ON THE CONCEPT OF THE CRITICAL BAND

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Around each frequency a critical band can be found, in which signals can affect the perception of that frequency. The critical band can be considered to be a measure of the fusion (integration) of sounds, or as the minimum frequency difference for separation (resolution) of signals. In audiology the second notion is to be preferred, since different critical bands may carry different — and therefore important — parts of the information. We have succeeded in measuring this aspect of hearing in a way only slightly influenced by secondary phenomena. Thresholds of tones have been determined at a frequency inside a variable gap in a wide-band noise signal. The data support the critical-band values as reported by Feldtkeller and Zwicker. Fletcher's values should be disregarded entirely; these are derived from only one type of experiment, an experiment that has been demonstrated to be insufficient.

At the largest gap widths employed, masked thresholds do not decrease as deeply as one might expect on the basis of a rigourous critical-band model. The remaining masking may be explained as a large-distance effect as if the responsible mechanism operated as a realistic linear filter. The equivalent filter response has been determined from the data; it ressembles that of a third-order band-pass filter. We consider such filter responses as associated to auditory receptors, each receptor being the unit governing the detection of a given test tone. Together covering the auditory frequency range, each receptor is sensitive over a limited frequency range,. The associated filter response expresses the auditory frequency resolution.

In further experiments we were led to the conclusion that the ear selects the most favourable receptor in order to attain the lowest possible threshold. With such an extended model it even becomes possible to describe the extraordinary small size of the frequency D.L.

If the critical band really reprensents a physical limitation of the information-transmission-capacity of the ear, it is interesting to study these phenomena in patients with defective hearing. Our preliminary results show that, apart from difficulties associated with poor intensity discrimination, patients with central lesions most often exhibit normal resolution in the frequency domain. On the other hand, in cases of cochlear lesions the receptor response curve is often wider than normal, indicating poor frequency resolution. Apart from the clinical use of these data, they are suggestive as to the site of the underlying mechanism.

A PROPOS DE LA NOTION DE LA BANDE CRITIQUE

La bande critique (critical band, Frequenzgruppe) aurait plus d'utilité si on la considérait comme un index de résolution de fréquence en audition. Nous avons déterminé le seuil de masquage pour un ton qui se trouve situé au milieu d'une région de fréquence où l'intensité spectrale du bruit masquant a été abaissée. On peut conclure de ces expérimentations que la bande critique est bien décrite par la caractéristique d'un filtre passe-bande du troisième ordre.

Cette notion peut se traduire, du point de vue clinique, pour déterminer le pouvoir de résolution de fréquence pour les patients atteints d'une surdité de perception; en effet dans les lésions centrales la caractéristique de la bande critique est souvent presque normale, alors que, dans plusieurs cas de lésions cochléaires, elle parait étendue à une plus grande bande de fréquences. A propos de ces données nous voulons suggérer que le mécanisme responsable se trouve dans la cochlée et n'utilise pas des processus nerveux centraux.

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