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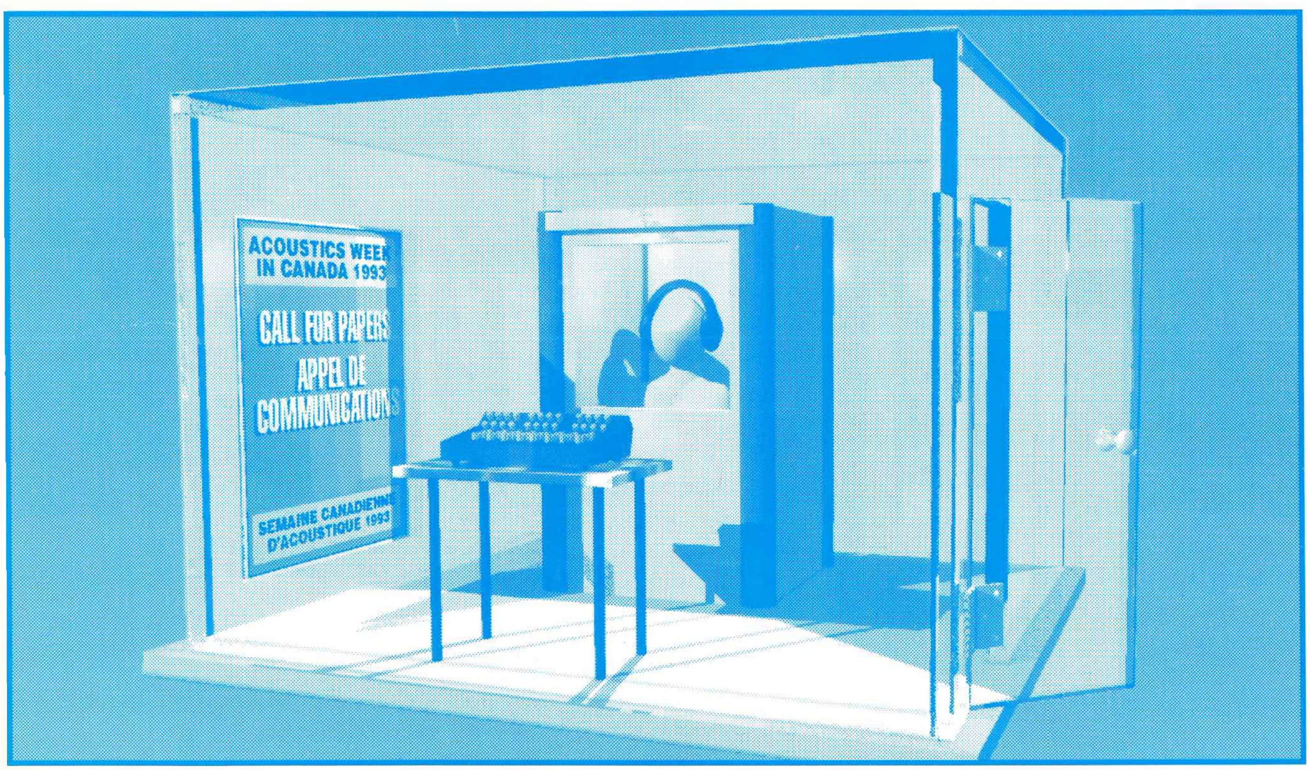

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PRESIDENT'S MESSAGE

Where have all the Students Gone?

At the Annual General Meeting in Vancouver, I identified two areas of concern for the Canadian Acoustical Association: the lack of involvement of student members and the decrease in submissions to our journal, *Canadian Acoustics*.

The CAA is a charitable organization dedicated to education in acoustics (among other things) and we offer a considerable number of student prizes representing a large proportion of our expenses each year - or so it should be. In fact, our student membership is declining and we do not award many of our prizes - not because there are no deserving students, but because there are no applicants! The Directors have not awarded their $500 award for the best student paper in *Canadian Acoustics* for two years in a row - there have been no student papers! We have never awarded the $500 Eckel Student Prize in Noise Control - again, no applicants. Also this year, we did not award the $800 Bell Speech Prize or the $3000 Shaw Postdoctoral Prize. The CAA is having serious difficulty meeting its objectives in this regard. I don't have the answer, but I suspect that we are not getting the message across to the students. I appeal to all CAA members to make an effort to increase student membership and to promote the CAA prizes among eligible candidates.

The editors of *Canadian Acoustics* have done a top-notch job over the last several years improving the appearance and content of the journal. Apart from research articles, the journal carries the annual Call for Papers and Proceedings for Acoustics Week in Canada, the annual membership list, and several articles of general interest. It is our principal means of communication in the Association. At present, the reservoir of articles for *Canadian Acoustics* is running dry. My second appeal to CAA members is to support our Journal by submitting articles or encouraging others to submit articles. These articles need not be heavy, academic research articles. Application notes, technical tips, and information articles are more than welcome.

MOT DU PRÉSIDENT

Où sont passés tous les étudiants?

A l'assemblée générale annuelle de Vancouver, j'ai identifié deux points d'intérêt pour l'Association Canadienne d'Acoustique: le manque d'implication des membres étudiants et le déclin dans les soumissions d'articles pour notre journal l'*Acoustique Canadienne*.

L'ACA est un organisme à but non-lucratif dédié entre autres à la formation en acoustique et offre un nombre important de prix étudiants; ce qui représente une bonne proportion de nos dépenses annuelles - ou devrait l'être. En fait, le nombre de membres étudiants est en décroissance et nous ne décernons pas plusieurs de nos prix non pas parce qu'il n'y pas d'étudiants méritants mais plutôt parce qu'il n'y a pas de candidats. Depuis deux ans, les Directeurs n'ont pas décerné leur prix de 500$ pour le meilleur papier étudiant publié dans l'*Acoustique Canadienne* - il n'y a pas eu d'articles soumis par des étudiants! Nous n'avons jamais remis le prix Eckel en contrôle du bruit (d'un montant de 500$) - encore une fois, pas d'application. De plus, nous n'avons pas décerné cette année le Prix 'Bell Speech' au montant de $800 ni le Prix Postdoctoral Shaw de $3000. L'ACA éprouve de sérieuses difficultés à rencontrer ses objectifs à l'égard des prix. Je n'ai pas de réponse mais je crois que nous ne transmettons pas bien le message aux étudiants. Je lance un appel à tous le membres de l'ACA afin de fournir un effort pour accroître le nombre de membres étudiants et de promouvoir les prix de l'ACA auprès des candidats potentiels.

Les rédacteurs de l'*Acoustique Canadienne* ont accompli un travail de haute qualité au cours des dernières années afin d'améliorer l'apparence et le contenu du journal. En plus des articles scientifiques, le journal publie l'appel annuel aux communications et les actes de la Semaine Canadienne de l'Acoustique, la liste annuelle des membres et plusieurs articles d'intérêt général. Le journal représente notre moyen prévilégié de communication à l'intérieur de l'association. En ce moment, le réservoir d'articles pour l'*Acoustique Canadienne* est à sec. Mon deuxième appel aux membres est de contribuer au succès du journal en soumettant des articles ou en encourageant d'autres personnes à en soumettre. Ces articles n'ont pas besoin d'être des articles de recherche pure et dure. Les notes d'application, les conseils techniques et les articles d'information sont plus que bienvenus.

THE EFFECT OF AGING ON REACTION TIME IN AUDITORY DETECTION AND DISCRIMINATION TASKS

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ABSTRACT

This research investigated the effect of aging on sensory information processing and decision-making. Detection thresholds in quiet and in noise and temporal acuity, and their associated choice reaction times were measured in two groups of normal-hearing subjects, differing in age. All three psychophysical tasks utilized a four-interval forced-choice procedure. The results indicated that there were no differences in duration discrimination or choice reaction time as a function of aging. However, the variability in choice reaction times was significantly greater for the older group, signifying greater heterogeneity in the time for decision-making. Erroneous responses generally took longer to make than correct responses. For the younger group, the erroneous response time increased with task complexity.

SOMMAIRE

Cette étude s'intéresse à l'effet de l'âge sur le traitement de l'information sensorielle et la prise de décision. Les seuils d'audition dans le silence et dans le bruit, l'acuité temporelle ainsi que les temps de réaction associés ont été mesurés chez deux groupes de sujets d'âges variés et dont l'audition était normale. La procédure de choix forcés à quatre intervalles a été utilisée pour les trois tâches psychoacoustiques. Les résultats démontrent qu'il n'y a pas de différence significative en fonction de l'âge pour les épreuves de discrimination de la durée ou pour le temps de réaction. La variabilité dans le temps de réaction était toutefois significativement plus grande dans le groupe plus âgé, ce qui indique une plus grande hétérogenéité dans le temps requis pour une prise de décision. Les reponses incorrectes étaient en general plus longues à venir que les réponses correctes. Pour le groupe de jeunes sujets, le temps de réponse incorrecte augmentait avec la complexité de la tâche.

1. INTRODUCTION

Both sensory information processing and decision-making are affected by aging. In the former category, a well documented finding is the deterioration of temporal acuity. Herman, Warren and Wagener (1977), for example, found that the interaural time delay required by older subjects for sound lateralization was twice that observed for younger subjects. In contrast, there were no differences in the minimum interaural intensity required by the two groups. Similar time-related difficulties have been demonstrated in animal models for free-field sound localization (e.g., Harrison, 1981; Brown, 1984). This decline in sensitivity to the temporal parameter is neither related to hearing loss nor confined to differences in stimulus input to the two ears. Abel, Krever and Alberti (1990) found significantly increased duration difference limens with aging in a diotic listening experiment. As well, a number of investigators have reported a marked decline in speech intelligibility as early as 40 years, when the stimulus materials are degraded by temporal interruption or reverberation (e.g., Bergman, Blumenfeld et al., 1976; Bergman, 1980).

There is evidence that these stimulus processing decrements have a neuroanatomical basis. Age-related degenerative changes have been documented throughout the auditory pathway. These include hair cell damage in the cochlea with nerve deterioration (Johnsson and Hawkins, 1972), neuron loss in the brainstem (Casey and Feldman, 1982), ganglion cell degeneration, including a change in the shape and a decrease in the number and size of cells in the ventral cochlear and superior olivary nuclei, inferior colliculus and medial geniculate (Kirikae, Sato and Shitara, 1964), and a loss of neurons in the superior temporal region of the cortex (Chandler and Grantham, 1991).

There are also data to support the contention that difficulties observed with aging reflect changes in cognitive function, particularly selective attention and decision-making. Attentional deficits have been demonstrated in vigilance experiments. In a watch-keeping task, Surwillo and Quilter (1964) found that subjects over the age of 60 years responded to fewer targets than younger subjects, and showed a greater decline in performance over time. Signal detection studies have shown that individuals aged 60 to 80 years adopt a more cautious criterion than those aged 21 to 35 years, suggesting that they require stronger evidence before making a decision (Craik, 1969; see also Rees and Botwinick, 1971; Potash and Jones, 1977). However, Gordon-Salant (1986) has argued that response bias is task-dependent. In her experiments on word recognition in noise, elderly subjects adopted a less conservative criterion. The explanation given for the difference in outcome was increasing confidence in the accuracy of one's own responses with aging but greater cautiousness in relation to externally controlled events.

Historically, reaction time has been used as an index of cognition, specifically to estimate the time taken for each of the stages that occur between the presentation of a stimulus and response (Donders, 1869; Smith, 1968). *Simple reaction time* (e.g., key tap to tone onset) is comprised of the times for the cortical registration of a particular event and response execution. *Choice reaction time,* which is obtained by requiring a different response for each of a number of possible stimuli, adds the times for stimulus identification and choice. These two stages represent intervening cognitive events. Both simple and choice reaction times increase significantly after the fourth or fifth decade of life. According to Welford (1980), this increase reflects changes in performance strategy rather than a deterioration in sense organ or motor function.

2. RATIONALE

The present experiment was conducted to investigate the effect of aging on measures of sensation and choice reaction time for different psychophysical tasks. The tasks investigated included signal detection in quiet (Det/Q), signal detection in noise (Det/N), and duration discrimination (Discrim). In all three, a four-interval forced-choice paradigm with four response alternatives was used, requiring subjects to compare auditory stimulus events presented across a series of listening intervals (pure tone vs quiet, pure tone in noise vs noise alone, and long vs short duration for a one-third octave noise band).

It could be argued that within a restricted age group, the three tasks should yield the same reaction time because they require the same degree of choice. A finding of increasingly longer reaction times for discrimination as compared with detection would suggest that the level of complexity in decision-making (i.e., a comparative judgement vs. the detection of an event) is an important factor. Previous studies support the conclusion that the effect of task complexity on choice reaction time will interact with aging (Cohen and Faulkner, 1983). So that the age-related effect of a possible distractor on performance could be assessed, a continuous noise background of moderate intensity was introduced in the second detection task. Published data also indicate that temporal acuity, as measured by the difference limen for stimulus duration, will decline with age, even when hearing remains normal (see above).

In all three tasks, the stimulus frequency was 4000 Hz, based on our previous findings of age-related high-frequency decrements in both frequency and duration discrimination (Abel, Krever and Alberti, 1990). For the detection tasks, the stimulus duration was 300 ms (including a rise/decay time of 50 ms). For the discrimination task, the standard duration was 220 ms (including a rise/decay time of 10 ms). These values were sufficiently long to preclude the effect of temporal integration which would change the detection threshold, and possibly provide a loudness cue in duration discrimination (Garner, 1947; Green, Birdsall and Tanner, 1957). A one-third octave noise band was used in preference to a pure tone for duration discrimination, in order to avoid possible spectral changes (and thus a pitch cue) which might be confounded with a change in duration.

3. METHODS AND MATERIALS

3.1 Subjects

Two groups of 15 subjects with screened normal hearing, aged 20-30 (young) and 50-60 (old) years, were tested. Potential candidates in these two age groups were rejected if their hearing thresholds at 4000 Hz exceeded 20 and 40 dB SPL, respectively. The difference in the hearing criterion reflected an allowance for presbycusis (Brant and Fozard, 1990). All subjects were volunteers who had responded to advertisements posted in selected locations at the University of Toronto and Mount Sinai Hospital. Although several had previously participated in psychoacoustic experiments, none were familiar with the protocols of the present study. Upon completion of the experiment, subjects were paid $15 for their services and were reimbursed for public transit or parking expenses.

3.2 Apparatus

The experiment was carried out in a double-walled IAC booth. The ambient noise levels were less than the maximum allowable levels for headphone testing specified in ANSI Standard S3.1-1977. The pure-tone and one-third octave band stimuli used for the experiment were generated respectively by means of a Hewlett-Packard Multifunction Synthesizer (Model 8904A) and Bruel & Kjaer Noise Generator (Type 1405), in conjunction with a Bruel & Kjaer Band Pass Filter (Type 1617). A Coulbourn Instruments Modular System was used to control the stimulus selection and fine adjustment of stimulus level, duration and envelope shaping. The output of this system was fed to a Hewlett-Packard manual range attenuator (Model 350D) and Rotel integrated stereo amplifier (Model RA-1412) for presentation to the subject binaurally (and diotically) over a Telephonics matched headset (TDH-49P). The system was controllable from an AST Premium 286 personal computer (Model 140X) via the use of IEEE-488 and Lablinc interfaces, and digital I/O lines. The intensities of the two types of stimulus were calibrated at the earphone by means of a Bruel & Kjaer artificial ear (Type 4153). Subjects responded using a custom designed handheld response box which comprised a set of five LEDs to cue events on a trial and four microswitches for responding. The latter were accurate to within 1 ms.

3.3 Procedure

3.3.1 Detection

The detection thresholds for both the quiet and noise background conditions were measured using a four-interval forced-choice procedure. On each trial the subject was presented a 1/2-sec warning light followed in succession by four listening intervals of 300 ms duration, separated by pauses of 300 ms. These events were cued by a horizontal array of five LEDs on the response box. The pure-tone stimulus was presented in one of the four listening intervals, the choice randomly determined. The subject was instructed to depress the response key corresponding to the LED that was coincident with the stimulus, as soon as the last LED in the series was extinguished. In the noise background condition, white noise at an intensity of 54 dB SPL was continuously present throughout the trial block.

The intensity of the stimulus was varied across blocks of 32 trials, so as to generate a psychometric function with the proportion of correct responses, P(C), ranging from 0.25 (chance) to 1.00 (perfect) performance. The detection threshold, defined as that intensity yielding P(C) equal to 0.625, was interpolated using a straight line visual best fit to the data points obtained for the various blocks. A minimum of two points was considered sufficient, as long as one value of P(C) was between 0.30 and 0.625, and the other was between 0.625 and 0.90. In practice, three to four blocks were required to satisfy this condition.

3.3.2 Discrimination

The paradigm used for the duration discrimination task was similar to that for detection. On each forced-choice trial, four one-third octave noise band stimuli were presented, three standards and one comparison, whose duration exceeded the standard by Δt ms. The subject was required to choose the listening interval that coincided with the longest of the four auditory events. Across blocks of 32 trials, the value of Δt was varied so as to generate a psychometric function with P(C) ranging between 0.25 and 1.00. The discrimination threshold, defined as that Δt for which P(C) was 0.625, was interpolated from a visual fit to the data points obtained for the blocks presented. The requirement for two data points within different ranges of P(C) was the same as that specified for detection.

3.3.3 Choice Reaction Time

The correct and incorrect reaction times associated with the detection and discrimination thresholds were obtained by plotting the proportion of correct responses against the median reaction time (correct and incorrect) for each block of trials obtained within subject for the various tasks. Straight lines were then fit by eye to these reaction time psychometric functions. The correct and incorrect reaction times associated with P(C) = 0.625 were then interpolated to give the values of reaction time at threshold. Median reaction times for each trial block were used in preference to means based on the reported observation of skewness in reaction time distributions (Moody, 1970; and Abel, Rajan and Giguère, 1990).

3.3.4 Instructions and Practice

For both the detection and discrimination paradigms, subjects were instructed to respond as quickly as they could, without sacrificing accuracy, and to guess on each trial, if uncertain. The entire experiment was replicated twice in each subject, so that the effect of practice could be determined for the various measures. In approximately half the subjects in each group, the two replications were conducted within the same session which lasted approximately one and a half hours, and in half, the replications were conducted during two different sessions of approximately 45 min, separated by no more than one week. This allowed an evaluation of the possible dissipation of practice over time. For the first replication, the detection in quiet task was always presented first, followed by the detection in noise and duration discrimination tasks in random order. For the second replication, the order of the three tasks was counter-balanced across subjects within groups.

4. RESULTS

The median detection and discrimination thresholds for the three tasks are presented in Table 1 for each of the four group by replication (Rep) conditions. Table 2 and Figure 1 show the median reaction times for the two response types (Resp), correct and error, corresponding to these threshold measurements. In the figure, the data points for the three tasks have been joined for each of the four replication by response type conditions to aid visual comparison. The slopes of the lines have no theoretical significance. All medians, for both threshold and reaction time, are based on 15 observations. Since there were no statistically significant differences for second replications held on the same or different days, the data for the two subgroups in the second replication were collapsed.

Nested analyses of variance (ANOVA) were applied to the threshold data for each of the three tasks to assess the effects of age (between groups) and replication (within groups), and to the reaction time data to assess the effects of age (between groups) and task, replication and response type (within groups). Because of the differences in the dispersion of scores across conditions, particularly for the reaction time data, a rank transformation was applied to each of the four data sets prior to statistical analysis (Conover and Iman, 1981).

4.1 Thresholds

Age was a significant main effect for the detection threshold measured both in quiet and in noise ($F=39.71$, $p<0.001$, $df=1$ and $F=16.24$, $p<0.001$, $df=1$, respectively). This outcome was expected given the difference in the hearing selection criterion for the two groups. In spite of the difference, the thresholds in quiet for both groups, i.e., 9 and 19 dB SPL (see Table 1, replication 2), were within the range of normal hearing for young listeners (Yantis, 1985). The median detection thresholds in noise, 37 and 38 dB SPL, were similar for the two groups. Given that the white noise masker was 54 dB SPL, the signal to noise ratio for threshold detection was approximately -16 dB, a value close to that reported previously (e.g., Green, 1976). Neither the threshold in quiet or in noise changed significantly with replication.

In contrast, the duration discrimination threshold, Δt, did decrease significantly with replication ($F=101.30$, $p<0.05$, $df=1$) but was not affected by age. As shown in Table 1, this practice effect was evident only for the older of the two groups, although the interaction of age and replication did not reach statistical significance ($F=3.46$, $p<0.10$, $df=1,28$). The observed values of 45 to 52 ms for the four group by replication conditions were close to those documented in the literature for unpracticed normal hearing subjects for a standard duration of 300 ms (Thompson and Abel, 1992) but somewhat larger than those for practiced listeners (Abel, 1972).

4.2 Reaction Time

4.2.1 Medians

The ANOVA on the reaction time data indicated that there were significant main effects of task ($F=12.31$, $p<0.001$, $df=2$), replication ($F=26.25$, $p<0.001$, $df=1$) and response type ($F=106.68$, $p<0.001$, $df=1$); a significant two-way interaction of task by response type ($F=3.63$, $p<0.05$, $df=2,56$); and a significant three-way interaction of task by replication by response type ($F=4.05$, $p<0.05$, $df=2,56$). Age was not significant either as a main effect or in interaction with the other three variables.

Post hoc pairwise comparisons of ranked reaction times for the three *tasks* indicated that there were significant differences only for the erroneous responses made by the younger group. In the first replication, the error reaction time was significantly less for detection in noise than for duration discrimination. Since the detection in quiet task was always presented first in this replication, its relatively greater reaction time compared with detection in noise may have been due to lack of familiarity. In the second replication, the error reaction time for detection in quiet was significantly less by 160 ms than that observed for duration discrimination, with the outcome for detection in noise falling between.

With respect to the *replication* effect, post hoc comparisons showed that there were significant decrements in reaction time with practice only for the erroneous responses made in detection in quiet. This outcome (approximately 125 ms) was significant for both groups and was likely due again to the non-random order of tasks in the first replication. Generally, erroneous responses took longer to make than correct responses. *Response type* was a significant factor for the younger group in both replications of duration discrimination, and for the older group in both replications of detection in quiet and duration discrimination, and in the second replication of detection in noise.

A separate nested ANOVA of the differences between correct and erroneous reaction times, calculated within subject for combinations of task and replication, indicated that task, group by task and group by task by replication were statistically significant factors ($F=6.41$, $p<0.01$, $df=2,56$; $F=5.33$, $p<0.01$, $df=2,56$; and $F=3.66$, $p<0.05$, $df=2,56$, respectively). Post hoc pairwise comparisons indicated that after practice (i.e., in the second replication), the older group showed a significantly greater difference than the younger for detection in quiet (150 msec vs 40 msec). For the younger subjects, the difference observed for duration discrimination was greater than that for detection in quiet (130 msec vs 40 msec) with the result for detection in noise (90 msec) falling midway between the two (see Table 3).

4.2.2 Variance

A statistical analysis was also conducted to determine the effect of age on the range of choice reaction times. Variance ratios (i.e., the ratio of the square of the standard deviations) were computed for the reaction time scores observed for the two groups in each task by replication by response type condition. Significant F-ratios (one-tailed test) were obtained in the first replication for the error reaction time in duration discrimination ($F=3.58$, $p<0.025$, $df=14,14$), and in the second replication for correct and error reaction times in detection in quiet ($F=2.55$, $p<0.05$, $df=14,14$ and $F=12.12$, $p<0.001$, $df=14,14$), the error reaction time for detection in noise ($F=4.69$, $p<0.01$, $df=14,14$) and the correct and error reaction times for duration discrimination ($F=11.31$, $p<0.001$, $df=14,14$ and $F=5.71$, $p<0.01$, $df=14,14$).

5. DISCUSSION

The purpose of this experiment was to further explore the previously reported detrimental effect of aging on auditory temporal information processing. The index of temporal processing chosen was the minimum perceptible change in stimulus duration. Choice reaction times (correct and error) were measured in order to determine the relative importance of decision-making, in comparison with sensory function. Detection thresholds in quiet and in noise and their associated reaction times were also obtained to determine whether the effect of aging was specific to temporal acuity or more pervasive in perception.

The results showed that aging did not affect duration discrimination. Although the minimum perceptible change was relatively longer for the older than the younger subjects in the first replication, the performance of the two groups was virtually identical after practice. Observed age-related differences in the detection thresholds could be accounted for by the admission criteria. These findings lead to the conclusion that aging, in the range studied, does not affect sensory function.

Age was also not a significant factor for choice reaction time, neither as a main effect nor in interaction with task, replication or response type. However, in both replications the difference in the time taken to make a correct and an erroneous response was greater for the older subjects, although this was only significant in the detection in quiet task. Age also significantly affected the variance in the time taken to respond. Even after practice, the correct and error reaction times in detection in quiet and duration discrimination, and the error reaction time in detection in noise covered a broader range in the older group. These outcomes suggest that regardless of task, there is greater heterogeneity in the difficulty of decision-making for the older compared with the younger subjects.

A question raised at the outset was whether choice reaction time would be the same for the three tasks since a common methodology was used. The results indicated that task was an important determinant of the time taken for erroneous judgements. For the younger group, after practice errors in duration discrimination took approximately 150 ms longer to make than errors in either of the two detection tasks. For the three tasks, the differences between erroneous and correct reaction times were 40, 90 and 130 ms, respectively. The difference of 40 msec for detection in quiet was similar to the value reported by Abel, Rajan and Giguère (1990) for well-practiced young adults. Thus, the nature of the judgement, rather than the degree of choice was the important determinant of performance.

In a series of papers, Surwillo has presented evidence of a positive correlation between the period of the alpha rhythm of EEG activity and reaction time (Surwillo, 1961; 1963; 1964). Such data are supportive of the notion that brainwave cycles provide a unit of time for the programming of events by the central nervous system (see, for example, Bishop, 1936; Stroud, 1955). According to Surwillo's findings, the period of the alpha cycle will increase with age, and his contention is that this slowing of brain activity is responsible for the progressively longer decision reaction times observed with aging.

The data for practiced young adults in the present study are supportive of the concept of a central clock. The time to make an erroneous response added approximately the equivalent of the alpha half cycle, i.e., 50 ms. This difference was incremented by multiples of 50 ms for each of detection in noise and duration discrimination. The trend was not evident for the older listeners. After practice, the differences between the two response type reaction times were 150 ms for both detection in quiet and duration discrimination and 110 ms for detection in noise, values which were not significantly different. There was also significantly greater variance in the reaction time data of the older listeners. Surwillo's theory might attribute this outcome to greater heterogeneity of the alpha cycle with aging.

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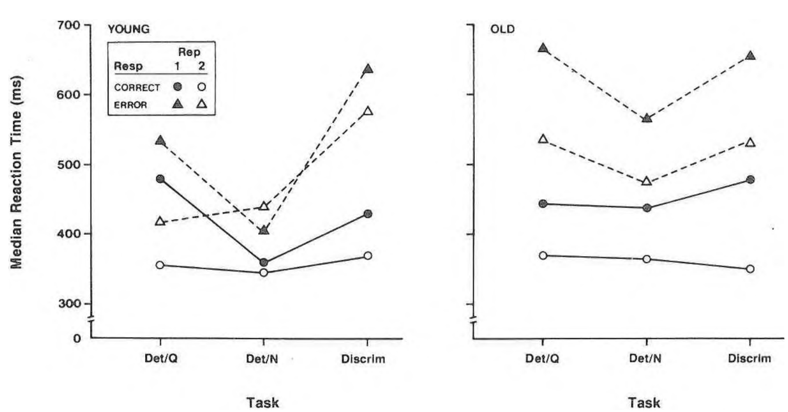

Figure 1. The Effect of Aging, Task and Replication on the Median Reaction Time for Correct and Erroneous Responses

Table 1. The Effect of Aging and Replication on the Detection and Discrimination Thresholds

			TASK	
Group	Rep	Det/Q	Det/N	Discrim
Young	1	8.0 ± 3.3*	37.0 ± 1.1*	46.0 ± 6.8+
	2	9.0 ± 2.5	37.0 ± 0.7	48.0 ± 6.9
Old	1	21.0 ± 5.4	38.0 ± 1.1	52.0 ± 7.3
	2	19.0 ± 4.6	38.0 ± 1.1	45.0 ± 10.4

*Median (dB SPL) ± 1 avg. dev.
+Median (msec) ± 1 avg. dev.

Table 2. The Effect of Aging, Task and Replication on Reaction Time

				TASK	
Group	Resp	Rep	Det/Q	Det/N	Discrim
Young	Correct	1	480 ± 116*	360 ± 103	430 ± 105
		2	355 ± 85	345 ± 85	370 ± 85
	Error	1	535 ± 219	405 ± 227	640 ± 233
		2	420 ± 114	440 ± 129	580 ± 136
Old	Correct	1	445 ± 132	440 ± 106	480 ± 119
		2	370 ± 122	365 ± 74	350 ± 183
	Error	1	670 ± 245	570 ± 186	660 ± 363
		2	540 ± 360	480 ± 248	540 ± 312

*Median (msec) ± 1 avg. dev.

Table 3. The Effect of Aging, Task and Replication on the Difference in Reaction Time for Correct and Erroneous Responses

			TASK	
Group	Rep	Det/Q	Det/N	Discrim
Young	1	95 ± 129*	70 ± 134	130 ± 183
	2	40 ± 79	90 ± 62	130 ± 92
Old	1	280 ± 136	80 ± 124	180 ± 273
	2	150 ± 240	110 ± 212	150 ± 229

*Median Difference (msec) ± 1 avg. dev.

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THE BENEFITS OF FIELD TESTING THE ACOUSTIC PERFORMANCE OF SOUND ISOLATION ROOMS

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ABSTRACT

Sound Isolation Rooms, typically used for auditory examination and research, are designed to provide a Noise Reduction in excess of ninety decibels and a background noise level approaching the auditory threshold. The Noise Reduction of these specialized rooms, as published by the various manufacturers, are usually laboratory tested in accordance with ANSI/ASTM E 596. Although methods of field testing these rooms have been proposed, there is no standardized procedure that allows the in-situ performance to be directly compared to the laboratory measurements. One main consideration is the physical environments surrounding a Sound Isolation Room placed in a building, which varies greatly from the uniform test conditions of a reverberation chamber. Numerous Sound Isolation Rooms were recently field-tested for their acoustic performance. Airborne sound isolation, background noise and structureborne sound isolation were investigated. For determining airborne sound isolation in the field, a simplified measure of Noise Reduction was used. Airborne sound leakage paths were clearly identified within the rooms. Consequently, these areas of deficiency were treated to optimise the on-site, airborne sound isolation. The measurements of background noise and structureborne sound isolation also revealed limitations in the acoustic performance that resulted in useful information for the examination and research personnel using these rooms.

SOMMAIRE

Les chambres d'isolation acoustique, dans lesquelles l'on fait l'examination auditive ou la recherce audiologique, sont déssinées afin d'insonoriser au delà de quatre-vingt dix (90) décibels tout en ayant un bruit de fond au seuil de l'audition. La réduction des niveaux publié par les manufacturiers pour ces chambres proviennent d'éssais en laboratoire conformément au standard ANSI/ASTM E-596. Plusieurs méthodes d'essais en place (après l'installation dans un batîment) ont été proposée mais aucune d'elles permetterait une comparaison directe aux résultats de laboratoires. Le variable principal c'est l'environment acoustique entourant la chambre dans un batîment qui varie nessairement d'une salle de réverberation.

Réçament, nous avons eu l'occasion de vérifier la performance acoustique de plusieurs de ces chambres dans des hôpitaux. Le niveau d'insonorisation fût déterminé par une mesure simplifiée de la réduction des niveaux, l'isolation structurelle avec une machine à impactes standardisé et le bruit de fond fût mesuré. Les lacunes acoustiques fûrent clairement identifiées et corrigées. Ceci améliora l'insonorisation subtantielment. Les mesures de briut de fond et de l'isolment structurel démontrèrent des limitaions importantes pour les usagers de ces chambres.

1. INTRODUCTION

One of the first successful applications of a lightweight, double-wall enclosure for sound isolation was at an industrial site in 1953. Since that time, the design of Sound Isolation Rooms (SIRs) has improved and their use has expanded to include many applications where acoustic isolation is critical. Along with their popular use as an audiometric testing facility, these modular units are utilized for industrial noise control, music practice rooms, broadcast studios, and test cells for various medical and life sciences.

A notable feature of these rooms is that their construction is modular. This gives them the ability to be easily fabricated within existing buildings at almost any location that provides the space. Also, these rooms can be disassembled and relocated, if the need arises.

The acoustic performance required from a SIR is highly dependent on its application. Perspective user groups typically base their purchase decision on the manufacturers published data of Noise Reduction and maximum Background Noise Levels. Once a SIR is installed on-site, they are usually not tested acoustically for their field performance. One reason may be the fact that there is no standardized procedure that allows the in-situ acoustic performance to be directly compared to the manufacturers data of Noise Reduction (ANSI/ASTM E596). It does seem, though, that many user groups rely on the expertise of the manufacturer and construction personnel to provide a SIR with optimum acoustic performance.

Eight Sound Isolation Rooms, used primarily for audiometric examination and research, were field tested for their acoustic performance. Airborne sound isolation, background noise and structureborne sound isolation were all investigated. Several acoustic deficiencies were disclosed that resulted in acoustic performance much less than optimum. In many cases, these deficiencies were easily corrected so that the on-site performance was optimized. The following describes the field test methods used to measure these rooms and summarizes the measurement results. The benefits of field testing these rooms are also outlined, based on the test results and site experiences.

2. LABORATORY TESTING VS. FIELD TESTING OF NOISE REDUCTION

For determining the airborne sound isolation of SIRs, manufacturers have them tested for Noise Reduction (NR) by a certified laboratory in accordance with ANSI/ASTM E596 Laboratory Measurement of the Noise Reduction of Sound-Isolating Enclosures. This standard test method requires that all four sides and the top of the SIR be exposed to the testing sound source. Also, the sound pressure level created by this source must be very uniform along all of these five surfaces. The laboratory requirements [free volume greater than 200 m^3, at least ½ wavelength clearance between chamber surfaces and isolation room walls, non-parallel alignment] give fairly uniform exposure of the top and all sides.

The physical environment surrounding a SIR placed in a building is different for each installation and varies greatly from uniform laboratory conditions. Field installations will often have the ceiling and one or more walls protected by the building surfaces and finishes. Therefore, one might expect better noise reduction for the field installations, given that the measured sound pressure level outside the exposed faces should be similar for field and laboratory.

To date, there is no standardized method for measuring sound isolation in the field so that the results can be directly compared to the laboratory NR. There has been considerable controversy in the past about how to measure a field NR and just how meaningful the results are. It is understood, though, that ASTM is currently working on a field NR standard.

3. FIELD TEST METHODS

3.1 Airborne Sound Isolation

A simplified measurement of NR was performed in the field to determine sound isolation of the rooms tested. A commercial sound reinforcement system was used to generate broad-band pink noise around the exposed surfaces of the SIRs. To produce a satisfactory sound pressure level within these double-walled enclosures, the sound systems used were capable of generating a reverberant level of 111 decibels, A-weighted when measured one metre from the test enclosure.
Typically, the loudspeakers were positioned with the speaker fronts directed away from the test room surfaces. The distance between the loudspeakers and the measuring microphone was as far as practical to create a reverberant sound field around the rooms and maintain the required sound pressure levels.

Two stationary microphone positions were chosen inside the SIRs. The microphones were placed at least 1000 mm away from each other and set 900 mm and 1200 mm from the floor.

Although two sampling positions inside the enclosure is far from ideal, this limited sampling was chosen mostly because of time constraints. Substantial spatial variation in the sound pressure is to be expected in these small and non-reverberant enclosures. Therefore, more extensive sampling within the "useful volume" of these rooms is recommended for greater accuracy. Two stationary microphones positions were also chosen outside and near to the exposed surface(s) of the tested rooms. Both of these 'source' microphones were at least 1000 mm from all vertical surfaces and 1200 mm from the floor. For each pair of source/receiving microphones, sound pressure levels were measured simultaneously. All sound levels were sampled for a duration of 30 seconds to obtain the Equivalent Continuous Sound Level (Leq). The one-third octave band results were stored on the floppy disk of a real-time analyzer for future reference.

The measured sound pressure levels within the SIRs were corrected for signal-to-noise in each one-third octave band. This involved logarithmic subtraction of the measured background noise levels in each room. When the signal-to-noise was less than four decibels, two decibels were added to the uncorrected level and the actual NR is assumed to be greater than this value. The reported results are an average value of the two microphone positions using the mean-square pressure method.

3.2 Background Noise

The background noise produced within the SIRs is predominantly due to the ventilation system. The sound pressure level, in the standard I.S.O. frequency bands, was measured at one position within each room. The measurement location was the first of the two positions that were used for the airborne sound isolation measurements. The Leq was taken over 30 seconds with the room ventilation system operating.

3.3 Structureborne Sound Isolation

There are both field (ASTM E 1007-84) and laboratory (ASTM E 492-86) standards for evaluating impact sound transmission. These standards specifically outline how to measure floor-ceiling assemblies of all kinds. Both of these methods are based on the use of a calibrated tapping machine that conforms to the specifications in ISO 140/IV - 1978(E).

The impact sound measurements that were done on the SIRs involve a different transmission path than the standard floor-to-ceiling. The greater concern was whether impacts (eg. high heels, dropped items) on the floor directly outside the rooms could be heard within the rooms. A standard tapping machine was used for this measurement and was placed on the floor 1200 mm from the door of each room under test. The Leq was measured for a duration of 30 seconds at one position in the room. It is important to note that the ISO tapping machine does not produce impacts that correlate well with the most usual type of impact; specifically footsteps. Therefore, it cannot be resolved that the noise level and characteristic measured within the rooms is the same as that produced by footsteps. The differences in the noise levels between similar rooms, however, can be directly compared and the effect of variables (eg. floor finish) can be determined.

Four of the rooms were tested in the manner described. The floor finish directly outside three of these rooms consisted of vinyl directly on concrete. The room finish outside of the fourth room was a commercial carpet on concrete. Since the structureborne test described was not formally part of the commissioning process, the other four enclosures were not investigated using the tapping machine. However, the results of the rooms tested show that this can be a useful method to identify structureborne sound flanking.

Another "impact" source that was used in another instance is the slam of a nearby office door. This particular office is located across the corridor from a SIR on the second floor of a building. The noise levels encountered in the test room were recorded while the office door was slammed shut.

4. MEASUREMENT RESULTS AND SITE OBSERVATIONS

4.1 Airborne Sound Isolation

There is an advantage to comparing the measured, in-situ performance of NR to the laboratory results of a similar enclosure. Regardless of the absolute value of NR, the one-third octave spectra performance should be typical of a double-leaf partition. That is, the field and laboratory values should both be increasing at a rate close to 18 dB per octave after the fundamental mass-air-mass resonance of the wall/ceiling system. The slope of the performance gradually decreases in the higher frequencies from secondary resonances. As well, the signal-to-noise limitations of the measuring equipment also affects the slope of the recorded performance at the higher frequencies. However, any large variance in the performance spectra does indicate that sound leakage is occurring.

These sound isolation deficiencies show up quite dramatically because of the high sound transmission loss rating of the construction. Examples of the airborne sound isolation measured for specific SIRs and the effect of sound leakages are shown in Figure 1, 2 and 3.

Field measurement results are compared to the laboratory NR values of a similar room and variances in the spectral shapes can be observed. Figure 1 shows the results of a SIR where sound leakage is occurring through the door bottom of one of the double doors and the light fixture located on the ceiling. Spectrum shape has certainly been

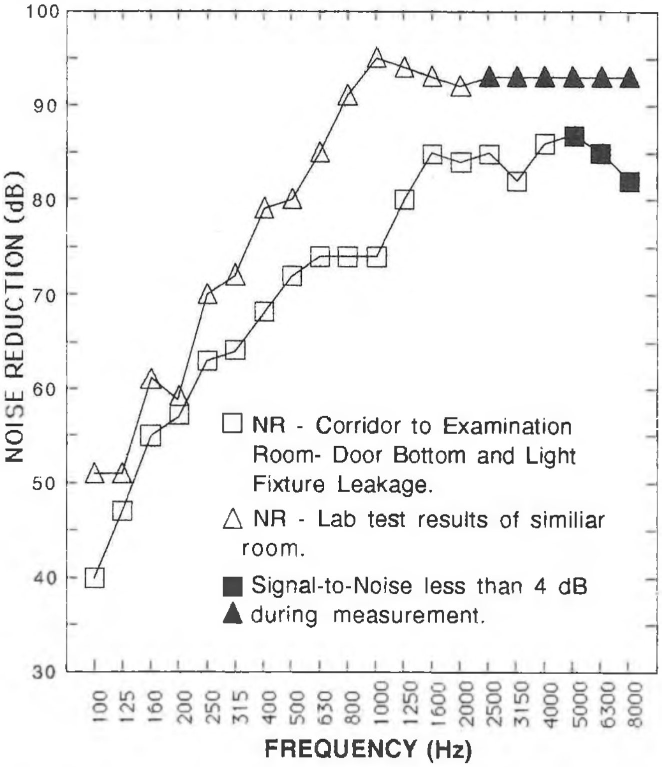

Figure 1. Field Noise Reduction Measurement Versus Laboratory Noise Reduction (ASTM E 596 - 78) of Sound Isolation Room - Effect of Sound Leakage.

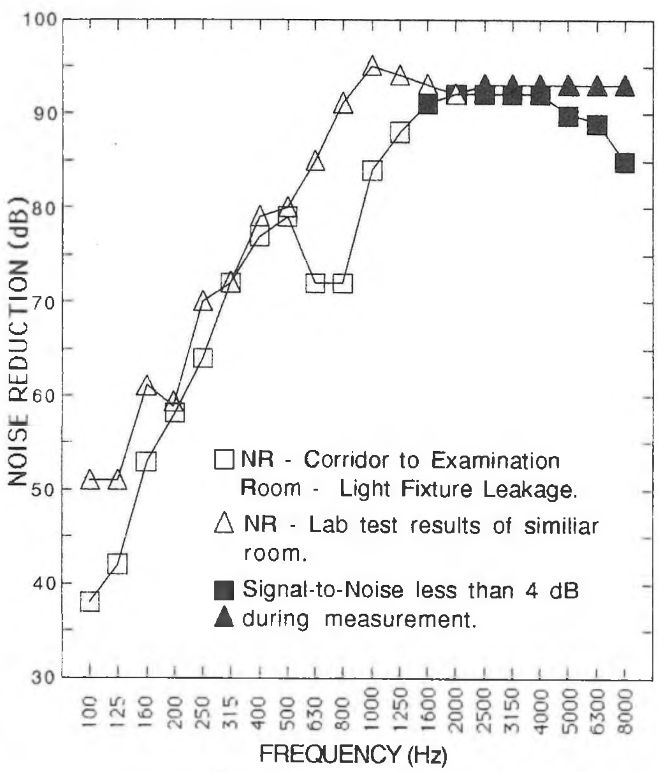

Figure 2. Field Noise Reduction Measurement Versus Laboratory Noise Reduction (ASTM E 596 - 78) of Sound Isolation Room - Effect of Sound Leakage.

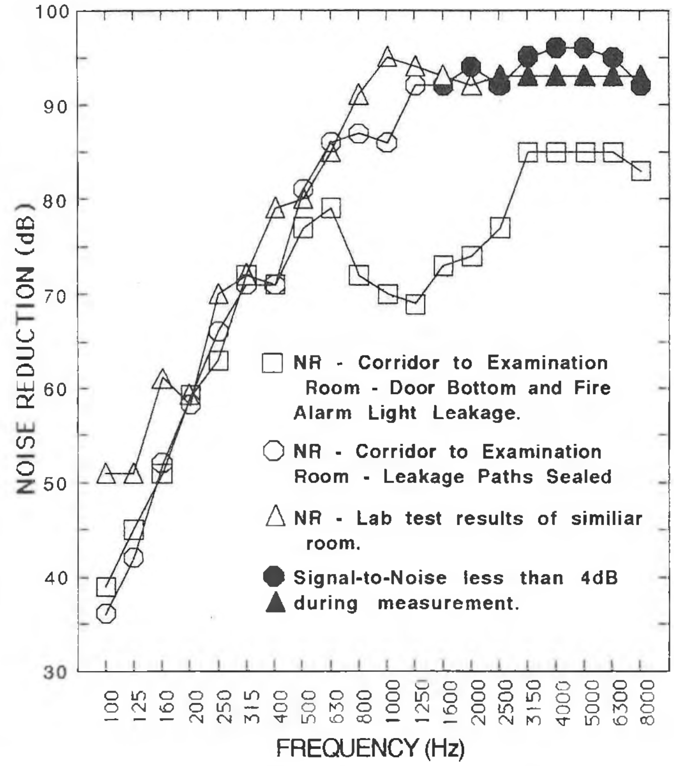

Figure 3. Field Noise Reduction Measurements - Effect of Sealing Sound Leakage Paths.

altered due to these acoustic deficiencies. Figure 2 shows another similar room where the only sound leakage occurring is through the ceiling light fixture. A dramatic 'dip' in performance is obvious at the 630 Hz and 800 Hz bands. In Figure 3, the result of sealing two construction deficiencies is shown. In this room, sound leakage was noticed along the door bottom and a site-installed fire alarm light. The airborne sound isolation of this room was greatly increased when these deficiencies were corrected. For this room, on-site NR values after the leakage paths were sealed are surprisingly close to the lab NR values.

4.2 Background Noise

The results of background noise levels measured within eight SIRs has been compiled. The range of sound pressure levels measured at specific one-third octave bands is shown in Figure 4.

As a comparison, the maximum allowable sound pressure levels for audiometric testing (ANSI S3.1 - 1977) are also illustrated. In addition to the standard ISO frequency bands shown, audiometric testing uses measurement frequencies of 750 Hz, 1500 Hz, 3000 Hz and 6000 Hz. The maximum allowable sound pressure levels are shown for these frequencies. However, no site measurement data is given at these one-third octave bands because filters with similar centre frequencies were unavailable during testing. While these peculiar frequency bands are not

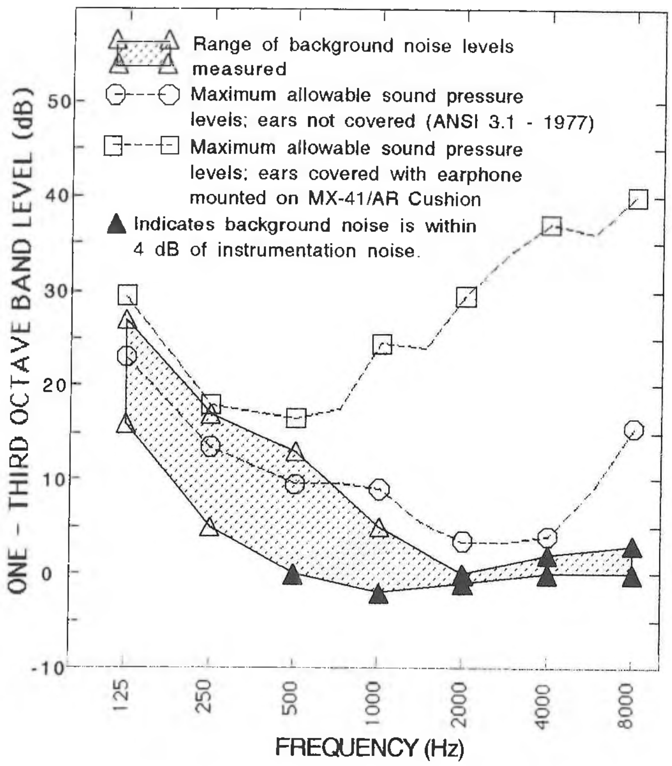

Figure 4. Range of Background Noise Levels Measured Within Eight Sound Isolation Rooms - Ventilation System On.

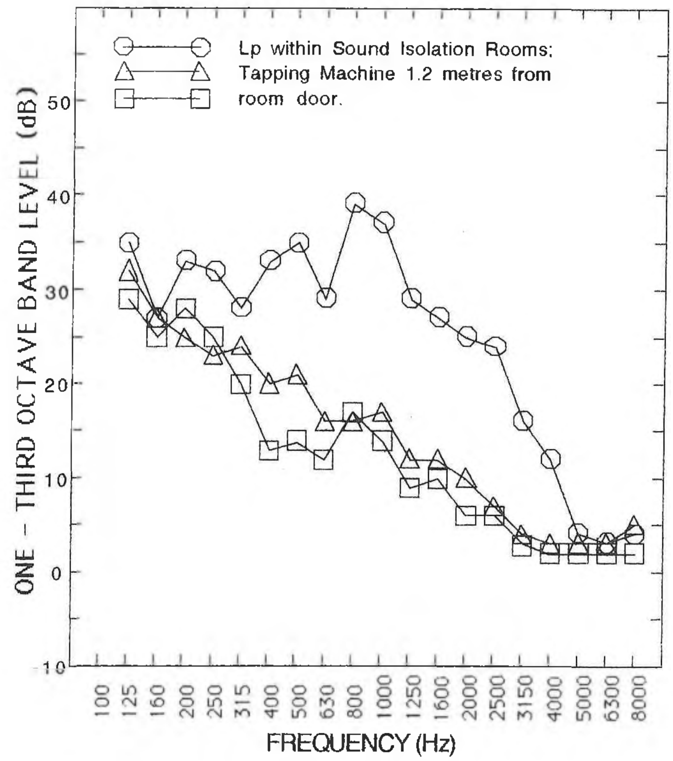

Figure 5. Assessment of Structureborne Sound Isolation Using ISO Tapping Machine; All rooms on main floor level of same building with vinyl on concrete floor finish.

always measureable, most acoustic personnel can measure the standard frequency bands.

In all eight rooms, the sound pressure levels were within the maximum allowable when the ears are covered with the standard earphone mounted on an MX - 41 AR cushion. With the ears uncovered, three of the eight rooms did not comply with the maximum allowable levels at the low frequencies. If audiometric testing without earphones was done in these three rooms, the problem of excessive background noise levels would need to be analyzed and resolved.

4.3 Structureborne Sound Isolation

The measurement results for the structureborne sound tests are shown in Figure 5 and 6. Figure 5 is a plot of the sound pressure levels measured in three separate rooms with the Tapping Machine located on a vinyl-to-concrete floor just outside the room doors. All three SIRs were of the same make and located at the same facility. The sound pressure levels were reasonably similar in two of the rooms. However, one of the rooms recorded much greater levels, which is indicative of significant bridging between the building structure and the SIR.

The room that was tested with the tapping machine located on carpet were not measurable in the SIR. That is, the resultant sound levels were below the measured background noise levels in the room. Figure 6 illustrates the sound pressure levels created in another SIR when a nearby office door is slamming closed. The results are compared to ANSI S3.1 - 1977. These results clearly show that structureborne flanking exists and that audiometric tests may be affected by the occurrence of this noise.

Another case of structureborne flanking was observed during the measurement of background noise within a SIR located on the second floor of a building. The results of noise levels taken both during and after normal working hours is shown in Figure 7. During normal working hours, the background noise levels were significantly higher, with a peak level occurring at 125 Hz. After normal working hours, the levels were much lower. In both cases, the ventilation system supplying the test room was confirmed to be operating. The specific source of the noise during normal working hours is suspected to be equipment, related to the building mechanical system. This equipment is likely transmitting vibration to the building structure. As a result, structureborne noise is being transmitted to the room via mechanical bridging between the structural floor and the SIR.

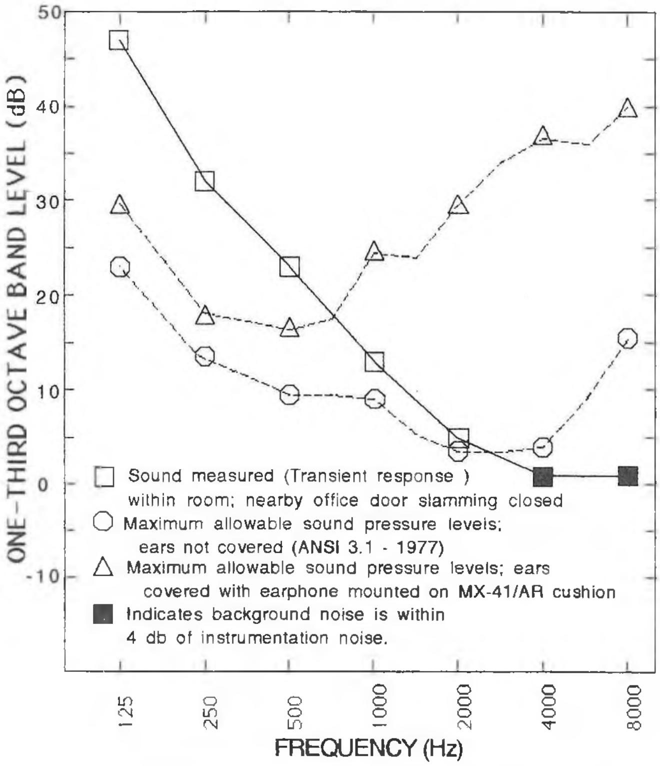

Figure 6. Structureborne Sound - Effect of Nearby Office Door Slam.

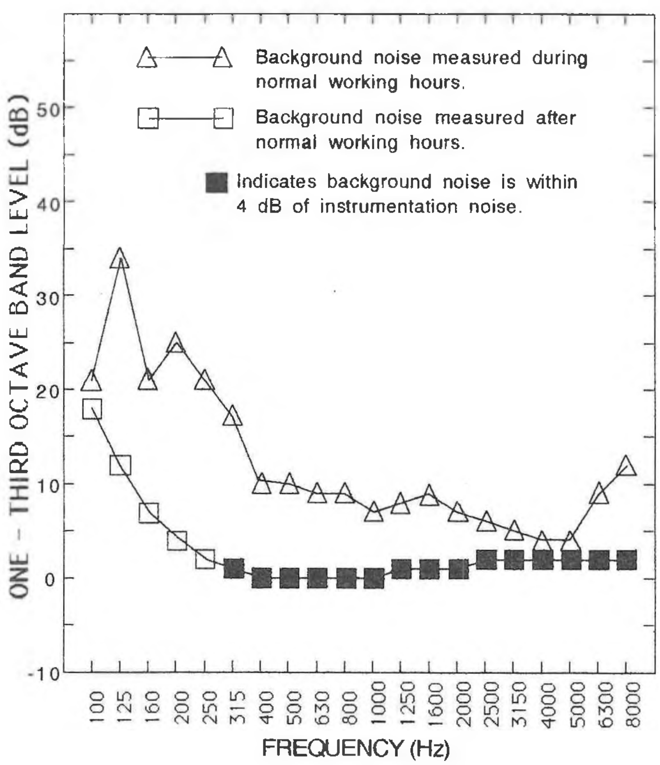

Figure 7. Background Noise Levels Measured in Sound Isolation Room - Influence of Extraneous Machinery Noise (Structureborne).

5. CONCLUSIONS

The acoustic performance of several Sound Isolation Rooms has been investigated in the field using simplified measurement methods. The test results are an indication of the types of acoustic deficiencies that occur when these specialized enclosures are installed on-site. The experience of doing acoustic commissioning on these rooms has resulted in a list of benefits that supports the field testing of these rooms. The most noteworthy ones are:

1. Identifies structureborne flanking and airborne sound leakage paths. Remedial measures for these optimize the on-site acoustic performance of the room.
2. Evaluates compliance with any construction specifications relating to the room (performance or otherwise).
3. Evaluates compliance with applicable regional, national or international standards (eg. ANSI S3.1), if this is important criteria.
4. Defines high and low on-site thresholds of acoustic performance criteria for the individual room. In certain sensitive research applications, this may be required to validate results.
5. Provides a resource of information that may be useful in the planning stages of future installations.
6. Provides manufacturers and authorized installers of these types of rooms with information that may prove useful in improving their existing design and/or installation details.

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SOUND MASKING SYSTEMS: A GUIDELINE

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1. Why Sound Masking?

Recognizing the importance of good office acoustics, PWC has established commitments for acoustic performance in the office (see reference 1): maximum background noise levels; and maximum length of reverberation time. The lower limits presented for background noise are considered optimal: in the open office this equates to about 45 - 48 dB(A); in closed offices 37 - 42 dB(A).

The highest possible levels of background noise maximize noise isolation (privacy), and thus, the optimum office will be characterized by noise levels which are based on these levels as *targets*, rather than *maximums*.

Levels which are too high cause raised voices and stress, levels which are too low are distracting since occupants can hear quieter, distant sounds. Consider the sound of a dripping tap: during the day with other noises present it is inaudible; at night-time in the silence it can become very distracting.

Sound masking should be considered for all new fit-up and for retrofit to existing fit-up, when the levels of background noise are (or are anticipated to be) more than 5 dB below the optimum levels at frequencies between 250 and 4000 Hertz, at some or all locations. Sound masking should only be considered when adequate levels of acoustic absorption are present: an acoustic ceiling and screens are essential prerequisites.

Sound masking is suitable for both open and closed offices to improve acoustic privacy. Space planning with sound masking can avoid the need to build partition walls above the ceiling to achieve confidential privacy between closed offices (when the door is closed). The judicious use of sound masking around closed offices and meeting rooms can increase acoustic security by reducing the signal to noise ratio in the surrounding areas. Further information on this aspect of the application of sound masking can be found in reference 2.

Persons with hearing impairments require low background noise levels for proper functioning of hearing aids, and thus sound masking is *not* suitable for the spaces which they occupy.

2. What is Sound Masking?

Sound masking is the artificial introduction of the optimum levels and spectrum of background sound into the office. The spectrum is shaped and is NOT white noise or pink noise, although these terms are sometimes used incorrectly to describe sound masking.

Masking sound contains a smooth spectrum of multiple sound frequencies, primarily in the human voice range. Natural sources of sound masking include waterfall and wave noise. HVAC noise is usually unsuitable for sound masking since it is unlikely to have the right spectrum, is often too quiet, and usually varies in space and time. Similarly, music is also unsuitable since it contains tonal sounds (information) and can thus be distracting.

Sound masking uses speakers located in the ceiling plenum to introduce sound into the workplace. The depth of the ceiling plenum and the tile material (mineral or glass fibre) are important issues: each speaker will normally cover from 24 to 40 square metres of floor space. The speakers are normally anchored to the slab using cable or chain. Power requirements can vary from low voltage AC or DC, to 120 VAC.

Depending on the voltage and local code requirements conduit may be necessary, although this is normally not the case - local authorities should always be consulted to determine if conduit is required. In Ontario, cabling rated to FT6 or better does not require conduit.

Ideally, all areas on a floor should be covered, as partial systems will draw attention to their presence and thus reduce their effectiveness.

3. Types of Sound Masking Systems

Centralized systems use signal generation and amplification equipment located in a central place, usually a closet or control room, which should be secure to prevent tampering. Distributed systems provide signal generation and amplification equipment at each (or every two or three) speakers. Centralized systems offer greater potential for system-wide and zone control, but at the expense of the more localized adjustment and tuning possible with distributed systems. Centralized systems may offer greater economies of scale. Distributed systems are less likely to fail on a system-wide basis due to the failure of one component.

Most sound masking systems provide the capability for both music and paging inputs.

Sound masking is normally a tenant fit-up expense, and costs approximately $10 per square metre of floor space.

4. Supply, Installation and Maintenance

While there are firms which supply and assemble components provided by others, and those which will sell the client components which they must install and adjust themselves, PWC experience has been that sound masking systems purchased in such a manner are unlikely to meet requirements. Ideally, one firm should quote for the design, installation, tuning, *and* maintenance of a sound masking system to ensure client satisfaction. Few firms in Canada meet this criteria.

Suppliers of sound masking systems will bid based on a specification of what is required (most firms have developed their own performance standard), and drawings of the space identified for coverage. They will also provide recommendations on the timing for installation, and should be knowledgeable and able to provide advice on related acoustic issues. Beware of those who claim that sound masking is a panacea for all that is wrong with open office acoustics.

Maintenance of sound masking systems is normally limited to ensuring continued function of all components, periodic adjustments of levels to account for any drift, and re-evaluation when changes to the use of configuration of the space occur.

For further information contact Greg Clunis, P.Eng., Interior Environmental Engineer, Public Works Canada HQ, (613) 736-2151.

References

1. Making Your Workplace Work: A Tenant's Guide to PWC Buildings, 1990.

2. Acoustics Guidelines for High Security Spaces, Public Works Canada, 1992.

Canadian Acoustics / Acoustique Canadienne 20(3) 37-38 (1992)

PRELIMINARY SIMPLIFIED MODELS FOR PREDICTING SOUND PROPAGATION CURVES IN FACTORIES

Murray Hodgson

Occupational Hygiene Programme / Department of Mechanical Engineering,
University of British Columbia,
2324 Main Mall, Vancouver, BC V6T 1Z4.

In this summary paper, the simplified models are incorrect. The correct models are as follows:

Frequency-independent models

Empty: $SP_E(r) = -11.4 - 7.3 \log r$

Empty+absorption: $SP_{EA}(r) = -11.4 - 10.3 \log r$

Fitted: $SP_F(r) = -9.1 - 12.3 \log r$

Fitted+absorption: $SP_{FA}(r) = -9.1 - 15.3 \log r$

Frequency-dependent model

$$SP(r) = (I_E + \Delta I_F) - 3.3\ (S_E + \Delta S_F + \Delta S_A) \log r$$

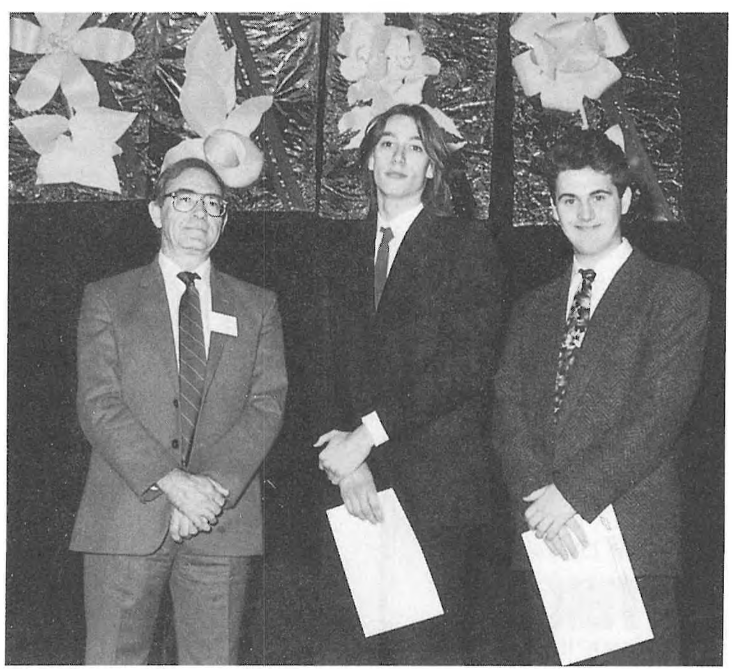
Band	I_E	ΔI_F	S_E	ΔS_F	ΔS_A
125	-11.6	1.9	2.2	1.7	0.6
250	-11.3	2.1	2.1	1.7	1.0
500	-11.5	2.6	2.2	1.3	1.5
1000	-11.1	3.3	1.9	1.5	1.4
2000	-11.4	2.4	2.1	1.3	0.6
4000	-11.2	1.7	2.6	1.7	0

YOUTH SCIENCE FAIR 1992

Canadian Acoustical Association Prize Winners

Allen Attard and Leo Comitale

Play It Again S.A.M.



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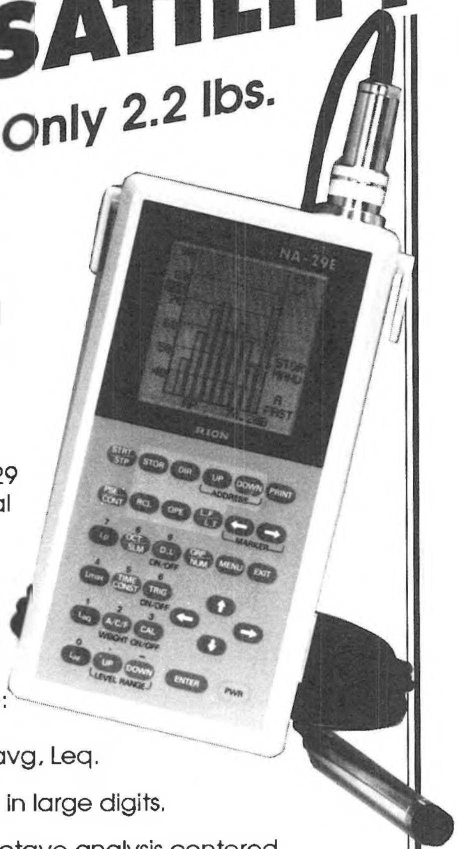

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- ❑ Spectrum comparisons.

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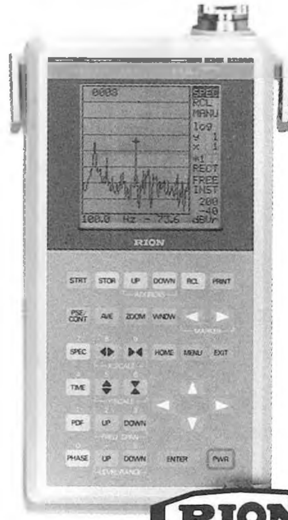

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CALL FOR PAPERS

Acoustics Week In Canada

October 4-8, 1993

Acoustics Week in Canada 1993 will be held at the Delta Chelsea Inn, Toronto, Ontario. The symposium will take place on October 6th, 7th, and 8th. The social programme will include a welcome wine and cheese on Tuesday evening, October 5th, a banquet on Wednesday evening, October 6th, and a closing reception at noon on Friday, October 8th. The Annual Business Meeting of the Association has been scheduled for Thursday afternoon, October 7th. The local planning committee will not be taking on the responsibility of arranging the seminars which normally precede the symposium. Anyone interested in giving a seminar should contact Sharon Abel with the details. Meeting rooms will be set aside for this purpose on Monday and Tuesday, October 4th and 5th. There will be an exhibition of acoustical measurement instrumentation, software and acoustical materials. Please contact John Hemingway (Tel/Fax: 416 949-2164) for information.

SYMPOSIUM

The programme will include daily plenary sessions, followed by three parallel sessions of invited and contributed presentations. Authors are invited to submit abstracts for these sessions in any area of acoustics and vibration. These include:

- Noise and Vibration
- Architectural Acoustics
- Acoustical Sources
- Physical Acoustics
- Musical Acoustics
- Speech, Hearing and Communication
- Land Use Planning
- Acoustical Measurement
- Electroacoustics
- Performance Acoustics

The organizers will develop several structured sessions with round table discussions on particular themes. All submissions will be reviewed for suitability, and accepted abstracts will be published in *Canadian Acoustics.* Abstracts should be limited to 300 words and must be received by April 30, 1993. Instructions for the preparation of abstracts are provided in this issue of the journal. Completed abstracts should be directed to:

Dr. Moustafa Osman
Ontario Hydro
700 University Ave., H13
Toronto, Ontario.
M5G 1X6
Tel: (416) 592-4988

Students are particularly invited to participate and awards will be given to the three best presentations. Students must signify their intention to compete by submitting a special form (see March issue) along with the abstract.

Host City: Toronto, Home of the World Champion Blue Jays
Chair: Dr. Sharon Abel, Tel: (416) 586-8278

APPEL DE COMMUNICATIONS

Semaine Canadienne d'Acoustique

4-8 Octobre 1993

La Semaine Canadienne d'Acoustique aura lieu a l'auberge Delta Chelsea de Toronto, Ontario. Le congrès se tiendra du 6 au 8 octobre. Parmis les activités sociales, une soirée de vins et fromages le mardi 5 octobre, un banquet le soir du mercredi 6 octobre et une réception de clôture à midi le vendredi 8 octobre. L'assemblée générale annuelle se tiendra l'après-midi de jeudi 7 octobre. Le comité d'organisation ne sera plus responsable pour organiser des séminaires, qui normallement précedent le congrés. Des personnes intéressées à organiser un tel séminaire doivent prendre contact avec Sharon Abel. Des salles de conférence spéciales pour ces seminaires seront réservées le lundi et le mardi, 4 et 5 octobre. Il y aura une exposition d'instruments des mesures acoustiques, de logiciel et de matérieaux acoustiques. Veuillez prendre contact avec John Hemingway (Tel/Fax: 416 949-2164).

CONGRES

Le programme du congrès commencera chaque jour par des sessions plénières, suivi par trois sessions parellèles d'invités spéciaux et de générales. Les auteurs sont invités à soumettre leur résumés pour ces sessions dans tous les domaines de l'acoustique et des vibrations. Il s'agit de:

- Bruit et vibrations
- Acoustique architecturale
- Sources acoustiques
- Acoustique de physique
- Acoustique de musique
- Parole, Audition et Communications
- Aménagement du territoire
- Mesures acoustiques
- Electro-acoustique
- Acoustique des salles de spectacle

Les organisateurs planifiront plusieurs sessions stucturées avec tables rondes des thèmes particuliers. Tous les résumés seront révisés afin de vérifier leur pertinence et les résumés acceptés seront publiés dans l'*Acoustique Canadienne*. Les résumés doivent être limités à 300 mots et être reçus avant le 30 avril 1993. Les résumés soumis doivent être préparés selon les instructions pour la préparation des résumés inclus dans ce numéro de l'*Acoustique Canadienne*. Les résumés complets doivent être convoyés à:

Dr. Moustafa Osman
Ontario Hydro
700 University Ave., H13
Toronto, Ontario
M5G 1X6
Tel: (416) 592-4988

Les étudiants sont particulièrement invités à participer et des prix seront donnés selon les trois meilleures exposés. Des étudiants intéressés devront remplir un formulaire special (voir le numéro de mars 1993) accompagné d'un résumé.

Ville hôte: Toronto, la ville des champions mondiaux les Blue Jays
Présidente: Sharon Abel (Tel: 416 586-8278)

INSTRUCTIONS FOR THE PREPARATION OF ABSTRACTS

1) Quadruplicate copies of an abstract are required for each meeting paper; one copy should be an original. Send the four copies to the Technical Program Chairperson, in time to be received by April 30th. Either English or French may be used. A cover letter is not necessary.

2) Limit the abstract to 300 words, including title and first author's name and address; names and addresses of coauthors are not counted. Display formulas set apart from the text are counted as 40 words. Do not use the forms "I" and "we"; use passive voice instead.

3) Title of abstract and names and addresses of authors should be set apart from the abstract. Text of abstract should be one single, indented paragraph. The entire abstract should be typed double spaced on one side of 8 1/2 x 11 in. or A4 paper.

4) Be sure that the mailing address of the author to receive the acceptance notice is complete on the abstract, to insure timely deliveries.

5) Do not use footnotes. Use square brackets to cite references or acknowledgements.

6) Underline nothing except what you wish to be italicized.

7) If the letter l is used as a symbol in a formula, loop the letter l by hand and write "lc ell" in the margin of the abstract. Do not intersperse the capital letter O with numbers where it might be confused with zero, but if unavoidable, write "capital oh" in the margin. Identify phonetic symbols by appropriate marginal remarks.

8) At the bottom of an abstract give the following information:

a) If the paper is part of a special session, indicate the session;

b) Name the area of acoustics most appropriate to the subject matter;

c) Telephone Number, including area code, of the author to be contacted for information. Non-Canadian Authors should include country;

d) If more than one author, name the one to receive the acceptance notice;

e) Overhead projectors and 35mm slide projectors will be available at all sessions. Describe on the abstract itself any special equipment needed.

INSTRUCTIONS POUR LA PRÉPARATION DES RÉSUMÉS DE CONFÉRENCES

1) Quatre copies du résumé sont requises pour chaque papier soumis; une des copies doit être un original. Envoyer les quatre copies au Président du Comité technique, suffisamment à l'avance pour qu'elles soient reçues avant le 30 avril. L'anglais ou le français peut être utilisé. Une lettre de présentation n'est pas requise.

2) Limiter le résumé à 300 mots, incluant le titre, le nom et l'adresse du premier auteur; les noms et les adresses des co-auteurs ne sont pas comptabilisés. Les formules en retrait du texte comptent pour 40 mots. Ne pas utiliser la forme "je" ou "nous"; utiliser plutôt la forme passive.

3) Le titre du résumé, les noms et les adresses des auteurs doivent être séparés du texte. Le texte du résumé doit être présenté en un seul paragraphe. Le résumé entier doit être dactylographié à double interlignes sur une face d'une page 8 1/2 x 11 pouce ou du papier A4.

4) S'assurer que l'adresse postale complète de l'auteur qui doit recevoir l'avis d'acceptation est inscrite sur le résumé afin d'assurer une livraison rapide.

5) Ne pas utiliser les notes de bas de page. Utiliser les crochets pour les références et les rermerciements.

6) Ne souligner que ce qui doit être en italique.

7) Si la lettre l est utilisée comme symbole dans une formule, encercler la lettre l à la main et écrire "lc ell" dans la marge du résumé. Ne pas introduire la lettre majuscule O dans les chiffres lorsqu'elle peut être confondue avec zéro, mais se cela n'est pas possible, écrire "O majuscule" dans la marge. Identifier les symboles phonétiques à l'aide de remarques appropriées dans la marge.

8) A la fin du résumé, fournir les informations suivantes:

a) Si la communication fait partie d'une session spéciale, indiquer laquelle;

b) Identifier le domaine de l'acoustique le plus appropié à votre sujet;

c) Le numéro de téléphone, incluant le code régional, de l'auteur avec qui l'on doit communiquer pour information. Les auteurs étrangers doivent indiquer leur pays;

d) S'il y a plus d'un auteur, mentionner le nom de celui qui doit recevoir l'avis d'acceptation;

e) Des projecteurs à acétates et à diapositives seront disponibles dans chaque session. Indiquer les besoins spéciaux, si nécessaire.

The Canadian Acoustical Association
L'Association Canadienne d'Acoustique

MINUTES OF THE BOARD OF DIRECTORS MEETING

October 7, 1992
Sheraton Plaza 500 Hotel, Vancouver, B.C.

Present:	A. Behar	B. Dunn	F. Laville	W. Sydenborgh
	E. Bolstad	T. Embleton	C. Laroche	D. Whicker
	L. Brewster	S. Forshaw	T. Nightingale	
	D. Chapman	M. Hodgson	M. Roland-Mieszkowski	
Regrets:	S. Abel	J. Bradley	J. Hemingway	

1) The President, D. Chapman, opened the meeting at exactly 1:00 p.m.

a) Minutes of the last meeting of the Board are approved and adopted as published in *Canadian Acoustics*. Motion by B. Dunn, seconded by E. Bolstad.

b) The new letterhead is available now. It will no longer have the names of the officers on the bottom of the page. This is a substantial saving since this letterhead will not become outdated. The first 2000 were printed at a cost of $150.00.

c) Motion by T. Embleton that E. Shaw be the representative of the Canadian Acoustical Association at the International Institute of Noise Control Engineering (I-INCE) for input on the Regulatory Assembly. Seconded by S. Forshaw. I-INCE is fostering the promotion of scientific knowledge to all countries of the world. The objective is to make available a collection of documentation subjects such as Noise Control in Industry, The 3 dB or 5 dB Exchange Rate, etc.

2) Report on Acoustics Week 1992, Vancouver. Doug Whicker reported that pre-registration was very poor this year but that he expected a total attendance somewhere near 80. The Underwater Acoustics and Occupational Noise Exposure seminars were cancelled due to lack of interest. The seminar on Architectural Acoustics had a registration of 23 people and can be hailed as a success. On the financial side, it is estimated that the event will break even after the $2,000 "seed money" is taken into account.

3) Trevor Nightingale, representing a group of members from Ottawa, proposed that the 1994 meeting be held in the city of Ottawa. This is accepted and put on the agenda for approval at the membership meeting.

4) A. Behar reports on applications for student prizes to be awarded for papers presented at this symposium. The number in each session is: 1 for Noise Control, 2 for Occupational Noise, 1 for Speech and 5 each for Underwater Acoustics and Hearing Conservation. It is recommended that next year the signature and abstract be part of the application rather than part of the presentation.

5) Secretarial Report: W.V. Sydenborgh

Membership in the past year has fallen by 10%. Paid membership went from 277 last year to 225 this year. Student membership dropped from 52 in 1990 to 33 in 1991 to 25 in 1992. The recession can be blamed for some of this as well as fewer students in acoustical disciplines. M. Roland-Mieszkowski advised that he is working on a brochure, a draft of which will be available by the end of October. It is recommended that the secretarial budget be increased from $1500.00 to $1650.00 due to increases in postage and other costs. Moved by A. Behar, seconded by T. Embleton; carried. It is decided that the Secretary will invoice and collect membership dues, the Advertizing Editor will invoice advertisers with a copy to the Treasurer and the Treasurer will collect overdue accounts. The Treasurer will co-ordinate the above.

6) Treasurer's Report: E. Bolstad

The Auditor's report is received and signed by the President and Secretary. The notes to the Financial Statement, August 31, 1992, are published in Appendix A.

It is moved by S. Forshaw and seconded by B. Dunn that the Financial Report be accepted. Carried.

7) Award Committee. B. Dunn advised that a number of prizes awarded yearly to students go unawarded for lack of interest or lack of communication. He exhorts the committee members to publicize the awards. B. Dunn will send posters before Christmas this year announcing the categories. Chantal Laroche reports that the Directors' Awards have been decided and announcements will be made at the banquet on October 8. A list of Directors, complete with addresses and telephone numbers, will be made available for contact by prospective recipients. The Science Fair Award went to a CEGEP student from La Pocatière, PQ. The next Science Fair, to be judged by Michel Bochoud, is to be held in May 1993 in Rivière du Loup. A motion is made by B. Dunn that the prize money be increased from $250.00 to $500.00. Seconded by E. Bolstad. All in favour.

8) Toronto '93, S. Abel. Presented by T. Embleton. Planning for Acoustics Week '93 is well underway. It will be held October 4-8, 1993 in the Delta Chelsea Inn in downtown Toronto. Room rates will be $95.00 single or double. There will be exhibits, programmes for accompanying persons and a banquet. Register and book early, please. Report moved for acceptance by E. Bolstad, seconded by B. Dunn.

9) Nominations for Officers and Directors. Re-electable are the President, Treasurer, Editor-in-Chief. Not re-electable are the Secretary and the Membership Chairperson. Two Directors, L. Brewster and T. Embleton, finished their four-year stint. B. Dunn will propose the slate of candidates to the membership and, in addition, will accept nominations from the floor.

10) By-Law Review. Members of the Board of Directors will review the current CAA By-Laws and send reccommendations for change to a committee consisting of A. Behar and W. Sydenborgh by January 1, 1993. The By-Laws should be published in French as soon as possible. Motion for adoption by B. Dunn, seconded by E. Bolstad. Carried.

11 Next meeting. Possible date, Sunday, May 16, 1993 in Ottawa, Ontario, location of the meeting of the Acoustical Society of America.

12) Closing, 5:15 p.m. moved by B. Dunn, seconded by L. Brewster.

Minutes prepared by: W. V. Sydenborgh, Secretary

Canadian Acoustical Association
l'Association Canadienne d'Acoustique

MINUTES OF THE C.A.A. ANNUAL GENERAL MEETING

October 8, 1992, 4:00 p.m.
Sheraton Plaza 500 Hotel, Vancouver, B.C.

1) Opening of the meeting and welcome by D. Chapman. In his opening remarks, a special thanks was extended to D. Whicker, the convenor of the Vancouver Symposium, and his group of people for the excellent organization of all facets of this year's event.

2) Minutes of the 1991 Annual General Meeting, Edmonton, Alberta are presented for discussion. Since no objections came from the floor, the minutes are accepted as published in *Canadian Acoustics*. Moved by M. Hodgson, seconded by E. Bolstad.

3) President's Report. D. Chapman reflected on his first year in office and thanked those who assisted him, especially those retiring from office.

4) Secretary's Report. W.V. Sydenborgh showed concern for the membership status. Paid membership is as follows:

Members	225	Sustaining subscribers	20
Student members	25	Corporate subscriptions	60

This is an overall drop of 10% from last year. Membership across Canada by percentage is closely tied to the population percentage of the four geographical regions.

The Secretary's report is accepted as presented; so moved by M. Roland-Mieszkowski, seconded by G. Wong.

5) Treasurer's Report by E. Bolstad. The Treasurer presented the financial and auditors' report by Mr. Tipping. The financial report is adopted. Recommendation for all annual dues is no change from the current fees. So moved by R. Peppin, seconded by B. Dunn.

6) Report of the Editor of *Canadian Acoustics*, M. Hodgson. The Editor reported no major changes to the format in the past year. More papers are needed for publication. The following suggestions were made from the floor.

a) D. Whicker suggested papers of a less rigorous nature, such as consultants' reports.
b) B. Dunn suggested a whole issue on consultants' papers in the near future.
c) D. Chapman suggested publication of students' theses.

All of these proposals have been welcomed as indicated by the inside front cover of *Canadian Acoustics*. The editor's report is accepted. So moved by R. Hétu, seconded by D. Whicker.

7) Membership Chairman's Report. D. Chapman reports on J. Bradley's behalf. J. Bradley has composed and sent a general letter to prospective members with some results. A brochure is in the works and will be circulated to the Directors around the end of October. This brochure is being prepared by M. Roland-Mieszkowski and will be passed on to the next membership chairman for printing cost and circulation. J. Bradley regrets that he cannot stand for re-nomination. D. Chapman thanks him for the efforts of the past year.

8) Awards Committee Chairman Report. B. Dunn notes a lack of applications from prospective winners. Of the three Directors' Awards, only two were awarded. Fessenden and the Science Fair Award were granted this year. For the Edgar and Millicent Shaw prize of $3000.00, no applications received; same for the Bell prize ($800.00) and the Eckel Award ($500.00). B. Dunn blames some of this on communication and publicity problems. Report accepted. Moved by M. Roland-Mieszkowski, seconded by T. Embleton.

9) Convenor's Report 1992. D. Whicker reports that 57 paid registrants and 13 students are attending. Ten exhibitors are present and 85 tickets have been sold for the banquet. He hopes to break even, minus the $2,000.00 "seed money". He had one special appeal to attendees of future meetings. Please, please register early, to allow proper planning. Re: seminars - the seminar on Architectural Acoustics had 23 participants. The other two seminars were canceled due to lack of interest.

10) Report: Acoustics Week in Canada, Toronto 1993. Convenor, S. Abel. Tony Embleton reported on the convenor's behalf and announced that the symposium will be held from October 4 to October 8 in the newly-renovated Chelsea Inn in downtown Toronto. Plans are being made for accompanying persons' activities, a banquet and entertainment. The only difference from previous years will be that Seminars will be available for private sponsors only, rather than being C.A.A. sponsored. Contact, S. Abel.

11) Future Conventions. The 1994 Symposium will be hosted by Ottawa in October of that year. T. Nightingale made the proposal on behalf of the Ottawa Committee. Accepted via a motion by A. Behar, seconded by B. Dunn.

12) Nominations and Elections; B. Dunn, Chairman.

President:	Re-elected (by acclamation), D. Chapman.		
Editor:	Re-elected (by acclamation), M. Hodgson		
Treasurer:	Re-elected (by acclamation), E. Bolstad		
Secretary:	Elected, J. Hemingway		
Membership:	W. Sydenborgh		
Directors:	D. Quirt	2 yrs.	(for J. Hemingway)
	R. Ramakrishnan	4 yrs.	
	D. Jamieson	4 yrs.	

13) C.A.A. By-Laws, W.V. Sydenborgh. Recommendation that the By-Laws be translated and published in the French language. Accepted unanimously. D. Chapman to take action.

14) Other business. D. Chapman thanks the outgoing Secretary, Membership Chairman, and Directors (T. Embleton, L. Brewster and J. Hemingway) for their contributions to the C.A.A.

14) The meeting closes at 5:45 p.m. So moved by B. Dunn, seconded by A. Behar.

Minutes prepared by W.V. Sydenborgh

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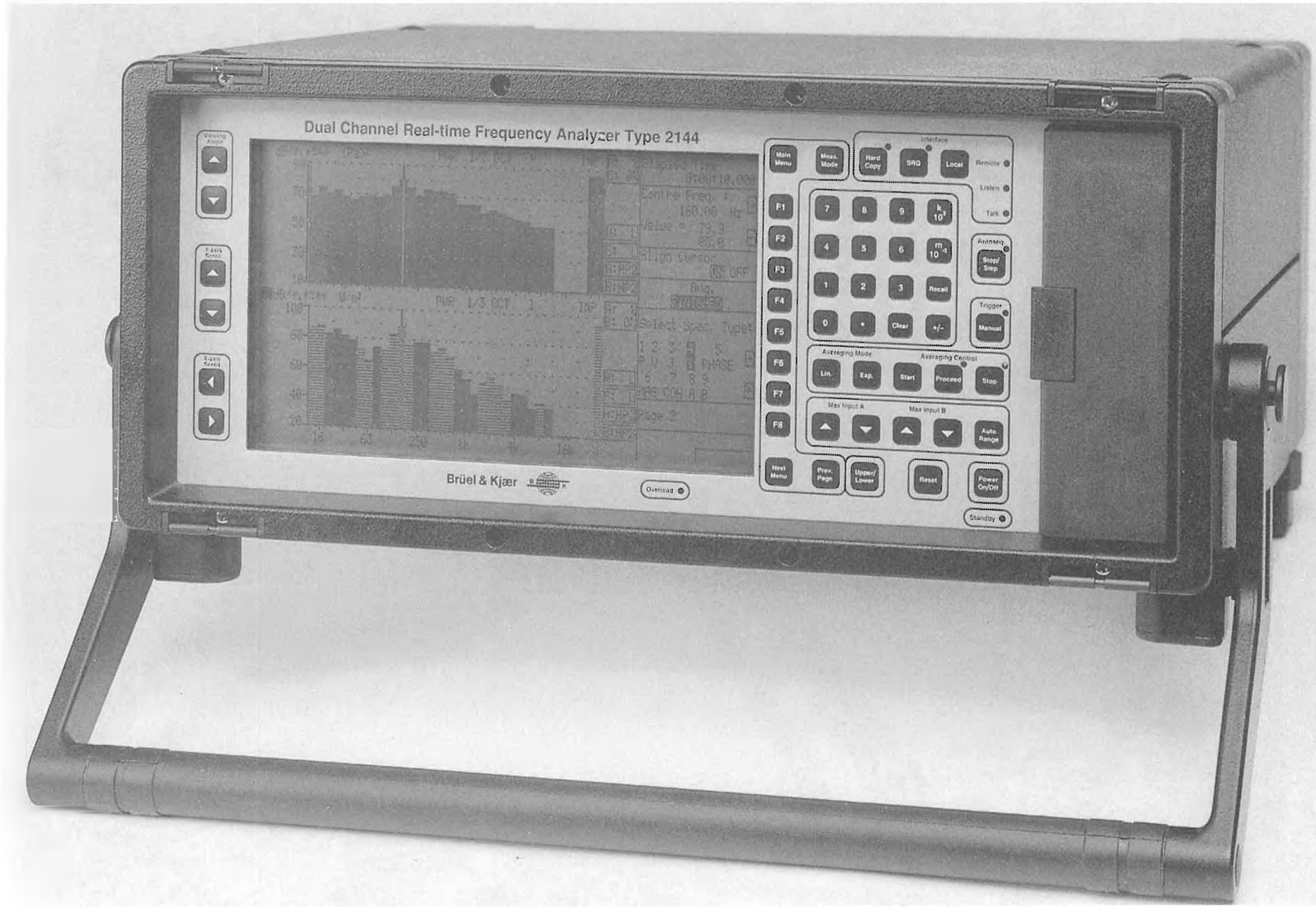
- The Type 2143 single-channel real time analyzer which can easily be upgraded to
- The Type 2144 dual-channel real time analyzer which can easily be adapted to become
- The Type 2145 vehicle analyzer with tracking included.



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The Canadian Acoustical Association
l'Association Canadienne d'Acoustique

1992 PRIZE WINNERS / RÉCIPIENDAIRES 1992

FESSENDEN STUDENT PRIZE IN UNDERWATER ACOUSTICS / PRIX ÉTUDIANT FESSENDEN EN ACOUSTIQUE SOUS-MARINE

Daniela DiIorio, University of Victoria

DIRECTORS' AWARDS / PRIX DES DIRECTEURS

Professional < 30 years / Professionel < 30 ans: **Francine Desharnais, DREA**

"Bottom loss in areas with ice-rafted sediments"

Professional ≥ 30 years / Professionel ≥ 30 ans: **Murray Hodgson, University of British Columbia**

"Review and critique of existing simplified models for predicting factory noise levels"

STUDENT AWARDS / PRIX ETUDIANT

Guy Brown, University of Sheffield

"Modelling auditory scene analysis: a representational approach"

Daniela DiIorio, University of Victoria

"Separation of acoustic multipaths in Saanich Inlet"

Raymond Panneton, Université de Sherbrooke

"Vibration and sound radiation of a circular cylindrical shell under a circumferentially moving force"

CONGRATULATIONS / FÉLICITATIONS

NOTICE OF THE CALL FOR PAPERS FOR THE 125th MEETING OF THE ACOUSTICAL SOCIETY OF AMERICA

OTTAWA, MAY 17 - 21, 1993

DEADLINE FOR ABSTRACTS TO BE RECEIVED IN OTTAWA IS
JANUARY 18, 1993

The Acoustical Society of America (ASA) will hold its 1993 spring meeting at the Château Laurier hotel in Ottawa. This meeting provides a rare opportunity for Canadian acousticians to attend, and present papers at, the ASA in Canada.

Subjects to be highlighted in special sessions include:
- new auditorium acoustics measurements - results and comparisons;
- sound intensity measurement, calibration and standards;
- noise and vibration of high speed trains;
- current issues in the measurement of noise exposure;
- effects of aging on hearing and touch;
- auditory front ends for speech recognizers;
- novel applications of ultrasound in medicine;
- acoustics in space;
- acoustical determination of polar ocean processes;
- and "hot topics" in acoustics.

The registration fee is $75 (US) for members and $ 125 (US) for nonmembers.

To obtain a copy of the CALL FOR PAPERS with instructions for the preparation of abstracts, or additional information, contact:

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NEWS / INFORMATIONS

CONFERENCES

XIIIth World Congress on Occupational Safety and Health: New Delhi, India, April 4-8, 1993. Contact: National Safety Council, P.O. Box 26754, Sion, Bombay 400 022, India. Tel: 407-3285; 407-3694; 409-1285, Fax: +91-22-525-657, Telex: 011-74577 CLI-IN, Cable: NASACIL.

Active Noise Control Conference: The Second Conference on Recent Advances in Active Control of Sound and Vibration, Blacksburg, Virginia, April 28-30, 1993.

International Noise and Vibration Control Conference: St. Petersburg, Russia, May 31 - June 3, 1993. Contact: Noise Control Association Leningrad Mechanics Institute, Professor Nickolai Igorevich Ivanov, St. Petersburg, Russia

6th International Congress on Noise as a Public Health Problem: Nice, France, July 6 - 9, 1993. Contact: Noise and Man '93, Inrets-Len, P.O. Box 24, 69675 Bron Cedex, France.

NOISE-CON 93: The 1993 National Conference on Noise Control Engineering, Williamsburg, Virginia, May 2-5, 1993. NOISE-CON 93 is being organized in conjunction with the Second Conference on Recent Advances in Active Control of Sound and Vibration.

INTER-NOISE 93: The 1993 International Congress on Noise Control Engineering, Leuven, Belgium, August 24-26, 1993. Contact: Inter-Noise 93, Conference Secretariat, Christine Mortelmans, TI-K VIV, Desgiunlei 214, B-2018, Antwerpen, Belgium.

Structural Intensity and Vibrational Energy Flow: 4th International Congress on Intensity Techniques CETIM, Senlis (Franco), August 31-September 2, 1993. Contact: CETIM, Secretariat of 4th International Congress on Intensity Techniques, Acoustical Department, BP 67-60304 SENLIS Cedex (France), Tel: (33) 44 58 34 15; Fax: (33) 44 58 34 00.

CONFÉRENCES

XIII^{e} Congrès mondial sur la santé et la sécurité du travail: New Delhi, Inde, du 4 au 8 avril 1992. Renseignements: National Safety Council, P.O. Box 26754, Sion, Bombay 400 022, Inde. Téléphone: 407-3285; 407-3694; 409-1285, télécopieur: +91-22-525-657, telex: 011-74577 CLI-IN, câble NASACIL

Conférence sur Recent Advances in Active Control of Sound and Vibration: Blacksburg, Virginie, du 28 au 30 avril 1993.

Conférence internationale sur le contrôle du bruit et des vibrations: St. Petersburg, Russie, du 31 mai au 3 juin 1993. Renseignements: Noise Control Association, Leningrad Mechanics Institute, Professeur Nickolai Igorevich Ivanov, St. Petersburg, Russie.

6^{e} Congrès international sur le bruit comme problème de santé publique: Nice, France, du 6 au 9 juillet 1993. Renseignements: Noise and Man '93, Inrets-Len,. Boîte postale 24, 69675 Bron Cedex, France.

Conférence Noise-Con 93: Williamsburg, Virginie, du 2 au 5 mai 1993. Conférence organisée conjointement à la Conférence sur Recent Advances in Active Control of Sound and Vibrations.

Conférence Inter-Noise 93: Leuven, Belgique, du 24 au 26 août 1993. Renseignements: Inter-Noise 93, Conferences Secretariat, Christine Mortelmans, TI-K VIV, Desgiunlei 214, B-2018, Antwerpen, Belgique.

4^{e} congrès international sur les techniques de mesure de l'intensité: Senlis, France, du 31 août au 2 septembre 1993. Renseignements: CETIM, secrétariat du 4^{e} congrès international sur les techniques d'intensité, Département d'Acoustique, B.P. 67, 60304 Senlis, Cedex, France: téléphone (33) 44 58 34 15; télécopieur (33) 44 58 34 00..

COURSES

Mechanical Vibrations: Seven Springs, Pennsylvania, April 5-9, 1993. Contact: AVNC, Continuing Education DIvision, 250 Shagbark Drive, RR#1, Chewsick, PA, 15024.

Penn State's June 1993 Program in Acoustics: General and Applied Acoustics (4 courses), Underwater Acoustics and Sonar (4 courses) and Noise and Vibration Control (3 courses). For further information contact: Dr. Alan D. Stuart, Summer Program Coordinator, The Penn State Graduate Program in Acoustics, P.O. Box 30, State College, PA, 16804, Tel: (814) 863-4128, Fax: (814) 865-3119.

Applied Noise & Vibration Control: November 16-19 in Chicago,Ill., Contact: Education Section, ASHRAE, 1791 Tullie Circle NE, Atlanta, GA 30329, Tel: (404) 638-8400, Fax (404) 321-5478.

COURS

Mechanical Vibrations: Seven Springs, Pennsylvanie, du 5 au 9 avril 1993. Renseignements: AVNC, Continuing Education Division, 250 Shagbark Drive, R.R. #1, Chewsick, PA 16094, USA.

Program in Acoustics: State College, Pennsylvanie, juin 1993. Programme d'une durée de quatre semaines comprenant 4 cours sur l'acoustique générale et appliquée, 4 cours sur l'acoustique sousmarine et les sonars et 3 cours sur la réduction des vibrations. Renseignements: Alan D. Stuart, Summer Program Coordinator, The Penn State Graduate Program in Acoustics, P.O. Box 30, State College, PA 16804, USA; téléphone (814) 863-4128, télécopieur (814) 865-3119..

Applied Noise and Vibration Control: Chicago, Illinois, du 16 au 19 novembre 1992. Renseignements: Education Section, ASHRAE, 1791 Tullie Circle NE, Atlanta, GA 30329; téléphone (404) 636-8400, télécopieur (404) 321-5478.

NEW PRODUCTS

AMETEK, Inc., has completed the purchase of DuPont Company's Air and Noise Monitoring Instrument business and begun moving the engineering and production of these portable electronic units to its Mansfield & Green instrument division in Largo, Florida. The Air and Noise Monitoring instruments are compact electronic units designed to be localy mounted or worn by workers to record their personal exposure. For more information, contact AMETEK, Inc., Station Square Two, Paoli, PA, 19401.

The Atlantic Canada Acoustics Inventory (ACAI) is now complete: It is a professional contact management database for DOS and MAC desktop or laptop personal computers. Contact: Guptill Consulting Services, P.O. Box 213, Site 16, RR#2, Armdale, Nova Scotia, B3L 4J2 or call (902) 852-3878.

The Inter-Noise 91 Conference Proceedings are available from Noise Control Foundation: THE COSTS OF NOISE was the theme of INTER-NOISE 91, the 1991 International Conference on Noise Control Engineering. INTER-NOISE 91 was sponsored by the International Institute of Noise Control Engineering (Inter-national/INCE) and was organized by The Australian Acoustical Society. The conference was held on the campus of the University of New South Wales in Sydney, Australia on December 2 -4, 1991. Three hundred and eleven papers on a wide variety of topics have been published in the INTER-NOISE 91 Proceedings. The two-volume set of proceedings contains 1289 technical pages and is available for $130.00 U.S. Order from Noise Control Foundation, P.O. Box 2469, Arlington Branch, Poughkeepsie, NY, 12603, U.S.A..

Noise Cancellation Technologies: What is said to be the first purchase, installation and use of electronic muffler technology in an industrial setting has been announced by Noise Cancellation Technologies, Inc. (NCT) and CSX Transportation (CSXT, Baltimore, MD). The first MasterVac to be retrofitted with an NCT Active Industrial Muffler is said to have shown noise reduction of over 80 percent and improved the equipment's fuel efficiency by 20 to 25 percent. The primary components of the NCT Active Industrial Muffler are one microphone, three speakers and a digital signal processing unit. For more information, contact Irene Lebovics, Noise Cancellation Technologies, Inc., 800 Summer Street, 5th Floor, Stamford, CT, 06901.

Scantek, Inc.: Scantek Inc., has introduced the new Diagnostic Instruments PL21 and PL22 portable FFT Analyzers. The PL21 is a single channel unit, the PL22 is a dual channel unit. These analyzers can be used for Rotating Machinery Analysis, Structural Analysis and Acoustical Analysis. For more information, contact Richard Peppin, Scantek, Inc., 916 Gist Avenue, Silver Sping, MD, 20910.

NOUVEAUX PRODUITS

AMETEK, Inc. a fait l'acquisition de la division des instruments de surveillance de l'air et du bruit de DuPont et a commencé à en déménager les installations de conception technique et de production à sa division d'instruments Mansfield & Green, située à Largo (Floride). Les instruments fabriqués sont des moniteurs électroniques portatifs destinés à être installés à un endroit précis ou à être portés par les travailleurs pour mesurer le niveau d'exposition. Renseignements: AMETEK, Inc., Station Square Two, Paoli, PA 19401, USA.

L'Institute of Acoustics of Atlantic Canada a terminé la préparation de son répertoire des personnes- ressources et des entreprises du domaine de l'acoustique. Ce répertoire est disponible sur disquette pour utilisation dans l'environnement DOS ou MAC. Renseignements: Guptill Consulting Services, Box 213, Site 16 R.R. #2, Armdale, Nouvelle-Écosse B3L 4J2; téléphone (902) 852-3878.

Les actes de la Conférence Inter-Noise 91 sont maintenant disponsibles auprès de la Noise Control Foundation. Le thème de la conférence était les coûts du bruit. Parrainée par l'International Institute of Noise Control Engineering (International/INCE) et organisée par l'Australian Acoustical Society, Inter-Noise 91 s'est tenue sur le campus de l'université New South Wales, Sydney, Australie, du 2 au 4 décembre 1991. Les actes regroupent 311 communications techniques portant sur un large éventail de sujets. On peut se procurer les deux volumes, 1 289 pages au total, moyennant la somme de 130 $US en écrivant à la Noise Control Foundation, P.O. Box 2469, Arlington Branch, Poughkeepsie, NY 12603, USA.

Noise Cancellation Technologies, Inc. (NCT) et CSX Transportation (CSXT, Baltimore, MD) viennent d'annoncer ce qui semble apparemment être la première installation d'un silencieux électronique dans un environnement industriel, et plus précisément sur MasterVac. Les résultats indiquent une réduction du bruit de plus de 80% et des économies d'énergie de 20 à 25%. Le <<NCT Active Industrial Muffler>> est composé d'un microphone, de trois haut-parleurs et d'une unité de traitement des signaux numériques. Renseignements: Irene Lebovics, Noise Cancellation Technologies, Inc., 800 Summer Street, 5th Floor, Stamford, CT 06901, USA.

Scantek, Inc. vient de lancer sur le marché deux nouveaux instruments de mesure: les analyseurs FFT PL21, à canal unique, et PL22, à deux canaux. Ces dispositifs conviennent à l'analyse sur machines rotatives, ainsi qu'à l'analyse structurelle et acoustique. Renseignements: Richard Peppin, Scantek, Inc., 916 Gist Avenue, Silver Spring, MD 20910, USA.

PEOPLE IN THE NEWS

In June 1992, Alfred Lightstone of Valcoustics Canada Ltd., was awarded the 2T5 Meritorious Service Medal by the Engineering Alumni Association of the Faculty of Applied Science & Engineering, University of Toronto, in recognition of distringuished service in/and for the profession in his 25-years since graduation.

LES GENS QUI FONT PARLER D'EUX

En juin 1992, l'Association des Anciens de la Faculté de Sciences Appliquées et de Génie de l'Université de Toronto a remis la médaille du service méritoire à Alfred Lightstone de Valcoustics Canada Ltd. en reconnaissance de sa contribution à la profession depuis le début de sa carrière, il y a 25 ans.

EMPLOYMENT

As a service to readers we will publish, at no charge, advertisements from employers looking for staff, and from individuals seeking employment. To take advantage of this service, simply send your advertisement to the Editor-in-Chief. Individuals wishing to remain anonymous may request the use of a file number, to be managed by the Editor.

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Research Students Sought

A new research group, concentrating on subjective and physical aspects of the (mainly acoustical) work environment, is starting up at the University of British Columbia. Current research projects include: prediction of sound fields in large offices; measurement and prediction of the acoustic properties of room surfaces; propagation and design of industrial acoustic warning signals; prediction of the performance of baffle arrays in non-diffuse sound fields.

Persons interested in pursuing a post-graduate degree in Mechanical Engineering on one of these subjects should send their resumé and academic record to:

Dr. Murray Hodgson
Department of Mechanical Engineering
University of British Columbia
2324 Main Mall
Vancouver, BC V6T 1Z4

Research Opportunities

The Acoustics and Vibration Group of Sherbrooke University (G.A.U.S), a Canadian leader in the field, is a team made up of four professors, two research attachés, two post-doctoral researchers and a dozen graduate students. Owing to recent financing from the Natural Sciences and Engineering Research Council of Canada (NSERC) for the establishment of a research chair in vibro-acoustics, the group is looking for three candidates to fill the following positions:

1 Postdoctoral Researcher in Vibration and/or Acoustics

Fundamental research in vibroacoustics investigating analytical, numerical or experimental aspects. Requirements: recent PhD in acoustics or vibro-acoustics. Languages - French or English. Remuneration - according to NSERC standards.

2 Research Assistants

Investigative and applied research in acoustics and vibrations. Requirements: MSc or PhD or equivalent; speaking and writing fluently in French. Remuneration: according to NSERC standards.

Send your resumé immediately and no later than 1 March 1993

To: **Professor Jean Nicolas**
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Sherbrooke, QC J1K 2R1
Tel: (819) 821 7157 Fax: (819) 821-7163

Acoustical Consultant Required

Well-established Vancouver firm requires a consultant with at least two years of recent experience in architectural acoustics and HVAC noise control. This is a full-time, permanent position to be filled as quickly as possible. Please apply to:

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Noise	5	Bruit
Psycho and physio-acoustics	6	Psycho et physio-acoustique
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PRIZE ANNOUNCEMENT

A number of prizes, whose general objectives are described below, are offered by the Canadian Acoustical Association. As to the first four prizes, applicants must submit an application form and supporting documentation before the end of February of the year the award is to be made. Applications are reviewed by subcommittees named by the President and Board of Directors of the Association. Decisions are final and cannot be appealed. The Association reserves the right not to make the awards in any year. For some awards applicants must be members of the Canadian Acoustical Association. Preference will be given to citizens and permanent residents of Canada. Potential applicants can obtain full details of the prizes and their eligibility conditions, as well as application forms and procedures from: The Secretary, Canadian Acoustical Association, P.O. Box 1351, Station F, Toronto, Ontario M4Y 2V9.

Edgar and Millicent Shaw Postdoctoral Prize in Acoustics

This prize is made to a highly qualified candidate holding a Ph.D. degree or the equivalent, who has completed all formal academic and research training and who wishes to acquire up to two years supervised research training in an established setting. The proposed research must be related to some area of acoustics, psychoacoustics, speech communication or noise. The research must be carried out in a setting other than the one in which the Ph.D. degree was earned. The prize is for $3000 for full-time research for twelve months, and may be renewed for a second year. Coordinator: Sharon Abel. Past recipients are:

1990 Li Cheng, Université de Sherbrooke

Alexander Graham Bell Graduate Student Prize In Speech Communication and Behavioural Acoustics

The prize is made to a graduate student enrolled at a Canadian academic institution and conducting research in the field of speech communication or behavioural acoustics. It consists of an $800 cash prize to be awarded annually. Coordinator: Don Jamieson. Past recipients are:

1990 Bradley Frankland, Dalhousie University
1991 Steven Donald Turnbull, University of New Brunswick
Fangxin Chen, University of Alberta
Leonard E. Cornelisse, University of Western Ontario

Fessenden Student Prize in Underwater Acoustics

The prize is made to a graduate student enrolled at a Canadian university and conducting research in underwater acoustics or in a branch of science closely connected to underwater acoustics. It consists of $500 cash prize to be awarded annually. Coordinator: David Chapman.

1992 Daniela DiIorio, University of Victoria

Eckel Student Prize in Noise Control

The prize is made to a graduate student enrolled at a Canadian academic institution pursuing studies in any discipline of acoustics and conducting research related to the advancement of the practice of noise control. It consists of a $500 cash prize to be awarded annually. The prize was inaugurated in 1991. Coordinator: Murray Hodgson.

Directors' Awards

Three awards are made annually to the authors of the best papers published in *Canadian Acoustics*. The first author must study or work in Canada. All papers reporting new results as well as review and tutorial papers are eligible; technical notes are not. The first award, for $500, is made to a graduate student author. The second and third awards, each for $250, are made to professional authors under 30 years of age and 30 years of age or older, respectively. Coordinator: Chantal Laroche.

Student Presentation Awards

Three awards of $500 each are made annually to the undergraduate or graduate students making the best presentations during the technical sessions of Acoustics Week in Canada. Application must be made at the time of submission of the abstract. Coordinator: Alberto Behar.

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l'Association Canadienne d'Acoustique

ANNONCE DE PRIX

Plusieurs prix, dont les objectifs généraux sont décrits ci-dessous, sont décernés par l'Association Canadienne d'Acoustique. Quant aux quatre premiers prix, les candidats doivent soumettre un formulaire de demande ainsi que la documentation associée avant le dernier jour de février de l'année durant laquelle le prix sera décerné. Toutes les demandes seront analysées par des sous-comités nommés par le président et la chambre des directeurs de l'Association. Les décisions seront finales et sans appel. L'Association se réserve le droit de ne pas décerner les prix une année donnée. Pour certains des prix, les candidats doivent être membres de l'Association. La préférence sera donnée aux citoyens et aux résidents permanents du Canada. Les candidats potentiels peuvent se procurer de plus amples détails sur les prix, leurs conditions d'éligibilité, ainsi que des formulaires de demande auprès de: Le Secretaire, Association Canadienne d'Acoustique, C.P. 1351, Station F, Toronto, Ontario M4Y 2V9.

PRIX POST-DOCTORAL EDGAR ET MILLICENT SHAW EN ACOUSTIQUE

Ce prix est attribué à un(e) candidat(e) hautement qualifié(e) et détenteur(rice) d'un doctorat ou l'équivalent qui a complèté(e) ses études et sa formation de chercheur et qui désire acquérir jusqu'à deux années de formation supervisée de recherche dans un établissement reconnu. Le thème de recherche proposée doit être relié à un domaine de l'acoustique, de la psycho-acoustique, de la communication verbale ou du bruit. La recherche doit être menée dans un autre milieu que celui où le candidat a obtenu son doctorat. Le prix est de $3000 pour une recherche plein temps de 12 mois avec possibilité de renouvellement pour une deuxième année. Coordonnatrice: Sharon Abel. Les récipiendaires antérieur(e)s sont:

1990 Li Cheng, Université de Sherbrooke

PRIX ETUDIANT ALEXANDER GRAHAM BELL EN COMMUNICATION VERBALE ET ACOUSTIQUE COMPORTEMENTALE

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) dans une institution académique canadienne et menant un projet de recherche en communication verbale ou acoustique comportementale. Il consiste en un montant en argent de $800 qui sera décerné annuellement. Coordonnateur: Don Jamieson. Les récipiendaires antérieur(e)s sont:

1990 Bradley Frankland, Dalhousie University
1991 Steven Donald Turnbull, University of New Brunswick
Fangxin Chen, University of Alberta
Leonard E. Cornelisse, University of Western Ontario

PRIX ETUDIANT FESSENDEN EN ACOUSTIQUE SOUS-MARINE

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) dans une institution académique canadienne et menant un projet de recherche en acoustique sous-marine ou dans une discipline scientifique reliée à l'acoustique sous-marine. Il consiste en un montant en argent de $500 qui sera décerné annuellement. Coordonnateur: David Chapman.

1992 Daniela Dilorio, University of Victoria

PRIX ETUDIANT ECKEL EN CONTROLE DU BRUIT

Ce prix sera décerné à un(e) étudiant(e) inscrit(e) dans une institution académique canadienne dans n'importe quelle discipline de l'acoustique et menant un projet de recherche relié à l'avancement de la pratique en contrôle du bruit. Il consiste en un montant en argent de $500 qui sera décerné annuellement. Ce prix a été inauguré en 1991. Coordonnateur: Murray Hodgson.

PRIX DES DIRECTEURS

Trois prix sont décernés, à tous les ans, aux auteurs des trois meilleurs articles publiés dans l'*Acoustique Canadienne*. Le premier auteur doit étudier ou travailler au Canada. Tout manuscrit rapportant des résultats originaux ou faisant le point sur l'état des connaissances dans un domaine particulier sont éligibles; les notes techniques ne le sont pas. Le premier prix, de $500, est décerné à un(e) étudiant(e) gradué(e). Le deuxième et le troisième prix, de $250 chaqun, sont décernés à des auteurs professionnels âgés de moins de 30 ans et de 30 ans et plus, respectivement. Coordonnatrice: Chantal Laroche.

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Trois prix, de $500 chaqun, sont décernés annuellement aux étudiant(e)s sous-gradué(e)s ou gradué(e)s présentant les meilleures communications lors de la Semaine de l'Acoustique Canadienne. La demande doit se faire lors de la soumission du résumé. Coordonnateur: Alberto Behar.

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L'abonnement pour la présente année est dû le 31 janvier. Les abonnements reçus avant le 1 juillet s'appliquent à l'année courante et incluent les ancient numéros (non-épuisés) de l'Acoustique Canadienne de cette année. Les abonnements reçus à partir du 1 juillet s'appliquent à l'année suivante.

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Submissions: The original manuscript and two copies should be sent to the Editor-in-Chief.

General Presentation: Papers should be submitted in camera-ready format. Paper size 8.5" x 11". If you have access to a word processor, copy as closely as possible the format of the articles in Canadian Acoustics 18(4) 1990. All text in Times-Roman 10 pt font, with single (12 pt) spacing. Main body of text in two columns separated by 0.25". One line space between paragraphs.

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