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Temps emprat	4 minuts 47 segons
Punts	11,47/12,00
Qualificació	**9,56** sobre 10,00 (**95,56**%)

Informació

Critical Bands and Masking

In this lab you will work with examples of the following facts/phenomena:

- **Asymmetry of Masking by Pulsed Tones**
- **Determination of Critical Bands by Masking**
- **Critical Bands by Loudness Comparison**
- **Backward and Forward Masking**
- **Influence of Masking Noise on Pitch**

It is important that you review and have at hand the slides on these topics and whatever other material that can be helpful. There are several questions that should be answered before listening to the sound examples. Please, respect this order as this will be an effective way for you to diagnose problems in your understanding of the topics. Then the examples can be helpful to clarify and reflect upon that.

Please, do not try to do this lab in a single session as you will feel burned at the end. It is advisable to plan 3 sessions distributed in different days. You'll get a better time with the activities and learning will be more effective.

Here you will find all the sounds used in the exercises, in case you prefer using them offline.

You will have 2 attempts to answer and the final grade will be the highest of both attempts. As there are several "open" questions to be corrected manually by the professor, the automatic score you could get at best is 7.1 (over 10).

Pregunta **1**

Correcte

Puntuació 1,00 sobre 1,00

Asymmetry of Masking by Pulsed Tones

You are about to listen to a demonstration that uses tones of 1200 and 2000 Hz, presented as 200 ms tone bursts separated by 100 ms. The unchanging masker is part of every pulse, while the test tone, added to every other pulse, decreases in 10 steps of 5 dB_{SPL} each, except the first step which is 15 dB. First the masker is 1200 Hz and the test tone is 2000 Hz, then the masker is 2000 Hz and the test tone 1200 Hz.

According to what you know about masking, your predictions will be that:

Trieu-ne una:

- a. The overall playback level will shift the predictions towards different possibilities
- b. We cannot tell, as it varies a lot from one listener to another
- c. masking will be more effective when the mask is 1200Hz and the signal is 2kHz than the other way round ✔
- d. masking will be more effective when the mask is 2kHz and the signal is 1200Hz than the other way round

Now you can listen to the example. Remember that this demonstration uses tones of 1200 and 2000 Hz, presented as 200 ms tone bursts separated by 100 ms. The unchanging masker is part of every pulse, while the test tone, added to every other pulse, decreases in 10 steps of 5 dB_{SPL} each, except the first step which is 15 dB. First the masker is 1200 Hz and the test tone is 2000 Hz, then the masker is 2000 Hz and the test tone 1200 Hz.

La resposta correcta és: masking will be more effective when the mask is 1200Hz and the signal is 2kHz than the other way round

Pregunta **2**

Correcte

Puntuació 1,00 sobre 1,00

Asymmetry of Masking by pulsed tones

Please, use your knowledge about the way the cochlea works to select the correct statements below.

Trieu-ne una o més:

- a. A masking tone tends to mask less effectively tones that are coded between the oval window and the place for the mask than tones between the place for the mask and the helicotrema
- b. A masking tone tends to mask more effectively tones of higher frequencies than tones of lower frequencies ✔
- c. A masking tone tends to mask more effectively tones that are coded between the oval window and the place for the mask than tones between the place for the mask and the helicotrema ✔
- d. A masking tone tends to mask more effectively tones of lower frequencies than tones of higher frequencies

Les respostes correctes són: A masking tone tends to mask more effectively tones of higher frequencies than tones of lower frequencies, A masking tone tends to mask more effectively tones that are coded between the oval window and the place for the mask than tones between the place for the mask and the helicotrema

Pregunta **3**

Completa

Puntuació 1,00 sobre 1,00

Asymmetry of Masking by pulsed tones

Finally, you can now listen to this file (example6.snd) and **write down the amount of pairs that you can hear in each phase**. In case your predictions were not observed please provide some explanation to that.

I think my predictions were correct, the masking tone is more effective with the higher frequencies than the lower ones, that way when the masking was 1.2KHz the masking was more effective than when it was 2KHz

Pregunta **4**

Correcte

Puntuació 1,00 sobre 1,00

Asymmetry of Masking by pulsed tones

If you would try it again but now using 100Hz and 150Hz, and then, a third experiment using 6 kHz and 6.3 kHz, would you observe the same trend and amount of masking in these two experiments? (it should be easy for you to create the stimuli and test them on your own perception, if you want -in that case, let me know that you did that).

Trieu-ne una:

- a. It would be the same, more or less, as each frequency in the pair is separated the same amount of CB from the other one
- b. As the critical bandwidth for 150 is around 60Hz whereas for 6.3kHz it is around 700Hz, masking should be stronger in the former casecase because both tones are separated less than a CB
- c. As 100 and 150 Hz are closer than 6.3 and 6 kHz, masking would be stronger in the former case than in the latter
- d. As the critical bandwidth for 150 is around 60Hz whereas for 6.3kHz it is around 700Hz masking should be stronger in the latter than in the former case, because both tones are separated less than a CB ✔
- e. No masking will be observed in any of these situations as the involved frequencies are too far away

La resposta correcta és: As the critical bandwidth for 150 is around 60Hz whereas for 6.3kHz it is around 700Hz masking should be stronger in the latter than in the former case, because both tones are separated less than a CB

Pregunta **5**

Correcte

Puntuació 1,00 sobre 1,00

Determination of Critical Bands by Masking

Using tables and/or formulas determine the approximate values for each question.

The CB of 200Hz (measured using Barks) is	100Hz ✔
The CB of 200Hz (measured using ERB) is	less than 50Hz (~47Hz) ✔
The CB of 400Hz (measured using Bark) is	a bit more than 100Hz ✔
The CB of 400Hz (when using ERB) is	more than 50Hz but less than 100Hz (~66Hz) ✔
The CB of 2kHz (measured using Barks) is	300Hz approx. ✔
The CB of 2kHz (measured using ERB) is	240Hz approx ✔
The CB of 4Khz (measured using Bark) is	700Hz approx ✔
The CB of 4kHz (measured using ERB) is	between 456 and 502 Hz approx, depending on the formula ✔
The CB of 7kHz (measured using Barks) is	1300Hz approx. ✔
The CB of 8kHz (measured using ERB) is	between 888 and 1175 Hz approx., depending on the formula ✔
The CB of 16kHz (measured using ERB) is	more than 1700Hz ✔

La resposta correcta és: The CB of 200Hz (measured using Barks) is → 100Hz, The CB of 200Hz (measured using ERB) is → less than 50Hz (~47Hz), The CB of 400Hz (measured using Bark) is → a bit more than 100Hz, The CB of 400Hz (when using ERB) is → more than 50Hz but less than 100Hz (~66Hz), The CB of 2kHz (measured using Barks) is → 300Hz approx., The CB of 2kHz (measured using ERB) is → 240Hz approx, The CB of 4Khz (measured using Bark) is → 700Hz approx, The CB of 4kHz (measured using ERB) is → between 456 and 502 Hz approx, depending on the formula, The CB of 7kHz (measured using Barks) is → 1300Hz approx., The CB of 8kHz (measured using ERB) is → between 888 and 1175 Hz approx., depending on the formula, The CB of 16kHz (measured using ERB) is → more than 1700Hz.

Pregunta **6**

Parcialment correcte

Puntuació 0,47 sobre 1,00

Determination of Critical Bands by Masking

We are going to demonstrate one of the experiments on masking made by Fletcher (1940). In this demonstration, a single 2000 Hz tone is masked by spectrally flat (white) noise of different bandwidths. First the bandwidth is broad, then it is 1000Hz, then 240Hz, and finally 10Hz. In order to determine the level of the tone that can just be heard in the presence of the noise, in each case, we present the 2000 Hz tone in 10 decreasing steps of 5 dB each.

According to what you know about Fletcher experiment and critical bandwidths (find out which is the CB for 2kHz, but you can assume it is 240Hz), select the true sentences below.

Trieu-ne una o més:

- [ ] a. As the bandwidth of the noise increases from 10Hz to 240, the amount of tones that can be heard decreases
- [ ] b. A bandwidth between 100Hz and 240Hz will always maximize the amount of perceived tones
- [x] c. The number of tones that can be heard increases as the bandwidth increases, but only up to a 1000Hz bandwidth ✖
- [ ] d. The number of tones that can be heard decreases as the bandwidth increases, but only up to a 1000Hz bandwidth
- [x] e. If we compare the 500Hz and the 1000Hz bandwidth cases, there will be no difference in the number of tones perceived ✔
- [ ] f. Using a bandwidth of 500Hz or bigger no masking should be observed
- [x] g. A narrow noise bandwidth (e.g. 10Hz) would make possible to hear more tones than a 240 noise bandwidth ✔

Les respostes correctes són: As the bandwidth of the noise increases from 10Hz to 240, the amount of tones that can be heard decreases, If we compare the 500Hz and the 1000Hz bandwidth cases, there will be no difference in the number of tones perceived, A narrow noise bandwidth (e.g. 10Hz) would make possible to hear more tones than a 240 noise bandwidth

Pregunta **7**

Completa

Puntuació 1,00 sobre 1,00

Determination of Critical Bands by Masking

Once you have answered the previous question let's do the experiment! (if you have downloaded the pack with all the sounds, these are cb1-cb5)

First listen to

(10 steps, 5dB each) and take note of the steps you can hear.

Now listen to

and take note of the steps you can hear.

Now listen to

and take note of the steps you can hear.

Now listen to

and note down the steps you can hear.

Finally, listen to

and take note of the steps you can hear.

Please, list below your results and discuss them, according to the predictions you advanced above. In case the predictions have not been fulfilled try to advance some explanation.

10 - normal

6 - broad

6 - 1 khz

6 - 240 hz

8 - 10 hz

As the bandwidth decreases, the number of tones increases

Pregunta **8**

Correcte

Puntuació 1,00 sobre 1,00

Critical Bands by Loudness Comparison

This demonstration provides another method for estimating critical bandwidth. The bandwidth of a noise burst is increased while its amplitude is decreased to keep the power constant. When the bandwidth is greater than a critical band, the subjective loudness increases above that of a reference noise burst, because...

Trieu-ne una o més:

- [x] a. Many more independent neurons are spiking ✔
- [x] b. The energy is passing through more than one auditory filter ✔
- [ ] c. Subjective loudness depends on waveform amplitude only
- [ ] d. Auditory filters are excited by second-order distortions created by the extended bandwidth

Les respostes correctes són: The energy is passing through more than one auditory filter, Many more independent neurons are spiking

Pregunta **9**

Correcte

Puntuació 1,00 sobre 1,00

Critical Bands by Loudness Comparison

A reference noise band, centered at 1000 Hz and with a 15% bandwidth (930-1075 Hz) is followed by a test band with the same center frequency and bandwidth. In subsequent pairs, the bandwidth of the test band is increased in 7 steps of 15% each, while the amplitude is decreased to keep the power constant. When the bandwidth exceeds the critical bandwidth at 1000 Hz, the loudness begins to...

Trieu-ne una:

- ( ) a. Oscillate
- ( ) b. Be harmful
- (•) c. Increase ✔
- ( ) d. Decrease
- ( ) e. Fade

La resposta correcta és: Increase

Pregunta **10**

Completa

Puntuació 1,00 sobre 1,00

Critical Bands by Loudness Comparison

Now you can listen to

(or the loudnesscomparison file from the downloaded pack) and **count which was the step (1-7) in which you noticed the targetted type of loudness change.** You can comment or elaborate on this demonstration, if you want.

The change happened in the 3rd step, but it was barely noticable. Its more clear in the 4th step. Thats because the bandwith is not in the critial bandwith.

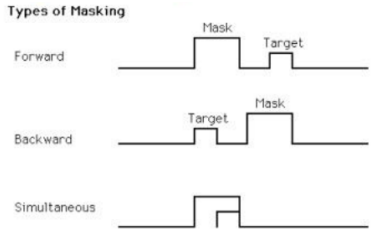
Pregunta **11**

Correcte

Puntuació 1,00 sobre 1,00

Backward and Forward Masking

Masking can occur even when the tone and the masker are not simultaneous.

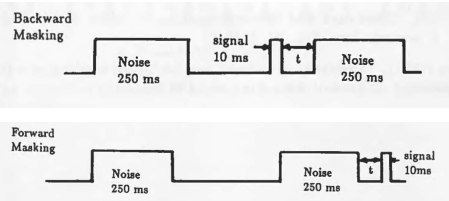


Forward masking refers to the masking of a tone by a sound that ends a short time (up to about 20 or 30 ms) before the tone begins. This effect suggests that recently stimulated sensors are not as sensitive as fully-rested ones.

Backward masking refers to the masking of a tone by a sound that begins after the tone has ended (up to 10 ms later, but the amount of masking decreases as the time interval increases). This effect apparently occurs at higher centers of processing in the nervous system where the neural correlates of the later-occurring stimulus of greater intensity overtake and interfere with those of the weaker, earlier stimulus.

In the backward masking part of this demonstration, we will hear a series of noise-tone-noise. Noise, narrow-band with a center on 2kHz (1900-2100 Hz) and a duration of 250ms, masks 10ms sinusoids at 2kHz. The intensity of the sinusoids decreases 4dB as we progress in time. You will go through 3 phases, according to the time "t" that separates the signal and the noise. In the first phase t is 100ms. In the second phase t is 20ms. Finally, t is 0ms. In each phase, each series of 10 noise-tone-noise (with decreasing tone amplitude) is presented twice.

The forward masking part of this demonstration follows the same structure than above but, in this case, the series is noise-noise-signal, with noise-signal temporal gaps as those used above (t=100ms, 20ms, 0ms).



Under these circumstances which are your predictions?

Trieu-ne una o més:

- [x] a. When the masker is presented at the same time than the signal (0 ms delay) we will hear the signal fewer times than when t > 0 irrespectively of the forward or backwards masking condition ✔
- [x] b. Forward masking will be more effective than backward masking when the gap signal-mask is long (100ms) ✔
- [ ] c. When the masker is presented with a 0ms separation from the signal, we will hear the signal for more times than in the case of t>0
- [ ] d. Backward masking will be more effective than forward masking

Les respostes correctes són: Forward masking will be more effective than backward masking when the gap signal-mask is long (100ms), When the masker is presented at the same time than the signal (0 ms delay) we will hear the signal fewer times than when t > 0 irrespectively of the forward or backwards masking condition

Pregunta **12**

Completa

Puntuació 1,00 sobre 1,00

Backward and Forward Masking

Now you can listen to the demonstration. Your task is to count how many tones can be heard and dump your results below. You can first listen to the series of tones (file "signal")

without any masking noise, in order to get familiar to the stimuli and sequence of presentation.

Now you can listen to the examples and count the number of clicks you can hear (files "forward" and "backward").

Did your experience match your predictions? If not, please try an explanation after dumping your results.

Forward masking is better since i could hear less tones

◄ Audiogram interpretation questionnaire

Salta a...

Lab3: Loudness Lab ►