

Walking Beats

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THIS IS NOT A DEFINITIVE FINAL REPORT

FORMATIVE evaluation studies like this one often:

- **are conducted quickly**, which may mean
 - small sample sizes
 - expedited analyses
 - brief reports

- **look at an earlier version** of the exhibit/program, which may mean
 - a focus on problems and solutions, rather than successes
 - a change in form or title of the final exhibit/program

Sound and Hearing – Formative Walking Beats

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Study 1 March 2002

PURPOSE

To get a preliminary impression of what visitors hear at the Walking Beats exhibit. Specifically, to determine

1. If visitors can hear the beats (e.g., the 'wow, wow' sound)
 - a. While standing still
 - b. While walking
 - c. When both speakers are emitting the same frequency
2. If visitors can hear a change in the frequency of the beats when they are walking
 - a. towards and away from speaker 1
 - b. compared to when they are standing still
3. If visitors can hear the beats when the 'wow wow' sound is described to them.

METHOD

- Semi-Structured Interviews

Activities and Set-up

- Visitors were recruited from near the Walking Beats exhibit
- Visitors were interviewed one-on-one. There were no group interviews.
- Sheets of paper were used to cover the label to prevent visitors from reading the explanatory text
- An evaluator guided each visitor's interactions with the exhibit. In particular, the visitor was asked to step through the following sequence of activities:
 - Stand and listen at speaker 1
 - Walk away from speaker 1 to speaker 2 and then walk back to speaker 1, and listen
 - Stand and listen for a 'wow wow wow' sound
 - Stand and listen (when both speakers are emitting the same frequency)

At the end of each activity, the evaluator prompted the visitor to describe what s/he heard.

Interview Times

Day	Date	Time of Day
Wednesday	3/13/02	PM
Saturday	3/16/02	PM

Data Collected

- N= 20
- Demographic Breakdown

Age Group	Count
8-12	1 (5%)
13-17	5 (25%)
18-20s	4 (20%)
30s	4 (20%)
40s	4 (20%)
50s	2 (10%)
60+	0 (0%)

Gender	Count
male	12 (60%)
female	8 (40%)

RESULTS

What visitors heard when they were asked to stand still at speaker 1 and listen.

- The analysis looks, in particular, at whether or not visitors described a 'beat' in what they heard. Visitors can describe the beat by
 - mimicking the rhythm
 - using terms such as "oscillation", "waves", "throbbing", "cycles", "rhythm", and "on and then off"
 - gesturing with their hands, (e.g., opening and closing their hands with the beats)
- The tally of the number of visitors who indicated beats in their description :

Stand Still and Listen	
beats	6 (30%)
no beats	14 (70%)

What visitors heard when they were asked to walk and listen.

- The portion looks at whether or not visitors describe a 'beat' in what they heard. The criteria for hearing beats are the same as those used to determine if visitors heard beats while standing still.
- The tally of the number of visitors who indicated beats in their descriptions :

Walk and Listen	
beats	16 (80%)
no beats	4 (20%)

Did visitors hear a difference when walking away compared to walking towards Speaker 1.

- A tally of the number of visitors who heard a difference:

Compare Sound in two directions	
different	13 (65%)
same	7 (35%)

- The types of differences visitors noticed. Note that 8 (40%) described a difference in the beats.

Differences between walking in the two directions	
No difference	7 (35%)
A difference in beats	8 (40%)
longer period	5 (25%)
beats vs. no beats	3 (15%)
Loudness	3 (15%)
No sound when away from Speaker 1	1 (5%)
Unknown – coder cannot determine	1 (5%)

Did visitors hear a difference when walking compared to when standing still

- Tally:

Compare standing still to walking	
different	17 (85%)
same	3 (15%)

- The types of differences visitors noticed with the number of visitors who described a difference in the beats.

Differences between standing still to walking	
A difference in beats	13 (65%)
Beats vs. no beats	8 (40%)
Different period	5 (25%)
No difference	3 (15%)
Unknown – coder cannot determine	2 (10%)
No sound when away from Speaker 1	1 (5%)
Loudness	1 (5%)

Did visitors hear a wow wow sound when prompted.

- Note that the evaluator mimicked the ‘wow wow’ sound and asked if the visitor can hear that sound. This, by itself, is a leading question and its results should not be interpreted outside the context of the larger set of activities.
- Tally. Note, nonetheless, that 3 visitors still did not hear the sound.

Hear ‘Wow Wow Wow’ (w/ prompt)	
yes	17 (85%)
no	3 (15%)

Did visitors hear a wow wow sound when both speakers were emitting the same frequency.

- [This question served as a check to determine if visitors still heard the ‘wow wow’ sound after the evaluator prompted them to listen for it in the preceding question.]
- Tally.

Hear ‘Wow Wow Wow’ (when off)¹	
yes	5 (26%)
no	14 (74%)

¹ Out of n=19. One visitor did not answer this question.

Did visitors hear a difference in sound when there was vs when there was not a frequency offset

- Tally.

Hear 'Wow Wow Wow' (when back on) ²	
yes	18 (100%)
no	0 (0%)

IMPRESSIONS

- Comparisons may help visitors hear the beats
 - 85% visitors heard a difference in the beats when asked to compare what they heard standing still and walking
 - 100% of the visitors heard a difference in the beats when asked to compare no beats (both speakers emitting the same frequency) to beats
- More visitors hear the beats when they walked between the speakers than when they simply stood still and listened. (However, it is possible that visitors were more attuned to the sound because they were first asked to stand and listen. That is, they may detect the beats because of the implicit comparison between standing still and walking.)

RECOMMENDATIONS

- Have visitors initiate the phenomenon. For example, allow the visitor to press a button that will produce the beats. (The button will time-out after a set period.) This sets-up an implicit comparison and allows visitors to compare no beats to beats.
- Also, it is possible that visitors expect to initiate the listening experience. That is, if they press a button, they expect something to happen. With the current design, visitors do not necessarily know that something is happening and, therefore, don't know that they should be listening for something special.
- On the label, recommend making comparisons between what visitors hear in walking in each directions, and in standing still.

² Out of n=18. Visitors who did not believe that there was any difference between the sounds were not included in this count..

Study 2

April 2002

PURPOSE

Background: In the first iteration, Speaker 1 was set up to emit 100Hz and Speaker 2 to emit 101Hz. Together, both speakers produced a 1Hz beat. In this second design iteration, the frequencies from both speakers were changed so that one speaker emitted 200Hz and the other emitted 202Hz, creating a 2Hz beat. It was believed that the 200Hz band was a less busy portion of the sound spectrum at the Exploratorium and, therefore, more visitors would be able to hear the phenomenon.

Goal:

To determine if there is any difference between what visitors hear at the 200Hz setting and what they reported hearing at the previous 100Hz setting, looking, in particular, at the following:

1. If visitors can hear the beats (e.g., the 'wow, wow' sound)
 - a. While standing still
 - b. While walking
 - c. When both speakers are emitting the same frequency
2. If visitors can hear a change in the frequency of the beats when they are walking
 - a. towards and away from speaker 1
 - b. compared to when they are standing still
3. If visitors can hear the beats when the 'wow wow' sound is described to them.

METHOD

- Semi-Structured Interviews

Activities and Set-up. This study uses the same protocol used in the evaluation at the 100Hz setting:

- Visitors were recruited from near the Walking Beats exhibit
- Visitors were interviewed one-on-one. There were no group interviews.
- Sheets of paper were used to cover the label to prevent visitors from reading the explanatory text
- An evaluator guided each visitor's interactions with the exhibit. In particular, the visitor was asked to step through the following sequence of activities:
 - Stand and listen at speaker 1

- Walk away from speaker 1 to speaker 2 and then walk back to speaker 1, and listen
- Stand and listen for a ‘wow wow wow’ sound
- Stand and listen (when both speakers are emitting the same frequency)

At the end of each activity, the evaluator prompted the visitor to describe what s/he heard.

Interview Time

Day	Date	Time of Day
Saturday	4/6/02	PM

Data Collected

- N= 20
- Demographic Breakdown

Age Group	Count
8-12	2 (10%)
13-17	1 (5%)
18-20s	2 (10%)
30s	8 (40%)
40s	4 (20%)
50s	3 (15%)
60+	0 (0%)

Gender	Count
male	9 (45%)
female	11 (55%)

RESULTS

What visitors heard when they were asked to stand still at speaker 1 and listen.

- The analysis looks at whether or not visitors described a ‘beat’ in what they heard. Visitors can describe the beat by
 - mimicking the rhythm
 - using terms such as “oscillation”, “waves”, “throbbing”, “cycles”, “rhythm”, and “on and then off”
 - gesturing with their hands, (e.g., opening and closing their hands with the beats)

These are the same criteria applied to the 100Hz study.

- The tally of the number of visitors who indicated beats in their descriptions:

Stand Still and Listen		
	200Hz	100Hz
beats	7 (35%)	6 (30%)
no beats	13 (65%)	14 (70%)

- There is no significant difference between the proportion of visitors who described beats for the 200Hz setting and for the 100Hz setting.

What visitors heard when they were asked to walk and listen.

- The portion looks at whether or not visitors describe a 'beat' in what they heard while walking. The criteria for hearing beats are the same as those used to determine if visitors heard beats while standing still.
- The tally of the number of visitors who indicated beats in their descriptions :

Walk and Listen		
	200Hz	100Hz
beats	9 (45%)	16 (80%)
no beats	11 (55%)	4 (20%)

- There was a **significant** difference in the proportion of visitors who described beats for the 200Hz and the 100Hz settings ($\chi^2 (1, N = 40) = 5.227$; $p = .022 < .05$). **Less** visitors described hearing beats at the 200Hz setting than at the 100Hz setting.

One possible explanation for this result is that when someone walks quickly from speaker2 to speaker1, his/her walking speed can match the 1Hz beat so that the beat is no longer apparent. It may be easier then to notice 'beats' in one direction and the absence of beats in the return direction, making beats more discernable. On the other hand, at 200Hz, the beat in one direction differs from the beat in the return direction only in speed (it is no longer merely the absence of presence of beats), which visitors may not immediately discern or describe.

Did visitors hear a difference when walking away compared to walking towards Speaker

1.

- A tally of the number of visitors who heard a difference:

Compare Sound in two directions		
	200Hz	100Hz
different	12 (60%)	13 (65%)
same	8 (40%)	7 (35%)

- There is no significant difference between the 200Hz and the 100Hz set-up.
- The types of differences visitors noticed. Note that 10 (50%) described a difference in the beats.

Differences between walking in the two directions		
	200 Hz	100 Hz
No difference	5 (25%)	7 (35%)
A difference in beats	10 (50%)	8 (40%)
longer period	8 (40%)	5 (25%)
beats vs. no beats	2 (10%)	3 (15%)
Loudness	1 (5%)	3 (15%)
No sound when away from Speaker 1	3 (15%)	1 (5%)
Unknown – coder cannot determine	0 (0%)	1 (5%)
No sound when walking	1 (5%)	0 (0%)

- There is no significant difference between the proportion of people who described a difference in the beats between the 200Hz setting and the 100Hz setting.

Did visitors hear a difference when walking compared to when standing still

- Tally:

Compare standing still to walking		
	200Hz	100Hz
different	12 (60%)	17 (85%)
same	8 (40%)	3 (15%)

- There is no significant difference between the 200Hz and the 100Hz setting.
- The types of differences visitors noticed including the number of visitors who described a difference in the beats.

Differences between standing still to walking		
	200 Hz	100 Hz
A difference in beats	9 (45%)	13 (65%)
Beats vs. no beats	3 (15%)	8 (40%)
Different period	6 (30%)	5 (25%)
No difference	4 (40%)	3 (15%)
Unknown – coder cannot determine	1 (5%)	2 (10%)
No sound when away from Speaker 1	2 (10%)	1 (5%)

Loudness	2 (10%)	1 (5%)
No sound when walking	2 (10%)	0 (0%)

- There is no significant difference between the proportion of visitors who reported a difference between the beats heard at the 200Hz setting and the 100Hz setting.

Did visitors hear a wow wow sound when prompted.

- Note that the evaluator mimicked the 'wow wow' sound and asked if the visitor can hear that sound.
- Tally

Hear 'Wow Wow Wow' (w/ prompt)		
	200Hz	100Hz
yes	20 (100%)	17 (85%)
no	0 (0%)	3 (15%)

- All the participants at the 200Hz setting reported hearing the 'wow wow' sound.
- There is no significant difference between the proportion of visitors who reported hearing the 'wow wow' sound for the 200Hz and the 100Hz case.

Did visitors hear a wow wow sound when both speakers were emitting the same frequency.

- Tally

Hear 'Wow Wow Wow' (when off) ³		
	200Hz	100Hz
yes	5 (26%)	5 (26%)
no	14 (74%)	14 (74%)

- Five (26%) of the visitors in the 200Hz case reported hearing the 'wow wow' sound even when both speakers were emitting the same frequency. Four of these visitors explained that the 'wow wow' sound was softer or fainter, yet, still there. The remaining one mentioned the sound was 'deeper'.

Did visitors hear a difference in sound when there was vs when there was not a frequency offset

- Tally.

Hear 'Wow Wow Wow' (when back on)		
	200Hz	100Hz ⁴
yes	18 (90%)	18 (100%)
no	2 (10%)	0 (0%)

³ Out of n=19. One visitor did not answer this question for the 200Hz and the 100Hz case.

⁴ Out of n=18. Visitors who did not report that there was any difference between the sounds when the 'wow wow' was first turned off, were not included in this count..

- The two visitors who did not hear the ‘wow wow’ sound when it automatically came back on were two out of the five visitors who did report hearing the ‘wow wow’ sound even when both speakers were emitting the same frequency.

SUMMARY OF RESULTS

Comparing 200Hz to 100Hz

- On all but one measure, there was no difference between what visitors reported hearing at 200Hz compared to 100Hz.
- There was, however, a significant difference between the proportion of people who described some kind of beat when they were first asked to describe what they heard while walking. Less visitors mentioned hearing a beat at the 200Hz setting as compared to the 100Hz setting.
- At both settings, 90% to 100% of the visitors heard the beats when they were asked to compare what they heard when both speakers emitting the same frequency to what they heard when there was a small frequency offset.

RECOMMENDATIONS

- The 200Hz setting does not provide a significant advantage in hearing beats compared to the 100Hz setting. On the contrary, it may be worse in allowing visitors to easily discern the beats.
- Instead, the results suggest that we should work on other aspects of redesign (including those suggested in the previous report) to restructure the visitors’ experience in order to help them hear the beats.

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