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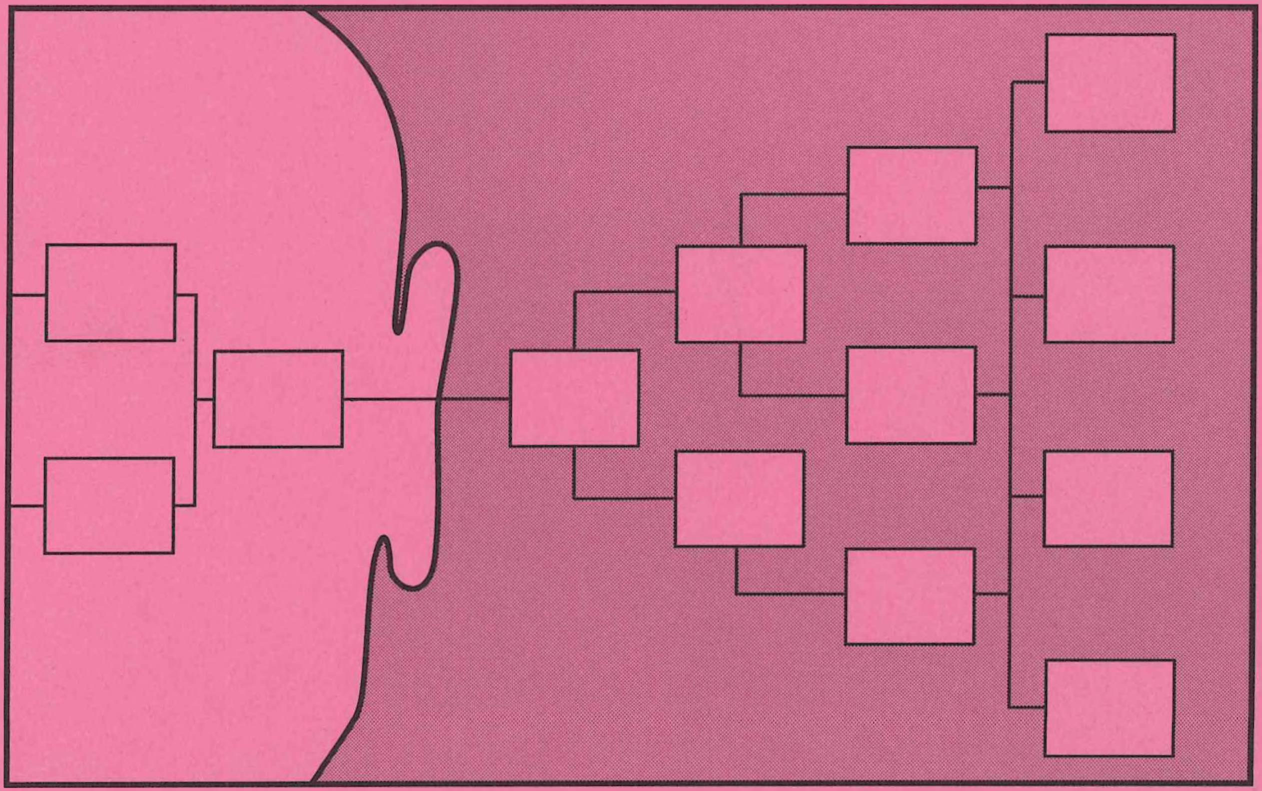

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ACOUSTIQUE CANADIENNE publie des articles arbitrés et des informations sur tous les domaines du son et des vibrations. On invite les auteurs à proposer des manuscrits rédigés en français ou en anglais concernant des travaux inédits, des états de question ou des notes techniques. Les manuscrits doivent être soumis au Rédacteur en Chef en 2 exemplaires. Les instructions pour la présentation des textes sont exposées à la dernière page de cette publication.

Graphic Design / maquette: S. Tuckett

EDITORIAL

This issue sees Canadian Acoustics under the editorial control of a new team, with Raymond Hétu of University de Montréal as editor-in-chief, and Murray Hodgson of University of Sherbrooke as assistant editor. Tim Kelsall of Hatch Associates continues as advertising editor. I am sure everyone joins us in thanking John Bradley and Gilles Daigle for their considerable work in making the journal what it is today, and in wishing them success with the research to which they will now be able to devote themselves more fully. I am sure everyone also looks forward to the flood of articles in Canadian Acoustics which will inevitably result!

We take the reins with considerable enthusiasm and a little trepidation. While being preoccupied with learning the trade and producing our first issue, we are also conscious of an inevitable desire to stamp our own mark on the journal. Certainly, a change of editorial team should be a time of re-evaluation. Fundamentally, this involves questions of what direction the journal should take. there will be more on this in the next issue. More immediately, you can expect a few changes. First, and thanks to the additional amount of money voted by the board of directors for each issue, we plan a change of style and format Secondly, we are looking for a new editor - anyone interested? Finally, we are introducing some new features, articles reviewing canadian acoustics activities, and View-point, where you can state your opinions on matters of concern to us all. All this aims to improve the journal and promote acoustics in Canada. We hope you will like it. If not, let us know. Wish us luck . We wish you happy and interesting reading.

EDITORIAL

La préparation de ce numéro de l'Acoustique canadienne a mené par une nouvelle équipe éditoriale, avec Raymond Hétu de l'Université de Montréal à titre de rédacteur en chef et de Murray Hodgson de l'Université de Sherbrooke à titre de rédacteur. Tim Kelsall de la firme Hatch Associates continue d'assumer la responsabilité de la publicité. Vous partagerez sans doute tous notre désir de remercier John Bradley et Gilles Daigle pour la somme de travail considérable qu'ils ont consacré à notre périodique. Nous leur souhaitons tout le succès qu'ils peuvent espérer des travaux de recherches auxquels ils peuvent maintenant se consacrer pleinement. D'ailleurs, nous anticipons tous le flot d'articles qui en résultera pour l'Acoustique canadienne!

Nous prenons les rennes avec beaucoup d'enthousiasme. Tout en nous apprenant le métier et en produisant notre premier numéro, nous sommes conscients de vouloir déjà imprimer notre marque dans le périodique. C'est aussi une excellente occasion de ré-évaluation, en soulevant la question des grandes orientations du périodique. Le prochain numéro fera davantage état de cette problématique. Dans l'immédiat, vous pouvez prévoir certains changements mineurs. Grâce à l'appui financier voté par les directeurs-ices, nous envisageons certaines modifications dans le style et le format. Par ailleurs, on est à la recherche d'un autre rédacteur; toute personne intéressée est invitée à se joindre à l'équipe de rédaction. Enfin, nous introduirons quelques nouveautés, tels des articles faisant état des activités en acoustique au Canada ainsi qu'une chronique - Point de vue - dans laquelle vous pouvez exposer vos opinions sur des sujets d'intérêt commun. Nous expérons que cela contribuera à améliorer le périodique et à promouvoir l'acoustique au Canada. Vos commentaires seront toujours les bienvenus. Bonne lecture!

ACOUSTICS WEEK **Sandman Inn, Calgary**

1987

SEMAINE D'ACOUSTIQUE **5 OCT - 9 OCT**

Major Workshops (Monday, 5 Oct. - Tuesday, 6 Oct.)

1. The issues and impact of the growth environmental and industrial noise guidelines.
   Diedre Benwell
   John Throckmorton
2. New horizons with the growth of computer application software for acoustics.
   Michael Mattson

Followup Technical Workshops (Wednesday, 7 Oct. - about 3 hours)

1. Analysis techniques in animal and human physiology.
   Jos Eggermont
2. Computer applications in speech related research.
   Donald Jamieson
3. The development of rural noise guidelines.
   Eugene Bolstadt

Paper Sessions (Thursday, 8 Oct. - Friday, 9 Oct.)

Events

1. General Meeting Thursday evening, 8 Oct.
2. Annual Banquet Thursday evening, 8 Oct.
3. Tour of Calgary Centre of Performing Arts with discussion of new major pipe organ. (Date not yet fixed.)
4. Attendance at concert by the Calgary Philharmonic Orchestra with Julian Weir playing the new organ, Friday, 9 Oct.
5. Other events are in planning stage.

* * * * * * *

Abstracts for full papers may still be sent and we will attempt to review them as quickly as possible. However, the deadline for the final paper cannot be changed. Thus late submitters may have little time between the abstract acceptance and the required submission of the formal paper.

Costs

1. Single, double or twin rooms will be reserved at $55/night. (You are unlikely to better this price in any good hotel.) Write:

   Attn: Glenda Hunter (CAA)
   Sandman Hotels & Inns
   888 7th Ave. S.W.
   Calgary, AB

2. Fees for the major workshops and technical workshops will be dependent upon enrollment. However, it is anticipated that with enrollments in excess of 10, the major workshops will be under $150, while the technical workshops will be under $50. Substantial enrollment will bring these fees down a great deal.

3. Registration fees will be:

	Members	Non-members*	Students
Before June 15	90	110	35
After June 15	115	135	50

*Membership is $15

4. It is anticipated that the annual banquet will be approximately $35.

5. Whether there will be luncheon tickets and what their price would be is not yet determined.

6. There will be charter airfare from Toronto.

7. Tickets to the Calgary Philharmonic will be $23.00.

Registration Form

		Before June 15 ☐	After June 15 ☐
I am:	Member ☐	$90	$115
	Non-member ☐	$110	$135
	Student ☐	$35	$50

I intend to: Give a paper ☐
Have a poster session ☐

Accompanied by ______ non-registrants.

I am staying at the Sandman Inn ☐

I wish to attend a major workshop ☐
Enclosed is a $30 deposit to hold my place ☐

1. Noise guidelines ☐
2. Computer software ☐

I wish to attend one or more technical workshops ☐
Enclosed is a $10 deposit for each to hold my place ☐

1. Physiology ☐
2. Speech ☐
3. Research guidelines ☐

Note: If workshop is cancelled, money will be refunded.

I plan to attend the banquet ☐ with ________ guests.

I would like there to be luncheon tickets ☐

I plan to attend the CPO concert ☐

I am sending $________ for ________ tickets. (Note that the number of CPO tickets may be limited.)

I am interested in a charter ☐ Date: ____________________

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APPLICATION OF MONAURAL FUSION TECHNIQUE FOR EXPLORATION OF POTENTIAL INTERACTION BETWEEN CHANNELS OF PHONETIC ANALYSIS

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ABSTRACT

Interaction of detectors in speech recognition has been investigated using a monaural superposition technique which permits simultaneous probing of individual detectors. Waveforms of two natural speech tokens of similar temporal patterns are mixed after careful period-by-period alignment. A stimulus continuum is generated by varying the relative amplitude of the two components. In monaural presentation certain speech stimulus types fuse in perception so that only one of the two components of the mixed stimulus is perceptible. Identification experiments have been conducted on the /bæ/-/dæ/, /ra/-/la/, and /i/-/æ/ continua. For all tested consonant pairs monaural fusion takes place. In the case of the vowels tested, fusion has not been observed. Instead, both component vowels are perceived simultaneously even for extreme level differences of 26 dB. This suggests that detectors responsible for recognition of vowels are essentially independent, while detectors for stop consonants interact in an inhibitory manner.

SOMMAIRE

L'interaction entre des détecteurs de traits phonétiques a été investiguée à l'aide d'une technique de superposition monaurale de paires de syllabes de type CV ou V produites par une voix humaine. La durée des syllabes dans chaque paire est semblable. Après un alignement des périodes correspondantes dans les deux syllabes, les deux signaux sont additionnés. Un continu de stimuli est créé en variant l'amplitude relative des deux composantes. Quand certains des stimuli composés sont présentés de façon monaurale, seulement une des deux composantes est perceptible. Les continus /bæ/-/dæ/, /ra/-/la/ et /i/-/æ/ ont été utilisés dans des tests d'identification. Dans le cas des stimuli de type CV les auditeurs ont eu l'impression d'un stimulus simple, tandis que dans le cas des stimulus de type V les deux composantes restaient perceptibles, même quand la différence de niveau était de 26 dB. Ceci suggère que les détecteurs de voyelles agissent de manière indépendante, tandis que l'excitation du détecteur d'une consonne réduit le niveau d'excitation des détecteurs d'autres consonnes.

1. INTRODUCTION

From the results of various experimental paradigms used for investigation of categorical perception, such as storage of speech stimuli in auditory and phonetic memory, masking, dichotic listening, and reaction time in identification and discrimination, it appears that vowels are perceived differently from consonants. An extensive review of this topic can be found in Studdert-Kennedy (1976). These differences seem to be related to the differences in temporal and spectral structures of consonant and vowel stimuli and to differences in the perceptual processing of these types of stimuli. Similarly, as will be seen in the following experiments, a monaural superposition technique, described below, shows fundamental perceptual differences between selected consonants and vowels.

It has been proposed in speech perception studies that speech recognition in channels of phonetic analysis is mediated by acoustic or phonetic feature detectors. The major support for this idea has come from selective adaptation studies. Shift of the category boundary toward the adapting stimulus on a two-category continuum can be explained as a result of desensitization of one of the two detectors which span the continuum (Eimas and

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* This paper is based on parts of the Ph.D. dissertation submitted by D.C. Stevenson to the Faculty of Graduate Studies and Research of the University of Alberta. His present address: MacDonald, Dettwiler and Associates, Vancouver, B.C., Canada.

Corbit, 1973; Miller, 1975, 1977; Ainsworth, 1977). Such a two-detector model has been quantitatively formulated by Elman (1979) and its properties further analyzed by Rozsypal, Stevenson, and Hogan (1985).

For the experimental hypothesis, it has been assumed that the perceptual differences between consonants and vowels are due to different organization of the system of channels of analysis. Speech signals for which monaural fusion takes place are presumed to be processed by channels interacting in an inhibitory way. That is to say, when the excitation of one of the two channels only slightly exceeds that of the other channel, then only the stronger stimulus is heard. Hence it is presumed that the channel more strongly excited inhibits the response of the other channel. On the other hand, channels of analysis dedicated to detection of non-fusing stimuli can be regarded as essentially independent.

To allow testing of this hypothesis, a monaural superposition technique was developed to determine the degree of interaction between posited channels of phonetic analysis for different speech types. To make a distinction between the technique and the resulting perceptual effect, the technique will be referred to as "monaural superposition." The term "monaural fusion" will be reserved for the perceptual phenomenon.

The technique is a modification of the dichotic fusion technique used by Halwes (1969), Ades (1974), Cutting (1976), and Repp (1976, 1980). For the monaural superposition technique, the stimuli are generated by mixing, in varying amplitude ratios, two or more tokens from distinct phonetic categories. Presentation is monaural. Waveforms of the mixed stimulus components must have a similar temporal structure so that they can be exactly aligned in time. In a two-category identification task, the composite stimulus is a mixture of an amplitude weighting α for one speech signal plus a weighting $(1-\alpha)$ for the other. The weighting parameter α defines a continuum which ranges from $\alpha=0$, representing the original token from one speech category, to $\alpha=1$, representing the other.

The resulting waveform contains the phonetic cues for both of the component speech categories. Each of the detectors involved is simultaneously stimulated by its respective typical speech input. In the experiments with consonant stimuli reported here, when the components are combined with approximately equal weight, the resultant signal is found to be perceptually ambivalent, and is perceived as either one or the other stimulus component.

2. EXPERIMENTAL METHOD

2.1 Subjects

Five volunteers, faculty members and graduate students with some phonetic training, including two of the authors, served as subjects in this study. Audiometric examination of the subjects revealed no marked hearing loss in the relevant frequency range below 4 kHz.

2.2 Generation of the test stimuli

All signal processing and subject testing were carried out with a special-purpose operating system designed for the DEC PDP-12 laboratory computer (Stevenson and Stephens, 1978). The quality of the resulting stimulus depends on the precision of the alignment. Misalignment of individual glottal periods may result in a detectable low-frequency noise in the mixed stimulus. The temporal alignment procedure will be described here briefly with the stimulus pair /bæ/-/dæ/ as an example. For more details, including spectrograms of the mixed stimuli, the reader is referred to Stevenson, Hogan, and Rozsypal (1985).

Stimuli /bæ/-/dæ/ have similar temporal and formant structure. Overall durations of both stimuli and the durations of initial formant transitions are comparable. When the same following vowel is chosen, both sets of formant trajectories asymptote toward the same target frequencies.. Both stimuli have a rising F1 onset transient. They are distinguished primarily by the initial frequency and direction of F2 and F3 transitions both of which rise for /bæ/ and fall for /dæ/. In reference to different segments of the stimuli, the following notation is adopted: /bæ/ stands for the entire CV syllable, /b/ for the initial nine periods containing the formant transitions extracted from that syllable, and /æ/ for the tenth through the last pitch period of the CV waveform comprising the steady-state vowel.

The feasibility of aligning the stimulus components depends in the first place on obtaining tokens of the two test stimuli with sufficiently close frequency and time parameters. A male native Canadian English speaker recorded multiple tokens of all of the stimulus components with fundamental frequencies of about 100 Hz and approximately equal steady-state vowel formant values. One pair, /bæ/ and /dæ/ for the first experiment, was then selected with the best matching fundamental frequencies and steady state formant values determined from spectrograms and waveform plots. The chosen tokens were digitized. The first nine glottal periods of these two waveforms were extracted and stored separately. The /b/ waveform with the higher fundamental frequency was arbitrarily selected as the "standard" segment for the period alignment. The signals /b/ and /d/ were segmented into individual pitch periods at zero crossings preceding the major peak. Each /d/ period was then cross-correlated with its corresponding /b/ period in order to determine the temporal shift for best match. The trailing ends of the aligned /d/ periods were then truncated to match the length of their /b/ counterparts. A new /d/ formant transition signal was created by concatenating these time-shifted and truncated /d/ periods. Thus the pitch contours of the resulting /d/ waveform and the original /b/ waveform optimally matched on a period-for-period basis. Formant frequencies are not affected by this signal operation. The new /d/ was then scaled in amplitude so that its computed overall intensity was equal to that for the /b/.

These /b/ and /d/ signals, together with the steady-state vowel /æ/ extracted from /bæ/, were used as the basic components for construction of the test stimuli. The two formant transitions were added together point by point with a relative amplitude weighting α/b/+(1-α)/d/ and then concatenated to the steady-state vowel nucleus /æ/. The linear weighting of the /b/ and /d/, along with the convergence of both of these waveforms to the same steady-state vowel ensured continuity of the amplitude envelope of the mixed formant transitions and the vowel nucleus.

Exactly the same procedure was followed for the construction of the /ra/-/la/ stimuli. In the case of the /i/-/æ/ vowel stimuli, the full length of one vowel signal was matched period-by-period to the other vowel signal in identical manner used for aligning of segments containing the formant transitions of the consonantal stimuli.

2.3 Apparatus

The stimuli were recorded in an acoustically isolated chamber using a Sennheiser MD 421N microphone and a TEAC AR-70 tape recorder. The same tape recorder was used also for subsequent digitization of the audio recordings by a DEC PDP-12 computer. A Rockland Series 1520 Programmable Dual Hi/Lo Filter with 24 dB/oct slope was used as an anti-aliasing filter, set to the Butterworth characteristics and pass-band from 70 to 7000 Hz. The sampling rate was 16 kHz and the resolution of the A/D and D/A converters was 10 bits. For technical considerations of digital processing of speech signals see Rozsypal (1976).

The stimuli were delivered to a remote listening station over lines with a signal-to-noise ratio better than 55 dB and then smoothed by the same filter identically set as for anti-aliasing. The output of the filter was amplified by a Braun CSV 250 power amplifier modified for headphone output. Its output was fed into a bus which serviced Telephonics TDH-49 headphones in MX-41/AR cushions. The frequency response of the complete audio channel was 160-4000 Hz ±1 dB (100-5000 Hz ±2 dB). The listening level was set at 80 dB SPL for a continuous 1000 Hz sine wave with an RMS voltage equal to the RMS voltage for the steady-state vowel /æ/. The calibration of the apparatus was aided by the Brüel & Kjær Beat Frequency Oscillator 1022, Artificial Ear 4153, Pistonphone 4230, and Level Recorder 2307. The listening level was calibrated prior to each testing session.

The procedure for generating the stimuli was as follows: The pair of formant transitions of the two signals being combined were amplitude scaled by factors of α and (1-α), respectively. The value of α for each presentation was read in from a file of 21 randomized numbers representing equal steps of $\Delta\alpha=0.05$ from 0 to 1. The scaled formant transitions were added together point-by-point and concatenated to the steady-state vowel.

2.4 Testing procedure

The stimuli were presented on-line, monaurally to the right ear, to one or more subjects in a sound-treated room. The time required for the loading, scaling, addition and concatenation of the stimulus segments was approximately 1.5 s. After the stimulus was played back, response switches at the remote listening stations were monitored until all subjects responded. The response was a choice from two alternatives: "bæ" and "dæ" for the identification of stops, "ra" and "la" for liquids, and "i" and "æ" for vowels. The program then proceeded with the next presentation. The interstimulus interval was thus somewhat variable, averaging about four seconds.

The presentation was divided into blocks of 25 stimuli. All 21 conditions were exhausted before a new randomization cycle was started. A one-second 1000 Hz tone was played back at the end of each block followed by five seconds of silence. In a test run, each one of the α conditions was presented ten times for a total of 210 stimuli. The first block contained 15 practice stimuli. A testing session lasted about 20 minutes. Each subject participated in three testing sessions, held only once in a given day.

3. IDENTIFICATION RESULTS

A series of experiments was carried out to determine whether monaural fusion takes place for the following three speech categories: stops, liquids, and vowels. Except for the vowel identification experiment, the presentation paradigm in the following experiments was the same.

3.1 Identification of stops /bæ/-/dæ/

The first experiment involved identifications of the /bæ/-/dæ/ stimulus pair. The endpoint stimuli, being natural speech tokens of /bæ/ and /dæ/, always resulted in 100% correct identifications. Throughout the rest of the continuum the stimuli were perceived by all five subjects as clear instances of either /bæ/ or /dæ/. Each of the five subjects was tested three times. Identification results for the five subjects are shown in Figure 1, where the "bæ" identification rate is plotted as a function of an amplitude ratio of the /b/ component to the /d/ component expressed in decibels by the formula $20\log[\alpha/(1\text{-}\alpha)]$. None of the identification trials with stop stimuli presented any difficulty for the subjects. They heard only one clear representation of one of the stimulus components. No phonetic intrusions were reported in post-test interviews.

3.2 Identification of liquids /ra/-/la/

A stimulus continuum constructed from tokens of /ra/ and /la/ was presented to the subjects. The results are plotted in Figure 2. Although the identification functions appear as steep as in the stop consonant experiment, the subjective impression in this case was different. Whereas in the stop experiments only one of the two competing stimuli was consistently evident, for the /ra/-/la/ experiment there were cases observed where one stronger stimulus was perceived simultaneously with the other stimulus of lower loudness in the background. In post-test interviews, two of the subjects reported hearing on very few occasions additional perceptual blends: one heard either "bra" or "bla" and the other "bla".

3.3 Identification of vowels /i/-/æ/

Following the stimulus generation procedure of the preceding experiments, vowels /i/ and /æ/ were mixed. Initially, the response paradigm used in the consonant identification experiments was also applied for the testing of vowel identification. It became immediately obvious that this paradigm was unsuitable for the testing of vowels. The stimuli just simply did not fuse perceptually and, therefore, the subjects were unable to give a single category response. They heard both stimulus components simultaneously, except for the two extreme cases of $\alpha=0$ or $\alpha=1$ representing the original single vowel stimuli. This was verified with informal up-and-down runs of the amplitude parameter α in which the subjects were required to state whether they heard one or two of the vowel stimuli. No identification curves could thus be constructed. The vowel with the higher amplitude factor determined the stronger percept, which was accompanied by a simultaneous weaker percept of the other vowel. Since the step size was $\Delta\alpha=0.05$, this means that the weaker vocalic stimulus was audible down to at least 26 dB below the stronger one.

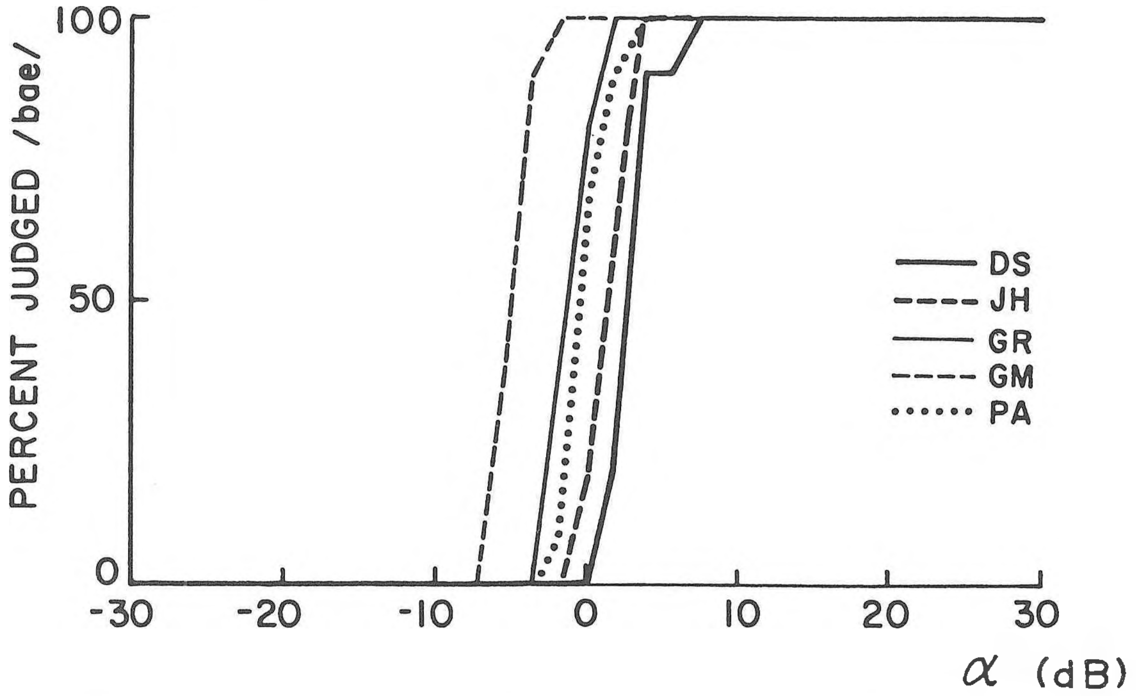


Figure 1. Identification by five subjects of the composite stimulus /bæ/-/dæ/ as a function of the amplitude ratio α of the /b/ to /d/ component expressed in decibels.

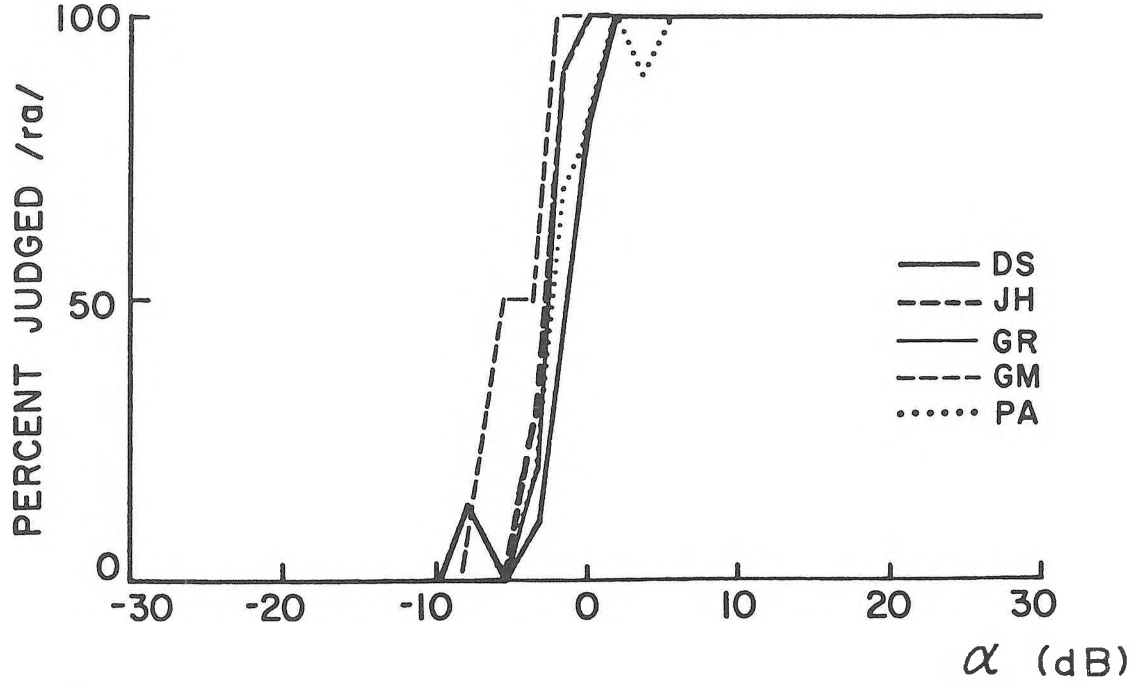


Figure 2. Identification by five subjects of the composite stimulus /ra/-/la/ as a function of the amplitude ratio α of the /r/ to /l/ component expressed in decibels.

4. DISCUSSION

The evidence from the limited number of stimulus pairs tested in this study suggests a fundamental difference between the perception of vowels and stop consonants. This difference can be viewed as being due to the organization of the decision stage of the recognition mechanism. In the case of stops, monaural fusion takes place consistently since only one of the mixed stimuli is perceived. The decision stage of the auditory analyzer selects one and only one of the alternatives. Thus it appears that the channels of phonetic analysis inhibit each other so that only the channel with the stronger stimulation is selected. On the other hand, stimuli such as vowels, for which monaural fusion is not observed, can be hypothesized as being processed by separate and essentially independent auditory channels. Each vowel component of the composite stimulus is independently recognized provided it exceeds a given detection threshold in its channel.

The results further validate the recurring idea in speech perception literature (Studdert-Kennedy, 1976) that there is a systematic difference in the processing of vowels and consonants. The validation stems from the fact that the difference between vowels and consonants appears consistently across various experimental paradigms mentioned in the introduction. Notably, the results for the stop, liquid, and vowel classes of speech sounds vary in a parallel manner to those in categorical perception. As the perception of stops, liquids, and vowels varies from most to least categorically perceived, so also the degree of interaction between the channels of analysis decreases correspondingly from stops through liquids to vowels. A result of a similar nature has been reported by Jamieson and Cheesman (1986) who found in a selective adaptation experiment that specific cues to voiced and voiceless consonants are processed by distinct auditory mechanisms located at different levels of the auditory system.

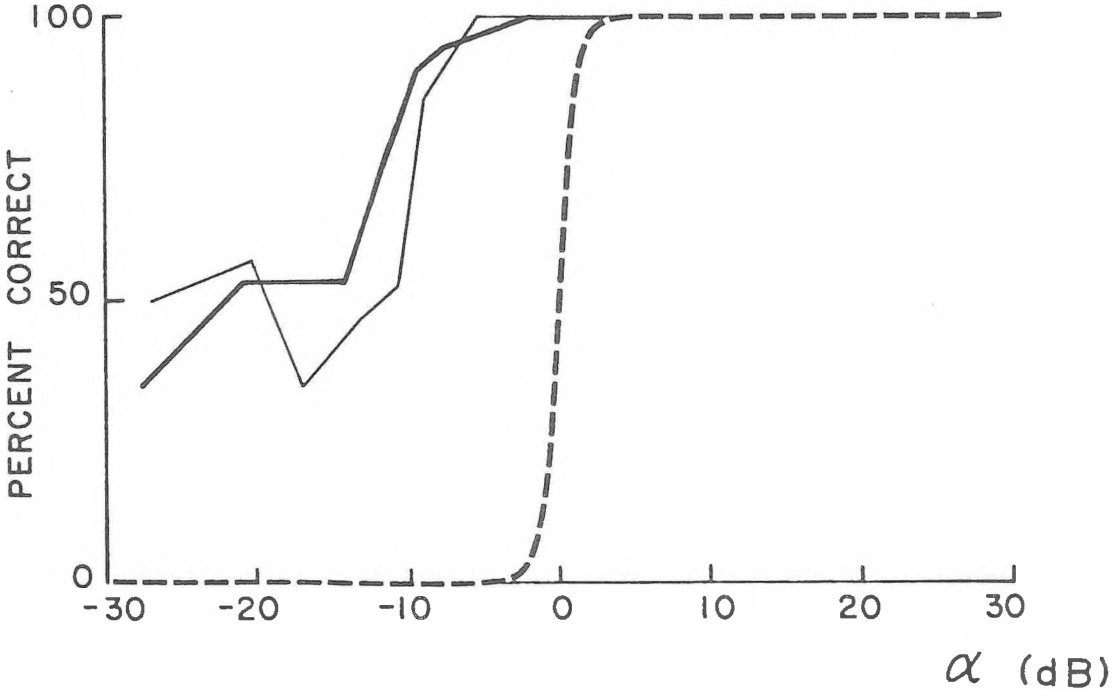


Figure 3. Identification by two subjects of the /bæ/ (heavy solid line) and /dæ/ (light solid line) stimuli in the presence of the /æ/ vowel masker, plotted as a function of the signal to masker amplitude ratio α expressed in decibels. As a reference, the averaged /bæ/-/dæ/ identification curve from Figure 1 is also shown (dashed line).

A note of caution should be made about the generality of the hypotheses of the dependence of the channels of auditory analysis for consonants and their independence for vowels. A simpler hypothesis can be based on peripheral properties of the auditory system, with acoustic similarity or dissimilarity of the mixed stimuli taken into account, irrespective of whether these stimuli are speech sounds or not. Obviously, if only the peripheral mechanisms were involved in the interaction between the mixed stimuli, it would be expected that simultaneous masking between two stimuli will become stronger as their spectral components become closer in frequency. To test whether this happens with our stimuli, a small-scale masking experiment was conducted. A masking stimulus was created by replicating one of the pitch periods of the steady-state vowel /æ/ to match the pitch contour of the /b/ formant transition. In addition, the amplitude of the /æ/ masker was scaled so that the intensities of the corresponding /æ/ and /b/ pitch periods were identical. This /æ/ vowel onset, when concatenated to the steady-state vowel from which it was gated out, produced a natural sounding vowel /æ/. This masker was combined with either the /b/ or /d/ formant transitions using 21 different relative amplitude weightings. Thus two sets of 21 stimuli were created, each ranging from pure /æ/ to either pure /bæ/ or /dæ/. These stimuli were presented in random order in a fully crossed design using an identical testing procedure to that described above. Two subjects, fully informed as to the nature of the experiment, were tested. Their task was to identify each stimulus as either "bæ" or "dæ". The percentages of correct identifications as a function of the amplitude weighting factor α are presented in Figure 3. For the purpose of comparison, the averaged /bæ/-/dæ/ identification curve from Figure 1 is also shown. The results indicate that the masking effect of the /æ/ component on the /b/ and /d/ transitions increased gradually with its amplitude: the correct identification curves are less steep than the identification curve from the /bæ/-/dæ/ experiment. Furthermore, for both the /b/ and /d/, nearly 100% correct identification was observed, even for stimuli which were about 10 dB weaker than the vowel masker. This indicates that the mutual masking between the /b/ and /d/ is more effective than that of the /æ/ masker, in spite of the fact that the frequency separation of loci for the F2 formant transitions for /b/ and /d/ is wider than for the vowel masker and either /b/ of /d/. This is not what would be expected if spectral masking were the only factor involved.

The authors are aware of the limited scope of this study. Before these hypotheses could be proposed for a wider class of speech stimuli, a fuller range of speech stimulus pairs must be tested. In the present study, only two phonetically similar consonant pairs and one phonetically dissimilar vowel pair have been tested. For greater confirmation of the hypotheses, two further tests must be carried out. One should include consonant pairs that vary in degrees of dissimilarity such as /ba/-/va/, /ba/-/wa/, or even /ta/-/sa/. Alignment of such stimuli can pose greater technical problems due to possible differences in temporal structure of these stimuli. The other test should include pairs of highly similar vowels such as /i/-/ɩ/. If the dissimilar consonant pairs still fused and the similar vowel pairs did not, only then would the results constitute strong evidence for the hypotheses suggested above.

The vowel combination /i/-/æ/ was the only one tested. Examination of other vowel pairs may prove to be productive, since varied perceptual effects can be expected, depending on the formant values of the two mixed vowels. Chiba and Kajiyama (1958, p.218) list these possible results: both vowels are clearly distinguished, only one of the two vowels is heard, either one or both of the vowels change quality, the two vowels are perceived as one vowel of different quality, or one of the vowels is heard in the background of the other.

By repeated playback of a boundary stimulus from a stop consonant continuum it is possible to hear either one or the other component of the mixed stimulus, as the listener so chooses, but never both components simultaneously. The receptor appears to be in a bistable state, where a change in the subjects' bias can shift the response from one category to another. This auditory effect can be likened to the "Necker cube" phenomenon in visual perception. Either of two forms of this reversible visual pattern, where all edges, including the "hidden" ones, are equally prominent, can be perceived, but never both simultaneously. The binaural counterpart of this phenomenon has been noted by Ades (1974) who observed that simultaneous presentation of /bæ/ into one ear and /dæ/ into the other results in a single fused percept heard as either one or the other stimulus. The "Necker cube" phenomenon further supports the hypothesis of inhibitory interaction between channels of phonetic analysis, in which the channels interact in such a way that only the most strongly excited one is perceived. Saunders (1980, p.95) noted that this phenomenon has three characteristic features of the cusp catastrophe: bimodality, sudden jumps, and hysteresis. Such sensory behavior was modelled by Zeeman (1976) using Duffing's equation.

The monaural superposition method was also tested with a three-way combination of stimuli (Stevenson, 1979). A mixed /ba/-/da/-/ga/ stimulus was constructed by component weighting α/b/+β/d/+γ/g/ concatenated with an /a/, where $\alpha+\beta+\gamma=1$. The scaling factors were varied in steps of 0.05. The stimuli were presented as in the previous experiments, except that three response options "ba", "da", and "ga" were provided. The results for the two subjects tested are shown in Figure 4, where the three symbols represent the modal values of ten judgements at each testing condition. The division of the response space into three distinct regions is apparent. The boundaries intersect in a trivalent point. By and large, the stimuli were perceived as clear exemplars of either /ba/, /da/ or /ga/.

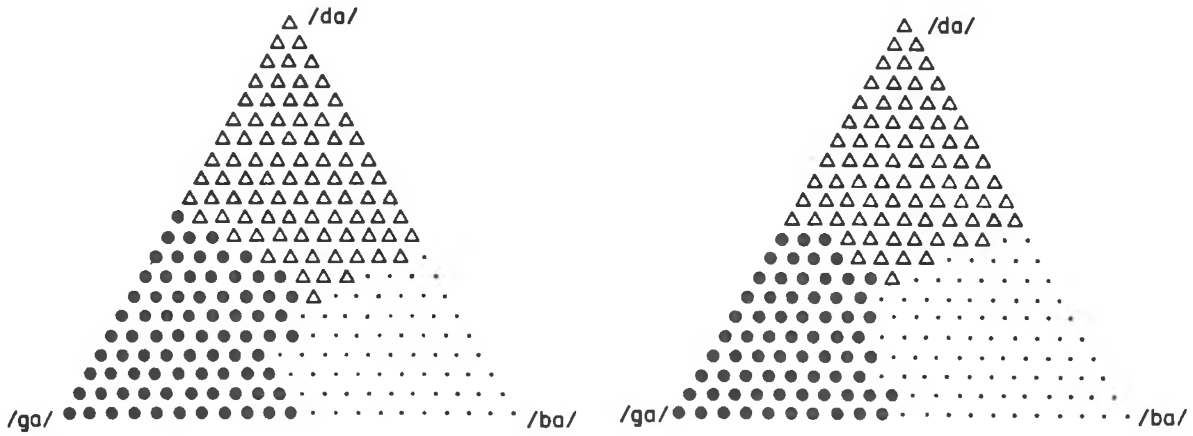


Figure 4. Results of the /ba/-/da/-/ga/ identification test for subjects JH (left) and DS (right).

APPENDIX: NOTES ON THE MONAURAL SUPPERPOSITION TECHNIQUE

The usefulness of the technique lies in the fact that real speech can be used to construct the stimuli, thereby preserving all necessary cues in the stimuli. Furthermore, identification of the endpoint stimuli on the continuum is unequivocal for all subjects. The monaural superposition technique can be equally well applied to synthetic stimuli with the advantage of simpler alignment of the mixed components, since they can be generated with an identical pitch contour and temporal pattern. Stimuli for multiple-category identification tasks can be generated by mixing more than two components. The monaural superposition stimuli are characterized by the amplitude weighting factor of the mixed components, representing a simple unidimensional continuum which permits an easy specification of the independent stimulus variable by a single physical parameter.

Although a variety of speech tokens can be used, a perfect monaural fusion can be obtained only with stimuli of similar temporal structure which differ only in spectral cues. The method works best with CV or CVC stimuli where the vowel is the same for both constituent stimuli and the mixed consonants, either in the initial or final position, are members of the same manner class, but differ in place of articulation. Within-category discrimination of stimuli for which monaural fusion takes place is increasingly difficult as the stimuli approach the category prototype. This property of the monaural superposition technique may make it unsuitable for discrimination experiments testing categorical perception. The reader is referred to Repp (1981) and Stevenson *et al.* (1985) for additional information on the applicability, advantages, and limitations of the monaural superposition technique

The monaural superposition technique merits comparison with the traditional technique of interpolated parameters used heretofore in testing categorical perception of speech stimuli. Judged on the basis of an identification experiment, the mixed stimulus continuum and the traditional continuum of interpolated parameters may appear as perceptually equivalent. Comparing these two continua using synthetic stimuli /da/-/ga/, Repp (1981) not only found that they produce virtually identical identification curves, but also that the increment in reaction time for boundary stimuli was of equal magnitude, suggesting that the boundary stimuli produced by the two techniques are equally ambiguous. The distinction between the two methods could emerge only if the subjects are allowed open or multiple-category responses such as confidence ratings of the responses, evaluations of the difficulty of the task, or naturalness judgements of the stimuli. The equivalence reported by Repp is not likely to be observed, for instance, on the /b/-/g/ continuum, provided the subjects are also permitted the "d" response. This continuum has been tested indirectly in the three-category identification experiment /ba/-/da/-/ga/ by the stimuli with the missing /da/ component, i.e., $\beta=0$. Corresponding results can be found on the bottom row of the response triangle in Figure 4. For both subjects tested, a complete absence of "d" responses was evident, even in the raw data. This precludes the hypothesis that a psychoacoustic fusion, i.e., an averaging of F2 transitions of /ba/ and /ga/, may produce a /da/-like percept (Cutting, 1976). On the other hand, in a corresponding interpolated parameters experiment, the F2 transition of the synthesized stimuli must necessarily pass through the /d/ locus of this formant, and thus be likely to yield some "d" responses. Radically different results between the two methods can be expected in the vowel perception experiments. While in the mixed /i/-/æ/ experiment both vowels are heard simultaneously, in a parallel interpolated parameters experiment the responses should cover the full range of the front vowels /i/-/ɪ/-/e/-/ɛ/-/æ/, heard one vowel at a time.

REFERENCES

Ades, A.E. (1974). "Bilateral component in speech perception," J. Acoust. Soc. Am. **56**, 610-616.

Ainsworth, W.A. (1977). "Mechanisms of selective feature adaptation," Percept. Psychophys. **21**, 365-370.

Chiba, T. and Kajiyama, M. (1958). *The Vowel: Its Nature and Structure* (Phonetic Society of Japan, Tokyo).

Cutting, J.E. (1975). "Aspects of phonological fusion," J. Exp. Psychol. Hum. Percept. Perform. **104**, 105-120.

Cutting, J.E. (1976). "Auditory and linguistic processes in speech perception: Interference from six fusions in dichotic listening," Psych. Rev. **83**, 114-140.

Eimas, P.D., and Corbit, J.D. (1973). "Selective adaptation of linguistic feature detectors," Cogn. Psychol. **4**, 99-109.

Elman, J.L. (1979). "Perceptual origins of the phoneme boundary effect and selective adaptation to speech: A signal detection theory analysis," J. Acoust. Soc. Am. **65**, 190-207.

Halwes, T.G. (1969). *Effects of Dichotic Fusion on the Perception of Speech,* Ph.D. thesis, University of Minnesota, Minneapolis, Minnesota.

Jamieson, D.G. and Cheesman, M.F. (1986). "Locus of selective adaptation in speech perception," J. Exp. Psychol. Hum. Percept. Perform. **12**, 286-294.

Miller, J.L. (1975). "Properties of feature detectors for speech: Evidence from the effects of selective adaptation on dichotic listening," Percept. Psychophys. **18**, 389-397.

Miller, J.L. (1977). "Properties for feature detectors for VOT: The voiceless channel of analysis," J. Acoust. Soc. Am. **62**, 641-648.

Repp, B.H. (1976). "Identification of dichotic fusions," J. Acoust. Soc. Am. **60**, 456-469.

Repp, B.H. (1980). "Stimulus dominance in fused dichotic syllables: Trouble for the category goodness hypothesis," J. Acoust. Soc. Am. **67**, 288-305.

Repp, B.H. (1981). "Perceptual equivalence of two kinds of ambiguous speech stimuli," Bull. Psychonom. Soc. **18**, 12-14.

Rozsypal, A.J. (1976). "Digital gating of speech signals," Lang. Speech **19**, 57-74.

Rozsypal, A.J., Stevenson, D.C., and Hogan, J.T. (1985). "Dispersion in models of categorical perception," J. Math. Psychol. **29**, 271-288.

Saunders, P.T. (1980). *An Introduction to Catastrophe Theory* (Cambridge University Press, Cambridge).

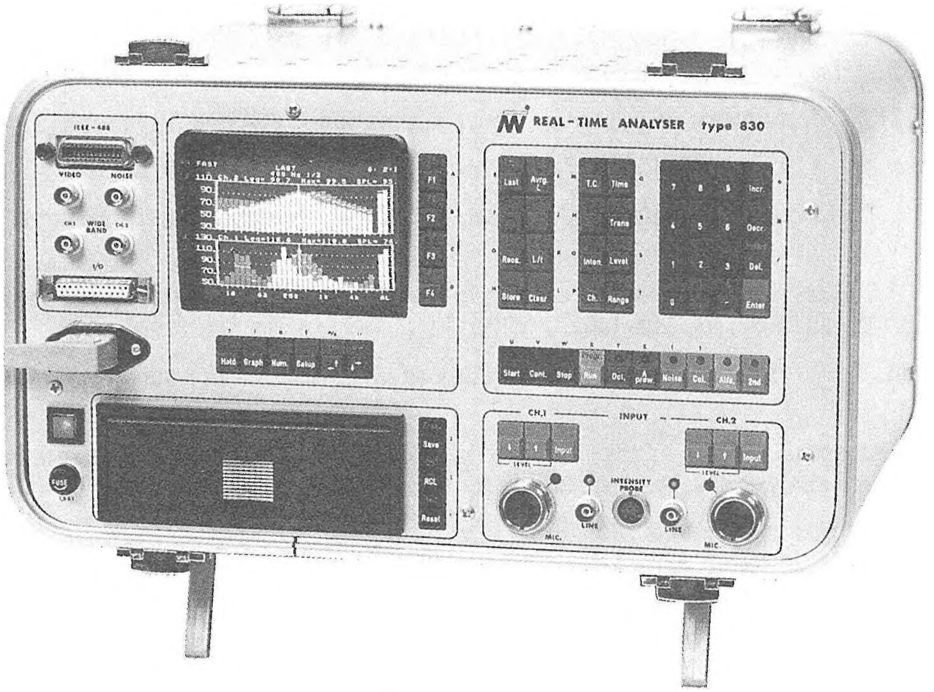
Stevenson, D.C., and Stephens, R.C. (1978). "A programming system for psychoacoustic experimentation," Proc. of the 11th DECUS (Canada) Symposium, Ottawa, 15-17.

Stevenson, D.C. (1979). "Categorical Perception and Selective Adaptation Phenomenna in Speech," Ph.D. thesis, University of Alberta, Edmonton, Alberta.

Stevenson, D.C., Hogan, J.T., and Rozsypal, A.J. (1985). "Generation of speech continua through monaural fusion," Behav. Res. Math. Instr. Comput. **17**, 102-106.

Studdert-Kennedy, M. (1976). "Speech perception," in *Contemporary Issues in Experimental Phonetics*, edited by N.J. Lass (Academic Press, New York), pp. 243-293.

Zeeman, E.C. (1976). "Duffing's equation in brain modelling," Bull. Inst. Math. and Appl. **12**, 207-214.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THE EFFECT OF LINING REVEALS WITH SOUND ABSORBENT MATERIAL

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Concordia University, Montréal

ABSTRACT

The sill and reveal of a panel or window system are known to influence the acoustic transmission of the system and it is known that lining the reveal with sound absorbent material can increase the sound reduction index. This work examines the influence of a window to sill or reveal ratio upon the known effects, by testing two window sizes whilst maintaining sill or reveal depths. The potential for marked increase in sound reduction index by reveal absorbent lining is also examined and deductions concerning its use are made.

SOMMAIRE

Les appuis (intérieur et extérieur) d'une fenêtre (ou d'un panneau en laboratoire) peuvent affecter la transmission acoustique d'un système de fenêtre. Il est aussi connu que fait de recouvrir ces appuis d'un matériau acoustiquement absorbant augmente l'indice de réduction du son. Ce projet étudie l'influence des appuis en considérant deux fenêtres de dimensions différentes tout en gardant constante la largeur des appuis. Il est également question de l'usage de recouvrements absorbants pour les appuis de manière à obtenir un accroissement sensible de l'indice de réduction du son.

1. INTRODUCTION

The transmission of sound through window and wall systems is known to be influenced by many physical features such as room size, panel size, mounting conditions and so on; amongst these influencing factors, it has been shown [1], [2], that the sill or reveal of a panel system or a combination of both, will also influence the transmission of sound, and that these particular features may be engineered to increase the sound reduction index of the system [3] - particularly by lining the reveal with sound absorbent material.

As in Reference [3] both sills and reveals are considered here to consist of equal depth projections from the four sides of a rectangular panel or window. That projection towards the source room will be referred to as a 'sill', whilst the projection towards the reception room will be referred to as a 'reveal'.

Two questions arise from these earlier works; "What is the effect of panel to sill or reveal dimensions"?, and "What limits of use in frequency or extent of lining might apply"? This paper presents the results of recent measurements undertaken at the Centre for Building Studies which contribute towards answering these question.

2. THE EXPERIMENTAL FACILITY AND TEST ARRANGEMENTS

The transmission loss suite of the Centre for Building Studies at Concordia University consists of two isolated rectangular rooms of differing dimensions. The larger room has a volume of 95 m^3 and the smaller room of volume 34 m^3. The Schroder cut off frequency for the larger room is 250 Hz. In the present tests the smaller room was employed as the receiving room and was lined on three adjacent surfaces with a proprietary 10cm thick sound absorbent material to facilitate the measurement of transmitted energy by a sound intensity measurement system. The test facility is described more fully in reference [4].

A heavy filler wall was constructed in the test aperture between the two rooms on either side of steel frames which marked the boundary between them; the wall Sound Transmission Class (STC) was determined to be 60.

The test panel was mounted flush to the source room surface in order to accurately assess the surface incidence intensity as inferred from the reverberant source room sound pressure level measurements, however, the flush mounted condition was necessarily disturbed by the mounting of sill projections into the source room for some of the measurements.

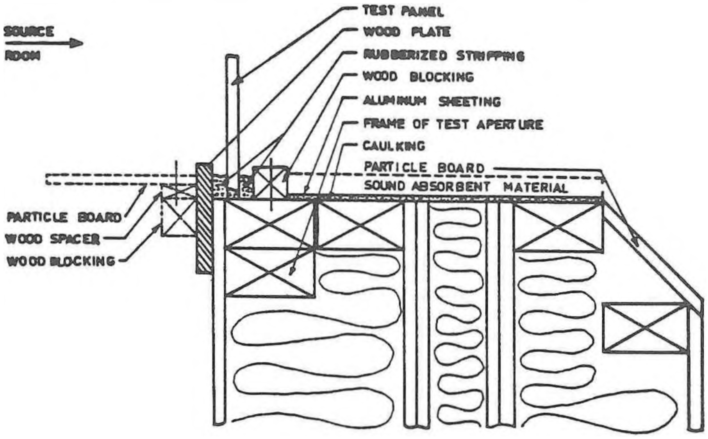


FIGURE 1. MOUNTING OF TEST PANEL ON FILLER WALL WITH SILL OR ABSORBENT MATERIAL

The mounting, shown in Figure 1, resulted in a 39.4 cm (15.5") deep reveal with the option of adding sill projections or lining the reveal with absorbent material.

Two panel sizes were tested 1.14 m x 1.14 m x 0.64 cm (1/4") thick glass and 1.52 m x ·1.52 x .64 cm (1/4"), and the filler wall was designed for successive demolition in order to accomodate these sizes.

3. TEST PROCEDURE

White noise was generated in the source room by two loudspeakers placed in the corners of the room opposite the test aperture and the mean sound pressure levels in the source room were measured using a rotating microphone boom (B & K 3923P). The microphone described a plane circular path at 70° from the horizontal and the length of the arm was 1.6 m, this configuration was chosen so that the microphone cleared the walls and stationary diffusers by at least 0.8 m. The minimum distance from the microphone to speaker was

1 m. and the period of a complete revolution of the microphone was 32 seconds.

All measurements were computer controlled and fed to a third octave analyser. In this case, the Sound Intensity Analyser type 2134/3360 from Brüel and Kjaer.

The incident intensity was calculated from the mean sound pressure level as measured in the reverberant source room.

The transmitted sound intensity was measured directly using a B & K Sound Intensity Microphone Probe type 3519 with a face-to-face microphone configuration. The 1/2" microphones with 12 mm spacer were chosen; this gave a useful frequency range of 125 Hz to 5 k Hz with an accuracy of ± 1dB assuming a monople source. An averaging time of 8 seconds was selected.

The intensity radiated by the panel was measured at 81 evenly distributed points over the measured plane and the microphone probe was mounted on a mechanical traverse system that enabled it to be fixed during each measurement interval. The probe was then moved by hand from point to point, although later developments will include the automation of this traverse. A point array measurement system was chosen to allow the construction of surface intensity profiles; surface profiles for the present panels are presented and discussed in reference [5]. Selection of array point numbers, averaging times and pressure to intensity ratios are also discussed in reference [5].

4. TESTS AND RESULTS

Two sets of tests with two sizes of 6 mm glass panel were undertaken.

The first series of tests involved measuring the sound intensity on the reception side at a distance of 5.08 cm. (2"), from the panel for a no sill condition, then with a 19 cm. sill, and then with a 38 cm. sill; each sill was constructed of 16 mm (5/8") wood particle board. For these tests the permanent 39 cm. reveal was in the bare condition and the reception measurement was chosen close to the panel (5 cm.) to avoid extraneous reveal effects.

Figure 2 displays the sound transmission loss of the 1.14 m x 1.14 m ($1.3m^2$) panel with no sill, 19 cm. sill, and 38 cm. sill, whilst Figure 3 displays the sound transmission loss of the 1.52 x 1.52 m ($2.3m^2$) panel with no sill, 19 cm. sill, and 38 cm. sill.

Figure 4 displays the difference in transmission loss between the no sill and 38 cm. sill condition for both sizes of panel.

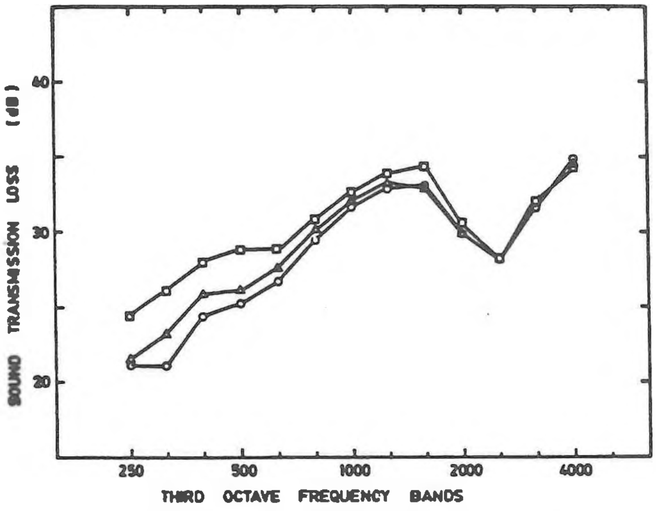


FIGURE 2 TRANSMISSION LOSS FOR A 1.3 m^2 SQUARE PANEL WITH A 39 cm REVEAL IN THE PRESENCE OF □-□ NO SILL, △-△ 19 cm SILL, ○-○ 38 cm SILL. TRANSMITTED INTENSITY MEASUREMENTS TAKEN 5.4 cm (2") FROM THE PANEL SURFACE.

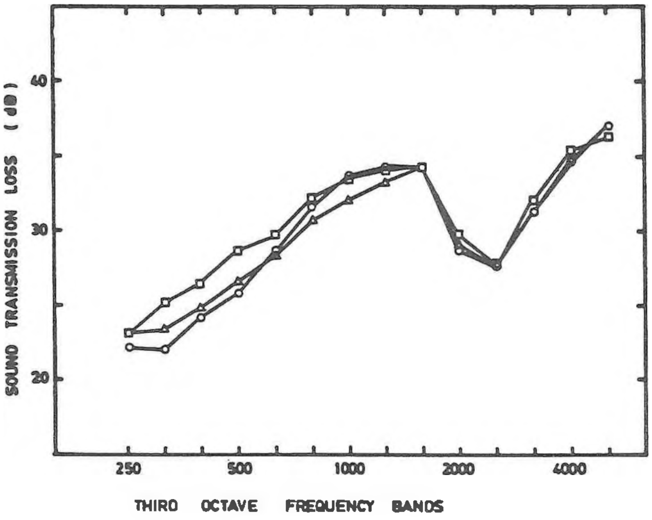


FIGURE 3 TRANSMISSION LOSS FOR A 2.3 m^2 SQUARE PANEL WITH A 39 cm REVEAL IN THE PRESENCE OF □-□ NO SILL, ▲-▲ 19cm SILL, ○-○ 38 cm SILL. TRANSMITTED INTENSITY MEASUREMENTS TAKEN AT 5.4cm (2") FROM THE PANEL SURFACE.

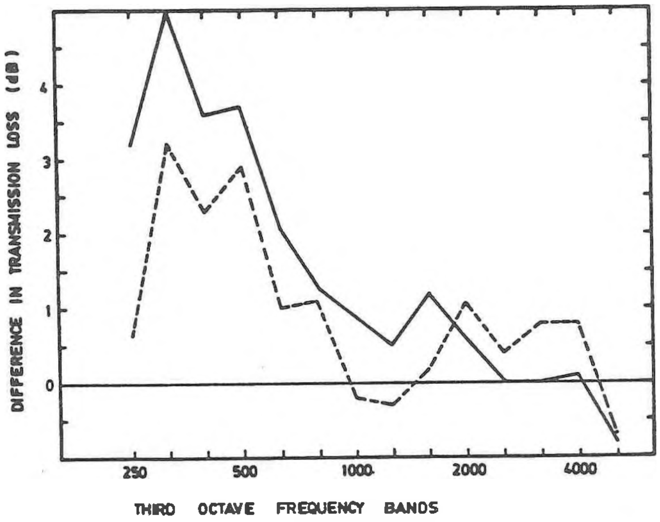


FIGURE 4 TRANSMISSION LOSS WITH A 38 cm SILL SUBTRACTED FROM THE TRANSMISSION LOSS WITH THE SILL REMOVED, FOR A 1.3m AND 2.3m SQUARE PANEL.
LEGEND —— 1.3 m^2 SQUARE PANEL
--- 2.3 m^2 SQUARE PANEL

Octave Band Centre Frequency HZ	Thickness	
	2.54 cm (1")	5.08 cm (2")
125	8	27
250	19	68
500	57	91
1000	88	98
2000	96	98
4000	88	99

TABLE 1: The Sabine Absorption Coefficient of the Reveal Absorbent Lining Material. (as supplied by the manufacturer)

The second series of tests involved lining the reveal with progressive thickness 2.54 cm (1"), 5.08 cm (2"), and 10.16 cm (4") of a propriatory open cell polyurethane foam sound absorption material. The absorbent material's sabine sound aborption coefficients, as supplied by the manufacturer, are shown in Table 1 for the 2.54 cm and 5.08 cm thickness.

For this series of tests there was no sill projection and to compare the overall effect of differing sound absorbent material thickness, the transmitted sound intensity was measured over the plane of the reveal at the reception room side.

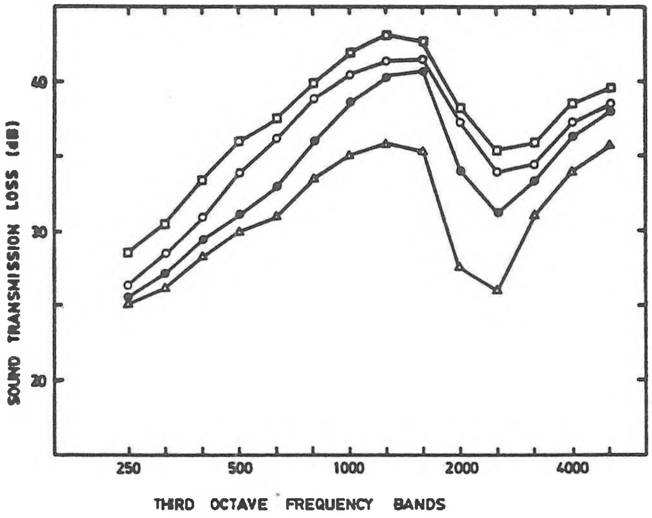


FIGURE 5 SOUND TRANSMISSION LOSS OF A 23 m^2 SQUARE PANEL FOR SUCCESSIVE INCREASE OF 38cm REVEAL ABSORBENT MATERIAL THICKNESS.

LEGEND:
▲-▲ NO ABSORBENT.
●-● 2.54 cm (1") ABSORBENT.
○-○ 5.08 cm (2") ABSORBENT.
□-□ 10.16 cm (4") ABSORBENT.

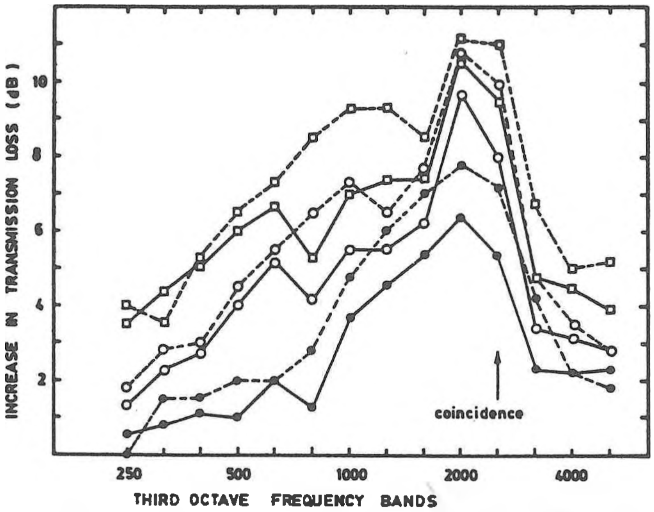


FIGURE 6. INCREASE IN TRANSMISSION LOSS FOR LINING THE 38 cm REVEAL WITH SOUND ABSORBENT MATERIAL IN RELATION TO SIZE OF PANEL AND THICKNESS OF ABSORBENT.

LEGEND
--- 1.3 m^2 SQUARE PANEL
— 2.3 m^2 SQUARE PANEL
● ● 2.54 cm (1") ABSORBENT
○ ○ 5.08 cm (2") ABSORBENT
□ □ 10.16cm (4") ABSORBENT

Figure 5 displays the results of lining the reveal for the 1.3 m^2 panel whilst Figure 6 displays the increase in transmission loss for the 1.3 m^2 and 2.3 m^2 square panels for varying thickness of sound absorbent reveal lining.

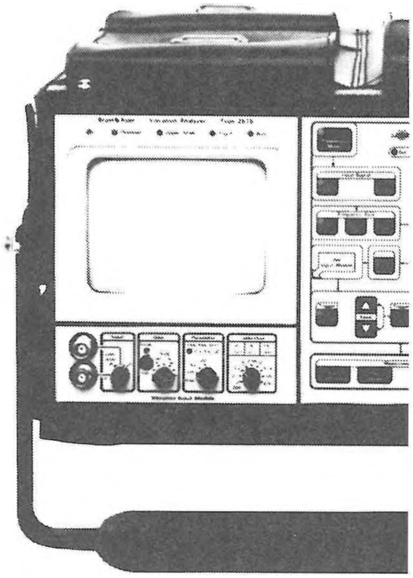
As part of the lined reveal series, measurements of the transmitted intensity over cross sectional planes located at varying distances from the panel surface were taken.

5. DISCUSSION

The effect of sills in relation to reveal dimensions have been discussed by others [1], [2], and Figures 2 and 3 display a usual finding of lowest transmission loss for matched sill and reveal whilst the no sill condition in the presence of a large reveal leads to the highest transmission loss. Differences in transmission loss values may be seen in Figure 4 to be most prominent at low frequencies, with a maximum difference of 5 dB, gradually reducing to below 1 dB at and above the coincidence third octave band of 2500 Hz.

Both panel sizes display the same total trend but below coincidence the smaller panel (1.3 m^2) yields a higher difference, that is, the smaller the panel - the greater the sill influence; this finding is also true when the curves of Figure 4 are corrected for differences resulting from the use of different panels (see Ref. [5]).

About and above the coincidence region, the sill effect appears more to influence the larger panel however, because the differences in this region



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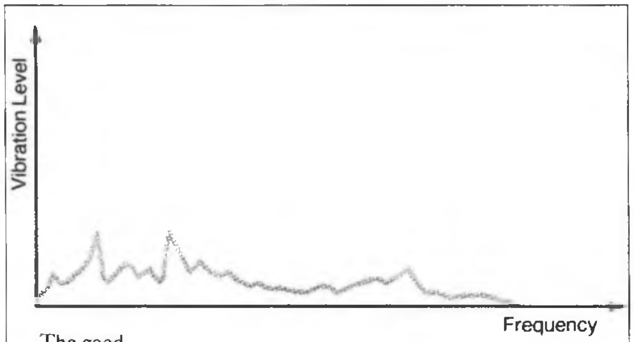

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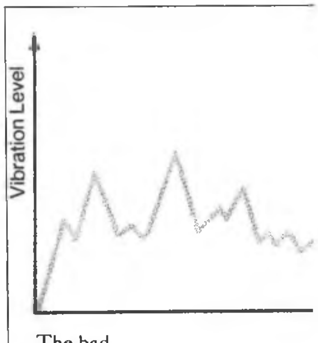

The bad
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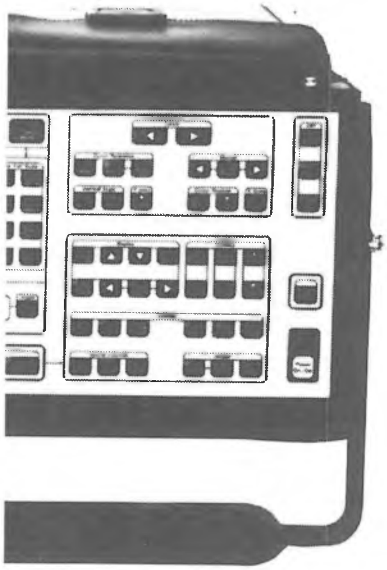

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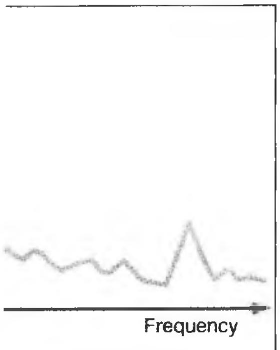

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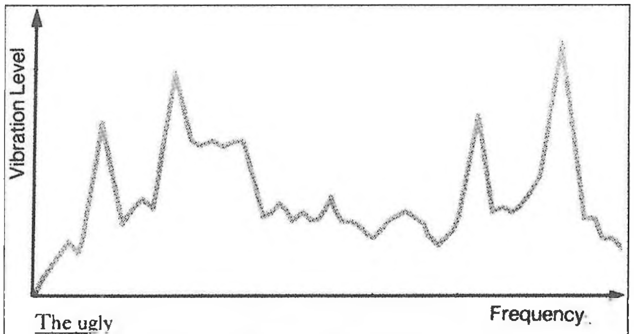

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are below 1 dB this trend should not be generalized from the present results.

Figure 5 displays the results of lining the reveal with absorbent material. Clearly, the thicker the absorbent, the greater the attenuation, with increases of sound transmission loss ranging from 6 to 10 dB over much of the spectrum for the 10.16 cm (4") thick absorbent.

Figure 6 displays the increase in sound transmission loss for both sizes of panel whilst varying, the reveal absorbent thickness.

The general trends are the same for both panels and for absorbent thickness, namely a gradual increase of sound transmission loss from low frequency up to the coincidence region and then a rapid reduction in effect. The 1.3 m^2 panel with the exception of minor excursion, displays the greater effect being typically 1 to 2 dB higher in attenuation than the 2.3 m^2 panel.

Absorbent Thickness mm	Increased Attenuation / Third Octave (dB)	
	1.3 m^2 panel	2.3 m^2 panel
25.4 (1")	3.7	2.9
50.8 (2")	5.7	4.7
101.6 (4")	7.4	6.4

TABLE 2: The average increase in attenuation for each third octave from 250 to 4000 Hz for varying area of panel and thickness of reveal absorbent material. Lined reveal depth 38 cm.

Table 2 highlights this aspect further by displaying the increased attenuation averaged over the third octaves from 250 Hz to 4000 Hz, for each panel size and absorbent lining thickness. Based upon this measure the 1.3 m^2 panel typically exhibits a 1 dB per third octave improvement over the 2.3 m^2 panel.

It may also be noted from Table 2 that the average increase of attenuation is about 2 dB for doubling of lining thickness - naturally this trend cannot continue indefinitely, however, its limits may not simply be a matter of improved sound absorption coefficient for increased thickness.

Returning to Figure 6, it can be seen for both panel size and absorbent thickness that the region of greatest attenuation is from about 1K Hz to coincidence at 2.5 kHz; initially one may ascribe this result to the high absorption coefficients reported for this material at those frequencies, however this influence is not evident at the frequencies above coincidence, in fact the increased attenuation above coincidence is similar to the attenuation at very low frequency where the absorbent material exhibitslower absorption coefficients.

This finding can be explained by considering the power flow regimes determined for these panels (see Reference [5]), namely at lower frequencies 250 Hz to 630 Hz the prominent energy transmission is from corner radiation, from 800 Hz to 2000 Hz panel perimeter radiation is prominent, whilst above coincidence a planar full panel radiation is found. The present results suggest maximum attenuation for good absorption coefficient in the presence of panel perimeter radiation although useful attenuation might be achieved in the presence of low frequency type corner radiation and high absorption coefficients.

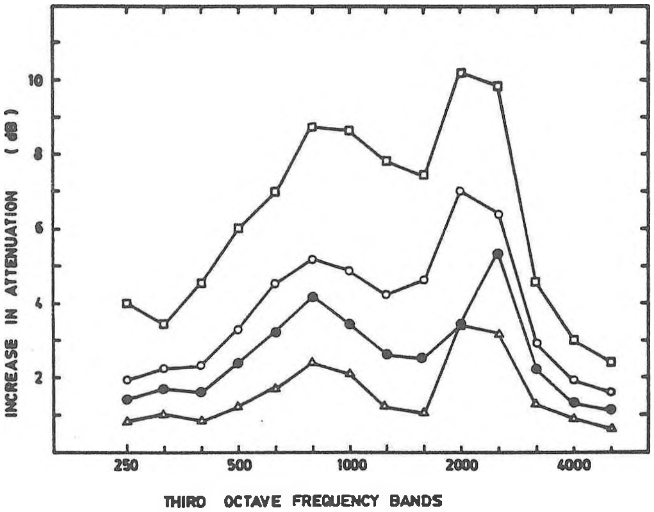

FIGURE 7 INCREASE IN ATTENUATION WITH MEASUREMENT PLANE FROM THE PANEL WITH A 38 cm (15") ABSORBENT LINED REVEAL FOR A 1.3 m² SQUARE PANEL AND 5.08 cm (2") ABSORBENT. DATUM: TRANSMITTED INTENSITY AT 7.5 cm (3") FROM PANEL.
LEGEND: △–△ 15cm (6") FROM PANEL;
●–● 22.5 cm (9") FROM PANEL;
○–○ 30 cm (12") FROM PANEL;
□–□ 38 cm (15") FROM PANEL.

Figure 7, displays the results of increased attenuation at different intensity measurement planes from the panel surface; the datum for this series of tests is the sound transmission loss measured at 7.5 cm (3") from the panel surface and the planes are successive 7.5 cm (3") intervals from the datum up to 38 cm (15") from the panel.

For all measurement distances, the general observations made with respect to Figure 6 are evident and the increased attenuation (dB) generally appears to progress constantly for measurement plane distances up to 30 cm. (12") from the panel, an enhanced attenuation is then apparent to the next measurement plane at 38 cm (15") for all frequencies below coincidence; this may be the result of 'view factor' considerations with respect to the proximity and view the active portions of the panel have of the lined reveal. This may also explain why in all measurement cases, the low frequency attenuation is higher than found at very high frequency even though the absorption coefficient of the reveal lining material will be better at the high frequencies. One may suppose a finite limit to the achievable increased attenuation for increased lined reveal depth, however, the present measurements indicate that this limit has not yet been encountered for the lining material used here.

6. CONCLUSIONS

The conclusions of the present work may be stated as follows:

i) Sill and reveal effects reported by other workers are confirmed, with most influence being found at low frequencies and for matched sill and reveal conditions.

ii) The sill effect does depend upon panel size, with a smaller panel for given sill exhibiting stronger influence.

iii) The presence of absorbent lined reveals can appreciably enhance the sound insulation of a panel system.

iv) The increase in sound insulation was relatively constant as a function of transmission path, although non linear geometry or view factor effects may be encountered for longer transmission paths (greater than 30 cm. (12") in the present measurements).

v) Maximum increase of sound insulation can be achieved in the presence of edge type panel radiation.

vi) Sound insulation with lined reveals does depend upon panel size with increased insulation being associated with the smaller panel for given reveal.

vii) Increase of sound insulation can be expected for lined reveals longer than 38 (15") centimetres.

viii) Increase of sound insulation can be expected for thickness of reveal lining greater than 10 (4") centimetres.

REFERENCES

1. Kihlman, T., Nilsson, A.C., "The Effect of Some Laboratory Designs and Mounting Condition on Reduction Index Measurement", J. Sound. Vib. 24(1972), pp. 349-364.

2. Guy, R.W., Mulholland, K., "Some Observations on Employing a Panel's Sill and Reveal to Enhance Noise Reduction", Applied Acoustics, 3 (1979), pp. 377-388.

3. Guy, R.W., Sauer, P., "The Influence of Sills and Reveals on Sound Transmission Loss", Applied Acoustics 17 (1984), pp. 453-476.

4. Lang, M.A., "Lightweight Acoustic Research Facility", Applied Acoustics, 14 (1981), pp. 207-214.

5. De Mey, A., Guy, R.W., "Exploiting the Laboratory Measurement of Sound Transmission Loss by the Sound Intensity Technique", Applied Acoustics, 20 (1987), pp. 1-18.

POINT DE VUE / VIEW-POINT

Le caractère insidieux de la surdité professionnelle

A l'occasion du 12e Congrès international d'acoustique, les chercheurs intéressés à l'épidémiologie de la surdité professionnelle ont célébré un centenaire! En effet, c'est bien en 1886 que Thomas Barr, un otologiste de Glasgow, publiait les résultats d'une des toutes premières enquêtes de surdité menée auprès de travailleurs exposés au bruit.[1] Il démontrait, entre autres choses, que les 100 riveteurs examinés avaient une audition déficiente par comparaison à un autre groupe de travailleurs non-exposés au bruit.

Cette perspective historique soulève un paradoxe important: après 100 années d'acquisition de connaissances sur la surdité professionnelle, comment se fait-il que le bruit soit encore omniprésent dans le milieu industriel? Comment expliquer que la surdité due au bruit représente la maladie professionnelle irréversible la plus prévalente et la plus coûteuse en termes d'indemnisation? Comment se fait-il qu'aujourd'hui, ce type de surdité affecte près de 2 % de toute la population adulte masculine et que le bruit au travail soit par conséquent une des causes les plus fréquentes de déficience auditive?

On ne peut évidemment attribuer cet état de fait au manque de connaissances quant aux effets nocifs du bruit sur l'audition. Parmi les facteurs qui peuvent expliquer cette situation, le caractère *insidieux* des méfaits du bruit sur l'audition m'apparait comme étant prépondérant et ce, pour quatre raisons majeures.

En premier lieu, ce caractère insidieux résulte du phénomène de la fatigue auditive. En effet, l'employé qui est affecté à un poste de travail bruyant souffre de fatigue auditive dès le premier jour. Or, les manifestations de cette perturbation réversible de l'audition revêtent les mêmes caractéristiques perceptuelles que la surdité professionnelle: perte de sensibilité en hautes fréquences, perte de sélectivité fréquentielle, altération de la perception de l'intensité sonore, etc. Par conséquent, dans les heures qui suivent la journée de travail, la personne qui a été exposée à des bruits intenses compose avec des incapacités auditives partielles et en imposent certains des inconvénients à son entourage familial (écoute de la télévision à un plus haut niveau sonore, voix plus forte, demande de répéter dans des conversations en présence d'un bruit de fond). La personne exposée au bruit et son milieu familial apprennent donc dès le départ à composer avec certaines manifestations d'une surdité due au bruit [2]. Pourtant, si l'on mesure son acuité auditive au moment du retour au travail, elle s'avèrera tout à fait normale! Dans ces conditions, à quel moment la personne exposée quotidiennement au bruit à son milieu de travail découvrira-t-elle que sa perte auditive est devenue irréversible? Il faudra que cette perte soit déjà très importante et que ses conséquences soient fortement ressenties par la victime ou son entourage.

Deuxièmement, la perte permanente d'acuité auditive due au bruit semble elle-même évoluer très lentement. C'est ce qui se dégage des résultats des différentes enquêtes de surdité professionnelle même s'il s'agissait d'études transversalles. Ces données synthétisées sous la forme d'un modèle étiologique a fait l'objet d'une norme internationale [3]. On peut constater, par exemple, qu'à 100 dBA-8heures, à la fréquence audiométrique la plus affectée et chez les individus les plus sensibles à l'égard des effets du bruit, le taux annuel de détérioration de l'audition est d'environ14 dB au cours de la première année d'exposition, de 10 dB la seconde année, de 3dB après 5 ans et de 1,5 dB après 10 ans. A aucun moment, on n'observe de chute abrupte de l'acuité auditive. Contrairement à la plupart des surdités acquises à l'âge adulte, l'apparition de celle-ci n'est généralement pas perceptible de la part de la personne qui en est victime. Cette évolution est à ce point insidieuse que des examens audiométriques impeccables ne permettent pas de détecter de variations significatives sur une base annuelle [4-5].

Le caractère insidieux des effets auditifs du bruit est également lié à deux autres aspects du problème: il s'agit de la nature des incapacités auditives et de leur signification sociale. En effet, d'une part, la principale conséquence de la perte (temporaire ou permanente) d'audition due au bruit se manifeste par une perte de sélectivité fréquentielle. Il en résulte une baisse de capacité à communiquer verbalement en présence d'un bruit ambiantou dans un environnement réverbérant. Ainsi, la personne atteinte d'une perte d'audition due au bruit affiche un comportement auditif ambigu pour elle-même et pour son entourage: sa capacité auditve fluctue en fonction des conditions sonores ambiantes. L'entrourage interprète cette ambiguité en termes de mauvaise volonté, d'inattention et de refus de communiquer. La victime se reproche de manquer de concentration ou d'intérêt. Dans un cas comme dans l'autre, le problème n'est pas associé à la surdité [6]. La famille souffre elle aussi des conséquences de cette surdité partielle sans aider à les minimiser, bien au contraire [2].

D'autre part, même à un stade avancé d'incapacité auditive, le travailleur résiste souvent à admettre qu'il souffre d'une surdité. Il reconnaîtra une série de situations comme étant incapacitantes pour lui sans toutefois les expliquer par la surdité [2]. Cette attitude peut être attribuée au fait que la surdité est stigmatisée. Etre sourd est associé à être distrait, faible d'esprit ou au minimum au fait d'avoir vieilli prématurément. Le travailleur semble réagir au fait de se voir physiquement diminué en reconnaissant sa surdité.

En somme, il y a une convergence malheureuse entre le phénomène de la fatigue auditive, le mode de progression de la surdité, la nature et la signification des ses manifestations, faisant en sorte que la surdité professionnelle soit une maladie très sournoise et insidieuse. Pour cette raison, il n'est peut-être pas étonnant que l'on accuse un tel retard dans l'élimination du bruit des lieux de travail. En tant que professionnel de l'acoustique, nous avons intérêt à comprendre cette situation et à sensibiliser la population aux conséquences indésirable de la surdité due au bruit.

Références

[1] Barr, T. Enquiry into the effects of loud sounds upon the hearing of boilermakers and others who work amid noisy surroundings. Proceedings of the Philosophical Society of Glasgow, 1886, 17: 223-239.

[2] Hétu, R., Lalonde, M. , Getty, L. Psychosocial disadvantages associated with occupational hearing loss as experienced in the family. Audiology. (in press).

[3] Acoustics - Determination of occupational noise exposure and estimation of noise-induced hearing impairment. International Organization for Standardization, ISO-DIS/1999.2, 1985.

[4] Burns, W. and Robinson, D.W. Hearing and Noise in Industry. London: Her Majesty's Stationery Office, 1970, p.21.

[5] Hétu, R. Critical analysis of the effectiveness of secondary prevention of occupational heaing loss. Journal of Occupational Medicine, 1979, 21: 251-254.

[6] Hétu, R. La surdité professionnelle: un handicap sensoriel trop discret. Santé mentale au Québec, 1981, 6: 155-163.

BOOK REVIEW

Sound Insulation of Partitions in Broadcasting Studio Centres: Field Measurement Data

by: K.E. Randall, D.J. Meares, and K.A. Rose
Research Department, Engineering Division
British Broadcasting Corporation
October, 1986. (Publication UDC 534.833.522)

A Review by J.D. Quirt, Acoustics Section, Institute for Research in Construction, National Research Council Canada, Ottawa, K1A 0R6.

One would hope that a large report summarizing 15 years of acoustical studies by the Research Department of the Engineering Division of The British Broadcasting Corporation would be packed with examples of clever acoustical engineering, and a source of inspiration and guidance for designers. Some of the raw materials for such a publication are present.

The report presents the results for sound transmission between 350 pairs of rooms. Most of these are assembled in 38 major groups, each with a characteristic partition construction.

The noise reductions achieved range from impressive to decidedly mediocre (with the latter predominating), in part because such techniques as consistent avoidance of vibration transmitting connections between the leafs of cavity walls, use of large interleaf cavities, and filling cavities with absorptive material were only intermittently employed. Instead, what the report documents is primarily the use of massive multileaf masonry partitions, most of which include obvious weak links such as windows or doors to adjacent corridors. The presence of such weak elements is clearly noted, but no attempt is made to quantify their effect on the noise reduction.

Overall, the most disappointing shortcoming of the report is the absence of specific details that would permit a designer to duplicate the better constructions, or accurately predict their performance between a given pair of rooms. Detail drawings are rare. Some of the most effective partitions are for "box within a box" designs with both rooms mounted on vibration isolation pads, but no drawings, technical specifications or performance data for the vibration isolators are given. Noise reductions and typical reverberation times are presented, but data on room volumes and partition areas (to allow extrapolation from these results for design of other rooms) are not given. The number of panes in the windows are carefully reported, but there is no information on important variables such as separation between the layers of glass. Typical glass thickness is mentioned only once (on page 4). Anyone hoping to extract useful design information from this report should read the five-page introduction very carefully.

One can only hope that the authors' decision to present the data without evaluation will not encourage duplication of the less successful designs by designers with limited understanding of acoustics.

My disappointed reaction to this report is probably unfair. The problem is that it presents almost nothing more than what the fine print in the title promises: field measurement data. With the inclusion of more technical details and analysis of the factors limiting the noise reduction, this might have been an important reference document for acoustical designers. It isn't.

NEWS

ASTM NEWS

The 1987 ASTM Publications Catalog, describing 66 volumes of the Annual Book of ASTM Standards, as well as several hundred ASTM Special Technical Publications, Compilations, Data Series and Standard Adjuncts is now available free of charge.

Contact Jacqueline Nolden, ASTM Marketing and Promotion Services, 1916 Race Street, Philadelphia, Pennsylvania 19103. Tel: 215-299-5594.

Paul A. Strigner, Senior Research Officer of the National Research Council, has been elected to the ASTM Board of Governers for a three-year term.

PENN STATE SUMMER ACOUSTICS COURSES

The Penn State University graduate programme in Acoustics is offering six accredited graduate courses in acoustics and signal processing this summer from 1-27 June. Courses offered include: Fundamentals of Acoustics, Underwater Sound Propagation, Sonar Engineering, Digital Signal Processing, Electroacoustic Transducers and Acoustical Data Measurement and Analysis.

For further information contact: Dr. A.D. Stuart, Summer Program Coordinator, Penn State Graduate Programme in Acoustics, P.O. Box 30, State College, PA 16804, Tel. 814-863-4128.

F.V. HUNT POST-DOCTORAL RESEARCH FELLOWSHIP IN ACOUSTICS

Applications are invited for the 1988 version of this fellowship. Candidates must be ASA members and have recently received, or be about to receive, their doctorate. The amount of the award is US $ 23,000, and the application deadline is 1 September 87.

Contact Mrs. B.H. Goodfriend, Secretary, ASA, 500 Sunnyside Blvd., Woodbury, NY 11797

UP-COMING CONFERENCES/ CONGRES A VENIR

Dates	Conference/ Congrès	Location/ Eplacement
11-15 May 87	Acoustical Society of America	Indianapolis, IN
12-14 May 87	International Conference on Flow Induced Vibrations	Bowness-on Windermere, England
28-30 May 87	VIII International Cochlea Symposium	Halle, DDR
I-5 June 87	American Industrial Hygiene Association Annual Meeting	Montreal
4-5 June 87	Ist International Noise and Vibration Control Conference	London, England
8-9 June 87	Noise-Con '87	Pen State University Pennsylvania
8-11 June 87	4th International Meeting on Low Frequency Noise and Vibration	University of Umea Sweden
I8-24 June 87	6th Federation of Acoustical Societies of Europe Congress	Lisbon, Portugal and Madrid, Spain
22-26 June 87	International Symposium or Fisheries Acoustics	Seattle, Washington
6-9 July 87	Ultrasonics International '87	London, England
23-26 Aug 87	I987 International Computer Music Conference	University of Illinois
I3-I8 Sept 87	4th European Conference on Non-destructure Testing	London, England
I5-I7 Sept 87	Inter-Noise '87	Beyging, China
5-9 Oct 87	Canadian Acoustics Week	Calgary
8-I3 Nov 87	IV International Symposium on Audiological Medicine	Canary Islands,Spain
I6-20 Nov 87	Acoustical Society of America	Miami, Fl

13-18 Déc 87	American Society of Mechanical Engineers Annual Meeting	Boston, MA
10-13 Apr 88	British Institute of Acoustics Spring Conference	Cambridge, England
21-25 Aug 88	5th International Congress on Noise as a Public Health Problem-Noise '88	Stockholm, Sweden
22-26 Aug 88	7th Federation of Acoustical Societies of Europe Symposium (Theme-speech)	Edinburgh Scotland
30 aug-1 sept 88	Inter-Noise '88	Avignon, France
24-31 Aug 89	13th International Congress on Acoustics	Belgrade, Jugoslavia

LE GAUS RECHERCHE DES CANDIDATS AU DOCTORAT

Le groupe d'acoustique de l'Université de Sherbrooke (GAUS) est à la recherche de candidats qui effectueraient leurs études doctorales au GAUS. Les candidats devraient avoir une bonne formation en physique ou en génie avec de l'acoustique ou un sujet connexe. Le sujet de recherche pourrait être choisi à partir de ceux du groupe, soient

- la modélisation des champs sonores dans les locaux
- l'intensimétrie
- la modélisation et mesure de l'impédance de matériaux
- la modélisation des sources de bruit
- la vibration et le rayonnement de structures

Faire parvenir votre C.V. à Murray Hodgson, Ph. D. - GAUS, Département de génie mécanique, Université de Sherbrooke, Sherbrooke, Québec, J1K 2R1. Tél.: 819- 821-7144

GAUS SEEKING DOCTORAL STUDENTS

The acoustics group of the University of Sherbrooke (GAUS) is looking for candidates to undertake doctoral studies at the GAUS. Candidates should have a strong education in physics & engineering with acoustics or a related subject. Research topics can be chosen from those of the group, i.e.,

- modelling sound fields in enclosures
- sound intensity measurement
- modelling and measurement of the impedance of materials
- modelling noise sources
- vibration and structural radiation

Applications from aglophone candidates are most welcome. Supervision and thesis can be in English.

Send your C.V. to Murray Hodgson, Ph. D. - GAUS, Département de génie mécanique, Université de Sherbrooke, Sherbrooke, Québec, J1K 2R1. Tél.: 819- 821-7144

NEWS RELEASE FROM THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

Since Archimedes sat in a bathtub and discovered that the volume of an object could be determined by its displacement in water, engineers have been trying to find a drier, more comfortable method for determining the volume of the human body.

Now they appear to be on the brink of a solution using an acoustical method to measure body volume that could benefit premature infants and adults with nutritional problems, according to W. Gregory Deskins, senior scientist, Hoover Keith & Bruce Inc., Houston, Texas.

Deskins uses the principle of the Helmholtz resonator to determine the volume of an object in a specially constructed box called an acoustic body volumeter.

The Helmholtz resonator principle is observed when air is blown over the top of a soft drink bottle. An empty bottle produces a different sound from a bottle with some liquid still inside, and every level of liquid produces a unique sound.

The acoustic body volumeter, which would come in both child and adult sizes, employs the same principle as the soft drink bottle. Background noise amplified to produce feedback causes the empty chamber to resonate at its natural frequency. When mass is inserted into the chamber, the frequency rises.

The relative amounts of fat and lean mass in the body are important in determining proper feeding of premature infants and proper diet for obese adults and others with nutritional problems.

To determine body composition, scientists need to know the body's density. Body density is a factor of mass and volume.

"A non-invasive, reliable, safe and rapid system for measuring body volume would be a significant development", Deskins told attendees at the American Society of Mechanical Engineers (ASME) Winter Annual Meeting, Anaheim, California. In most cases the adult's body volume is still determined by total submersion in a tank of water. Total submersion is not possible with infants.

Deskins is currently using known volumes of water in balloons to calibrate the chambers. Testing with human subjects and comparison with measurements from the conventional immersion method still must be done.

The effects of clothing, hair, motion and position must also be determined.

He suggested that there might be a non-medical use for the volumeter, determining the density of marketable animals, e.g. beef cattle, which would allow farmers and cattle buyers to estimate the leanness of the meat.

NEWS FROM THE INSTITUTE OF NOISE CONTROL ENGINEERING

NOISE-CON TECHNICAL PROGRAM IS ANNOUNCED

More than one-hundred technical papers will address the theme "High Technology for Noise Control" at NOISE-CON 87, the l987 National Conference on Noise Control Engineering. NOISE-CON 87 will be held at the Pennsylvania State University, one of the leading institutions in the United States concerned with acoustics and noise control engineering. The conference will be held on the Penn State Campus on 1987 June 8-10. The conference will be preceeded by a seminar on "Advanced Techniques for Noise Control" which is being sponsored by the Institute of Noise Control Engineering. NOISE-CON 87 is jointly sponsored by Penn State and the Institute.

The conference will open with a Plenary session on June 08 which will feature a Distinguished Lecture by Dr. Miguel C.Junger on "Shipboard Noise: Sources, Transmission and Control." The Distinguished Lecture Series will continue each morning. Tuesday's lecture will be presented by Dr. Leonard Meirovitch on "Control of Distributed Structures." Dr. Tony F.W. Embleton will present a Distinguished Lecture title "Outdoor Sound Propagation" on Wednesday morning.

The Technical Program will cover a broad range of topics in noise and vibration control. Many papers will be presented on newly-emerging noise control techniques such as intensity measurements, active noise reduction, active control of structureborne noise and vibration, imaging techniques and power flow in noise control. For the first time, there will be intensive coverage of noise control of marine structures. Numerous papers have also been submitted to report progress in combustion noise, biomedical uses of acoustics, numerical techniques in noise control and aeroacoustics of air moving devices. A special round table discussion with representatives of instrumentation manufacturers will also be on the technical program.

Jiri Tichy is the General Chairman for the meeting and Sabih Hayek is the Technical Program Chairman. Gerhard Reethof is the Exhibits Chairman, and James Prout is the Tour Chairman.

Prospective attendees who need more information about the conference can contact the Conference Secretary, Ms. Barbara Crocken, NOISE-CON 87, Graduate Program in Acoustics, The Pennsylvania State University, University Park, PA l6802, telephone: (8l4) 865-6364.

NEWS FROM THE INSTITUTE OF NOISE CONTROL ENGINEERING

NOISE CONTROL SEMINAR TO BE HELD BEFORE NOISE-CON 87

The Board of Directors of the Institute of Noise Control Engineering will sponsor a seminar on Advanced Techniques for Noise Control to be held just before the NOISE-CON 87 conference at the Pennsylvania State University. The Seminar will be held at the Sheraton Hotel in State College, Pennsylvania on I987 June 4-6. Six topics have been selected which represent key areas in noise control engineering:

- Sound Intensity Techniques
- Active Noise Control
- Machinery Noise Monitoring and Diagnostics
- Airport Noise and Monitoring Systems
- Modal Analysis
- Structural Damping

The seminar staff includes the following individuals (in order of their presentation above: Professor Malcolm J. Crocker (Auburn University), Professor Jiri Tichy (The Pennsylvania State University), Professor Richard H. Lyon (MIT), Mr. Kenneth M. Eldred (KEE Engineering), Dr. Glen Steyer (Structural Dynamics Research Corporation), and Dr. Eric E. Ungar (BBN Laboratories). While this will be the fifteenth presentation of the INCE Seminar, it will be the third offering of the seminar which has been revised to cover advanced techniques in the field. The advanced topics to be presented in June have been arranged to complement NOISE-CON 87 which will have the theme "High Technology for Noise Control".

Participants in the Seminar will receive an excellent overview of topics of current importance in noise control engineering. The Seminar will cover detailed appraisals of current applications of new methods in noise control.

Additional information on the INCE Seminar to be offered next June may be obtained by writing to the Institute of Noise Control Engineering, P.O. Box 3206 Arlington Branch, Poughkeepsie, NY I2603, or by telephoning (9I4) 462-6719 between the hours of 9.00 a.m. and 4.00 p.m. EST.

CANADIAN ASSOCIATION OF PHYSICISTS

ASSOCIATION CANADIENNE DES PHYSICIENS

PROFESSIONALISM AND THE NATURAL SCIENTIST: WHO WANTS TO BE A PROFESSIONAL!

DATE : MONDAY JUNE 15, 1987
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PLACE: 60 ST GEORGE ST, PHYSICS DEPT
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This is an evening meeting at the CAP congress open to all natural scientists. Make a point of attending. It has been organized by the CAP Committee on Professionalism to promote a discussion on the position of the natural scientist in the professional arena.

We have a lively keynote speaker Mr Allan Leal. You will be entertained and provoked. You will hear both advantages and disadvantages of being governed by a professional statute. He has extensive experience in the area having chaired a 5-year review of some of the professional statutes of Ontario.

We have three practising scientists to outline some of their experiences in the professional arena:

* M. Michalski, a biologist working at his own consulting company
* R.W. Moore, a biochemist performing clinical work at a hospital
* M.J. Bronskill, a medical physicist practising at a cancer institute

For preparation you may ponder the following quote from George Bernard Shaw: "All professions are conspiracies against the laity".

Be sure to come. It is an evening to be entertained as well as to ask where should the natural scientist be in our society.

Background of the speakers:

* Allan Leal, Vice Chairman,
  Ontario Law Reform Commission

* R.W. Moore, Former President,
  Ontario Society of Clinical Chemists

* M. Michalski, Former Chairman,
  Ontario Chapter, Canadian Society of Environmental Biologists

* M.J. Bronskill, President,
  Canadian College of Physicists in Medicine

Please give this notice wide circulation by posting/ circulating/ copying/ publishing. For further information contact Peter Kirkby, Research Division, Ontario Hydro at (416) 231-4111 EX 6957.

Last Meeting for the Year 1986-87 of the Toronto Chapter

On March 11, the last meeting of the Toronto Chapter was held in the Auditorium of the Mount Sinai Hospital.

The theme of the meeting was Industrial Audiometry. There were three speakers at the meeting:

Mr. Paul Stoner (Biotechnics) presented the topic "CSA standards applicable to audiometry". Besides the standards themselves, the audience was very much interested in their applications to the proposed noise regulations. One of the most controversial subjects was the background noise limits for audiometric test sites.

Mr. Erol Davis (Sound Links Data) presented a new computerized system for audiometry, where a signal generator is driven by a computer, that in turn receives and processes the information. An advantage of the system is that by using artificial intelligence, it can even produce reports with recommendations on how to follow-up a case.

Our final speaker, Patricia Abramowicz (Canadian Hearing Society) discussed the way the Society perform industrial audiometric tests and how data are handled. One of the issues that was discussed extensively was the definition of the "significant threshold shift" that may trigger a follow-up.

Mr. Bill Ruth, president of the newly formed Canadian Society for Hearing Conservation, made a presentation on the new society and invited the attendee to cooperate with their activities.

As with all meetings of the Toronto Chapter, this was well attended and the discussions during and after the presentations were lively and extensive.

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