Confusion Patterns: Average NH Ears

<table>
<thead>
<tr>
<th>Primary Cue Varied</th>
<th>Conflicting Cues Removed</th>
</tr>
</thead>
<tbody>
<tr>
<td>f103 /ka/</td>
<td></td>
</tr>
<tr>
<td>m115 /ta/</td>
<td></td>
</tr>
</tbody>
</table>

Figure 4.16: Comparison between the primary cue varied and removal of the conflicting cues using confusion patterns for f103 /ka and m115 /ta/.

examine the effects of the removal of the conflicting cues on the average NH ears, HI ears from the LEG, and HI ears from the HEG. We want to study the patterns of errors made by an ear, and determine if the errors due to the influence of the conflicting cues. Also, we want to find answer to the key unanswered question, can the removal of the conflicting cues improve speech intelligibility for HI ears as it did for NH ears in Li and Allen study (Li and Allen 2011).

Our analysis begin with the average NH ears and compare the performance between varying the masking of the primary cue and the removal of the conflicting cues as illustrated in Fig. 4.16. The red vertical line in Fig 4.16 separates the two experiments, the varying the masking of the primary cue on the left side of the figure, and the removal of the conflicting cues on the right side on the figure.

The results for f103 /ka/ when the primary cue was removed for both experiments, show more confusions for the first experiment, the varying of the masking of the primary cue. The entropy is reduced when the conflicting cues were removed. The number of confusion errors are reduced from 3 when the conflicting cues were not removed, to 2 when the conflicting cues were removed. For both experiments, the /pa/ token is the dominate confusion.
Figure 4.17: Comparison between the primary cue varied and removal of the conflicting cues using confusion patterns for f103 /ka/.

error. For both experiments, when the primary cue was restore to it original form, one subject made an error at 0 [dB] SNR and no error when the primary cue was amplified by 6 [dB].

As for m115 /ta/, the removal of the primary cue shows the importance of the burst feature in speech perception. The probability of confusion errors are high, due to the removal of the necessary and sufficient cue. The NH ears did not make any errors when the primary cue was unmodified and amplified by 6 [dB]. These result results are consistent with Kapoor study (2012). The NH ears have no or low error because they perform very well when the SNR is above a specific critical low SNR (Singh and Allen 2012, Régnier and Allen 2009). Next, we review f103 /ka/ and m115 /ta/-confusion pattern results for HL ears form the LEG.

The confusion patterns for f103 /ka/ for LEG, is shown in Fig. 4.17. As explained earlier, the red vertical line in this figure, separates the two
Confusion Patterns for m115 /tɑ/: Low Error Group

Figure 4.18: Comparison between the primary cue varied and removal of the conflicting cues using confusion patterns for m115 /tɑ/.

Experiments. When comparing both experiments, every HI ears from LEG, except H10-R, the number of error confusion is the reduced or the same, when the conflicting cues were removed. The confusion errors /pa/ was the dominate error of choice, when the conflicting cues were removed. No HI ears did not reported a /ka/, when the conflicting cues were removed, when the primary cue was restore to its original form (i.e., unmodified token), two HI ears (H102-R, H110-R), reported a confusion error /pa/, at 0 [dB] SNR, when the conflicting cues were not removed. As a result of the removal of the conflicting cues, the same two HI ears were reported a error confusion /pa/, have no error confusion at any SNR. The errors made by H102-R and H110-R, were due to the impact of the conflicting cues. The removal of the conflicting cues, demonstrates that H102-R and H110-R, were able to improve consonant identification for f103 /ka/.

Fig. 4.18 shows the confusion pattern results for m115 /tɑ/ for the HI.
The confusion pattern results for m15 for HI ears from the FGC are shown in Fig. 4.20. There are six challenges for improving speech perception of high frequency sounds. The HI ears from FGC have at least five of these challenges. The HI ears from HGC have four of these challenges.

The HI ears that were removed were those with the most error on the primary cue. The HI ears were removed because the HI ears would not perform well on these cues. The error was increased when the HI ears were removed. The number of error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed. The error was increased when the HI ears were removed.

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Confusion Patterns for f103 /ka/: High Error Group

Figure 4.19: Comparison between the primary cue varied and removal of the conflicting cues using confusion patterns for f103 /ka/.

errors. We expected the error rate to be high, when primary cue was removed and the conflicting cues were not removed. However, that was not the case for two HI ears, H105-L and H107-L. These ears have an error rate below 25% quiet condition. But, the error rate increase to 1 when the conflicting cues were removed. We will revisit H105-L and explain the strategy of identifying m115 /ta/. When the primary cue was unmodified and conflicting cues were removed, the error rate increased for H105-L and H107-L. These ears are depending on the secondary cues, as it was shown when the conflicting cues were not removed they have a much lower error rate. The removal of the conflicting cue can improve speech perception for some HI ears (H106), and is also can degrade speech perception for some HI ears (H105-L, H107-L).
Figure 4.20: Comparison between the primary cue varied and removal of the conflicting cues using confusion patterns for m115 /ta/.

4.3.3 Case Study: Decoding Strategy for Recognizing m115

Earlier we analyzed the confusion patterns for H105-L. In this section, we revisit the results from H105-L for when the primary cue of the m115 /ta/ was removed, and the confusion patterns show the error rate is 0 at 18 [dB] SNR, as shown in Fig. 4.21. The left panel shows the A1-gram of m115 /ta/. The green highlighted region, is the modification parameter for removing the primary cue for /ta/. The blue outline is the possible secondary cues that H105-L used for recognizing m115 /ta/. Additionally, the time and frequency location of the blue outline share similar perceptual cues as the /ða/ sound. The middle and right panels, show the masking of the primary cue's confusion pattern results for the removal and unmodified of the primary cue, respectively. Next we provide an explanation of the H105's
Figure 4.21: HI05-L Decoding Strategy for Recognizing m115 /ta/. The caption explains your hypothesis, that the caption is using the correct cue, rather than the incorrect (NI) cue. This cannot detect the target token, m115 /ta/, with an error rate of 0. Then a 9 [dB] SNR was added to the token, the error rate increased to two-thirds. However, the ear was confused with a competing sound /ba/, in which its cues lie within the offset of the target’s primary cue. Likewise, take for instance the unmodified condition at 18 [dB] SNR, the ear have a two-thirds error rate of identifying the target token. But the same error confusion /ba/ was reported against the target token. Finally, as the SNR decreased, the noise have characteristics that behave as a low pass filter, in which it masks the high frequency components similar to the removal of the primary cue. As a result, as the noise increased, the error rate decreased as a function of the SNR. As the matter of fact, at 0 [dB] SNR, the error rate that was reported for recognizing the target token is 0.

The result inversely behaves like the removal of the primary cue. The /ba/ sound is a mid to high-frequency sound, and when the noise masked the high-frequency components, there still residual remained at the mid-frequency and may be perceived as /ma/.
We hypothesize that it seems likely this scenario for HI05-L recognizing m115 /ta/, when the primary cue of /ta/ was removed, or masked for the case when the primary cue was not removed, the /ta/ was perceived. This event occurred because, 1) the perceptual cues that are associate at the onset of the primary cue (i.e., blue outline in Fig. 4.21), are the necessary and sufficient secondary cues that HI05-L uses for recognizing the /t/ sound, and 2) due to the masking effects of the noise, the primary cue and conflicting cues were masked, and the token behaves more like m115 /ta/ when the primary cue was removed. When the strength of the primary cue, and/or conflicting cues, are reduced due to the noise masking effects, the strength of the primary’s offset play a significant role for HI05-L for not reporting sounds that are associate with the conflicting cues. This case study is a perfect example that demonstrates that the HI ears are not only uses the primary cue for correct recognition, but also uses the secondary cues.

I can't understand what you're saying.

What seems to be going on is the subject is taking the /t/ as cue (blue box) as it is not removed, nor masked due to its high energy, so the subject is using /t/ as the /k/ cue.