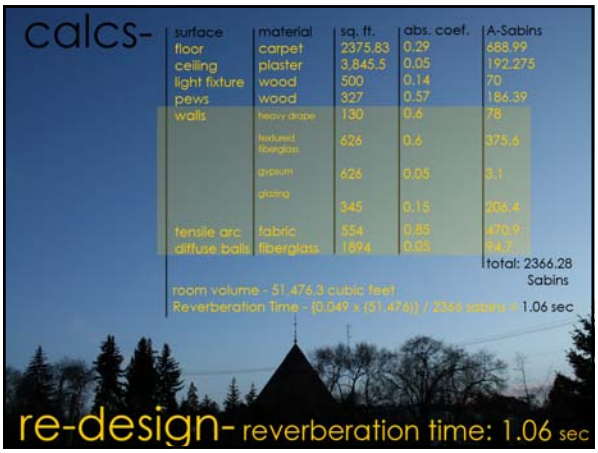

light studies
shot 1
shot 2
shot 3
this image represents how well the curved perimeter walls reflect the sound. It would appear that the curved surface focuses the light in a particular direction.
this picture shows how well the light reflects off the splayed ceiling to the adjacent walls and space. To some degree, the curve diffuses the sound at some degree.
This shows the acoustic event that heppens when the light is shined along the curved wall. The surface is very efficient at carrying the sound all the way across its circumference., which creates a "whispering room effect".
physical model


existing design
The space as is definitely has some appropriate acoustic uses. For a church with a "silence" goal that utilizes one speaker, the space is adequate. But as soon as you go beyond the single speaker or any type of liturgical performance (which utilize high reverberation times), the space then becomes disadvantageous. The reverberation time around the "stage: is way too problematic for the performers, while the uneven distribution of sound reflections is disadvantageous to the listeners.
GOALS: An adaptive strategy that decreases reverberation time for small scale musical performances is needed along with a mechanism to more evenly distribute the sound to the entire space.
St. Augustine's Church

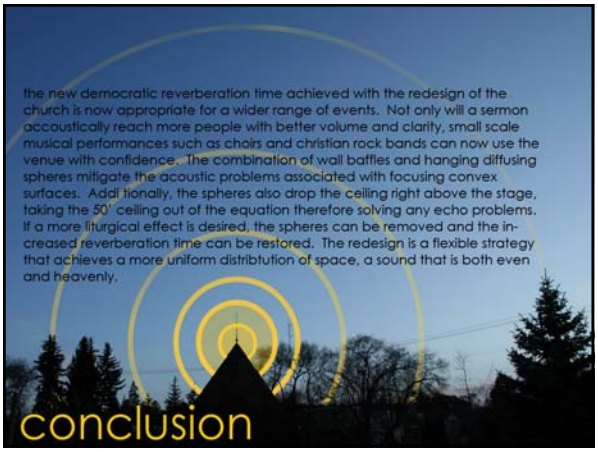

acoustic features
1. sound diffusers - baffles were placed along the walls in the circular plan to provide more evenly diffuse sound, rather than focusing it.
baffle panels
difusers placed around wall
St. Augustine's
re-design - plan

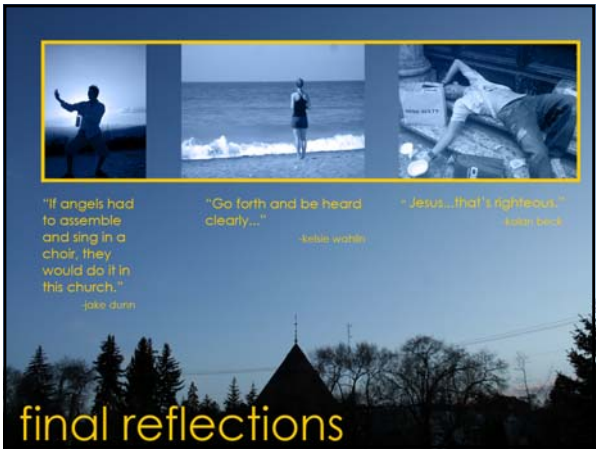

acoustic features
2. hanging spheres - not only could these objects be incorporated as lighting fixtures to integrate with the existing general diffuse lighting scheme, they would also serve as diffuse reflectors. They would be arranged above pulpit/stage in a manner to more directly reflect sound to the perimeter of the room, instead of letting it travel up the cone and be reflected strongly back towards the center of the plan.
hanging spheres of light
dead zone is mitigated
re-design - section


new reflections
shot 1
shot 2
shot 3
the lit up baffles show that they will diffuse the sound vs. focus it.
the new redesign features provide much more light distribution in the space vs. the initial light studies.
this image shows the amount of diffuse sound the hanging spheres reflect off of each other.
re-design - light studies


calcs-
surface | material | sq. ft. | abs. coef. | A-Sabins
floor | carpet | 2375.83 | 0.29 | 688.99
ceiling | plaster | 3,845.5 | 0.05 | 192.275
light fixture | wood | 500 | 0.14 | 70
pews | wood | 327 | 0.57 | 186.39
walls | heavy drape | 130 | 0.6 | 78
textured fiberglass | 626 | 0.6 | 375.6
gypsum | 626 | 0.05 | 3.1
glazing | 345 | 0.15 | 206.4
tensile arc diffuse balls | fabric | 554 | 0.85 | 470.9
fiberglass | 1894 | 0.05 | 94.7
total: 2366.28 Sabins
room volume - 51,476.3 cubic feet
Reverberation Time - (0.049 x (51,476)) / 2366 sabins = 1.06 sec
re-design- reverberation time: 1.06 sec


a new space
re-design - renderings


the new democratic reverberation time achieved with the redesign of the church is now appropriate for a wider range of events. Not only will a sermon accoustically reach more people with better volume and clarity, small scale musical performances such as choirs and christian rock bands can now use the venue with confidence. The combination of wall baffles and hanging diffusing spheres mitigate the acoustic problems associated with focusing convex surfaces. Addi tionally, the spheres also drop the ceiling right above the stage, taking the 50' ceiling out of the equation therefore solving any echo problems. If a more liturgical effect is desired, the spheres can be removed and the in-creased reverberation time can be restored. The redesign is a flexible strategy that achieves a more uniform distribtution of space, a sound that is both even and heavenly.
conclusion


"If angels had to assemble and sing in a choir, they would do it in this church."
-jake dunn
"Go forth and be heard clearly..."
-kelsie wahlin
" Jesus...that's righteous."
-adam beck
final reflections