Perceived Boundary Effects in an Automotive Vehicle Interior

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A study was conducted to better understand the perceived mid-to-high-frequency timbral and spatial changes in a sound field due to the proximity to loudspeakers of reflective, semi-rigid surface boundaries similar to those of passenger vehicles. For the purpose of the study, a simple structure was mocked up to represent the interior boundaries of an automotive vehicle. Adjustable and removable panels were used so the effects of different panel combinations and loudspeaker locations could be investigated. Objective parameter measurements and binaural recordings were made for each of the combinations. Subjective tests were then performed to study listener impressions and correlate the results to the objective measurements.

0 INTRODUCTION

The results presented in this paper are from a general experiment aimed at understanding the relationship between the perception of the soundfield in a vehicle interior and the presence of nearby boundaries. It is postulated that an understanding such as this will benefit us in describing the contribution of each loudspeaker location and boundary surface to the spatial and timbral aspects of the soundfield.

Past work by Bech [1],[2] Toole and Olive[3],[4],[5] and Schuck et al [6] has illustrated the effects of loudspeaker location on preference and timbre in listening rooms. The purpose of this paper is to investigate the application of their work to the smaller, more complicated boundaries of a vehicle interior. The results would then be related to the practical aspect of sound system design and development for the vehicle environment.

1 EXPERIMENTS

1.1 Preliminary Experiment

A preliminary experiment was run using rudimentary boundary representations of a vehicle's interior: Windshield, instrument panel (IP) and front doors. In the preliminary experiment, the material used for the panels was 9.5 mm thick foam insulation board with

aluminum skin surfaces. It was light-weight for ease of manual manipulation, but rigid with a smooth surface. A loudspeaker was mounted on the top of the instrument panel on each side of the vehicle. The setup allowed us to modify the boundaries extensively, hear the effects, make binaural recordings and verify that the effects were being recorded. Through the live listening and binaural recordings, we determined the basic contribution of each panel to the effects heard and determined the best program material for the general experiment.

1.2 General Experiment

In the general experiment, the vehicle interior was represented by flat panels with appropriate damping characteristics for each of the chosen boundaries. Flat panels were chosen to simplify construction of the boundaries and to simplify analysis of interactions between the boundaries and speakers. The materials were changed in this experiment from what was used in the preliminary experiment and this did effect the results. The windshield, IP, and upper door areas had a reflective surface similar to hard plastic or glass. The lower doors were covered with cloth and the roof was covered with a foam-backed cloth similar to what is found in a vehicle, and the floor was carpeted. The walls of the room used for the experiment were treated to absorb as much low frequency energy as possible (100 - 200 Hz) so the room would not color the upper bass and midrange. The panels were removable, and any practical combinations of panels was possible. The angle between the windshield and the IP was calibrated and adjustable, and the loudspeaker locations were also variable. The loudspeaker locations were either in the top side locations of the IP or the mid or lower portion of the door. There was confirmation that the mocked up vehicle interior had similar acoustic properties to an actual vehicle. This was done through subjective listening, measurements and dimension comparison.

A matrix of all the useful panel and loudspeaker combinations was made to minimize the number of trials. [Figure 1.] Based on our knowledge of vehicle interiors and the results of the preliminary experiment, the total experimental set was reduced considerably to a manageable number (28). From the preliminary experiment, we determined that both door panels (left and right) would be used when the boundary variable being investigated was the door. Also, we decided to have no rear panel in all the experiments. Its primary contribution was accentuated bass, not midrange/treble, and would only add confusion to the timbral results and spatial judgments. In the preliminary experiment, we could modify the windshield angle instantaneously, and from that determined the angle increments we would investigate (55°, 70°, 90°, and 180°). We also determined from that exploratory investigation that there was an "optimum" angle for the windshield where spatially and timbral the soundfield was at its best. Later on we will illustrate that the optimum angle was not what we determined from the preliminary experiment and that the angle increments could have been slightly different to be more meaningful. These differences can be attributed to the materials used for the boundary panels.

The experiments consisted of varying the panel combinations or loudspeaker locations and investigating the effects on the perceived soundfield. There were five basic experimental setups, from which the following variable sets were investigated:

Experiment 1A: Boundary Variables = Windshield Angle (55°, 70°, 90° and 180°)
Experiment 2: Boundary Variables = Door & Roof Panels
Experiment 3: Boundary Variables = IP(70°) & Roof Panel
Experiment 4: Loudspeaker Location Variable = IP Location
Boundary Variables = Windshield Angle
Experiment 5: Loudspeaker Location Variable = Door Location
Experiment 4/5: Loudspeaker Location Variable = IP & Door Locations
Experiment 1B: Boundary Variables = Windshield Angle (Listening Pos = Center)

Illustrations 1. and 2. show the relative positions of the panels, listener, and loudspeakers.

For each combination, a source program was played through the loudspeakers and recorded using a KEMAR dummy head. A 90 mm diameter fullrange loudspeaker (100Hz - 20kHz) was used for all of the loudspeaker variable locations. In addition, a pair of enclosed subwoofers were used (also in stereo) for the frequency range of 40 - 100Hz. The source program material included:

Program 1: Monaural Spoken Word (Male Voice)
Program 2: Broad-band Music: "Into the Night" (Little Feat)
Program 3: Pink Noise Bursts Panned Left to Right
Program 4: Drum Kit Impacts

The material was chosen to benefit the listener in rating both the spectral and spatial quality of each combination with respect to a reference setup [7]. The reference used the same 90 mm loudspeakers. They were mounted in a large vertical panel facing the "listening position". The panel was large enough to reduce or eliminate front to rear cancellation at the lowest frequency of use. The reference was equalized to a small degree for a perceived flatness of the response, and that equalization was used for all of the boundary and location variables.

For each combination, impulse response measurements were made (with MLSSA) using a single microphone and the KEMAR dummy head. Impulse measurements taken on each of the boundary combinations as well as the reference location were used to produce energy time curves (ETC's), and frequency response graphs for analysis. Measurements were also made on several additional boundary combinations to provide greater detail of the interactions. Most of the objective measurements were made on the left hand side (the driver position) of the vehicle. Experiment 1B was conducted with KEMAR equally spaced between the left and right loudspeaker locations. Time and spatial averaged measurements using a six microphone array (used for documenting audio systems in vehicles) were made using an uncorrelated pink noise source. The measurements made

with the six-microphone array corresponded well with the frequency responses derived from MLSSA measurements and will not be discussed beyond that. The MLSSA frequency responses were capable of providing more detail and were therefore used for comparison and analysis.

Binaural recordings were made on RDAT and edited on a PC as *.wav files. The length of the edited sources were between 20 to 30 seconds. The edited recordings were arranged into six different listening test sessions and played back from that PC's hard drive through a pair of binaural earphones. The listening tests were therefore blind.

Several trained listening subjects with known audiometric acuity were used to evaluate the RDAT recordings. The benefit of trained listeners has been well established [7], [8]. The listeners for these experiments were trained using the method established by Olive [7]. The subjects were given some instruction on the type of cues to listen for in the binaural recordings to help relate the earphone listening experience to the live listening experience. The type of spatial errors which can occur are in-head localization and front-to-back reversals [9], [10]. The listeners were coached in these errors and the use of loudness cues to relate in-head locations to external ones. The recordings were presented to the listeners with the same programs for each trial, but randomized within each session. The subjects were asked to provide a preference rating (relative to the reference) for the selections presented to them in each trail. The subjects were then asked to rate both the timbral and spectral nature of the soundfield, as well as provide written comments during each trial and verbal comments after each session.

The results of the listener testing were statistically analyzed using a multivariate repeated-measures analysis of variance (ANOVA) model. The model analyzes each factor (Listener, Boundary or Loudspeaker Location Variable, and Program) and their interactions to determine their effect on the Listeners' Preference rating, Timbral Balance rating, and Spatial Quality rating (the dependent variables).

Each of the dependent variables for each of the experiments was statistically analyzed as a separate model. The combined ANOVA tables for the experiments are shown at the end of the paper. [Tables 2 - 8.] The significance of the variation is listed for each dependent variable by each Effect (i.e., source of variation). The results of the statistical analysis and effects of the subjective results are summarized in Table 1. Those results are described in the following sections.

A comparison between listener preferences, ratings and comments and observations of the measured data is then made following the subjective results.

2 EXPERIMENTAL RESULTS: BOUNDARY VARIABLES

2.1 Statistical Analysis & Effects of Subjective Results

2.1.1 Experiment 1A: Boundary Variable = Windshield Angle

The loudspeaker location was in the IP, in the Back position (152 mm from to the edge of the IP).

ANOVA Table 2 and Means Tables 9, 16, 23, and 30 indicate, and Means Charts 1 - 5 (with 95% Confidence Levels) illustrate, that the 55° windshield angle was the largest factor to contribute to variance in the listeners' responses for Preference Rating. The listeners individually had the greatest variance overall, but as can be seen in Chart 3 the listeners agree in general that the 55° angle was preferred over the others. The 90° angle was a close second in preference. The 55° angle also had the best Treble Balance (same Tables and Charts 6 - 10). The 90° & 180° angles were the best in Midrange Balance (Charts 11 - 15). And the boundary variables had no effect on the Bass Balance (Charts 16 - 20). The 55° angle was also considered to have the best Spatial Quality. (Charts 21-25).

When comparing the overall effects of the Program material itself and its effects among the listeners, Voice and Music were the most useful in determining Preference. If there was an effect in Timbre Balance, then music was the best in determining it. Voice was the most effective in determining Spatial and Music was the worst. It might be expected that the Noise would have been the best program for determining Timbral Balance, but the duration of each of the noise bursts was not long enough for the listener to make a good judgment.

The Means charts similar to the ones used to illustrate the effects in Experiment 1A can be generated from the values listed in the Means Tables. For the sake of brevity, those charts will not be displayed for every experiment. But they have been generated and used by the authors to visually inspect the data for the interaction trends which are reported.

2.1.2 Experiment 2: Boundary Variable = Door & Roof Panels

The loudspeaker location was IP Back again.

It can be seen in ANOVA Table 2 and Means Tables 10, 17, 24, and 31 that the Boundary Variable of IP w/o Door & Roof was the most preferred, and the addition of the Roof panel was the most significant variable in the lowering the preference. The IP w/o Door & Roof also had the best Treble and Bass Balance, and the Roof also contributed most to the worst cases. The Boundary Variables had no effect on the Midrange Balance. The IP

w/o Door & Roof also had the highest Spatial Quality rating, and the presence of the Door lowered the quality the most; the lowest being with the Door & Roof present.

Music was again the most effective in distinguishing Preference. There was no Program effects for the Timbral Balances. Noise was the most effective in determining Spatial Quality.

2.1.3 Experiment 3: Boundary Variables = IP(70°) & Roof Panel

The loudspeaker location was in the Doors, High (762 mm from the floor).

ANOVA Table 4 and Means Tables 11, 18, 25, and 32 indicate that the Boundary Variable of Doors w/o the IP & Roof was the most preferred, and preference was lowered most by the presence of the roof. The presence of the IP with windshield had no effect. There was no effect of the Boundary Variables on the Treble and Midrange Balance. Treble was all negative and the Midrange was neutral. The only effect of the variables on the Bass Balance was that the Doors w/ Roof combination was the worst. The levels for Bass Balance were consistent with Experiment 2's Doors w/ Roof and Doors combinations. The Doors w/o IP and Roof Boundary Variable had the highest Spatial Quality rating, and the presence of the Roof lowered the quality ratings the most. The ratings were consistent with those of Experiment 2's IP w/ Doors combinations.

Music was the most effective in distinguishing Preference. There was no Program effects for the Timbral Balances. Noise was the most effective in determining Spatial Quality.

2.2 Objective Measurements

For the following analysis, to simplify the interactions, only single ear and loudspeaker combinations are considered unless otherwise stated.

2.2.1 Experiment 1A: Boundary Variable = Windshield Angle

Graphs 1 and 2 show the frequency response characteristics and Graphs 3 and 4 show the ETC's for the different windshield angles and reference using KEMAR's left and right ears. The ETC's have been averaged to make overlays and viewing easier.

Comparing the frequency characteristics, it can be seen that there is a left-right proximity bias because the listener is not positioned an equal distance from each loudspeaker. The right loudspeaker SPL is typically 2-4 dB less than the left loudspeaker due to the nearly 2:1 distance from the ears. The high-frequency SPL is also greater for the left side because the head is closer to and aligned more directly with the left loudspeaker. As the windshield angle becomes smaller (< 75°), the mid- and high-frequency SPL increases due to reflections off the windshield. For angles less than 55°, which is typical of most automobiles, the left side high-frequency SPL (above 4 kHz) is greater than the right side.

The response smoothness becomes quite irregular as the angle becomes smaller due to the comb filtering effects. Also, there is a small (≈ 2 dB) increase in the frequencies below 400 Hz due to boundary reinforcement.

The ETC's show that as the windshield angle becomes smaller and more energy is reflected back toward the listener, the reflection amplitude gets larger and the separation between the direct and reflected energy peaks become smaller. Between 55° to 90° there is a general broadening of the initial energy peak as multiple reflections are fused together to form a bundle [11]. For angles less than 70°, the amplitude of the direct energy is smaller than that of the reflected energy. At 55°, the angle is so small that the initial peak and first reflections are fused together to yield a more ideal looking impulse but with a reduced decay envelope slope beyond 7 ms due to the increased reflection energy density. The time scale is reduced on this graph to depict greater detail.

2.2.2 Experiment 2: Boundary Variable = Door & Roof Panels
Experiment 3: Boundary Variables = IP(70°) & Roof Panel

Graphs 5 through 8 show the results of adding individual boundaries around a single IP loudspeaker location. It can be seen that with the addition of each boundary, the frequency response aberrations become larger in amplitude and more frequent. Compared to the reference there is a 2-3 dB increase in the bass level with the addition of each boundary, particularly the roof. The right side has slightly more high-frequency output above 8 kHz and there is also some significant peaking in the midband region caused by the reflections.

The ETC's show that as additional boundaries are added, the initial energy peak becomes broader as the reflections fuse together with the direct energy. There is also a substantial decrease in the ETC slope with the addition of each boundary. It is interesting to note that adding just the doors increases the ETC energy beyond the initial bundle more than the roof and/or door and roof together. This is because the roof is padded and absorbs some of the high frequency energy reflected by the windshield and doors. Graphs 9A and 9B show the non averaged ETC's for the left and right ears with both the left and right loudspeakers playing. Notice the comb filter spacing effects and long decay time.

2.3 Objective vs. Subjective Results

2.3.1 Experiment 1A: Boundary Variable = Windshield Angle

Generally, there is good correlation between the objective and subjective results for this portion of the experiment. In spectral terms, the ANOVA results show no significant changes to the bass balance as the windshield angle changed, although a slight bass increase could be heard. There was significance to the mid- and high-frequency balance

that can be attributed to a high-frequency accentuation for smaller angles and a high-frequency rolloff for the larger angles. A perceived change to the timbre is caused by the mid-high frequency accentuation and comb filtering effects which adds harshness to the sound quality. The treble balance drove the overall preference and spatial quality for the driver's position. The spatial quality rating for 180° was the lowest most likely because of the reduced high frequency SPL and loss of clarity.

Although it is difficult to draw hard conclusions from the data concerning the significance of the spatial aspects, it is possible to deduce various assumptions. The prevalent phenomena observed as the angle's reduced are: A broadening of the initial energy peak (from 30 μs to 3 ms) and the reduced decay envelope slope of the ETC's. Although the broadening of the initial peak and increased decay level adds loudness, body and spaciousness to the sound, it also reduces the imaging quality of the sound stage. Instead of a stable and well defined image formation at or near the loudspeaker location (for a single loudspeaker), the reflected and direct energy are summed together (a fusion zone) [12] to cause image or localization blur as described in Blauert [13]. The perceived location of the image is spread vertically between the loudspeaker location and the points where the reflections occur on the windshield. It should be kept in mind that for the smaller angles, the reflected energy can be greater than the direct energy and that time-intensity trading is occurring [13], [14]. It has also been observed that the image blur is frequency dependent as the mid to high frequencies are elevated toward the windshield (given the speaker directivity) and the mid to lower frequencies appear to stay closer to the speaker position.

As a side note, while investigating interaural ETC's the authors were reminded that both the left and right ears receive a signal from the closest speaker (left) before the signal from the farther speaker (right) arrives. As seen in Graph 10 the crosstalk signal is nearly the same amplitude and lags just behind the direct signal. It can also be seen that beyond the initial energy bundle the decay envelope amplitude is greater for the crosstalk signal which pulls the image toward the opposite side increasing a lateral image blur. The localization cues are substantially biased toward the near side of the vehicle which explains why it is so difficult to produce a well defined and stable virtual sound image in this environment.

2.3.2 Experiment 2: Boundary Variable = Door & Roof Panels
Experiment 3: Boundary Variables = IP(70°) & Roof Panel

Spectrally, there's good agreement between the objective and subjective results for this portion of the experiment. In experiment 2, the combination with the least number of boundaries (IP with 70°) were preferred overall. In general, the bass drove the preference ratings because the addition of any boundary substantially reinforced the low frequencies as shown in graphs 5 and 6. With the addition of the doors there was also an increase in the mids and treble. The IP/Roof boundaries increased the bass somewhat less than the doors, and the treble was worse than any other combination given the absorption by the

roof padding. The IP/Door/Roof boundaries also added a severe bass resonance and hollow characteristic to the sound quality as the vehicle became more enclosed. It should be noted that some amount of masking may take place for the treble frequencies given the substantial bass increase. In experiment 3 the upper door location was generally preferred and not affected by the windshield addition. The bass contribution caused by the roof was significant in reducing the overall preference rating.

Spatially the combination with the least number of boundaries (windshield only) was preferred [15]. The presence of the door boundaries caused the most significant drop in the spatial quality ratings and the roof made it worse. This can be attributed to the increased reflection density with each boundary addition and also to the bass energy increase that occurs when the doors or roof are added or the high frequency decrease when the roof is added. This increases the masking of the mid- and high-frequencies causing a loss of clarity which may reduce the ability to localize. It was also noticed that with the addition of the doors the image seemed to spread out laterally and become more diffuse (or blurred). With the addition of the roof, the image was elevated and became much larger.

3 EXPERIMENTAL RESULTS: LOUDSPEAKER LOCATION VARIABLE

3.1 Statistical Analysis & Effects of Subjective Results

3.1.1 Experiment 4: Loudspeaker Location Variable = IP Location Boundary Variable = Windshield Angle

ANOVA Table 5 and Means Tables 12, 19, 26, and 33 indicate that for the Loudspeaker Location Variable of IP Back, the windshield angle of 55° was the most preferred, and that for the Loudspeaker Variable of IP Forward, the windshield angle of 70° was most preferred. The same combinations also had the best Treble Balance and neutral ratings for Midrange Balance. There was no effect for Bass Balance. For the Loudspeaker Location Variable of IP Back, the windshield angle of 55° had the highest Spatial Quality (and the highest Quality of all variables for this experiment). For the Loudspeaker Variable of IP Forward, the windshield angles of 55° and 70° both had the highest Spatial Quality.

Music was the most effective in determining Preference. If there was an effect in Timbral Balance, then music and noise was the best in determining it. Voice and Music was the most effective in determining Spatial Quality.

3.1.2 Experiment 5: Loudspeaker Location Variable = Door Location

ANOVA Table 6 and Means Tables 13, 20, 27, and 34 indicate the High Door location is preferred, has the best Treble and Bass Balance, is neutral in Midrange Balance, and has

upper door location is slightly closer to the listener's ears than the IP locations. The initial energy bundle has spread out over a 2 ms span, then drops about 15 dB and stays at a fairly constant level for the next 40 ms. There are some high level reflections occurring from the door locations at 9 ms intervals which correspond to a lateral reflection between the loudspeaker and doors. It can also be seen that the lower door ETC has a lower initial energy bundle, but after 12 ms the amplitude increases above all other curves due to the large number of reflections.

3.3 Objective vs. Subjective Results

The forward IP location was preferred overall for all combinations and the lower door location had the lowest preference The two door IP locations had a similar response characteristic and sounded similar. It can be seen that for the lower door location, the high-frequencies above 2 kHz roll off rapidly. This is due to the severe off-axis condition from the loudspeaker to the ear and absorption by the lower portion of the interior. The right lower door loudspeaker has more high frequency SPL than the reference because there's a direct path from the loudspeaker to the door and reinforcement by the boundaries. Comparing the two subjectively, the lower door location sounds very dull and diffuse. This is more than likely due to the high-frequencies being masked by the low-frequencies and some compensation by the reduced left channel high-frequency SPL. The diffuse nature is due to the multiple reflections and high energy density.

4 EXPERIMENTAL RESULTS: DRIVER'S POSITION vs. CENTER POSITION

4.1 Statistical Analysis & Effects of Subjective Results

4.1.1 Experiment 1B: Boundary Variable = Windshield Angle (Center Position)

ANOVA Table 8 and Means Tables 15, 22, 29, and 36 indicate that all windshield angles are equally preferred except for 70°, which is definitely not preferred. The angle of 55° had the best Treble Balance (all others were equal). All angles were close to being neutral with the exception of 70° which had the worst Midrange Balance. There was no effect on the Bass Balance. The 70° angle also had the lowest Spatial Quality. The other angles were all nearly equal in Quality and equal Experiment 1A's 55° angle for the driver's position.

Voice was the most effective for determining Preference. There was no Program effect for Timbral Balance. There was almost not effect for Spatial Quality, except that Music was the least effective. The Midrange Balance drove the ratings for the center listening position.

Measurements show that the frequency response and ETC's for the center position are similar to the left position and there was good agreement between the left and center

the best Spatial Quality. Music was the most effective for Preference and Timbral Balance. And Noise was the most effective for Spatial Quality.

3.1.3 Experiment 4/5: Loudspeaker Location Variable = IP & Door Locations

Loudspeaker location data from Experiment 4 and 5 with the windshield angle equal to 70° were combined to analyze the effect, in general, of the Loudspeaker Location. The trials for the listening test were randomized and the preferences were relative to the reference for each response, so the data could be combined into a unique experiment.

ANOVA Table 7 and Means Tables 14, 21, 28, and 35 indicate that the IP forward (152 mm from the windshield and IP joint) location was preferred and that the Door High location was almost equally preferred. The Door High location had the best Treble Balance, and both of the IP locations were the same in ranking and second behind the Door High location. Midrange Balance was neutral for IP locations and a little lacking for the Door High location. The IP Forward location was slightly preferred for Bass. The most significant effect in the Spatial Quality is that the Door Low location (457 mm from the floor) did not have a high Spatial Quality rating.

Music was the most effective in distinguishing Preference. There was no Program effects for the Timbral Balances. Noise was the most effective in determining Spatial Quality.

3.2 Objective Measurements

3.2.1 Experiment 4: Loudspeaker Location Variable = IP Location
Boundary Variable = Windshield Angle
Experiment 5: Loudspeaker Location Variable = Door Location
Experiment 4/5: Loudspeaker Location Variable = IP & Door Locations

For this portion of the experiment, the loudspeaker locations were moved to determine the effects on the sound field. The locations include: Forward IP, Back IP, Upper Door and Lower Door. The windshield (70°), doors and roof were put in place for all of these measurements.

As seen in Graphs 11 and 12 frequencies below 1 kHz, there is a bass and mid-frequency increase, for all combinations compared to the reference. The IP locations have 2-3dB more bass rise than the doors. The upper door location has the flattest frequency response, while the left lower door locations exhibit a high-frequency roll off above 2 kHz. The right lower door has more high-frequency output than the reference. There's a 2-2.5 kHz peak caused by a roof reflection that occurs for all locations except the lower door.

The ETC's for this group (Graphs 13 and 14) exhibit similar characteristics to the previous experiments. All of the initial energy peaks arrive at approximately the same time with the exception of the lower door location which arrives about 700 μs later. The

listener locations. The ratings for the center were consistently higher than that of the driver location because of the symmetrical sound field.

5 SUMMARY

It is the authors' opinion that we have met the goal of this study and have gained a better understanding of the automotive vehicle soundfield. To summarize some of the findings: The center seat location is preferred over the left or right side as expected. For IP mounted loudspeakers, smaller windshield angles (< 55°) and a location closer to the windshield (forward) is preferred for the best overall results but the upper door was a very close second. The door and roof boundaries added substantial bass energy to the sound characteristic and were judged the worse for spatial preference. Music was the overall preference as a program source for testing spectral aspects, but noise, and then voice, was preferred for testing spatial aspects. In terms of listener performance there was generally good agreement among the listeners, but their variance was typically the largest of all variables. Even though the listeners had the largest variation, there was good agreement among them for preference and quality rating.

It should be noted that the for most of this study single loudspeaker and ear combinations were investigated. In practice, there may be several low-, mid-, and high-frequency loudspeakers located in various areas of the vehicle with different firing angles, grilles, panel resonances etc. With these additional variables, it easy to understand why it's so difficult to produce a well-balanced and natural soundfield in a automotive vehicle.

This general experiment was the authors' first attempt at quantifying the boundary effects of an automotive vehicle environment beyond what is known intuitively and from experience. For the most part, much more was learned about the methods used and what to test for than finding new discoveries about the environment. The authors plan to continue these experiments to increase the statistical data base.

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BOUNDARY EFFECTS GENERAL EXPERIMENT SETUP MATRIX

Exp.	Comb.	Kemar/Ref Pos.		Loudspeaker Location				IP Windshield Angle				Door	Roof
#	#	1	2	A	B	C	D	55°	70°	90°	180°		
1A													
	1	x											
	2			x				x					
	3			x					x				
	4			x						x			
	5			x							x		
1B	6		x										
	7			x				x					
	8			x					x				
	9			x						x			
	10			x							x		
2													
	1	x											
	2			x					x				
	3			x					x			x	
	4			x					x				x
	5			x					x			x	x
3													
	1	x											
	2					x						x	
	3					x			x			x	
	4					x						x	x
	5					x			x			x	x
4													
	1	x											
	2			x				x				x	x
	3			x					x			x	x
	4			x						x		x	x
	5			x							x	x	x
	6				x			x				x	x
	7				x				x			x	x
	8				x					x		x	x
	9				x						x	x	x
5													
	1	x											
	2					x			x			x	x
	3						x		x			x	x
4/5													
	1	x											
	2			x					x			x	x
	3				x				x			x	x
	4					x			x			x	x
	5						x		x			x	x

Ear level = 45" from floor
1 = driver position = (center - 12")
2 = center position

A = back = 6" from edge of IP
B = forward = 6" from windshield/IP joint
C = high = 30" from the floor
D = low = 19" from the floor

FIGURE 1

Exp	Variable	Pref	Prog	Treb Bal	Prog	Mid Bal	Prog	Bass Bal	Prog	Spatial	Prog
1A:	Windshield Angle	55°	Music	55°	Music	90° & 180°	NE	NE	NE	55°	Voice
2:	Door & Roof Panels	IP w/o Dr & Rf	Music	IP w/o Dr & Rf	NE	All Neutral	NE	IP w/o Dr & Rf	NE	IP w/o Dr & Rf	Noise
3:	IP (70°) & Roof Panel	Dr w/o IP & Rf	Music	NE	NE	All Neutral	NE	Drs w/Rf WORST	NE	Dr w/o IP & Rf	Noise
4:	IP Back: Windshield Angle	55°	Music	55°	Music/Noise	55° & 70°	Music	NE	NE	55°	Voice/Music
	IP Fwd: Windshield Angle	70°	Music	70°	Music/Noise	55° & 70°	Music	NE	NE	55° & 70°	Voice/Music
5:	Loudspkr Door Location	Door High	Music	Door High	Music	Door High	Music	Door High	Music	Door High	Noise
4/5:	Loudspkr IP & Door Loc	IP Fwd	Music	Door High	Music	IPs/Dr High	Music	IP Fwd	Voice/Music	Dr Low WORST	Noise
1B:	Windshield Ang. (Center Pos)	70° WORST	Voice	55°	NE	70° WORST	NE	NE	NE	70° WORST	Music Worst

Prog Column= Most Effective Program Material
NE = No Effect

Table 1. SUMMARY OF PREFERENCE & RATINGS from Subjective Results

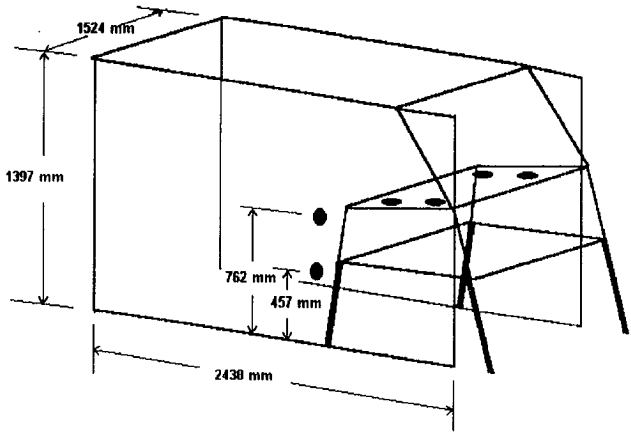
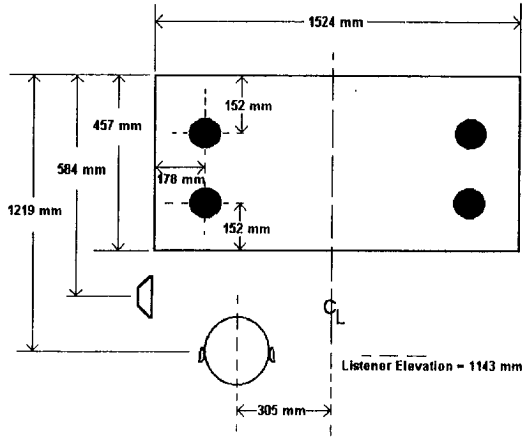
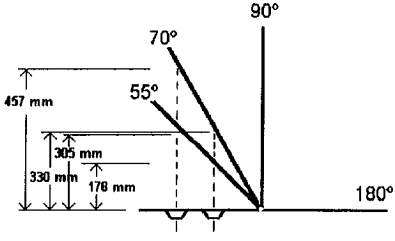


Illustration 1. Panel Combinations for Boundary Effects Experiments.



(Instrument Panel & Door Loudspeaker Plan View)



(Instrument Panel Side View)

Illustration 2. Dimensions of Listening Position & Angle Reflections.

ANALYSIS OF VARIANCE

EXPERIMENT: 1A	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER	6.93	0.010	8.74	0.005	7.88	0.007	22.56	0.000	12.84	0.002
BND VAR.	5.54	0.097	2.91	0.202	14.60	0.027	0.24	0.862	10.36	0.043
PROGRAM	2.07	0.283	2.59	0.228	3.26	0.179	3.57	0.162	1.14	0.459
LISTENER BY BND VAR.	2.39	0.026	2.14	0.044	1.79	0.095	1.28	0.287	2.61	0.016
LISTENER BY PROGRAM	2.62	0.016	2.27	0.034	1.99	0.062	2.41	0.025	0.81	0.683
BND VAR. BY PROGRAM	1.05	0.472	3.96	0.026	2.01	0.156	4.22	0.022	1.45	0.294
LISTENER BY BND VAR. BY PROGRAM	2.31	0.001	1.97	0.004	1.03	0.448	1.53	0.048	1.67	0.022

TABLE 2. ANALYSIS OF VARIANCE. EXPERIMENT 1A
BOUNDARY VARIABLE = WINDSHIELD ANGLE

ANALYSIS OF VARIANCE

EXPERIMENT: 2	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER	45.54	0.000	11.04	0.005	22.30	0.001	47.96	0.000	8.60	0.010
BND VAR.	18.51	0.019	8.75	0.054	7.94	0.061	14.67	0.027	27.45	0.011
PROGRAM	12.07	0.035	0.78	0.580	4.88	0.113	1.98	0.295	6.90	0.073
LISTENER BY BND VAR.	1.60	0.164	3.45	0.006	3.30	0.008	4.14	0.002	9.98	0.000
LISTENER BY PROGRAM	5.33	0.000	1.18	0.363	1 96	0.082	2.46	0.032	1.27	0.307
BND VAR. BY PROGRAM	3.42	0.041	1.42	0.305	3.73	0 031	5.90	0.007	3.77	0.030
LISTENER BY BND VAR. BY PROGRAM	0.80	0.788	1.00	0.507	1.05	0.433	1 20	0.257	0.91	0.639
(Greenhouse-Geisser)	0.80	0.535								
(Huynh-Feldt)	0.80									

TABLE 3. ANALYSIS OF VARIANCE. EXPERIMENT 2
BOUNDARY VARIABLE = DOOR & ROOF PANELS

ANALYSIS OF VARIANCE

EXPERIMENT: 3	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER (Greenhouse-Geisser) (Huynh-Feldt)	39.30	0.001	4.93	0.052	35.51 35.51 35.51	0.001 0.106 .	45.13	0.000	1.74	0.279
BND VAR.	81.83	0.002	1.46	0.362	1.35	0.406	0.60	0.656	5.24	0.104
PROGRAM	22.50	0.015	2.58	0.228	6.46	0.080	27.43	0.011	3.48	0.167
LISTENER BY BND VAR.	1.75	0.146	1.16	0.390	2.40	0.050	1.78	0.139	2.90	0.024
LISTENER BY PROGRAM	12.02	0.000	5.06	0.002	3.63	0.009	6.95	0.000	3.18	0.016
BND VAR. BY PROGRAM	2.29	0.116	1.06	0.466	2.16	0.133	3.07	0.055	0.81	0.619
LISTENER BY BND VAR. BY PROGRAM	1.92	0.016	0.70	0.882	1.12	0.352	1.60	0.059	0.90	0.632

TABLE 4. ANALYSIS OF VARIANCE. EXPERIMENT 3
BOUNDARY VARIABLE = IP (@70°) & ROOF PANEL

ANALYSIS OF VARIANCE

EXPERIMENT: 4	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER	29.44	0.003	6.70	0.046	24.60	0.004	100.99	0.000	6.56	0.048
VARIABLES	16.43	0.001	0.87	0.571	23.18	0.000	1.84	0.219	3.65	0.055
PROGRAM	1.36	0.402	6.06	0.087	11.31	0.038	17.81	0.020	20.51	0.017
LISTENER BY VARIABLES	1.30	0.248	1.45	0.167	1.18	0.335	3.35	0.001	0.93	0.579
LISTENER BY PROGRAM	1.18	0.387	5.28	0.004	6.81	0.001	3.36	0.023	2.60	0.055
VARIABLES BY PROGRAM	1.62	0.140	1.16	0.365	1.23	0.318	0.82	0.670	1.48	0.187
LISTENER BY VARIABLES PROGRAM	1.00	0.496	1.14	0.279	2.07	0.001	1.10	0.327	1.03	0.449

TABLE 5. ANALYSIS OF VARIANCE. EXPERIMENT 4
LOUDSPEAKER LOCATION VARIABLE = IP LOCATION
BOUNDARY VARIABLE = WINDSHIELD ANGLE

ANALYSIS OF VARIANCE

EXPERIMENT: 5	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER	16.16	0.001	12.09	0.002	11.88	0.002	35.58	0.000	1.49	0.293
(Greenhouse-Geisser)	16.16	0.019	12.09	0.063	11.88	0.067	35.58	0.012	1.49	0.338
(Huynh-Feldt)	16.16	0.001	12.09	0.037	11.88	0.046	35.58	0.000	1.49	0.293
LDSPKR LOC VAR.	788.68	0.001	2883.00	0.000	281.54	0.004	48.00	0.020	256.00	0.004
PROGRAM	2.13	0.198	8.56	0.014	9.96	0.010	51.19	0.000	2.81	0.130
(Greenhouse-Geisser)	2.13	0.262	8.56	0.081	9.96	0.036	51.19	0.017	2.81	0.224
(Huynh-Feldt)	2.13	0.198	8.56	0.037	9.96	0.010	51.19	0.011	2.81	0.166
LISTENER BY LDSPKR LOC. VAR.	10.22	0.003	7.16	0.009	4.67	0.031	4.80	0.029	11.15	0.002
(Greenhouse-Geisser)	10.22	0.041	7.16	0.104	4.67	0.137	4.80	0.121	11.15	0.028
(Huynh-Feldt)	10.22	0.003	7.16	0.071	4.67	0.067	4.80	0.029	11.15	0.002
LISTENER BY PROGRAM	0.73	0.709	1.24	0.315	3.43	0.005	4.06	0.002	1.28	0.292
(Greenhouse-Geisser)	0.73	0.524	1.24	0.382	3.43	0.137	4.06	0.141	1.28	0.373
(Huynh-Feldt)	0.73	0.695	1.24	0.315	3.43	0.005	4.06	0.031	1.28	0.292
LDSPKR LOC VAR. BY PROGRAM	4.40	0.058	0.58	0.647	0.64	0.616	0.88	0.504	2.70	0.139
(Greenhouse-Geisser)	4.40	0.117	0.58	0.576	0.64	0.572	0.88	0.449	2.70	0.219
(Huynh-Feldt)	4.40	0.058	0.58	0.647	0.64	0.616	0.88	0.451	2.70	0.139
LISTENER BY LDSPKR LOC VAR. BY PROGRAM	1.30	0.281	0.56	0.851	2.26	0.043	1.77	0.113	1.14	0.379
(Greenhouse-Geisser)	1.30	0.370	0.56	0.604	2.26	0.224	1.77	0.294	1.14	0.405
(Huynh-Feldt)	1.30	0.320	0.56	0.851	2.26	0.043	1.77	0.167	1.14	0.392

TABLE 6. ANALYSIS OF VARIANCE. EXPERIMENT 5
LOUDSPEAKER LOCATION VARIABLE = DOOR LOCATION

ANALYSIS OF VARIANCE

EXPERIMENT: 4/5	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER	22.78	0.005	11.71	0.018	7.63	0.036	82.98	0.000	2.47	0.201
LDSPKR LOC VAR.	219.55	0.001	46.66	0.005	11.74	0.036	8.48	0.056	4.85	0.114
PROGRAM	0.33	0.807	8.33	0.058	11.56	0.037	117.69	0.001	0.77	0.584
LISTENER BY LDSPKR LOC. VAR.	3.84	0.014	2.72	0.048	3.68	0.016	3.68	0.016	1.24	0.356
LISTENER BY PROGRAM	0.98	0.515	0.80	0.647	5.11	0.004	2.36	0.075	2.33	0.079
LDSPKR LOC VAR. BY PROGRAM	2.41	0.103	2.37	0.108	1.90	0.176	1.25	0.374	1.67	0.230
LISTENER BY LDSPKR LOC VAR. BY PROGRAM	1.65	0.069	1.28	0.230	1.14	0.345	2.03	0.018	0.80	0.742

TABLE 7. ANALYSIS OF VARIANCE. EXPERIMENT 4/5
LOUDSPEAKER LOCATION VARIABLE = IP & DOOR LOCATIONS

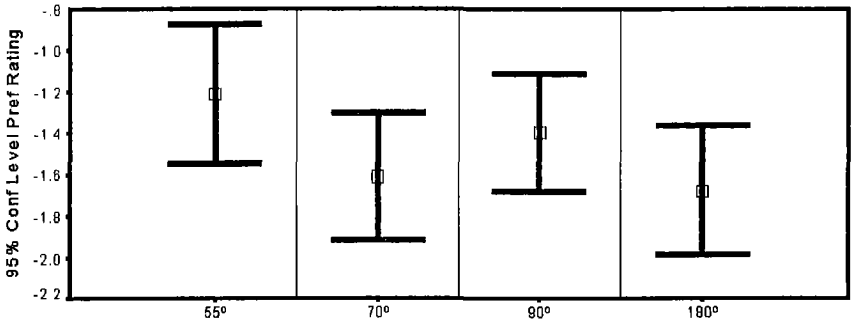
ANALYSIS OF VARIANCE

EXPERIMENT: 1B	Pref Rating		Treble Balance		Midrange Balance		Bass Balance		Spatial Quality	
Source of Variation	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F	F	Sig of F
LISTENER	9.60	0.007	4.57	0.043	21.91	0.001	23.50	0.001	4.12	0.054
BND VAR.	7.50	0.066	51.53	0.004	174.16	0.001	1.63	0.349	7.52	0.066
PROGRAM	5.50	0.098	6.62	0.077	4.24	0.133	1.29	0.419	10.76	0.041
LISTENER BY BND VAR.	1.87	0.097	2.10	0.062	1.97	0.079	1.56	0.177	1.20	0.353
LISTENER BY PROGRAM	2.79	0.018	1 49	0.203	2.16	0.056	1.95	0.082	2.54	0.027
BND VAR BY PROGRAM	0.97	0.516	2.62	0.084	0 61	0 765	0 91	0.553	0.90	0.558
LISTENER BY BND VAR. BY PROGRAM	1 31	0.162	0.90	0.647	1 46	0.084	0.89	0.672	1.01	0.490
(Greenhouse-Geisser)	1 31	0 457								
(Huynh-Feldt)	1 31									

TABLE 8. ANALYSIS OF VARIANCE. EXPERIMENT 1B
BOUNDARY VARIABLE = WINDSHIELD ANGLE (LISTENER @ CENTER POSITION)

OVERALL RESULTS

Experiment 1A



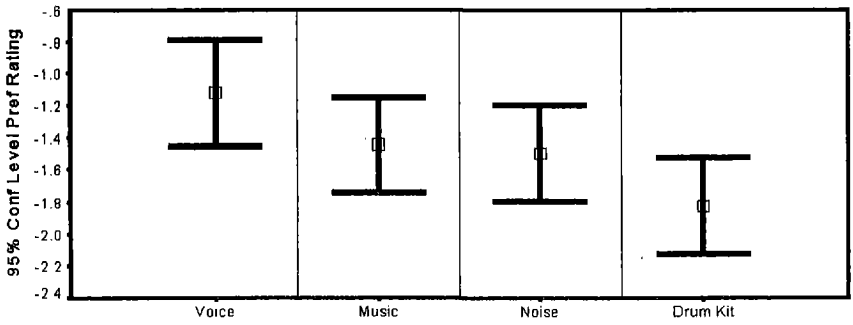
Effect: Windshield Angle

Dependent: Preference Rating

CHART 1.

OVERALL RESULTS

Experiment 1A

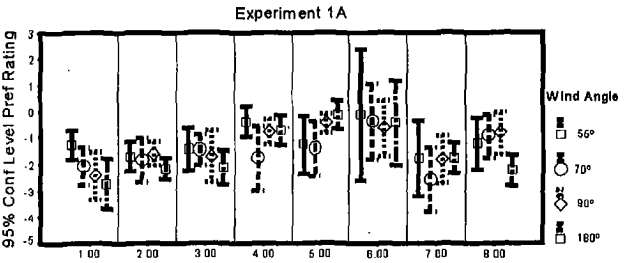


Effect: Program

Dependent: Preference Rating

CHART 2.

AGREEMENT AMONG LISTENERS

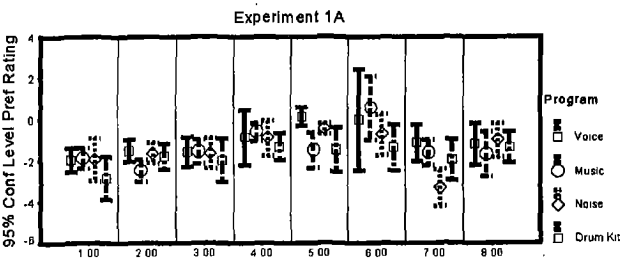


Effect Listener * Windshield Angle

Dependent Preference Rating

CHART 3.

EFFECTS OF PROGRAM ON LISTENERS

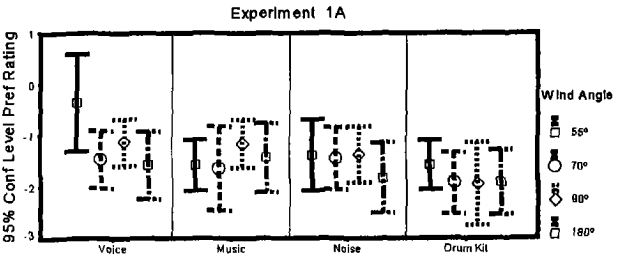


Effect Listener * Program

Dependent Preference Rating

CHART 4.

INTERACTION WITH PROGRAM



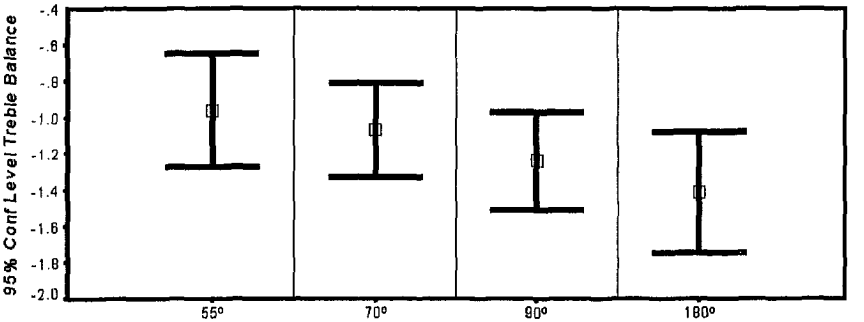
Effect Windshield Angle * Program

Dependent Preference Rating

CHART 5.

OVERALL RESULTS

Experiment 1A



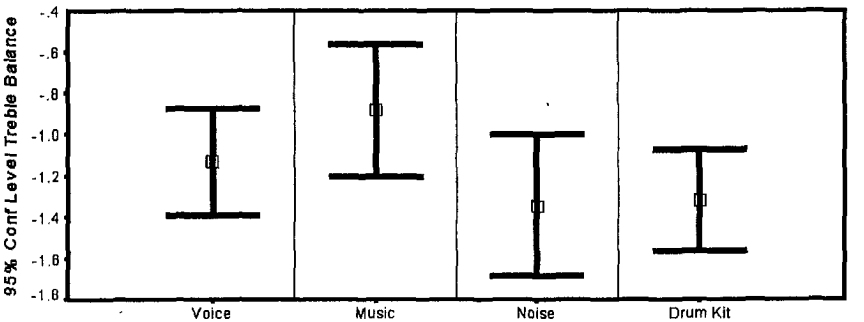
Effect: Windshield Angle

Dependent: Treble Balance

CHART 6.

OVERALL RESULTS

Experiment 1A

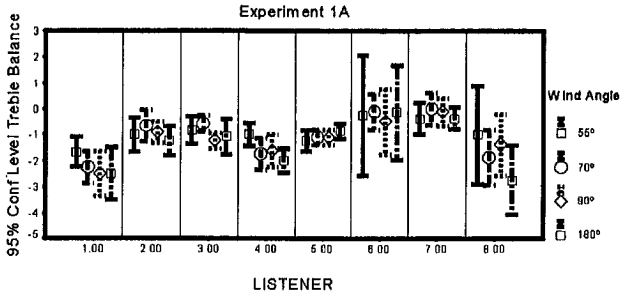


Effect: Program

Dependent: Treble Balance

CHART 7.

AGREEMENT AMONG LISTENERS

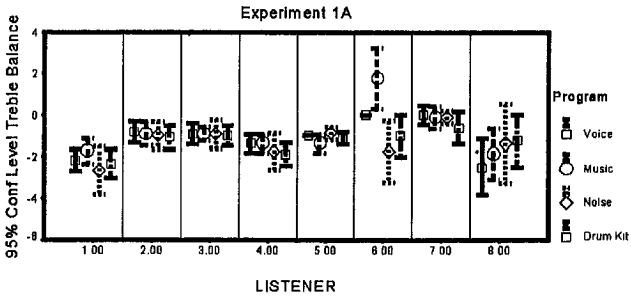


Effect Listener * Windshield Angle

Dependent Treble Balance

CHART 8.

EFFECTS OF PROGRAM ON LISTENERS

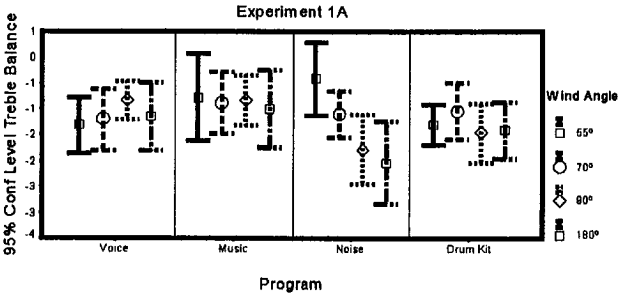


Effect Listener * Program

Dependent Treble Balance

CHART 9.

INTERACTION WITH PROGRAM



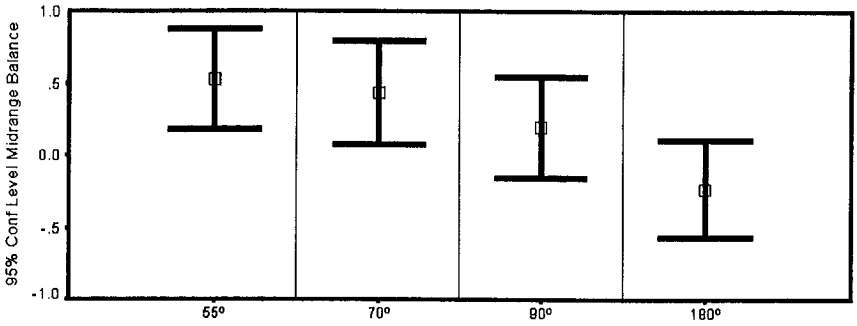
Effect Windshield Angle * Program

Dependent Treble Balance

CHART 10.

OVERALL RESULTS

Experiment 1A



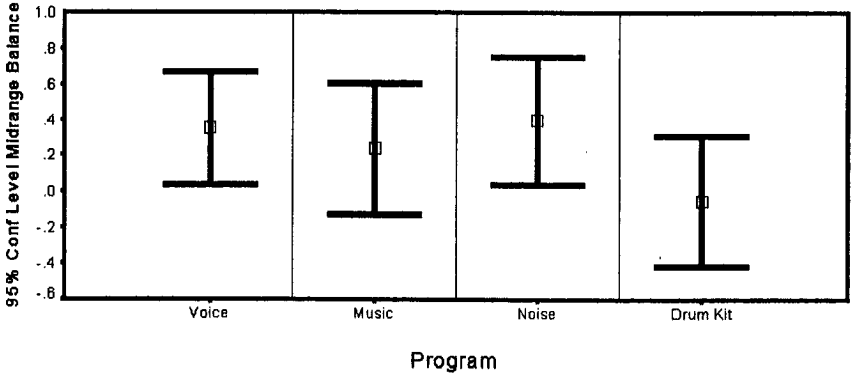
Effect: Windshield Angle

Dependent: Midrange Balance

CHART 11.

OVERALL RESULTS

Experiment 1A

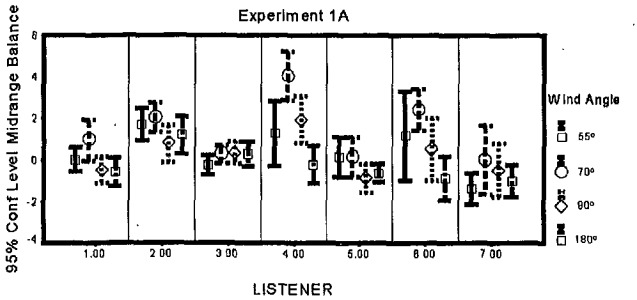


Effect: Program

Dependent: Midrange Balance

CHART 12.

AGREEMENT AMONG LISTENERS

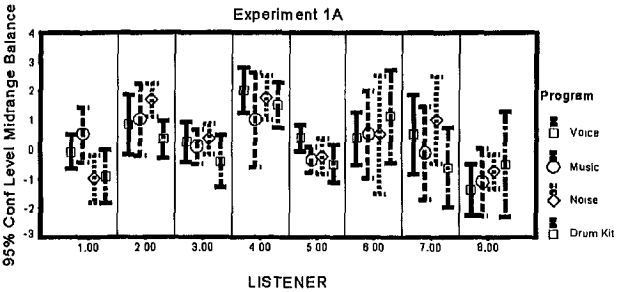


Effect Listener * Windshield Angle

Dependent Midrange Balance

CHART 13.

EFFECT OF PROGRAM ON LISTENERS

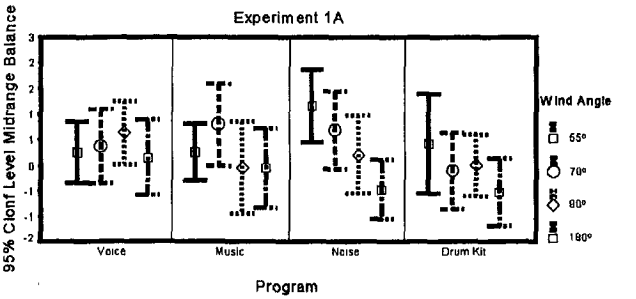


Effect Listener * Program

Dependent Midrange Balance

CHART 14.

INTERACTION WITH PROGRAM



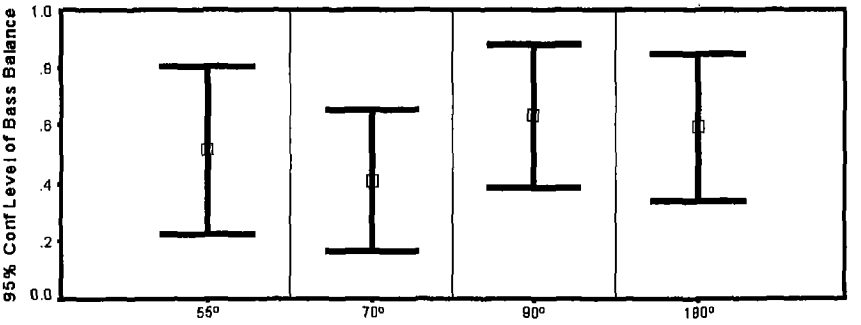
Effect Windshield Angle * Program

Dependent Midrange Balance

CHART 15.

OVERALL RESULTS

Experiment 1A



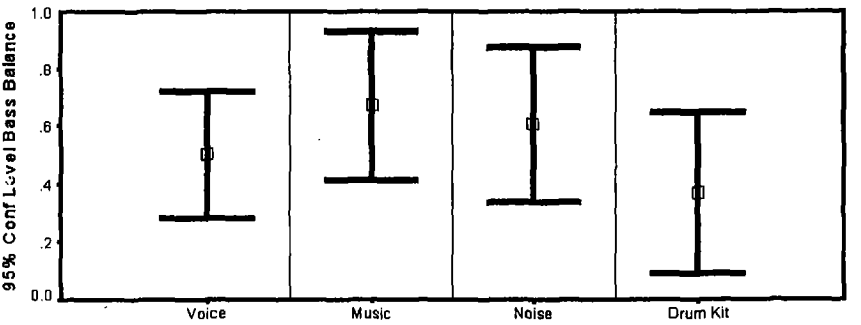
Effect Windshield Angle

Dependent Bass Balance

CHART 16.

OVERALL RESULTS

Experiment 1A

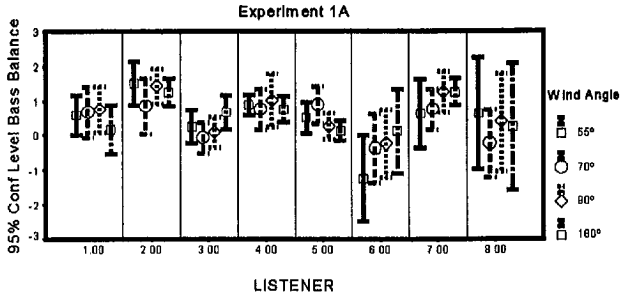


Effect Program

Dependent Bass Balance

CHART 17.

AGREEMENT AMONG LISTENERS

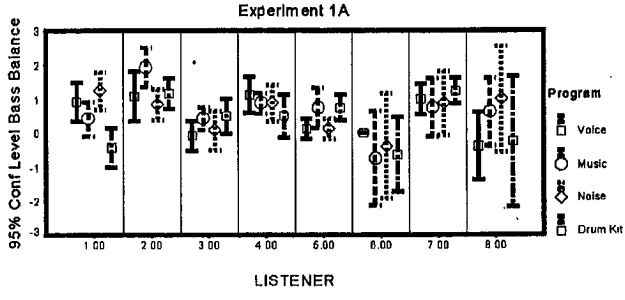


Effect: Listeners * Windshield Angle

Dependent: Bass Balance

CHART 18.

EFFECT OF PROGRAM ON LISTENERS

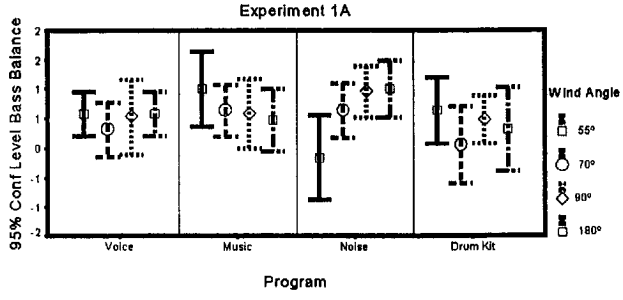


Effect: Listeners * Program

Dependent: Bass Balance

CHART 19.

INTERACTION WITH PROGRAM

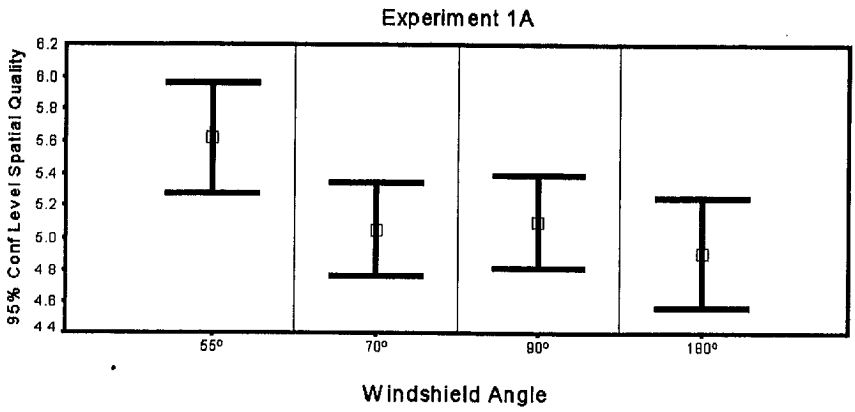


Effect: Listeners * Program

Dependent: Bass Balance

CHART 20.

OVERALL RESULTS

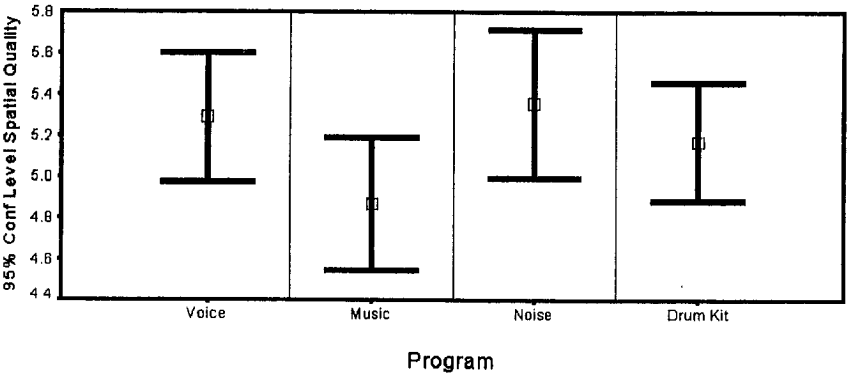


Effect: Windshield Angle

Dependent: Spatial Quality

CHART 21.

OVERALL RESULTS

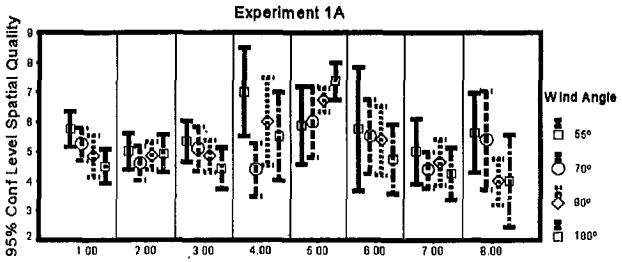


Effect: Program

Dependent: Spatial Quality

CHART 22.

AGREEMENT AMONG LISTENERS

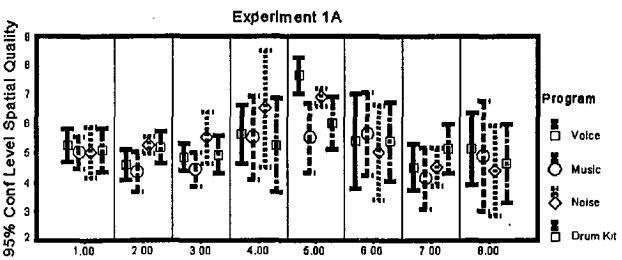


Effect: Listeners * Windshield

Dependent: Spatial Quality

CHART 23.

EFFECT OF PROGRAM ON LISTENERS

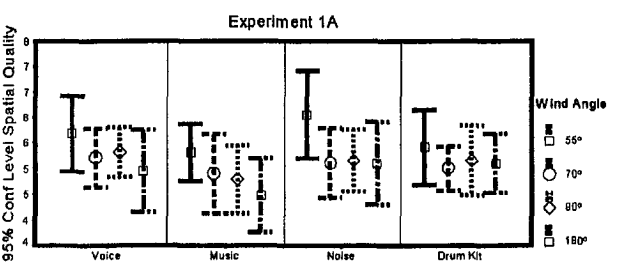


Effect: Listeners * Program

Dependent: Spatial Quality

CHART 24.

INTERACTION WITH PROGRAM



Effect: Windshield Angle * Program

Dependent: Spatial Quality

CHART 25.

OVERALL MEANS TABLE

	Pref		TBalance		MBalance		BBalance		Spatial Quality	
EXP 1A	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-2.14	0.38	-2.23	0.36	-0.38	0.40	0.54	0.30	5.08	0.30
Listener 2	-1.84	0.26	-0.96	0.26	0.96	0.42	1.25	0.28	4.83	0.26
Listener 3	-1.69	0.34	-0.94	0.22	0.06	0.30	0.23	0.22	4.92	0.30
Listener 4	-0.93	0.36	-1.59	0.26	1.56	0.44	0.84	0.22	5.72	0.64
Listener 5	-0.83	0.38	-1.09	0.14	-0.19	0.24	0.44	0.20	6.50	0.44
Listener 6	-0.40	0.70	-0.25	0.66	0.63	0.62	-0.44	0.48	5.34	0.60
Listener 7	-2.01	0.44	-0.22	0.24	0.19	0.62	0.97	0.30	4.56	0.36
Listener 8	-1.31	0.38	-1.75	0.60	-0.94	0.50	0.25	0.60	4.75	0.62
Windshield Angle 55°	-1.21	0.34	-0.96	0.32	0.53	0.34	0.51	0.28	5.62	0.34
Windshield Angle 70°	-1.61	0.30	-1.07	0.26	0.43	0.36	0.41	0.24	5.05	0.30
Windshield Angle 90°	-1.40	0.28	-1.24	0.26	0.20	0.34	0.63	0.24	5.11	0.28
Windshield Angle 180°	-1.67	0.32	-1.41	0.34	-0.22	0.34	0.59	0.26	4.91	0.34
Voice	-1.12	0.34	-1.13	0.26	0.36	0.32	0.50	0.22	5.29	0.32
Music	-1.44	0.30	-0.88	0.32	0.24	0.36	0.87	0.26	4.87	0.32
Noise	-1.50	0.30	-1.34	0.34	0.39	0.36	0.61	0.28	5.36	0.36
Drum Kit	-1.83	0.30	-1.32	0.24	-0.05	0.36	0.37	0.28	5.17	0.28

TABLE 9

	Pref		TBalance		MBalance		BBalance		Spatial Quality	
EXP 2	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-2.92	0.34	-2.42	0.30	-0.98	0.32	1.50	0.28	4.73	0.38
Listener 2	-2.61	0.38	-1.29	0.24	1.33	0.32	1.38	0.32	4.13	0.28
Listener 3	-1.55	0.26	-1.06	0.20	0.17	0.28	0.90	0.34	4.65	0.30
Listener 4	-2.28	0.44	-1.81	0.20	1.22	0.50	1.06	0.26	4.09	0.36
Listener 5	-1.10	0.38	-1.78	0.24	-0.94	0.52	1.38	0.36	4.94	0.52
Listener 6	-0.49	0.84	-0.88	0.44	-0.16	0.70	-0.88	0.38	5.00	0.44
Listener 7	-2.89	0.34	-0.66	0.36	-0.34	0.58	1.38	0.32	4.34	0.24
IP (70°) w/o Drs & Roof	-1.69	0.32	-0.97	0.26	0.60	0.38	0.49	0.24	5.01	0.28
IP (70°) w/ Doors	-2.08	0.42	-1.41	0.28	-0.25	0.38	1.19	0.26	4.34	0.24
IP (70°) w/ Roof	-2.19	0.36	-1.72	0.20	0.06	0.36	0.97	0.30	4.57	0.30
IP (70°) w/ Drs & Roof	-2.22	0.40	-1.68	0.22	-0.15	0.42	1.40	0.34	4.25	0.26
Voice	-2.29	0.32	-1.47	0.22	0.15	0.46	0.69	0.24	4.53	0.30
Music	-1.47	0.46	-1.40	0.26	0.04	0.36	1.25	0.36	4.66	0.26
Noise	-2.47	0.32	-1.52	0.28	0.31	0.38	1.04	0.26	4.34	0.30
Drum Kit	-1.94	0.34	-1.40	0.24	-0.24	0.34	1.06	0.32	4.65	0.28

TABLE 10

OVERALL MEANS TABLE

	Pref		TBalance		MBalance		BBalance		Spatial Quality	
EXP 3	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-3.47	0.30	-1.15	0.24	-0.77	0.40	2.23	0.20	3.46	0.20
Listener 2	-3.53	0.20	-1.52	0.16	1.92	0.44	1.92	0.30	3.94	0.18
Listener 3	-2.43	0.28	-0.81	0.12	-0.77	0.22	0.35	0.22	4.19	0.22
Listener 4	-2.17	0.46	-2.00	0.20	0.94	0.76	1.97	0.44	4.28	0.60
Listener 5	-1.67	0.32	-1.28	0.16	-1.69	0.32	1.69	0.36	4.09	0.36
Listener 6	-0.04	1.00	-1.25	0.40	0.28	0.80	-0.81	0.50	4.88	0.42
Doors w/o IP (70°) & Roo	-1.81	0.52	-1.32	0.18	-0.32	0.40	1.13	0.34	4.33	0.32
Doors w/ IP (70°)	-2.12	0.44	-1.37	0.20	0.07	0.46	1.15	0.38	4.28	0.28
Doors w/Roof	-2.83	0.44	-1.17	0.22	0.05	0.56	1.50	0.34	3.93	0.24
Doors w/IP (70°) & Roof	-2.86	0.38	-1.35	0.20	0.25	0.56	1.33	0.42	3.78	0.22
Voice	-2.42	0.46	-0.87	0.20	0.42	0.56	0.92	0.32	3.90	0.26
Music	-1.90	0.54	-1.58	0.18	-0.87	0.32	1.87	0.50	4.23	0.22
Noise	-2.53	0.36	-1.32	0.20	-0.02	0.50	1.23	0.32	4.30	0.30
Drum Kit	-2.77	0.42	-1.43	0.18	0.52	0.52	1.10	0.30	3.90	0.32

TABLE 11

	Pref		TBalance		MBalance		BBalance		Spatial Quality	
EXP 4	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-4.45	0.18	-2.13	0.24	-0.77	0.24	2.78	0.20	3.80	0.26
Listener 2	-3.84	0.10	-1.73	0.12	0.59	0.48	2.33	0.18	4.00	0.04
Listener 3	-2.96	0.20	-1.19	0.10	-0.75	0.18	0.84	0.16	3.92	0.20
Listener 4	-2.79	0.20	-2.09	0.14	0.20	0.34	1.11	0.20	4.08	0.30
Listener 5	-1.53	0.14	-1.56	0.14	-1.20	0.18	1.41	0.14	4.44	0.24
IP Back 55°	-2.91	0.38	-1.58	0.18	-0.08	0.40	1.65	0.28	4.30	0.32
IP Back 70°	-3.01	0.40	-1.70	0.20	0.00	0.42	1.68	0.34	4.15	0.30
IP Back 90°	-3.14	0.40	-1.78	0.20	-0.57	0.44	1.73	0.36	4.05	0.30
IP Back 180°	-3.39	0.34	-1.83	0.28	-0.90	0.42	1.78	0.32	3.93	0.32
IP Forward 55°	-3.05	0.38	-1.75	0.22	0.03	0.48	1.65	0.38	4.18	0.30
IP Forward 70°	-2.71	0.38	-1.65	0.20	0.08	0.40	1.53	0.30	4.18	0.24
IP Forward 90°	-3.19	0.40	-1.70	0.22	-0.57	0.42	1.75	0.32	4.05	0.22
IP Forward 180°	-3.52	0.34	-1.95	0.24	-1.05	0.42	1.80	0.34	3.55	0.26
Voice	-3.10	0.26	-1.61	0.14	0.13	0.34	1.30	0.16	4.22	0.18
Music	-3.29	0.26	-1.86	0.16	-1.05	0.22	2.13	0.22	3.81	0.18
Noise	-3.02	0.26	-1.89	0.18	-0.29	0.30	1.83	0.26	4.35	0.20
Drum Kit	-3.04	0.30	-1.60	0.14	-0.33	0.32	1.53	0.20	3.80	0.22

TABLE 12

OVERALL MEANS TABLE

EXP 5	Pref		TBalance		MBalance		BBalance		Spatial Quality	
	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-4.64	0.18	-2.25	0.64	-2.64	0.52	2.29	0.28	3.92	0.44
Listener 2	-3.69	0.20	-1.71	0.30	0.88	0.76	3.08	0.52	3.38	0.36
Listener 3	-3.06	0.36	-0.92	0.26	-1.21	0.26	0.75	0.18	3.33	0.32
Listener 4	-3.11	0.50	-3.03	0.36	-0.38	0.66	1.97	0.30	3.66	0.58
Listener 5	-1.92	0.28	-1.78	0.40	-1.97	0.36	1.28	0.30	3.84	0.32
Door High	-2.75	0.28	-1.24	0.22	-0.56	0.46	1.74	0.26	4.10	0.24
Door Low	-3.64	0.30	-2.75	0.26	-1.59	0.40	1.96	0.28	3.18	0.26
Voice	-3.07	0.46	-1.56	0.42	-0.82	0.78	1.12	0.40	3.65	0.30
Music	-3.43	0.40	-2.32	0.40	-2.00	0.36	2.65	0.42	3.47	0.44
Noise	-3.08	0.44	-1.88	0.46	-0.50	0.68	2.00	0.28	4.00	0.40
Drum Kit	-3.19	0.46	-2.21	0.44	-0.98	0.54	1.62	0.26	3.44	0.38

TABLE 13

EXP 4/5	Pref		TBalance		MBalance		BBalance		Spatial Quality	
	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-4.43	0.24	-2.23	0.40	-1.81	0.50	2.42	0.22	3.88	0.32
Listener 2	-3.76	0.14	-1.68	0.20	0.98	0.58	2.75	0.38	3.63	0.24
Listener 3	-2.82	0.30	-1.05	0.16	-0.90	0.22	0.75	0.18	3.60	0.26
Listener 4	-2.92	0.36	-2.71	0.28	0.02	0.48	1.63	0.26	3.85	0.42
Listener 5	-1.73	0.22	-1.60	0.28	-1.56	0.30	1.33	0.22	4.15	0.30
IP Back	-3.01	0.40	-1.70	0.20	0.00	0.42	1.68	0.34	4.15	0.30
IP Forward	-2.71	0.38	-1.65	0.20	0.08	0.40	1.53	0.30	4.18	0.24
Door High	-2.75	0.28	-1.24	0.22	-0.56	0.46	1.74	0.26	4.10	0.24
Door Low	-3.64	0.30	-2.75	0.26	-1.59	0.40	1.96	0.28	3.18	0.26
Voice	-3.06	0.34	-1.54	0.28	-0.37	0.56	1.13	0.26	3.91	0.24
Music	-3.17	0.34	-2.19	0.26	-1.48	0.32	2.44	0.34	3.74	0.34
Noise	-3.04	0.34	-1.83	0.30	-0.22	0.48	1.94	0.26	4.04	0.28
Drum Kit	-3.00	0.38	-1.94	0.32	-0.58	0.44	1.50	0.22	3.65	0.28

TABLE 14

OVERALL MEANS TABLE

EXP 1B	Pref		TBalance		MBalance		BBalance		Spatial Quality	
	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	-0.57	0.52	-0.71	0.32	-0.04	0.36	1.02	0.20	5.85	0.28
Listener 2	-1.54	0.26	-0.08	0.20	1.40	0.38	0.71	0.18	4.44	0.22
Listener 3	-1.78	0.22	-0.13	0.16	0.15	0.22	0.33	0.14	4.23	0.20
Listener 4	-1.14	0.42	-0.50	0.26	1.72	0.74	1.13	0.26	5.97	0.66
Listener 5	-0.76	0.38	-0.31	0.24	-0.31	0.36	0.97	0.14	6.47	0.46
Listener 6	-0.70	0.84	-0.22	0.38	0.78	0.72	-0.78	0.58	5.81	0.50
Listener 7	-1.92	0.40	-0.50	0.24	-0.72	0.50	0.97	0.30	5.00	0.46
Windshield Angle 55°	-1.04	0.32	0.00	0.20	0.38	0.40	0.66	0.24	5.65	0.34
Windshield Angle 70°	-1.83	0.32	-0.21	0.18	1.32	0.44	0.54	0.24	4.84	0.34
Windshield Angle 90°	-1.13	0.36	-0.43	0.20	0.22	0.36	0.51	0.28	5.22	0.30
Windshield Angle 180°	-0.87	0.38	-0.74	0.22	-0.18	0.30	0.81	0.20	5.49	0.36
Voice	-0.85	0.34	-0.40	0.16	0.38	0.34	0.78	0.20	5.40	0.34
Music	-1.41	0.42	-0.50	0.22	0.79	0.46	0.54	0.30	4.88	0.38
Noise	-1.28	0.28	-0.29	0.22	0.32	0.36	0.66	0.22	5.57	0.34
Drum Kit	-1.33	0.36	-0.18	0.20	0.25	0.40	0.54	0.24	5.34	0.28

TABLE 15

LISTENER * VARIABLE
MEANS TABLE

EXP 1A		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Windshield Angle 55°	-1.29	0.48	-1.67	0.52	0.00	0.74	0.58	0.52	5.75	0.56
	Windshield Angle 70°	-2.09	0.62	-2.25	0.56	-1.00	0.74	0.67	0.66	5.25	0.50
	Windshield Angle 90°	-2.45	0.82	-2.50	0.80	0.17	0.94	0.75	0.80	4.83	0.64
	Windshield Angle 180°	-2.74	0.86	-2.50	0.90	-0.67	0.66	0.17	0.64	4.50	0.52
Listener 2	Windshield Angle 55°	-1.73	0.50	-1.00	0.60	1.00	0.70	1.50	0.58	5.00	0.56
	Windshield Angle 70°	-1.85	0.74	-0.67	0.56	1.00	0.92	0.83	0.74	4.58	0.52
	Windshield Angle 90°	-1.62	0.40	-0.92	0.38	0.83	0.98	1.42	0.46	4.83	0.42
	Windshield Angle 180°	-2.18	0.36	-1.25	0.50	1.00	0.82	1.25	0.36	4.92	0.58
Listener 3	Windshield Angle 55°	-1.43	0.72	-0.83	0.48	0.00	0.78	0.25	0.44	5.33	0.62
	Windshield Angle 70°	-1.48	0.52	-0.59	0.30	0.58	0.46	-0.08	0.38	5.08	0.68
	Windshield Angle 90°	-1.72	0.88	-1.25	0.26	-0.08	0.46	0.08	0.38	4.83	0.48
	Windshield Angle 180°	-2.13	0.58	-1.08	0.62	-0.25	0.66	0.67	0.44	4.42	0.62
Listener 4	Windshield Angle 55°	-0.40	0.50	-1.00	0.38	1.50	0.38	0.88	0.26	7.00	1.26
	Windshield Angle 70°	-1.79	1.00	-1.75	0.50	1.75	1.30	0.75	0.50	4.38	0.74
	Windshield Angle 90°	-0.80	0.40	-1.63	0.52	1.25	1.12	1.00	0.66	6.00	1.26
	Windshield Angle 180°	-0.73	0.48	-2.00	0.38	1.75	0.50	0.75	0.32	5.50	1.26
Listener 5	Windshield Angle 55°	-1.27	0.92	-1.25	0.32	-0.50	0.66	0.50	0.38	5.88	1.10
	Windshield Angle 70°	-1.44	0.88	-1.13	0.26	0.13	0.46	0.88	0.46	6.00	1.00
	Windshield Angle 90°	-0.48	0.30	-1.13	0.26	0.00	0.38	0.25	0.32	6.75	0.32
	Windshield Angle 180°	-0.14	0.46	-0.88	0.26	-0.38	0.36	0.13	0.26	7.38	0.52
Listener 6	Windshield Angle 55°	-0.13	2.10	-0.25	1.96	1.88	1.28	-1.25	1.06	5.75	1.76
	Windshield Angle 70°	-0.39	1.20	-0.13	0.60	0.63	1.26	-0.38	0.84	5.50	1.06
	Windshield Angle 90°	-0.65	0.88	-0.50	1.06	0.50	1.30	-0.25	0.82	5.38	1.00
	Windshield Angle 180°	-0.45	1.36	-0.13	1.54	-0.50	0.66	0.13	1.04	4.75	0.98
Listener 7	Windshield Angle 55°	-1.79	1.20	-0.38	0.52	0.63	1.20	0.63	0.84	5.00	0.92
	Windshield Angle 70°	-2.61	1.00	0.00	0.54	1.75	0.74	0.75	0.50	4.38	0.52
	Windshield Angle 90°	-1.84	0.74	-0.13	0.46	-0.63	1.30	1.25	0.50	4.63	0.64
	Windshield Angle 180°	-1.79	0.48	-0.38	0.36	-1.00	0.66	1.25	0.32	4.25	0.74
Listener 8	Windshield Angle 55°	-1.25	0.82	-1.00	1.60	0.00	1.36	0.63	1.36	5.63	1.12
	Windshield Angle 70°	-0.94	0.68	-1.88	0.88	-1.00	0.54	-0.25	0.82	5.38	1.42
	Windshield Angle 90°	-0.84	0.66	-1.38	1.00	-0.63	0.74	0.38	1.20	4.00	0.66
	Windshield Angle 180°	-2.23	0.48	-2.75	1.12	-2.13	0.46	0.25	1.54	4.00	1.30

TABLE 16

LISTENER * VARIABLE
MEANS TABLE

		Pref		TBalance		MBalance		BBalance		Spatial Quality	
EXP 2		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	IP (70°) w/o Drs & Roof	-2.09	0.62	-2.25	0.56	-1.00	0.74	0.67	0.66	5.25	0.50
	IP (70°) w/ Doors	-3.38	0.58	-2.67	0.76	-1.25	0.56	1.75	0.36	4.58	0.76
	IP (70°) w/ Roof	-3.30	0.54	-2.42	0.58	-0.83	0.48	1.75	0.44	4.58	0.86
	IP (70°) w/ Drs & Roof	-2.90	0.76	-2.33	0.44	-0.83	0.78	1.83	0.48	4.50	0.94
Listener 2	IP (70°) w/o Drs & Roof	-1.85	0.74	-0.67	0.56	1.00	0.92	0.83	0.74	4.58	0.52
	IP (70°) w/ Doors	-2.69	0.64	-1.33	0.38	1.33	0.56	1.17	0.48	4.00	0.56
	IP (70°) w/ Roof	-2.96	0.54	-1.58	0.30	1.50	0.46	1.75	0.70	4.00	0.56
	IP (70°) w/ Drs & Roof	-2.93	0.94	-1.58	0.38	1.50	0.52	1.75	0.60	3.92	0.62
Listener 3	IP (70°) w/o Drs & Roof	-1.48	0.52	-0.59	0.30	0.58	0.46	-0.08	0.38	5.08	0.68
	IP (70°) w/ Doors	-1.57	0.58	-1.25	0.36	0.00	0.60	1.33	0.56	4.50	0.52
	IP (70°) w/ Roof	-1.41	0.40	-1.33	0.38	-0.17	0.48	1.00	0.66	4.58	0.58
	IP (70°) w/ Drs & Roof	-1.75	0.54	-1.08	0.46	0.25	0.66	1.33	0.76	4.42	0.62
Listener 4	IP (70°) w/o Drs & Roof	-1.79	1.00	-1.75	0.50	1.75	1.30	0.75	0.50	4.38	0.74
	IP (70°) w/ Doors	-2.21	0.84	-1.63	0.36	1.50	0.38	1.00	0.38	4.00	0.54
	IP (70°) w/ Roof	-2.75	0.96	-1.75	0.50	1.50	0.38	1.00	0.38	4.00	1.06
	IP (70°) w/ Drs & Roof	-2.35	0.76	-2.13	0.26	0.13	1.28	1.50	0.66	4.00	0.54
Listener 5	IP (70°) w/o Drs & Roof	-1.44	0.88	-1.13	0.26	0.13	0.46	0.88	0.46	6.00	1.00
	IP (70°) w/ Doors	-1.01	0.50	-1.88	0.46	-1.00	1.06	1.63	0.36	4.13	0.46
	IP (70°) w/ Roof	-0.79	0.66	-1.75	0.32	-0.75	0.74	0.75	0.50	5.88	0.96
	IP (70°) w/ Drs & Roof	-1.18	1.00	-2.38	0.36	-2.13	1.16	2.25	0.98	3.75	0.50
Listener 6	IP (70°) w/o Drs & Roof	-0.39	1.20	-0.13	0.60	0.63	1.26	-0.38	0.84	5.50	1.06
	IP (70°) w/ Doors	0.41	1.94	-0.13	0.80	-1.50	0.92	-0.75	0.82	5.00	1.00
	IP (70°) w/ Roof	-1.04	1.58	-2.00	0.76	-0.13	1.48	-1.25	0.74	4.75	0.74
	IP (70°) w/ Drs & Roof	-0.96	1.94	-1.25	0.74	0.38	1.50	-1.13	0.70	4.75	0.62
Listener 7	IP (70°) w/o Drs & Roof	-2.61	1.00	0.00	0.54	1.75	0.74	0.75	0.50	4.38	0.52
	IP (70°) w/ Doors	-3.41	0.48	-0.50	0.92	-1.25	0.50	1.88	0.46	4.13	0.26
	IP (70°) w/ Roof	-2.51	0.60	-1.13	0.60	-0.88	1.04	1.00	0.54	4.50	0.54
	IP (70°) w/ Drs & Roof	-3.03	0.50	-1.00	0.66	-1.00	0.76	1.88	0.70	4.38	0.52

TABLE 17

LISTENER * VARIABLE
MEANS TABLE

EXP 3		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Doors w/o IP (70°) & Ro	-3.58	0.38	-1.33	0.38	-0.92	0.52	2.33	0.44	3.33	0.28
	Doors w/ IP (70°)	-3.31	0.48	-1.17	0.48	-1.00	0.60	2.17	0.42	3.50	0.46
	Doors w/Roof	-3.55	0.70	-1.00	0.66	-0.42	1.16	2.25	0.50	3.25	0.44
	Doors w/IP (70°) & Roof	-3.44	0.82	-1.08	0.46	-0.75	0.78	2.17	0.34	3.75	0.36
Listener 2	Doors w/o IP (70°) & Ro	-3.36	0.34	-1.50	0.38	1.58	0.90	1.67	0.52	4.08	0.30
	Doors w/ IP (70°)	-3.40	0.36	-1.50	0.38	1.58	0.94	2.17	0.68	4.00	0.34
	Doors w/Roof	-3.71	0.40	-1.58	0.30	2.25	0.82	2.00	0.56	3.83	0.42
	Doors w/IP (70°) & Roof	-3.63	0.52	-1.50	0.30	2.25	0.86	1.83	0.60	3.83	0.42
Listener 3	Doors w/o IP (70°) & Ro	-2.04	0.60	-1.00	0.24	-0.83	0.42	0.42	0.38	4.50	0.52
	Doors w/ IP (70°)	-2.37	0.54	-0.83	0.22	-0.83	0.54	0.00	0.34	4.17	0.48
	Doors w/Roof	-2.82	0.56	-0.58	0.30	-0.83	0.48	0.42	0.46	4.08	0.38
	Doors w/IP (70°) & Roof	-2.51	0.48	-0.83	0.22	-0.58	0.38	0.58	0.46	4.00	0.42
Listener 4	Doors w/o IP (70°) & Ro	-1.06	0.84	-1.75	0.32	0.25	1.34	1.63	0.52	4.25	1.64
	Doors w/ IP (70°)	-1.71	0.50	-2.13	0.46	1.38	1.20	1.63	1.20	5.13	1.10
	Doors w/Roof	-2.88	0.70	-1.75	0.32	1.25	1.80	2.13	0.70	4.63	0.84
	Doors w/IP (70°) & Roof	-3.05	0.86	-2.38	0.36	0.88	1.80	2.50	1.00	3.13	0.80
Listener 5	Doors w/o IP (70°) & Ro	-0.98	0.22	-1.25	0.32	-1.63	0.36	1.38	0.36	5.00	0.54
	Doors w/ IP (70°)	-1.03	0.24	-1.25	0.32	-1.63	0.36	1.38	0.36	4.75	0.32
	Doors w/Roof	-2.31	0.56	-1.25	0.32	-1.63	0.84	2.00	0.92	3.50	0.54
	Doors w/IP (70°) & Roof	-2.35	0.58	-1.38	0.36	-1.88	0.88	2.00	0.92	3.13	0.26
Listener 6	Doors w/o IP (70°) & Ro	1.94	1.22	-1.13	0.80	-0.75	0.62	-1.13	0.88	5.38	1.00
	Doors w/ IP (70°)	0.48	1.64	-1.63	0.74	1.13	1.16	-0.88	0.60	4.75	0.98
	Doors w/Roof	-0.89	2.46	-1.00	0.84	-0.75	1.68	0.13	0.96	4.63	0.74
	Doors w/IP (70°) & Roof	-1.70	1.82	-1.25	0.82	1.50	2.04	-1.38	1.26	4.75	0.62

TABLE 18

LISTENER * VARIABLE
MEANS TABLE

EXP 4		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	IP Back 55°	-4.13	0 64	-2.00	0.38	-0.75	0.32	2.38	0.52	4.25	0.82
	IP Back 70°	-4.29	0.66	-2.13	0.46	-0.63	0.84	2.75	0.50	3.75	0.74
	IP Back 90°	-4.68	0.32	-2.13	0.60	-0.50	1.00	3.00	0.66	3.75	0.82
	IP Back 180°	-4.69	0.22	-2.00	1.20	-1.00	0.54	3.00	0.66	3.88	0.60
	IP Forward 55°	-4.31	0.54	-2.00	0.54	-0.88	0.46	2.63	0.52	3.75	0.74
	IP Forward 70°	-3.93	0.74	-2.25	0.50	-0.50	0.84	2.50	0.38	3.88	0.60
	IP Forward 90°	-4.75	0.08	-2.00	0.66	-0.50	1.00	3.00	0.66	4.25	0.50
	IP Forward 180°	-4.84	0.22	-2.50	0.84	-1.38	0.52	3.00	0.66	2.88	0.70
Listener 2	IP Back 55°	-3.74	0.48	-1.50	0.38	1.25	1.12	2.50	0.54	3.88	0.26
	IP Back 70°	-3.88	0.28	-1.63	0.36	1.13	1.48	2.25	0.62	4.00	0.00
	IP Back 90°	-3.81	0.26	-1.88	0.26	0.25	1.18	2.38	0.36	4.00	0.00
	IP Back 180°	-3.93	0.14	-2.00	0.00	-0.25	1.40	2.13	0.60	4.00	0.00
	IP Forward 55°	-3.96	0.20	-1.75	0.32	1.63	1.20	2.75	0.32	4.00	0.00
	IP Forward 70°	-3.84	0.32	-1.63	0.36	1.13	1.28	2.25	0.62	4.00	0.00
	IP Forward 90°	-3.73	0.32	-1.50	0.38	-0.13	1.28	2.25	0.50	4.13	0.26
	IP Forward 180°	-3.85	0.34	-2.00	0.00	-0.25	1.46	2.13	0.60	4.00	0.00
Listener 3	IP Back 55°	-3.01	0.38	-1.25	0.32	-0.25	0.50	0.88	0.26	4.38	0.52
	IP Back 70°	-2.95	0.68	-1.25	0.32	-0.38	0.36	1.00	0.54	4.00	0.54
	IP Back 90°	-2.90	0.50	-1.13	0.26	-1.13	0.60	0.50	0.38	3.88	0.60
	IP Back 180°	-3.36	0.48	-1.13	0.26	-1.13	0.60	1.00	0.54	3.50	0.54
	IP Forward 55°	-3.10	0.62	-1.25	0.32	-0.50	0.54	1.00	0.00	3.88	0.46
	IP Forward 70°	-1.99	0.34	-1.25	0.32	-0.50	0.38	0.50	0.54	4.00	0.54
	IP Forward 90°	-3.06	0.56	-1.25	0.32	-0.88	0.46	0.88	0.26	4.13	0.70
	IP Forward 180°	-3.28	0.64	-1.00	0.00	-1.25	0.50	1.00	0.66	3.63	0.52
Listener 4	IP Back 55°	-2.31	0.64	-1.88	0.26	0.38	0.84	1.13	0.26	4.75	0.82
	IP Back 70°	-2.48	0.66	-2.13	0.46	0.63	0.36	0.88	0.60	4.13	0.88
	IP Back 90°	-2.90	0.50	-2.25	0.32	-0.25	1.18	1.50	0.66	4.00	1.00
	IP Back 180°	-3.06	0.54	-2.00	0.38	-0.25	1.06	1.38	0.36	3.88	1.04
	IP Forward 55°	-2.43	0.42	-2.25	0.32	1.13	0.60	0.38	1.12	4.75	0.98
	IP Forward 70°	-2.58	0.36	-2.00	0.38	1.00	0.38	1.00	0.00	4.38	0.64
	IP Forward 90°	-3.03	0 76	-2.13	0.46	-0.25	1.18	1.13	0.26	3.75	0.50
	IP Forward 180°	-3.58	0.32	-2.13	0.46	-0.75	1.12	1.50	0.54	3.00	0.00
Listener 5	IP Back 55°	-1.35	0.24	-1.25	0.32	-1.00	0.54	1.38	0.36	4.25	0.90
	IP Back 70°	-1.44	0.30	-1.38	0.36	-0.75	0.50	1.50	0.54	4.88	0.80
	IP Back 90°	-1.39	0.40	-1.50	0.38	-1.25	0.50	1.25	0.32	4.63	0.52
	IP Back 180°	-1.92	0.50	-2.00	0.38	-1.88	0.46	1.38	0.36	4.38	1.00
	IP Forward 55°	-1.45	0.46	-1.50	0.54	-1.25	0.62	1.50	0.38	4.50	0.54
	IP Forward 70°	-1.24	0.34	-1.13	0.26	-0.75	0.32	1.38	0.36	4.63	0.52
	IP Forward 90°	-1.39	0.34	-1.63	0.36	-1.13	0.26	1.50	0.54	4.00	0.54
	IP Forward 180°	-2.06	0.36	-2.13	0.26	-1.63	0.36	1.38	0.52	4.25	0.62

TABLE 19

LISTENER * VARIABLE
MEANS TABLE

EXP 6		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Door High	-4.28	0.24	-1.00	0.66	-2.42	0.72	2.42	0.46	3.75	0.60
	Door Low	-5.00	0.00	-3.50	0.38	-2.86	0.78	2.17	0.34	4.08	0.68
Listener 2	Door High	-3.46	0.28	-1.17	0.34	1.33	1.00	2.75	0.78	3.75	0.44
	Door Low	-3.92	0.24	-2.25	0.26	0.42	1.14	3.42	0.68	3.00	0.50
Listener 3	Door High	-2.56	0.42	-0.50	0.30	-0.83	0.22	0.75	0.26	3.75	0.44
	Door Low	-3.56	0.42	-1.33	0.28	-1.58	0.38	0.75	0.26	2.92	0.38
Listener 4	Door High	-2.13	0.48	-2.19	0.28	0.81	0.74	1.69	0.36	4.94	0.50
	Door Low	-4.09	0.58	-3.88	0.26	-1.56	0.68	2.25	0.42	2.38	0.52
Listener 5	Door High	-1.83	0.40	-1.06	0.42	-1.75	0.46	1.25	0.42	4.06	0.46
	Door Low	-2.01	0.42	-2.50	0.44	-2.19	0.56	1.31	0.44	3.63	0.44

TABLE 20

EXP 4/5		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	IP Back	-4.29	0.66	-2.13	0.46	-0.63	0.64	2.75	0.50	3.75	0.74
	IP Forward	-3.93	0.74	-2.25	0.50	-0.50	0.84	2.50	0.38	3.88	0.60
	Door High	-4.28	0.24	-1.00	0.66	-2.42	0.72	2.42	0.46	3.75	0.60
	Door Low	-5.00	0.00	-3.50	0.38	-2.86	0.78	2.17	0.34	4.08	0.68
Listener 2	IP Back	-3.88	0.28	-1.63	0.36	1.13	1.48	2.25	0.62	4.00	0.00
	IP Forward	-3.84	0.32	-1.63	0.36	1.13	1.28	2.25	0.62	4.00	0.00
	Door High	-3.46	0.28	-1.17	0.34	1.33	1.00	2.75	0.78	3.75	0.44
	Door Low	-3.92	0.24	-2.25	0.26	0.42	1.14	3.42	0.68	3.00	0.50
Listener 3	IP Back	-2.95	0.68	-1.25	0.32	-0.38	0.36	1.00	0.54	4.00	0.54
	IP Forward	-1.99	0.34	-1.25	0.32	-0.50	0.38	0.50	0.54	4.00	0.54
	Door High	-2.56	0.42	-0.50	0.30	-0.83	0.22	0.75	0.26	3.75	0.36
	Door Low	-3.56	0.42	-1.33	0.28	-1.58	0.38	0.75	0.26	2.92	0.38
Listener 4	IP Back	-2.48	0.66	-2.13	0.46	0.63	0.36	0.88	0.60	4.13	0.88
	IP Forward	-2.58	0.36	-2.00	0.38	1.00	0.38	1.00	0.00	4.38	0.64
	Door High	-2.13	0.48	-2.19	0.28	0.81	0.74	1.69	0.36	4.94	0.50
	Door Low	-4.09	0.58	-3.88	0.26	-1.56	0.68	2.25	0.42	2.38	0.52
Listener 5	IP Back	-1.44	0.30	-1.38	0.36	-0.75	0.50	1.50	0.54	4.88	0.80
	IP Forward	-1.24	0.34	-1.13	0.26	-0.75	0.32	1.38	0.36	4.63	0.52
	Door High	-1.83	0.40	-1.06	0.42	-1.75	0.46	1.25	0.42	4.06	0.46
	Door Low	-2.01	0.42	-2.50	0.44	-2.19	0.56	1.31	0.44	3.63	0.44

TABLE 21

LISTENER * VARIABLE
MEANS TABLE

EXP 1B		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Windshield Angle 55°	-0.14	0.90	-0.08	0.72	0.00	0.50	1.08	0.30	6.00	0.56
	Windshield Angle 70°	-1.68	0.64	-0.25	0.56	0.92	0.86	0.75	0.44	5.50	0.68
	Windshield Angle 90°	-0.01	1.16	-1.08	0.46	-0.50	0.58	1.08	0.38	5.92	0.52
	Windshield Angle 180°	-0.44	1.12	-1.42	0.58	-0.58	0.62	1.17	0.48	6.00	0.50
Listener 2	Windshield Angle 55°	-1.46	0.46	0.08	0.46	1.67	0.72	0.67	0.44	4.58	0.52
	Windshield Angle 70°	-1.60	0.36	0.00	0.42	2.00	0.66	0.58	0.30	4.33	0.38
	Windshield Angle 90°	-1.42	0.60	-0.25	0.36	0.75	0.78	0.92	0.38	4.67	0.44
	Windshield Angle 180°	-1.68	0.62	-0.17	0.42	1.17	0.82	0.67	0.28	4.17	0.42
Listener 3	Windshield Angle 55°	-2.10	0.40	-0.17	0.34	-0.25	0.44	0.25	0.26	4.42	0.38
	Windshield Angle 70°	-1.58	0.46	-0.17	0.42	0.25	0.36	0.33	0.38	4.00	0.34
	Windshield Angle 90°	-1.89	0.46	0.00	0.24	0.33	0.44	0.42	0.30	4.25	0.36
	Windshield Angle 180°	-1.55	0.44	-0.17	0.34	0.25	0.50	0.33	0.28	4.25	0.44
Listener 4	Windshield Angle 55°	-0.40	0.58	0.00	0.38	1.25	1.30	0.88	0.88	6.88	0.96
	Windshield Angle 70°	-2.41	0.92	-0.38	0.52	4.00	1.00	1.13	0.46	4.88	1.34
	Windshield Angle 90°	-0.98	0.66	-0.75	0.50	1.88	0.96	1.13	0.26	5.38	1.12
	Windshield Angle 180°	-0.76	0.48	-0.88	0.60	-0.25	0.74	1.38	0.36	6.75	1.46
Listener 5	Windshield Angle 55°	-0.88	0.88	0.38	0.36	0.13	0.80	1.13	0.26	6.25	1.06
	Windshield Angle 70°	-1.56	0.74	-0.50	0.38	0.13	0.80	1.00	0.38	6.50	1.20
	Windshield Angle 90°	-0.44	0.62	-0.25	0.32	-0.88	0.60	0.88	0.26	6.50	0.84
	Windshield Angle 180°	-0.18	0.38	-0.88	0.46	-0.63	0.36	0.88	0.26	6.63	0.74
Listener 6	Windshield Angle 55°	-0.48	1.26	0.25	0.50	1.13	1.80	-0.13	1.44	6.88	1.16
	Windshield Angle 70°	-1.80	1.94	0.13	0.60	2.38	0.84	-1.13	1.04	4.75	0.90
	Windshield Angle 90°	-1.25	1.32	-0.25	0.98	0.50	1.26	-1.88	0.96	5.38	0.64
	Windshield Angle 180°	0.73	1.76	-1.00	0.76	-0.88	0.88	0.00	0.66	6.25	0.50
Listener 7	Windshield Angle 55°	-1.54	0.76	-0.38	0.52	-1.38	0.64	0.75	0.50	5.50	0.66
	Windshield Angle 70°	-2.48	0.96	-0.38	0.52	0.00	1.36	1.13	0.60	4.25	0.82
	Windshield Angle 90°	-1.99	0.88	-0.38	0.36	-0.50	1.06	0.63	0.52	4.88	0.96
	Windshield Angle 180°	-1.66	0.60	-0.88	0.46	-1.00	0.66	1.38	0.64	5.38	1.06

TABLE 22

LISTENER * PROGRAM
MEANS TABLE

EXP 1A		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-1.95	0.52	-2.17	0.48	-0.08	0.52	0.92	0.52	5.25	0.50
	Music	-1.87	0.46	-1.75	0.56	0.50	0.84	0.42	0.46	5.00	0.50
	Noise	-1.93	0.94	-2.67	1.06	-1.00	0.74	1.25	0.50	5.00	0.78
	Drum Kit	-2.83	0.94	-2.33	0.62	-0.92	0.84	-0.42	0.52	5.08	0.68
Listener 2	Voice	-1.49	0.48	-0.83	0.48	0.83	0.92	1.08	0.68	4.58	0.46
	Music	-2.47	0.48	-0.92	0.52	1.00	1.10	1.92	0.52	4.33	0.62
	Noise	-1.63	0.44	-1.00	0.60	1.67	0.52	0.83	0.42	5.25	0.26
	Drum Kit	-1.78	0.54	-1.08	0.52	0.33	0.56	1.17	0.42	5.17	0.48
Listener 3	Voice	-1.58	0.62	-0.92	0.46	0.25	0.60	-0.08	0.38	4.83	0.42
	Music	-1.56	0.52	-0.92	0.30	0.08	0.52	0.42	0.30	4.42	0.52
	Noise	-1.63	0.66	-0.93	0.62	0.33	0.44	0.08	0.52	5.50	0.80
	Drum Kit	-1.98	0.94	-1.00	0.42	-0.42	0.80	0.50	0.46	4.92	0.58
Listener 4	Voice	-0.88	1.10	-1.38	0.36	2.00	0.66	1.13	0.46	5.63	0.84
	Music	-0.60	0.36	-1.38	0.36	1.00	1.36	0.88	0.26	5.50	1.20
	Noise	-0.91	0.70	-1.75	0.74	1.75	0.62	0.88	0.46	6.50	1.70
	Drum Kit	-1.33	0.54	-1.88	0.46	1.50	0.66	0.50	0.54	5.25	1.34
Listener 5	Voice	0.11	0.36	-1.00	0.00	0.38	0.36	0.13	0.26	7.63	0.52
	Music	-1.50	0.74	-1.38	0.36	-0.38	0.36	0.75	0.50	5.50	1.00
	Noise	-0.46	0.22	-0.88	0.26	-0.25	0.50	0.13	0.26	6.88	0.26
	Drum Kit	-1.48	0.90	-1.13	0.26	-0.50	0.54	0.75	0.32	6.00	0.76
Listener 6	Voice	-0.04	2.04	0.00	0.00	0.38	0.74	0.00	0.00	5.38	1.36
	Music	0.53	1.32	1.75	1.24	0.50	1.26	-0.75	1.18	5.63	1.20
	Noise	-0.74	0.82	-1.75	1.24	0.50	1.70	-0.38	1.30	5.00	1.36
	Drum Kit	-1.36	0.92	-1.00	0.84	1.13	1.34	-0.63	0.92	5.38	1.12
Listener 7	Voice	-1.14	0.74	0.00	0.38	0.50	1.14	1.00	0.38	4.50	0.66
	Music	-1.63	0.52	-0.13	0.46	-0.13	1.34	0.75	0.74	4.13	0.88
	Noise	-3.31	0.74	-0.13	0.26	1.00	1.26	0.88	0.80	4.50	0.54
	Drum Kit	-1.95	0.82	-0.63	0.64	-0.63	1.12	1.25	0.32	5.13	0.70
Listener 8	Voice	-1.19	0.84	-2.50	1.14	-1.38	0.74	-0.38	0.84	5.13	1.04
	Music	-1.69	0.92	-1.88	1.04	-1.13	0.96	0.63	0.84	4.88	1.58
	Noise	-1.01	0.68	-1.38	1.60	-0.75	0.50	1.00	1.30	4.38	1.30
	Drum Kit	-1.36	0.62	-1.25	1.06	-0.50	1.52	-0.25	1.64	4.63	1.12

TABLE 23

LISTENER * PROGRAM
MEANS TABLE

EXP 2		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-3.31	0.74	-2.25	0.44	-1.17	0.64	1.33	0.52	4.58	0.64
	Music	-2.72	0.42	-2.75	0.36	-1.00	0.42	1.67	0.66	4.83	0.48
	Noise	-3.10	0.80	-2.67	0.80	-0.33	0.52	1.92	0.38	4.50	0.88
	Drum Kit	-2.54	0.68	-2.00	0.60	-1.42	0.80	1.08	0.58	5.00	0.92
Listener 2	Voice	-2.70	0.74	-1.33	0.38	1.92	0.68	0.75	0.66	3.75	0.44
	Music	-2.67	0.82	-1.17	0.54	1.08	0.84	1.83	0.68	4.25	0.56
	Noise	-3.01	0.64	-1.25	0.36	1.67	0.28	1.25	0.56	3.75	0.66
	Drum Kit	-2.06	0.80	-1.42	0.58	0.67	0.38	1.67	0.62	4.75	0.44
Listener 3	Voice	-1.31	0.56	-1.25	0.44	0.50	0.76	0.42	0.38	4.75	0.60
	Music	-1.58	0.50	-1.25	0.44	0.17	0.42	1.33	0.72	4.25	0.66
	Noise	-1.39	0.40	-0.76	0.26	0.08	0.52	0.33	0.44	4.92	0.52
	Drum Kit	-1.92	0.54	-1.00	0.42	-0.08	0.52	1.50	0.84	4.67	0.62
Listener 4	Voice	-2.16	0.92	-2.00	0.38	1.88	0.70	1.00	0.38	4.75	0.74
	Music	-1.55	0.66	-1.50	0.38	0.50	1.52	1.25	0.62	4.25	0.50
	Noise	-3.35	0.58	-2.13	0.46	1.38	0.84	0.63	0.36	3.38	0.74
	Drum Kit	-2.04	0.92	-1.63	0.36	1.13	0.70	1.38	0.52	4.00	0.66
Listener 5	Voice	-1.66	0.92	-1.75	0.50	-1.00	1.52	0.75	0.50	5.63	1.30
	Music	-0.69	0.94	-2.00	0.54	-1.13	0.70	2.00	1.00	4.88	0.80
	Noise	-0.79	0.36	-1.88	0.46	-0.13	0.60	1.50	0.66	4.75	1.06
	Drum Kit	-1.27	0.62	-1.50	0.38	-1.50	1.00	1.25	0.50	4.50	0.92
Listener 6	Voice	-2.03	1.02	-1.13	0.88	-0.38	1.56	-0.50	0.66	4.25	0.74
	Music	2.32	1.18	-0.50	0.76	0.75	0.82	-1.38	1.00	6.00	0.84
	Noise	-2.09	0.82	-0.88	1.16	-0.50	1.96	-0.38	0.52	4.88	0.60
	Drum Kit	-0.19	1.32	-1.00	0.84	-0.50	0.92	-1.25	0.74	4.88	0.88
Listener 7	Voice	-2.64	0.74	-0.38	0.52	-1.13	1.04	0.88	0.60	4.25	0.32
	Music	-2.16	0.60	-0.13	0.46	-0.13	1.22	1.50	0.76	4.50	0.54
	Noise	-3.55	0.56	-1.00	0.66	-0.25	1.50	1.88	0.70	4.13	0.60
	Drum Kit	-3.21	0.56	-1.13	1.04	0.13	0.70	1.25	0.32	4.50	0.38

TABLE 24

LISTENER * PROGRAM
MEANS TABLE

EXP 3		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-2.73	0 72	-0.50	0.46	-1.33	0.38	2.25	0.26	3.92	0.30
	Music	-3.15	0.32	-1.83	0.34	-0.83	0.34	2.67	0.44	4.00	0.24
	Noise	-3.60	0.50	-1.08	0.52	-1.92	0.30	2.50	0.30	3.08	0.16
	Drum Kit	-4.40	0.34	-1.17	0.34	1.00	0.78	1.50	0.30	2.83	0.34
Listener 2	Voice	-3.73	0.36	-0.83	0.22	3.17	0.64	1.33	0.28	3.58	0.30
	Music	-3.18	0.42	-2.00	0.00	0.08	0.68	3.33	0.44	4.00	0.00
	Noise	-3.53	0.40	-1.25	0.26	2.33	0.38	1.50	0.30	4.58	0.38
	Drum Kit	-3.69	0.42	-2.00	0.00	2.08	0.62	1.50	0.30	3.58	0.30
Listener 3	Voice	-2.53	0.62	-0.58	0.30	-0.33	0.56	-0.08	0.16	4.17	0.42
	Music	-2.59	0.54	-1.00	0.00	-1.08	0.38	0.83	0.48	4.00	0.42
	Noise	-2.48	0.40	-0.75	0.26	-1.08	0.38	0.33	0.44	4.50	0.46
	Drum Kit	-2.12	0.64	-0.92	0.30	-0.58	0.30	0.33	0.38	4.08	0.52
Listener 4	Voice	-2.43	0.94	-2.00	0.54	0.75	1.60	1.13	0.60	3.00	0.92
	Music	-2.55	1.00	-2.00	0.38	-1.25	1.46	2.25	1.34	4.38	0.74
	Noise	-1.73	0.72	-1.88	0.46	2.00	0.66	2.00	0.66	4.63	1.30
	Drum Kit	-2.00	1.02	-2.13	0.26	2.25	0.82	2.50	0.54	5.13	1.38
Listener 5	Voice	-1.78	0.64	-1.00	0.00	-1.75	0.50	1.25	0.32	4.38	0.74
	Music	-1.05	0.36	-2.00	0.00	-2.00	0.00	3.00	0.76	3.88	0.60
	Noise	-2.03	0.70	-1.13	0.26	-0.50	0.38	1.50	0.38	4.38	0.84
	Drum Kit	-1.81	0.68	-1.00	0.00	-2.50	0.38	1.00	0.00	3.75	0.62
Listener 6	Voice	-0.44	2.34	-0.63	0.52	1.88	1.38	-0.75	1.18	4.38	1.06
	Music	2.71	0.76	-0.63	0.52	-0.50	1.14	-1.50	0.84	5.50	0.84
	Noise	-0.84	1.46	-2.25	0.74	-0.63	1.50	-0.75	0.62	5.00	0.54
	Drum Kit	-1.61	1.86	-1.50	0.76	0.38	1.84	-0.25	1.18	4.63	0.76

TABLE 25

LISTENER * PROGRAM
MEANS TABLE

EXP 4		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-4.47	0.30	-1.81	0.32	-0.94	0.28	2.25	0.22	4.25	0.42
	Music	-4.21	0.40	-2.06	0.50	-1.06	0.38	3.13	0.24	3.69	0.36
	Noise	-4.29	0.50	-2.69	0.56	-1.31	0.24	3.44	0.48	4.38	0.44
	Drum Kit	-4.83	0.06	-1.94	0.34	0.25	0.60	2.31	0.24	2.88	0.44
Listener 2	Voice	-3.91	0.26	-1.44	0.26	2.31	0.30	1.56	0.26	4.00	0.00
	Music	-3.84	0.20	-1.94	0.12	-1.00	0.54	3.00	0.00	3.94	0.12
	Noise	-3.79	0.18	-2.00	0.00	-0.06	1.04	2.75	0.22	4.00	0.00
	Drum Kit	-3.83	0.20	-1.56	0.26	1.13	0.78	2.00	0.32	4.06	0.12
Listener 3	Voice	-2.85	0.36	-1.19	0.20	-0.44	0.40	0.56	0.32	4.31	0.44
	Music	-3.54	0.40	-1.13	0.18	-0.75	0.38	1.13	0.30	3.50	0.32
	Noise	-2.73	0.36	-1.31	0.24	-0.75	0.34	0.69	0.24	4.00	0.36
	Drum Kit	-2.71	0.40	-1.13	0.18	-1.06	0.34	1.00	0.32	3.88	0.36
Listener 4	Voice	-2.74	0.34	-2.13	0.18	0.88	0.44	0.94	0.22	3.94	0.50
	Music	-3.07	0.48	-2.06	0.28	-0.75	0.68	1.19	0.38	3.94	0.54
	Noise	-2.72	0.38	-2.13	0.24	1.19	0.28	1.00	0.44	4.44	0.68
	Drum Kit	-2.64	0.46	-2.06	0.34	-0.50	0.68	1.31	0.56	4.00	0.68
Listener 5	Voice	-1.53	0.22	-1.50	0.26	-1.19	0.28	1.19	0.20	4.63	0.48
	Music	-1.78	0.36	-2.13	0.26	-1.69	0.30	2.19	0.20	4.00	0.58
	Noise	-1.60	0.22	-1.31	0.24	-0.50	0.32	1.25	0.22	4.94	0.34
	Drum Kit	-1.21	0.28	-1.31	0.24	-1.44	0.26	1.00	0.00	4.19	0.42

TABLE 26

LISTENER * PROGRAM
MEANS TABLE

EXP 5		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-4.65	0.38	-1.33	1.34	-3.00	1.04	2.00	0.52	4.33	0.84
	Music	-4.73	0.28	-2.67	0.98	-3.00	1.16	2.67	0.42	4.00	0.90
	Noise	-4.73	0.30	-2.17	1.58	-2.33	0.42	2.83	0.34	4.17	0.96
	Drum Kit	-4.45	0.56	-2.83	1.08	-2.22	1.44	1.67	0.42	3.17	0.80
Listener 2	Voice	-3.83	0.42	-1.33	0.66	2.50	1.00	2.67	0.84	3.17	0.62
	Music	-3.75	0.42	-2.17	0.62	-1.67	0.66	4.67	0.42	2.83	0.62
	Noise	-3.42	0.40	-1.50	0.44	1.67	0.66	2.83	0.62	4.33	0.42
	Drum Kit	-3.75	0.42	-1.83	0.62	1.00	1.04	2.17	0.96	3.17	0.62
Listener 3	Voice	-2.65	0.60	-0.83	0.62	-1.33	0.42	0.00	0.00	3.50	0.44
	Music	-3.50	0.76	-1.00	0.52	-1.50	0.44	1.00	0.00	2.83	0.62
	Noise	-2.92	0.80	-0.83	0.62	-0.83	0.62	1.00	0.00	3.50	0.44
	Drum Kit	-3.17	0.68	-1.00	0.52	-1.17	0.62	1.00	0.00	3.50	0.86
Listener 4	Voice	-3.05	1.10	-2.88	0.60	-0.13	1.34	1.00	0.38	3.63	0.74
	Music	-3.65	0.76	-3.00	0.66	-1.63	0.64	2.75	0.50	3.25	1.46
	Noise	-2.65	1.02	-3.00	0.84	1.00	1.36	2.00	0.00	4.38	1.20
	Drum Kit	-3.10	1.18	-3.25	0.82	-0.75	1.18	2.13	0.46	3.38	1.20
Listener 5	Voice	-1.66	0.26	-1.13	0.70	-2.00	1.00	0.25	0.32	3.63	0.52
	Music	-1.94	0.44	-2.50	0.84	-2.25	0.62	2.25	0.32	4.25	0.50
	Noise	-2.15	0.82	-1.63	0.64	-2.00	0.84	1.50	0.38	3.63	0.92
	Drum Kit	-1.94	0.70	-1.88	0.80	-1.63	0.36	1.13	0.26	3.88	0.60

TABLE 27

EXP 4/5		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-4.35	0.44	-1.60	0.86	-2.20	0.94	2.00	0.30	4.40	0.62
	Music	-4.38	0.54	-2.60	0.62	-2.00	1.08	2.90	0.36	3.90	0.56
	Noise	-4.36	0.60	-2.10	0.92	-1.80	0.50	2.90	0.20	4.00	0.66
	Drum Kit	-4.62	0.36	-2.60	0.74	-1.23	1.32	1.90	0.36	3.20	0.58
Listener 2	Voice	-4.01	0.30	-1.20	0.40	2.60	0.62	2.00	0.74	3.50	0.44
	Music	-3.67	0.26	-2.10	0.36	-1.50	0.44	4.00	0.60	3.30	0.52
	Noise	-3.67	0.32	-1.70	0.30	1.80	0.40	2.90	0.36	4.20	0.26
	Drum Kit	-3.67	0.30	-1.70	0.42	1.00	1.04	2.10	0.56	3.50	0.44
Listener 3	Voice	-2.69	0.58	-1.00	0.42	-0.80	0.50	0.30	0.42	3.80	0.50
	Music	-3.30	0.58	-1.10	0.36	-1.00	0.52	1.20	0.26	3.10	0.46
	Noise	-2.64	0.56	-1.00	0.42	-0.80	0.40	0.80	0.26	3.80	0.40
	Drum Kit	-2.66	0.58	-1.10	0.36	-1.00	0.42	0.70	0.30	3.70	0.60
Listener 4	Voice	-2.93	0.74	-2.58	0.46	0.25	0.92	1.00	0.24	3.75	0.50
	Music	-3.16	0.70	-2.75	0.50	-1.00	0.70	2.00	0.78	3.75	1.14
	Noise	-2.78	0.70	-2.83	0.60	1.00	0.88	1.75	0.26	4.17	0.84
	Drum Kit	-2.79	0.84	-2.67	0.76	-0.17	0.94	1.75	0.44	3.75	0.92
Listener 5	Voice	-1.65	0.20	-1.17	0.48	-1.58	0.76	0 50	0.30	4.08	0.62
	Music	-1.67	0.38	-2.25	0.60	-1.92	0.52	2.25	0.26	4.50	0.58
	Noise	-2.00	0.56	-1.42	0.46	-1.33	0.80	1.50	0.30	4.00	0.70
	Drum Kit	-1.59	0.54	-1.58	0.58	-1.42	0.30	1.08	0.16	4.00	0.42

TABLE 28

LISTENER * PROGRAM
MEANS TABLE

EXP 1B		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Listener 1	Voice	-0.34	0.78	-0.75	0.50	0.33	0.52	1.25	0.36	5.50	0.38
	Music	0.44	1.12	-0.42	0.72	0.33	0.76	1.17	0.42	5.58	0.80
	Noise	-0.79	0.72	-0.92	0.80	-0.25	0.50	1.25	0.26	6.58	0.30
	Drum Kit	-1.58	1.14	-0.75	0.60	-0.58	0.96	0.42	0.38	5.75	0.44
Listener 2	Voice	-1.46	0.32	-0.25	0.44	1.33	0.52	0.83	0.22	4.08	0.30
	Music	-2.45	0.62	-0.25	0.50	2.33	0.90	0.67	0.28	3.92	0.46
	Noise	-1.06	0.24	0.17	0.22	1.17	0.74	0.58	0.38	4.58	0.30
	Drum Kit	-1.19	0.32	0.00	0.42	0.75	0.66	0.75	0.50	5.17	0.34
Listener 3	Voice	-1.68	0.52	-0.33	0.28	0.25	0.44	0.25	0.36	4.58	0.30
	Music	-1.62	0.38	-0.25	0.26	0.08	0.52	0.33	0.28	3.92	0.46
	Noise	-1.77	0.48	0.08	0.38	-0.08	0.38	0.33	0.28	4.17	0.34
	Drum Kit	-2.04	0.46	0.00	0.34	0.33	0.44	0.42	0.30	4.25	0.36
Listener 4	Voice	-0.88	0.90	-0.50	0.38	0.50	1.60	1.38	0.36	6.13	1.34
	Music	-1.88	1.06	-1.00	0.66	3.25	1.12	0.88	0.88	5.00	1.46
	Noise	-0.95	0.60	-0.25	0.50	1.38	1.36	0.88	0.26	7.50	0.92
	Drum Kit	-0.85	0.70	-0.25	0.50	1.75	1.24	1.38	0.36	5.25	0.90
Listener 5	Voice	0.20	0.46	-0.13	0.46	-0.75	0.50	1.00	0.00	6.75	1.12
	Music	-1.06	0.84	-0.25	0.62	-0.38	0.92	0.88	0.26	6.13	1.38
	Noise	-1.13	0.78	-0.50	0.54	0.13	0.80	1.00	0.00	6.38	0.52
	Drum Kit	-1.06	0.52	-0.38	0.36	-0.25	0.50	1.00	0.54	6.63	0.52
Listener 6	Voice	0.06	1.78	-0.25	0.50	1.25	1.34	-0.13	0.96	6.00	0.76
	Music	-1.18	1.82	-0.88	0.80	1.00	1.26	-1.63	1.26	5.75	1.40
	Noise	-1.38	1.32	-0.25	0.90	0.63	1.60	-0.38	1.26	5.25	0.90
	Drum Kit	-0.31	1.80	0.50	0.66	0.25	1.76	-1.00	1.00	6.25	0.82
Listener 7	Voice	-1.36	0.76	-0.50	0.54	-0.63	0.92	0.88	0.60	5.75	0.90
	Music	-2.43	0.52	-0.75	0.50	-1.25	0.74	1.25	0.62	4.50	0.66
	Noise	-1.99	0.98	-0.50	0.54	-0.63	0.74	0.88	0.60	5.25	1.12
	Drum Kit	-1.89	0.88	-0.25	0.32	-0.38	1.50	0.88	0.60	4.50	0.76

TABLE 29

VARIABLE * PROGRAM
MEANS TABLE

EXP 1A		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Windshield Angle 55°	Voice	-0.34	0.90	-1.32	0.50	0.26	0.56	0.58	0.36	5.68	0.70
Windshield Angle 55°	Music	-1.57	0.46	-0.79	0.80	0.26	0.52	1.00	0.62	5.32	0.54
Windshield Angle 55°	Noise	-1.38	0.66	-0.42	0.68	1.16	0.68	-0.16	0.68	6.05	0.82
Windshield Angle 55°	Drum Kit	-1.56	0.46	-1.32	0.38	0.42	0.92	0.63	0.54	5.42	0.68
Windshield Angle 70°	Voice	-1.45	0.52	-1.21	0.56	0.37	0.68	0.32	0.44	5.21	0.54
Windshield Angle 70°	Music	-1.64	0.78	-0.89	0.58	0.79	0.76	0.63	0.42	4.89	0.74
Windshield Angle 70°	Noise	-1.44	0.58	-1.11	0.42	0.68	0.72	0.63	0.44	5.11	0.64
Windshield Angle 70°	Drum Kit	-1.91	0.58	-1.05	0.52	-0.11	0.72	0.05	0.62	5.00	0.40
Windshield Angle 90°	Voice	-1.13	0.44	-0.84	0.36	0.63	0.58	0.53	0.60	5.32	0.46
Windshield Angle 90°	Music	-1.16	0.44	-0.84	0.46	-0.05	0.86	0.58	0.56	4.79	0.62
Windshield Angle 90°	Noise	-1.36	0.52	-1.79	0.64	0.21	0.72	0.95	0.42	5.16	0.58
Windshield Angle 90°	Drum Kit	-1.94	0.78	-1.47	0.54	0.00	0.58	0.47	0.38	5.16	0.66
Windshield Angle 180°	Voice	-1.57	0.62	-1.16	0.62	0.16	0.70	0.58	0.36	4.95	0.76
Windshield Angle 180°	Music	-1.42	0.64	-1.00	0.72	-0.05	0.74	0.47	0.50	4.47	0.70
Windshield Angle 180°	Noise	-1.81	0.66	-2.05	0.76	-0.47	0.56	1.00	0.48	5.11	0.76
Windshield Angle 180°	Drum Kit	-1.90	0.60	-1.42	0.52	-0.53	0.64	0.32	0.66	5.11	0.54

TABLE 30

EXP 2		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
IP (70°) w/o Drs & Roof	Voice	-1.50	0.56	-1.06	0.58	0.59	0.68	0.35	0.48	5.06	0.56
IP (70°) w/o Drs & Roof	Music	-1.80	0.82	-0.88	0.62	0.88	0.84	0.71	0.44	4.59	0.66
IP (70°) w/o Drs & Roof	Noise	-1.56	0.62	-0.95	0.40	0.88	0.74	0.65	0.48	5.35	0.60
IP (70°) w/o Drs & Roof	Drum Kit	-1.89	0.64	-1.00	0.52	0.06	0.76	0.24	0.58	5.06	0.44
IP (70°) w/ Doors	Voice	-2.48	0.64	-1.35	0.42	0.06	0.92	0.94	0.36	4.00	0.38
IP (70°) w/ Doors	Music	-1.08	0.98	-1.41	0.52	-0.35	0.56	1.12	0.72	4.88	0.38
IP (70°) w/ Doors	Noise	-2.77	0.60	-1.41	0.76	-0.41	0.70	1.29	0.42	3.76	0.40
IP (70°) w/ Doors	Drum Kit	-1.99	0.94	-1.47	0.60	-0.29	0.80	1.41	0.54	4.71	0.56
IP (70°) w/ Roof	Voice	-2.29	0.66	-1.76	0.36	-0.41	0.82	0.88	0.30	4.88	0.72
IP (70°) w/ Roof	Music	-1.74	0.80	-1.59	0.42	0.12	0.70	1.29	0.84	4.76	0.58
IP (70°) w/ Roof	Noise	-2.95	0.60	-2.00	0.42	0.76	0.66	0.65	0.56	4.12	0.60
IP (70°) w/ Roof	Drum Kit	-1.76	0.64	-1.53	0.42	-0.24	0.52	1.06	0.66	4.53	0.52
IP (70°) w/ Drs & Roof	Voice	-2.88	0.62	-1.71	0.38	0.35	1.22	0.59	0.64	4.18	0.54
IP (70°) w/ Drs & Roof	Music	-1.28	1.08	-1.71	0.54	-0.47	0.60	1.88	0.82	4.41	0.46
IP (70°) w/ Drs & Roof	Noise	-2.61	0.64	-1.71	0.50	0.00	0.82	1.59	0.54	4.12	0.52
IP (70°) w/ Drs & Roof	Drum Kit	-2.12	0.56	-1.59	0.34	-0.47	0.62	1.53	0.60	4.29	0.62

TABLE 31

VARIABLE * PROGRAM
MEANS TABLE

EXP 3		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Doors w/o IP (70°) & Roof	Voice	-1.46	1.34	-0.73	0.30	-0.27	0.94	1.00	0.56	4.33	0.74
Doors w/o IP (70°) & Roof	Music	-1.69	1.00	-1.47	0.34	-1.07	0.50	1.40	1.00	4.47	0.48
Doors w/o IP (70°) & Roof	Noise	-2.12	0.96	-1.47	0.34	0.00	0.90	1.07	0.64	4.53	0.80
Doors w/o IP (70°) & Roof	Drum Kit	-1.99	0.92	-1.60	0.26	0.07	0.74	1.07	0.56	4.00	0.58
Doors w/ IP (70°)	Voice	-2.58	0.78	-1.00	0.48	0.80	1.26	1.07	0.60	3.87	0.38
Doors w/ IP (70°)	Music	-1.77	1.00	-1.60	0.26	-0.53	0.84	1.53	1.10	4.67	0.46
Doors w/ IP (70°)	Noise	-1.98	0.72	-1.40	0.48	-0.27	0.74	1.00	0.48	4.47	0.52
Doors w/ IP (70°)	Drum Kit	-2.13	0.96	-1.47	0.34	0.27	0.66	1.00	0.76	4.13	0.76
Doors w/Roof	Voice	-2.55	0.56	-0.80	0.34	0.33	1.08	1.13	0.54	3.80	0.22
Doors w/Roof	Music	-2.01	1.40	-1.60	0.42	-0.80	0.66	2.40	0.78	3.93	0.42
Doors w/Roof	Noise	-3.01	0.52	-1.07	0.46	-0.20	1.10	1.53	0.62	4.33	0.50
Doors w/Roof	Drum Kit	-3.73	0.62	-1.20	0.44	0.87	1.44	0.93	0.54	3.67	0.70
Doors w/IP (70°) & Roof	Voice	-3.09	0.66	-0.93	0.42	0.80	1.26	0.47	0.82	3.60	0.54
Doors w/IP (70°) & Roof	Music	-2.13	1.06	-1.67	0.38	-1.07	0.60	2.13	1.04	3.87	0.38
Doors w/IP (70°) & Roof	Noise	-3.02	0.52	-1.33	0.42	0.40	1.20	1.33	0.84	3.87	0.44
Doors w/IP (70°) & Roof	Drum Kit	-3.21	0.58	-1.47	0.38	0.87	1.16	1.40	0.48	3.80	0.48

TABLE 32

VARIABLE * PROGRAM
MEANS TABLE

		Pref		TBalance		MBalance		BBalance		Spatial Quality	
EXP 4		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
IP Back 55°	Voice	-2.77	0.76	-1.40	0.32	0.40	0.90	1.20	0.40	4.70	0.52
IP Back 55°	Music	-2.90	0.76	-1.90	0.36	-0.60	0.62	2.00	0.66	4.40	0.62
IP Back 55°	Noise	-3.10	0.80	-1.70	0.30	0.30	0.60	1.90	0.56	4.30	0.60
IP Back 55°	Drum Kit	-2.86	0.64	-1.30	0.30	-0.40	0.96	1.50	0.44	3.80	0.72
IP Back 70°	Voice	-3.42	0.74	-1.70	0.42	0.60	0.90	1.30	0.30	4.30	0.52
IP Back 70°	Music	-2.81	0.80	-2.00	0.30	-0.80	0.50	2.10	0.92	4.20	0.84
IP Back 70°	Noise	-3.08	0.72	-1.80	0.50	0.30	0.74	1.90	0.70	4.10	0.56
IP Back 70°	Drum Kit	-2.71	0.96	-1.30	0.30	-0.10	0.92	1.40	0.54	4.00	0.60
IP Back 90°	Voice	-3.02	0.92	-1.70	0.30	0.20	0.78	1.20	0.66	4.20	0.50
IP Back 90°	Music	-3.34	0.58	-1.90	0.36	-1.40	0.44	2.10	0.62	3.50	0.34
IP Back 90°	Noise	-3.12	0.82	-1.90	0.56	-0.80	0.88	1.80	0.94	4.70	0.74
IP Back 90°	Drum Kit	-3.06	0.88	-1.60	0.44	-0.30	1.04	1.80	0.50	3.80	0.58
IP Back 180°	Voice	-3.39	0.62	-1.80	0.26	-0.40	0.86	1.40	0.62	3.90	0.46
IP Back 180°	Music	-3.73	0.42	-1.60	0.68	-1.40	0.62	2.30	0.42	3.50	0.34
IP Back 180°	Noise	-2.99	0.84	-2.10	0.76	-0.90	0.96	1.90	0.86	4.90	0.82
IP Back 180°	Drum Kit	-3.48	0.80	-1.80	0.40	-0.90	0.92	1.50	0.44	3.40	0.44
IP Forward 55°	Voice	-3.08	0.74	-1.80	0.50	0.50	1.20	1.50	0.44	4.40	0.62
IP Forward 55°	Music	-3.35	0.72	-1.90	0.46	-0.50	0.90	2.10	0.70	3.70	0.42
IP Forward 55°	Noise	-2.76	0.70	-1.70	0.42	0.30	0.80	1.70	1.00	4.40	0.32
IP Forward 55°	Drum Kit	-3.01	0.98	-1.60	0.32	-0.20	0.88	1.30	0.90	4.20	0.84
IP Forward 70°	Voice	-2.68	0.72	-1.30	0.30	0.20	0.98	1.00	0.42	4.40	0.54
IP Forward 70°	Music	-2.67	0.78	-1.90	0.46	-0.40	0.44	2.10	0.56	4.20	0.50
IP Forward 70°	Noise	-2.85	0.74	-1.70	0.30	0.20	0.78	1.80	0.72	4.10	0.36
IP Forward 70°	Drum Kit	-2.65	0.94	-1.70	0.52	0.30	1.00	1.20	0.50	4.00	0.52
IP Forward 90°	Voice	-3.10	0.90	-1.50	0.44	-0.10	0.96	1.50	0.44	4.20	0.58
IP Forward 90°	Music	-3.59	0.74	-1.70	0.30	-1.40	0.44	2.10	0.62	3.70	0.30
IP Forward 90°	Noise	-3.09	0.66	-2.10	0.46	-0.70	0.80	1.80	0.94	4.30	0.42
IP Forward 90°	Drum Kit	-2.98	0.96	-1.50	0.44	-0.10	0.82	1.60	0.44	4.00	0.42
IP Forward 180°	Voice	-3.36	0.64	-1.70	0.30	-0.40	0.96	1.30	0.52	3.70	0.42
IP Forward 180°	Music	-3.89	0.58	-2.00	0.52	-1.90	0.36	2.20	0.66	3.30	0.30
IP Forward 180°	Noise	-3.21	0.60	-2.10	0.70	-1.00	0.84	1.80	0.94	4.00	0.52
IP Forward 180°	Drum Kit	-3.62	0.66	-2.00	0.42	-0.90	0.82	1.90	0.46	3.20	0.72

TABLE 33

VARIABLE * PROGRAM
MEANS TABLE

EXP 5		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Door High	Voice	-2.68	0.64	-0.76	0.50	-0.24	1.18	0.94	0.50	4.00	0.34
Door High	Music	-2.85	0.52	-1.65	0.34	-1.53	0.48	2.59	0.60	4.12	0.44
Door High	Noise	-2.95	0.50	-1.12	0.48	-0.06	0.94	1.94	0.36	4.35	0.64
Door High	Drum Kit	-2.52	0.58	-1.41	0.38	-0.41	0.76	1.47	0.30	3.94	0.46
Door Low	Voice	-3.46	0.60	-2.35	0.42	-1.41	0.94	1.29	0.62	3.29	0.44
Door Low	Music	-4.01	0.50	-3.00	0.54	-2.47	0.42	2.71	0.62	2.82	0.64
Door Low	Noise	-3.22	0.76	-2.65	0.56	-0.94	0.94	2.06	0.44	3.65	0.46
Door Low	Drum Kit	-3.86	0.54	-3.00	0.56	-1.55	0.70	1.76	0.44	2.94	0.50

TABLE 34

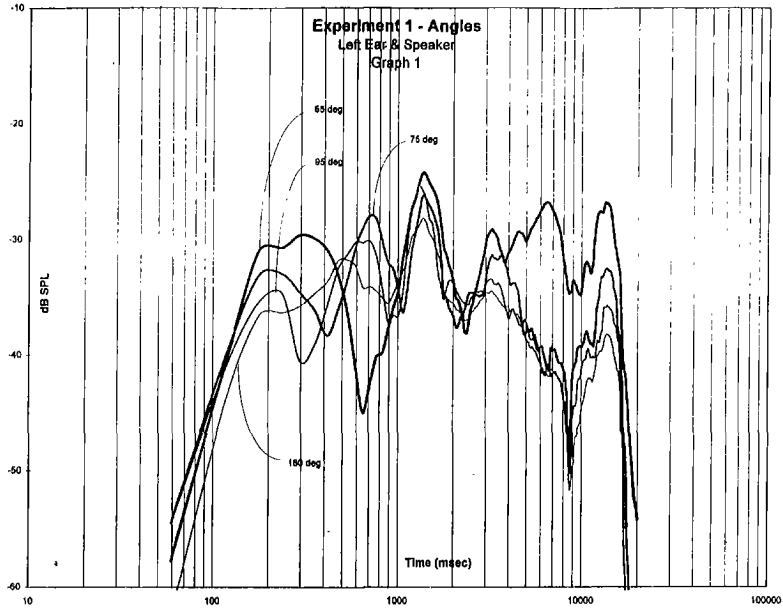
EXP 4/5		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
IP Back	Voice	-3.42	0.74	-1.70	0.42	0.60	0.90	1.30	0.30	4.30	0.52
IP Back	Music	-2.81	0.80	-2.00	0.30	-0.80	0.50	2.10	0.92	4.20	0.84
IP Back	Noise	-3.08	0.72	-1.80	0.50	0.30	0.74	1.90	0.70	4.10	0.56
IP Back	Drum Kit	-2.71	0.96	-1.30	0.30	-0.10	0.92	1.40	0.54	4.00	0.60
IP Forward	Voice	-2.68	0.72	-1.30	0.30	0.20	0.98	1.00	0.42	4.40	0.54
IP Forward	Music	-2.67	0.78	-1.90	0.46	-0.40	0.44	2.10	0.56	4.20	0.50
IP Forward	Noise	-2.85	0.74	-1.70	0.30	0.20	0.78	1.80	0.72	4.10	0.36
IP Forward	Drum Kit	-2.65	0.94	-1.70	0.52	0.30	1.00	1.20	0.50	4.00	0.52
Door High	Voice	-2.68	0.64	-0.76	0.50	-0.24	1.18	0.94	0.50	4.00	0.34
Door High	Music	-2.85	0.52	-1.65	0.34	-1.53	0.48	2.59	0.60	4.12	0.44
Door High	Noise	-2.95	0.50	-1.12	0.48	-0.06	0.94	1.94	0.36	4.35	0.64
Door High	Drum Kit	-2.52	0.58	-1.41	0.38	-0.41	0.76	1.47	0.30	3.94	0.46
Door Low	Voice	-3.46	0.60	-2.35	0.42	-1.41	0.94	1.29	0.62	3.29	0.44
Door Low	Music	-4.01	0.50	-3.00	0.54	-2.47	0.42	2.71	0.62	2.82	0.64
Door Low	Noise	-3.22	0.76	-2.65	0.56	-0.94	0.94	2.06	0.44	3.65	0.46
Door Low	Drum Kit	-3.86	0.54	-3.00	0.56	-1.55	0.70	1.76	0.44	2.94	0.50

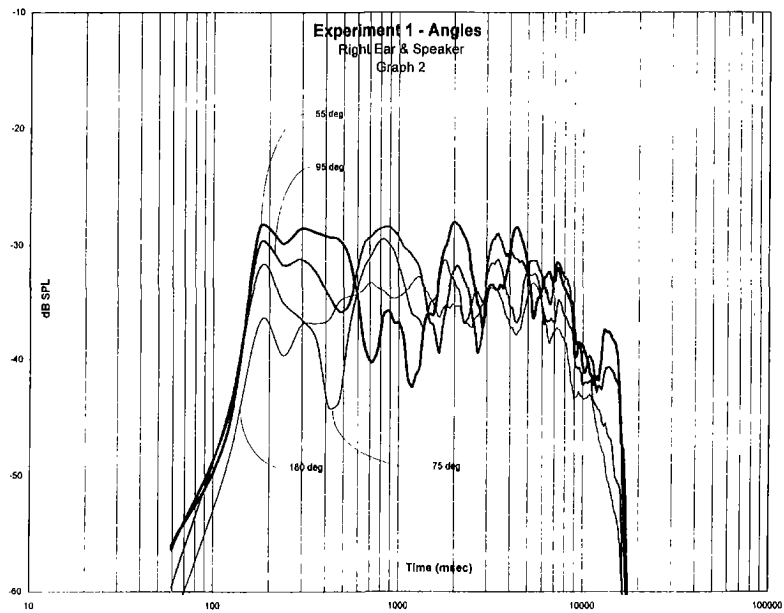
TABLE 35

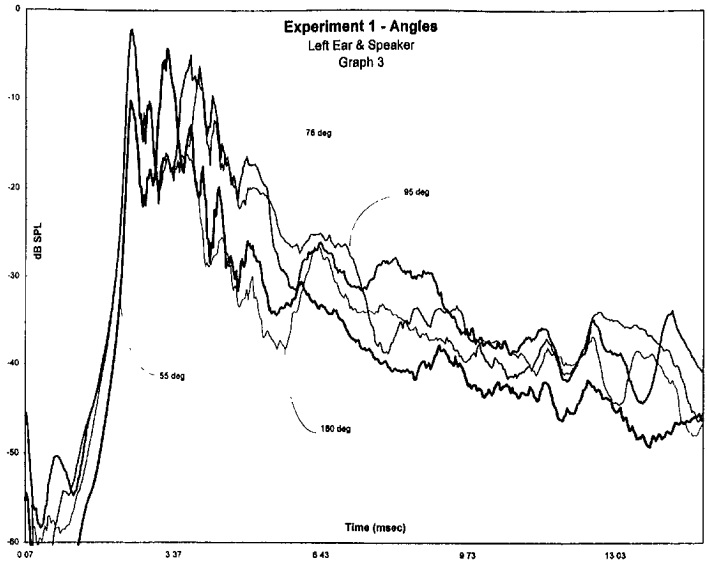
VARIABLE * PROGRAM
MEANS TABLE

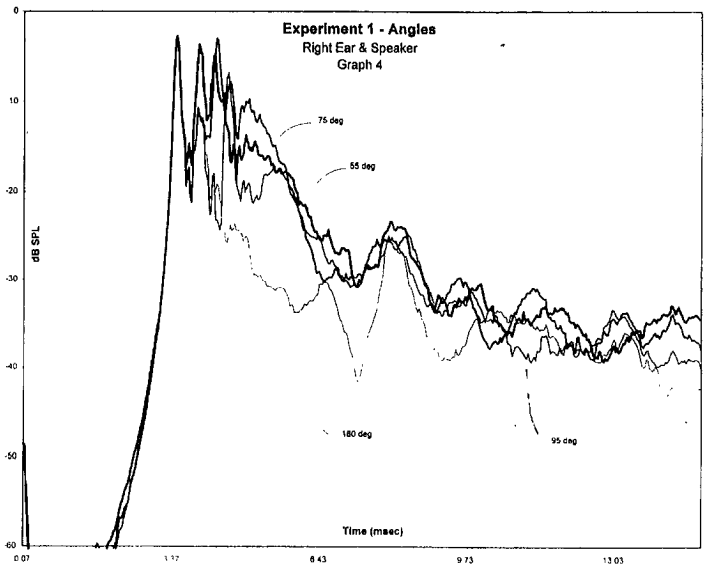
EXP 1B		Pref		TBalance		MBalance		BBalance		Spatial Quality	
		Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL	Mean	95% CL
Windshield Angle 55°	Voice	-0.96	0.72	-0.29	0.28	0.35	0.88	0.76	0.48	5.59	0.72
Windshield Angle 55°	Music	-1.24	0.54	0.00	0.38	0.65	0.82	0.41	0.70	5.47	0.76
Windshield Angle 55°	Noise	-1.38	0.44	0.06	0.56	0.76	0.70	0.71	0.28	5.65	0.66
Windshield Angle 55°	Drum Kit	-0.58	0.82	0.24	0.22	-0.24	0.72	0.76	0.40	5.88	0.66
Windshield Angle 70°	Voice	-0.99	0.66	-0.41	0.34	0.94	0.76	0.65	0.34	5.00	0.62
Windshield Angle 70°	Music	-2.55	0.62	-0.24	0.36	1.88	1.02	0.59	0.48	4.06	0.60
Windshield Angle 70°	Noise	-1.85	0.62	0.12	0.24	1.00	0.84	0.47	0.66	5.24	0.84
Windshield Angle 70°	Drum Kit	-1.92	0.48	-0.29	0.48	1.47	0.82	0.47	0.46	5.06	0.52
Windshield Angle 90°	Voice	-0.65	0.70	-0.29	0.28	0.29	0.54	0.65	0.42	5.35	0.54
Windshield Angle 90°	Music	-1.19	0.88	-0.88	0.42	0.47	0.92	0.47	0.68	4.65	0.72
Windshield Angle 90°	Noise	-0.83	0.40	-0.47	0.34	-0.18	0.46	0.76	0.40	5.71	0.56
Windshield Angle 90°	Drum Kit	-1.86	0.68	-0.06	0.40	0.29	0.80	0.18	0.64	5.18	0.46
Windshield Angle 180°	Voice	-0.78	0.72	-0.59	0.42	-0.06	0.50	1.06	0.36	5.65	0.74
Windshield Angle 180°	Music	-0.66	1.00	-0.88	0.48	0.18	0.76	0.71	0.48	5.35	0.86
Windshield Angle 180°	Noise	-1.06	0.66	-0.88	0.48	-0.29	0.58	0.71	0.28	5.71	0.74
Windshield Angle 180°	Drum Kit	-0.98	0.62	-0.59	0.34	-0.53	0.58	0.76	0.40	5.24	0.52

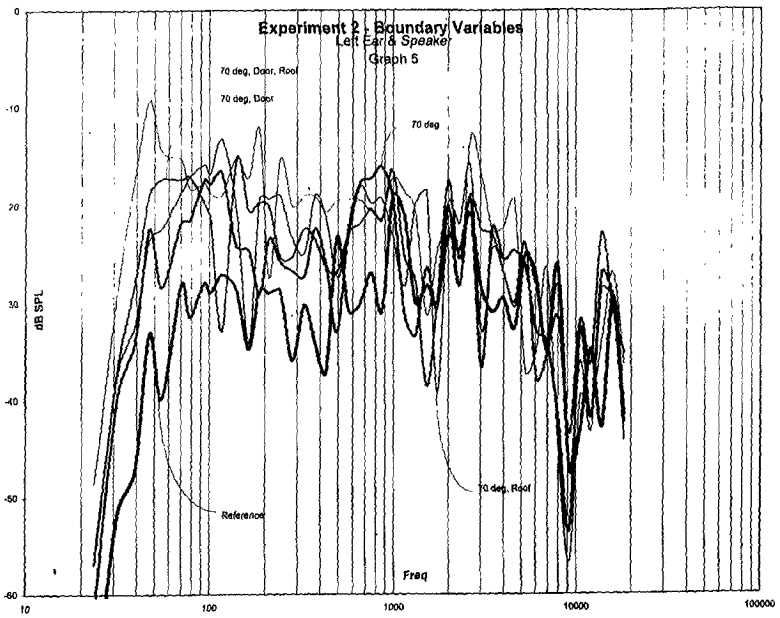
TABLE 36

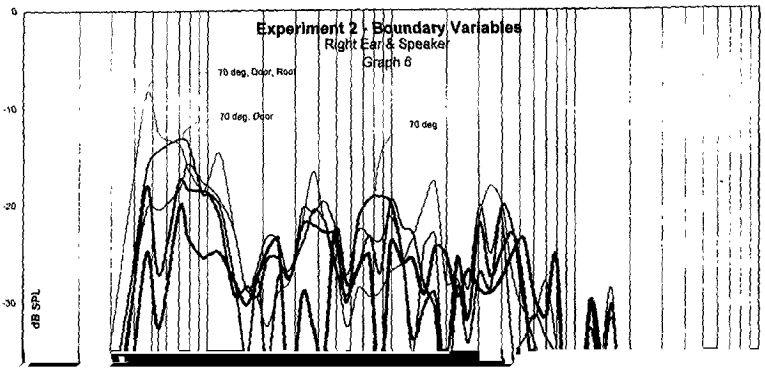

Experiment 1 - Angles
Left Ear & Speaker
Graph 1
65 deg
75 deg
95 deg
180 deg
dB SPL
Time (msec)
-10
-20
-30
-40
-50
-60
10
100
1000
10000
100000

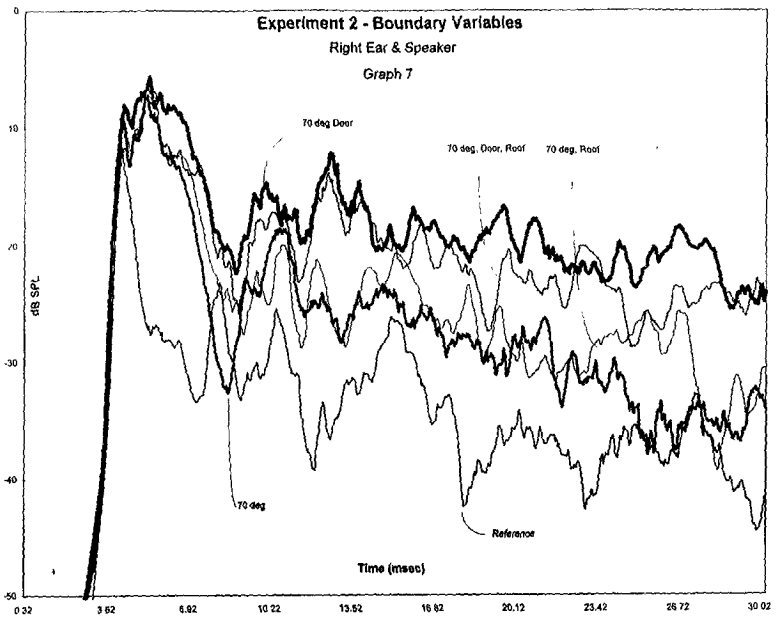

Experiment 1 - Angles
Right Ear & Speaker
Graph 2
55 deg
95 deg
180 deg
75 deg
dB SPL
Time (msec)
-10
-20
-30
-40
-50
-60
10
100
1000
10000
100000

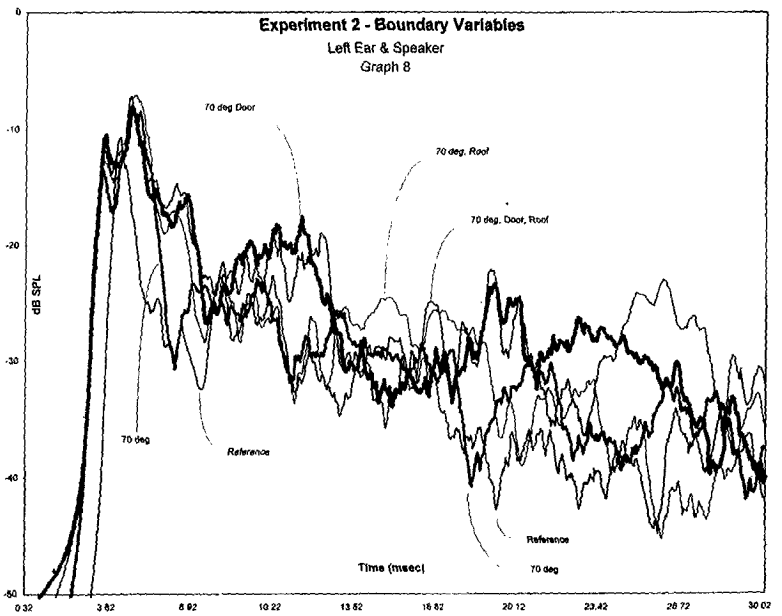

Experiment 1 - Angles
Left Ear & Speaker
Graph 3
75 deg
95 deg
55 deg
180 deg
dB SPL
Time (msec)
0
-10
-20
-30
-40
-50
-60
0.07
3.37
6.43
9.73
13.03

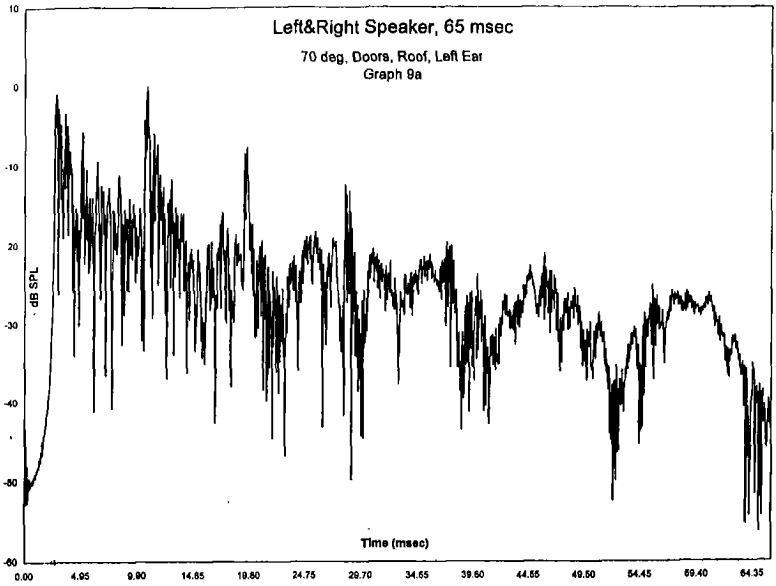

Experiment 1 - Angles
Right Ear & Speaker
Graph 4
75 deg
55 deg
180 deg
95 deg
dB SPL
Time (msec)
0
10
-20
-30
-40
-50
-60
0.07
3.17
6.43
9.73
13.03

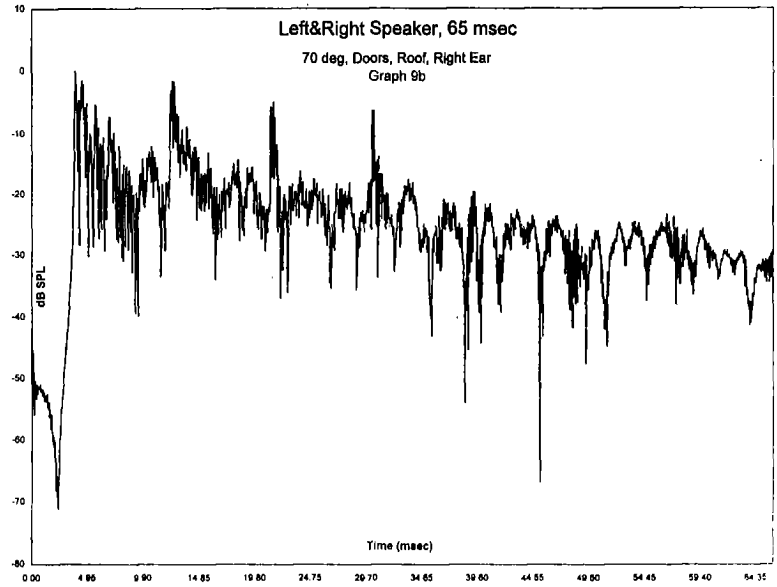

Experiment 2 - Boundary Variables
Left Ear & Speaker
Graph 5
70 deg, Door, Roof
70 deg, Door
70 deg
70 deg, Roof
Reference
dB SPL
Freq
0
-10
-20
-30
-40
-50
-60
10
100
1000
10000
100000

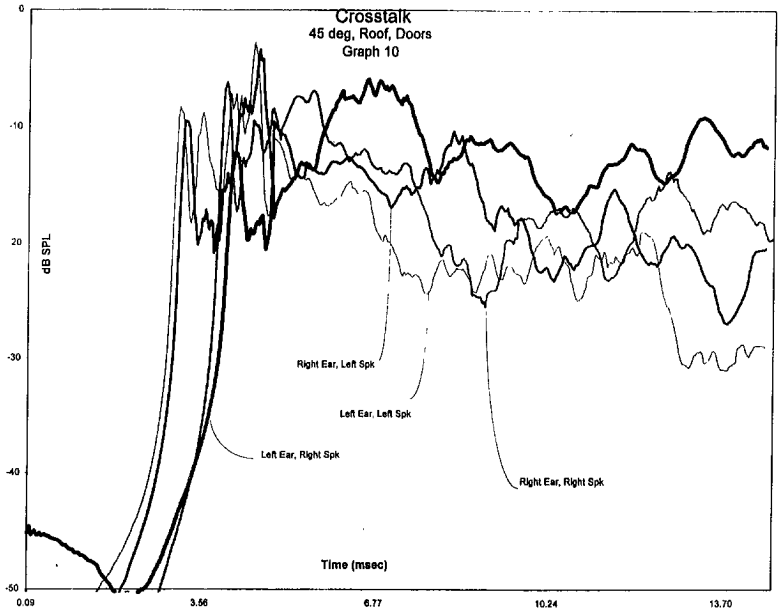

Experiment 2 - Boundary Variables
Right Ear & Speaker
Graph 6
70 deg, Door, Roof
70 deg, Door
70 deg
dB SPL
0
-10
-20
-30

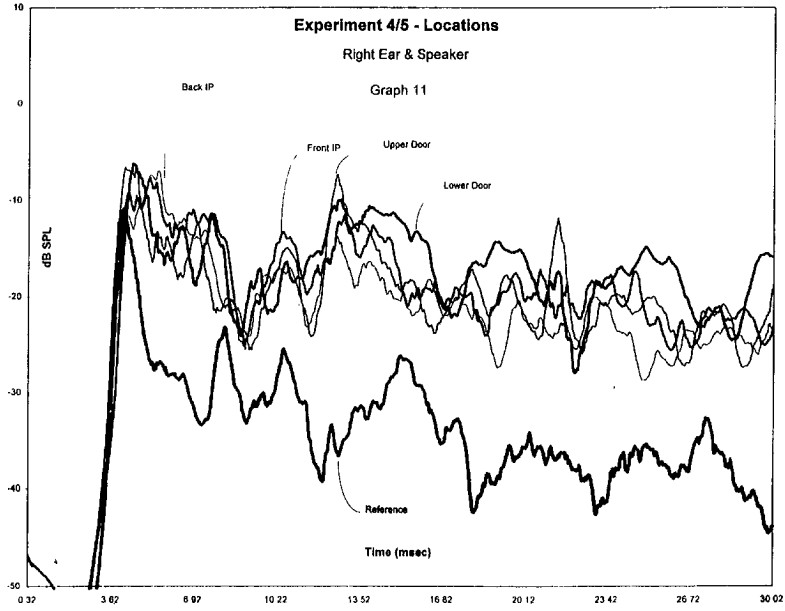

Experiment 2 - Boundary Variables
Right Ear & Speaker
Graph 7
70 deg Door
70 deg, Door, Roof
70 deg, Roof
70 deg
Reference
dB SPL
Time (msec)
0
10
-30
-40
-50
0.32
3.82
6.92
10.22
13.52
16.82
20.12
23.42
26.72
30.02

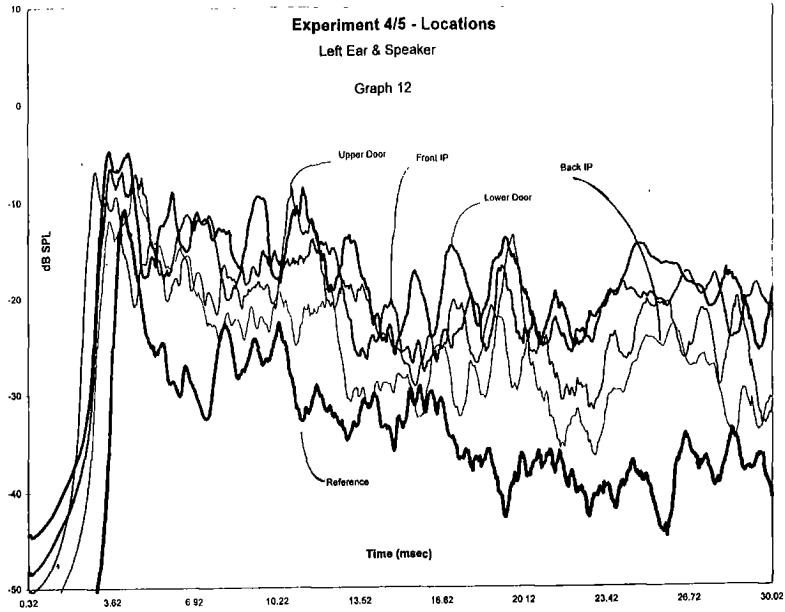

Experiment 2 - Boundary Variables
Left Ear & Speaker
Graph 8
70 deg Door
70 deg, Roof
70 deg, Door, Roof
70 deg
Reference
Reference
70 deg
dB SPL
Time (msec)
0
-10
-20
-30
-40
-50
0.32
3.82
6.92
10.22
13.52
16.82
20.12
23.42
26.72
30.02

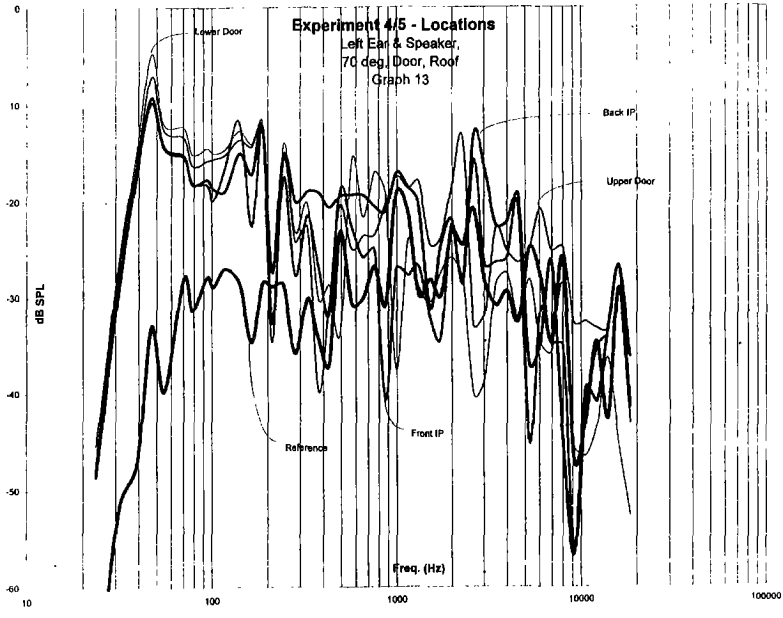

Left&Right Speaker, 65 msec
70 deg, Doors, Roof, Left Ear
Graph 9a
dB SPL
Time (msec)
10
0
-10
-20
-30
-40
-50
-60
0.00
4.95
9.90
14.85
19.80
24.75
29.70
34.65
39.60
44.55
49.50
54.45
59.40
64.35

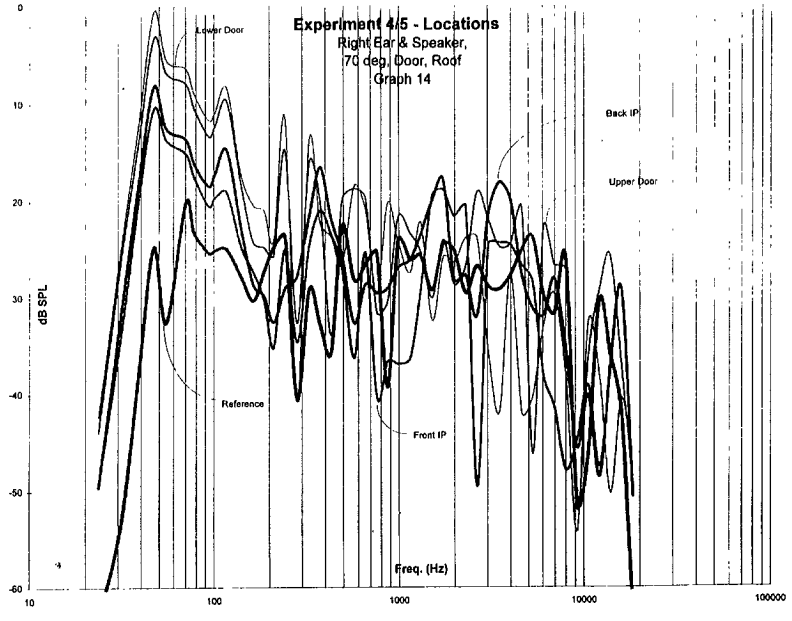

Left&Right Speaker, 65 msec
70 deg, Doors, Roof, Right Ear
Graph 9b
dB SPL
Time (msec)
10
0
-10
-20
-30
-40
-50
-60
-70
-80
0.00
4.95
9.90
14.85
19.80
24.75
29.70
34.65
39.60
44.55
49.50
54.45
59.40
64.35


Crosstalk
45 deg, Roof, Doors
Graph 10
dB SPL
Time (msec)
Right Ear, Left Spk
Left Ear, Left Spk
Left Ear, Right Spk
Right Ear, Right Spk
0
-10
-20
-30
-40
-50
0.09
3.56
6.77
10.24
13.70


Experiment 4/5 - Locations
Right Ear & Speaker
Graph 11
dB SPL
Time (msec)
Back IP
Front IP
Upper Door
Lower Door
Reference
10
0
-10
-20
-30
-40
-50
0.32
3.82
6.97
10.22
13.52
16.82
20.12
23.42
26.72
30.02


Experiment 4/5 - Locations
Left Ear & Speaker
Graph 12
Upper Door
Front IP
Back IP
Lower Door
Reference
dB SPL
Time (msec)
10
0
-10
-20
-30
-40
-50
0.32
3.62
6.92
10.22
13.52
16.82
20.12
23.42
26.72
30.02


Experiment 4/5 - Locations
Left Ear & Speaker,
70 deg. Door, Roof
Graph 13
Lower Door
Back IP
Upper Door
Front IP
Reference
dB SPL
Freq. (Hz)
0
10
-20
-30
-40
-50
-60
10
100
1000
10000
100000


Experiment 4/5 - Locations
Right Ear & Speaker,
70 deg, Door, Roof
Graph 14
Lower Door
Back IP
Upper Door
Reference
Front IP
dB SPL
Freq. (Hz)
0
10
20
30
40
50
60
10
100
1000
10000
100000