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COMPARISON OF VARIOUS METHODS FOR PREDICTING THE LOUDNESS AND ACCEPTABILITY OF NOISE

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COMPARISON OF VARIOUS METHODS FOR PREDICTING THE LOUDNESS AND ACCEPTABILITY OF NOISE

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I INTRODUCTION

The objective of this study was to compare commonly employed frequency weightings and calculation rating schemes with respect to their ability to predict the subjective effect of sound. Toward this end, it was necessary to collect, assimilate, and analyze the available data from both the laboratory and the field. Such data included those published in the open literature, as well as unpublished laboratory data. Only those studies that contained both a spectral analysis into third-octave or octave bands and subjective measurements could be incorporated into this evaluation. We did not examine many published data on the loudness of wholly artificial sounds in order to give priority to natural sounds, to simulated sounds, and to noises with tonal components.

This report presents the results of a detailed examination of 23 studies in which listeners judged either the loudness or acceptability (annoyance, objectionability, etc.) of sounds. These studies encompassed a wide variety of natural and simulated noise stimuli. The following parameters were examined in detail: (1) subjective attribute judged, (2) type of noise (e.g., aircraft, industrial, etc.), (3) presence or absence of tonal components, (4) mode of sound presentation, (5) effect of sound pressure level on observed discrepancies between measurements and predictions. Each of these factors is considered separately in the body of this report. Included in this final comparative analysis are computations of absolute mean differences between subjectively equal sounds, mean differences between calculated and measured levels, and standard deviations for each frequency-weighting and calculation system.

II OVERALL RESULTS

Table I identifies the 23 studies that were evaluated and summarizes their relevant characteristics. In most of these studies sounds were matched by listeners either to each other or to a standard sound. For every study eleven overall values were calculated based on six different frequency-weighting functions and five different calculation schemes. (The eleven functions and schemes are listed in the legend of Table II.) Third-octave-band pressure levels at

TABLE I. SUMMARY OF 23 STUDIES
In most of these studies, sounds were matched by listeners to either each other or to a standard.

LEGEND:

Type of Spectrum	Analysis	Mode of Presentation	Attribute Judged
Neg.=negative slope	T=third-octave-band pressure levels	DF=diffuse field	L=loudness
Pos.=positive slope	O=octave-band pressure levels	FF=free field	A=annoyance, acceptability, etc.
Mixed=various spectra		phones=earphones	

AUTHOR(S)	YEAR	NUMBER AND TYPE OF NOISES	OVERALL SPLs	TYPE OF SPECTRUM	ANALYSIS	MODE OF PRESENTATION	JUDGED ATTRIBUTE(S)	TONAL COMPONENTS
Berglund et al.	1976	3 aircraft, jackhammer, piledriver	57-99	neg.	T	phones	L	no
Borsky	1974	3 aircraft	75-100	neg.	T	DF	A	yes
Copeland et al.	1960	5 aircraft	90-103	neg.,flat	O	DF	L, A	no
Fishken	1971	13 artificial	30-93	flat	T	phones	L	yes
Hillquist	1967	21 trucks	80-105	neg.	O	FF	A	no
Jahn	1965/66	10 machine	74	mixed	T (O)	FF	L	?
Kryter	1959	8 aircraft	80-103	neg.,flat	O	DF	A	no
Kryter & Pearsons	1963	9 artificial	79-91	mixed	T	DF	A	no
Little	1961	2 jet engines	94-99	flat	O	DF	A	yes
Lübcke et al.	1964	20 machines	40,80	flat,mixed	T	FF,phones	L	no
Molino	1976	5 environmental	45-80	mixed	T	DF	L	no
Pearsons & Bennett	1969	50-70 real and simulated aircraft	64-91	mixed	T	FF	A	yes
Pearsons et al.	1968	72 artificial	59-110	mixed	T	FF	L, A	yes
Pearsons & Wells	1969	19 artificial	78-91	mixed	T	FF	A	yes
Quietzsch	1955	37 machines, motors, etc.	47-98	mixed	O	FF, DF	L	no
Rademacher	1959	24 motorcycles	71-87	neg.	O	FF	L	no
Robinson & Bowsher	1961	5 helicopter	88-97	mixed	T	DF	L, A	no
Spiegel	1960	20 artificial	45-84	mixed	T	DF	L	no
Wells (aircraft)	1970	30 aircraft	73-83	mixed,flat	T	FF	A	yes
Wells (unpubl.)	c.1970	33 aircraft	74-86	mixed,flat	T	FF	A	yes
Wells (300,400)	1969	102 artificial	70-95	mixed	T	FF	A	yes
Wells (UHV)	1972	25 transmission lines	57-78	flat	T	FF	A	yes
Yaniv	1976	11 household appliances	40,50 60	mixed	T	phones	L	no

frequencies from 25 or 50 Hz to 10,000 Hz were the input. (If a study gave only octave-band levels, these were converted to third-octave-band levels by setting each group of three third-octave bands equal and adjusting the level in each accordingly.) Figures 1 to 4 are computer plots of the A, D1, D2, and E frequency weightings. These plots encompass the entire audible spectrum between 10 and 20,000 Hz. However, in the actual calculations spectral energy below 25 Hz and above 10,000 Hz were not included.

The computer program for the eleven frequency-weighting and calculation schemes was a modified version of one furnished by the National Bureau of Standards. The derived values were compared directly to jury ratings.

Table II shows the standard deviations of the calculated levels for all those studies for which a meaningful measure of a calculation system's variability could be derived. Of the 23 studies, 20 are included in this overall summary. All 20 produced either a known loudness level against which the calculated level could be compared or they contained a large group of sounds that were judged approximately equal in perceived magnitude. Borsky's (1974) was the only study that did not require listeners to match sounds to a standard sound, but his category estimations permitted a determination of which sounds were approximately equally annoying. The experiments represented in Table II involved many kinds of sound presented over a wide range of sound pressure levels and with different instructions and modes of presentation. Nevertheless, at the bottom of the table, the overall means and their standard deviations as computed across studies are shown.

Before discussing the results of this analysis, it is first necessary to explain what information the individual standard deviations convey. Although the number of observers used in each study varied widely from study to study, this number did not enter into the computations. The number of experimental conditions denoted by "N" and the number of different sound spectra denoted by "n" did influence decisions as to what parts of a study to combine in calculating the standard deviation.

Standard deviations were first computed from a group of sounds within a study that were equated either to a common standard or to each other. Within a group it was possible to have some variation in SPL, in temporal patterns, in spectra, and in tone-to-noise ratio. Whenever appropriate, the standard

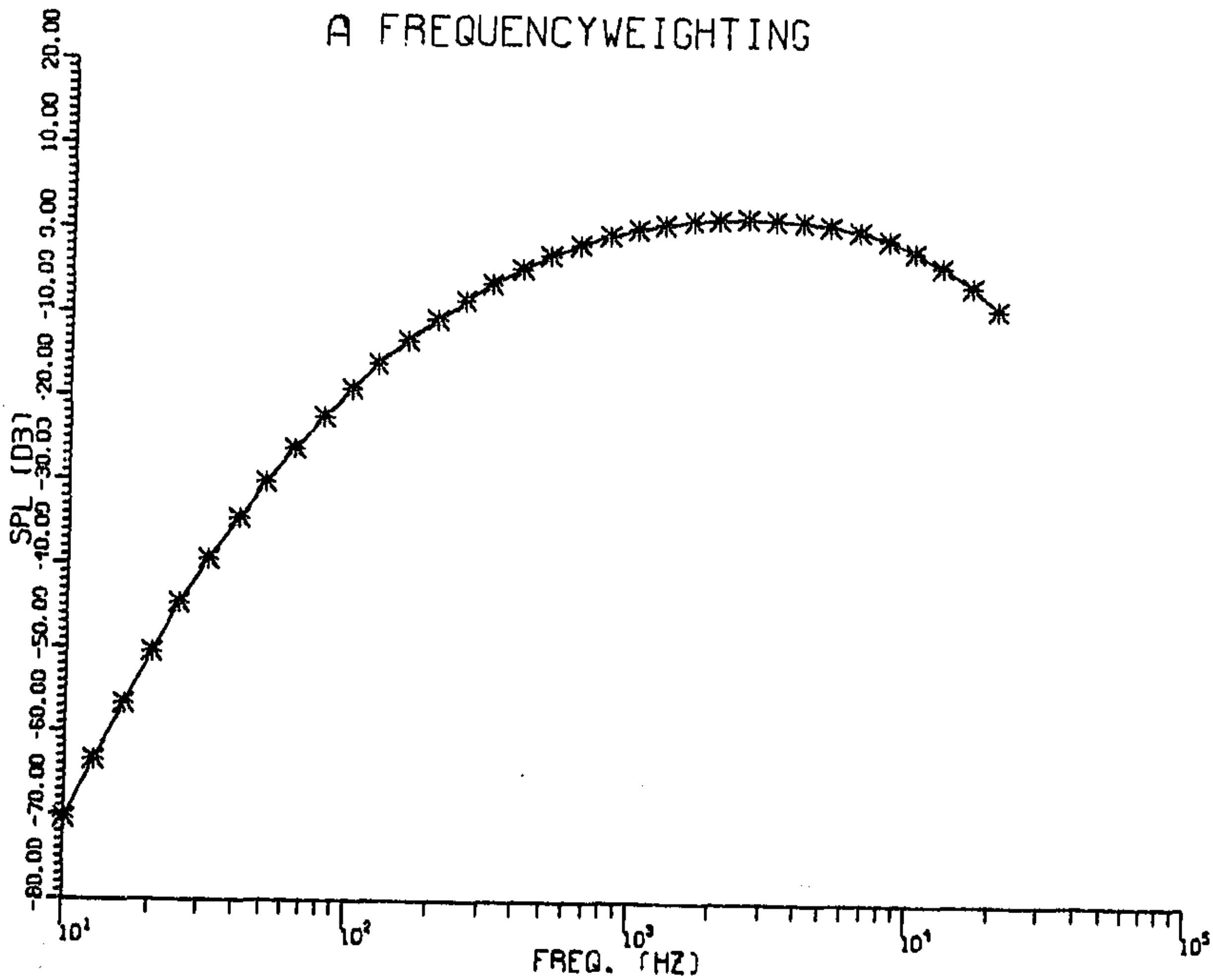


FIGURE 1. A WEIGHTING (NOVEMBER 1976)

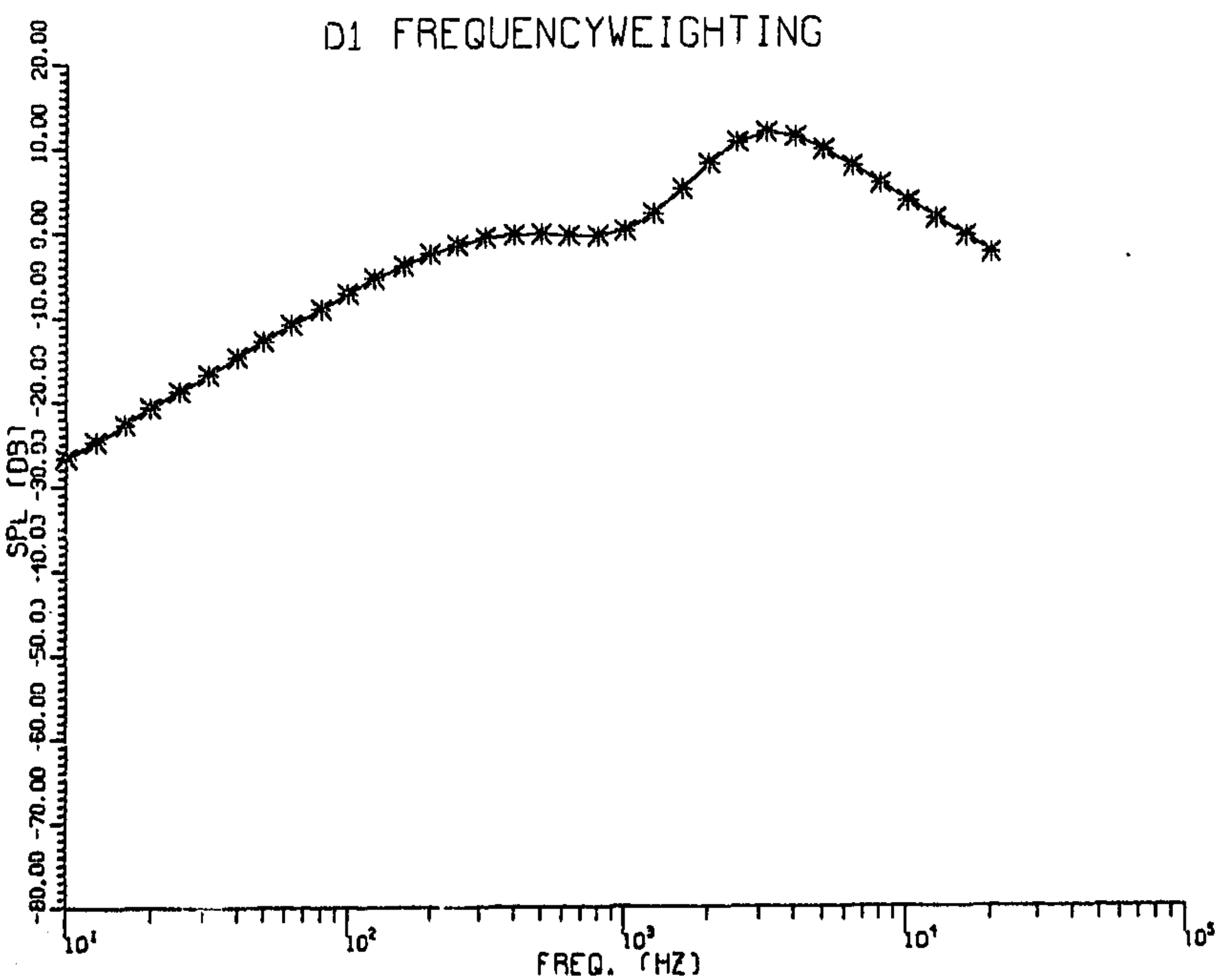


FIGURE 2. D_1 WEIGHTING (NOVEMBER 1976)

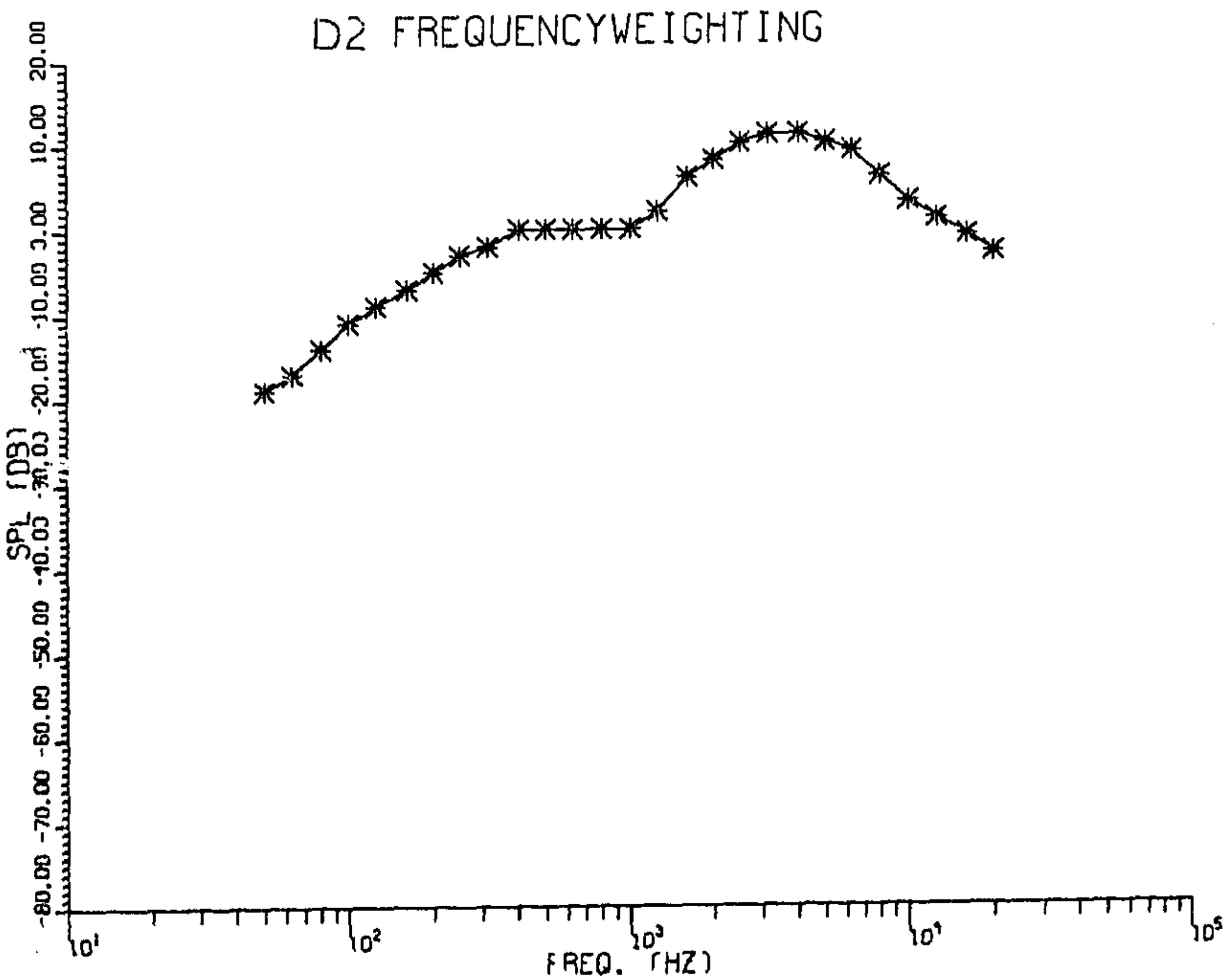


FIGURE 3. D_2 WEIGHTING (NOVEMBER 1976)

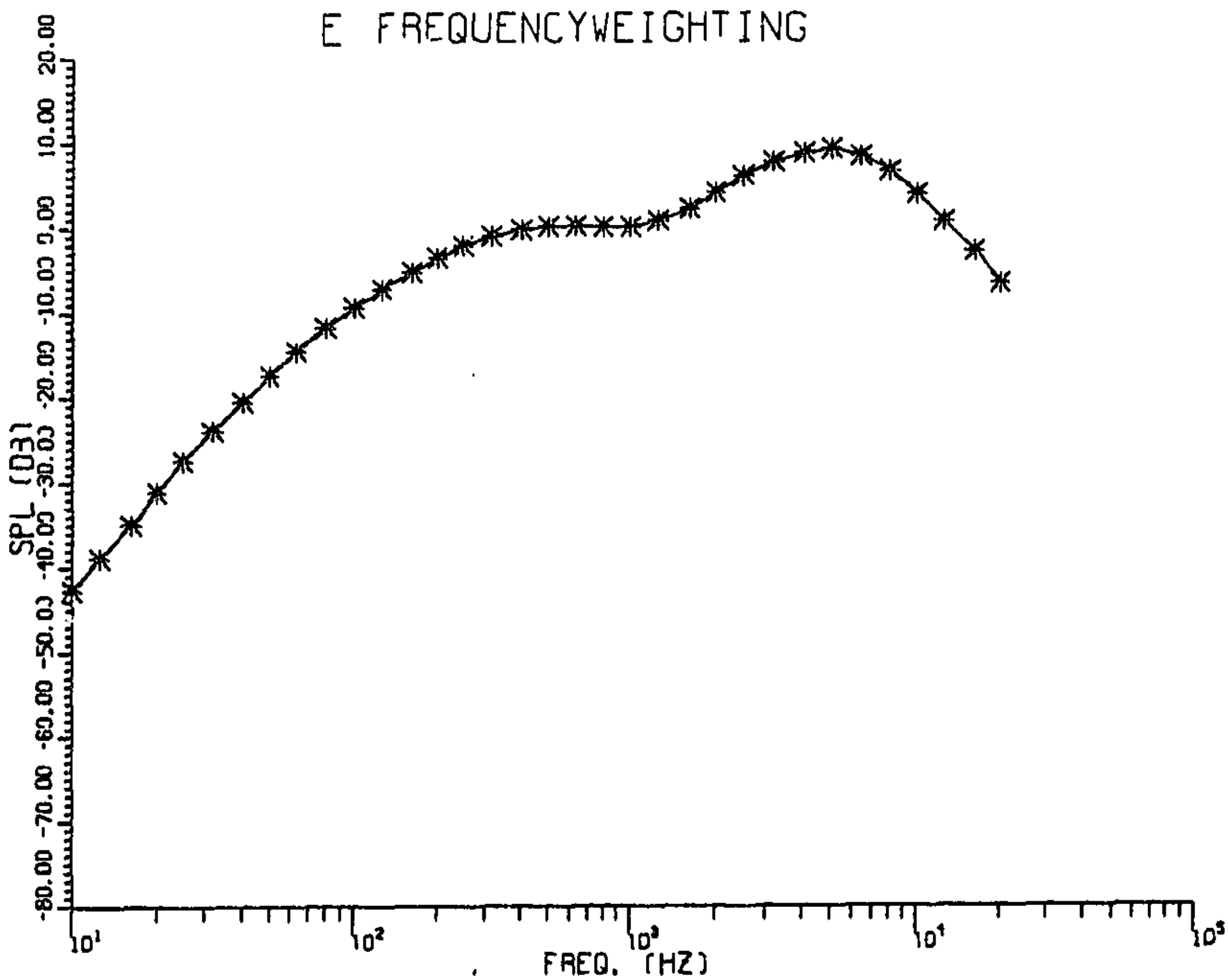


FIGURE 4. E WEIGHTING (NOVEMBER 1976)

TABLE II. VARIABILITY OF CALCULATED LEVELS OF NOISE.

(Standard deviations in dB computed either from the calculated levels of a group of sounds judged subjectively equal or from the differences between calculated and judged levels. The smaller the standard deviation, the closer the scheme comes to predicting the subjective equality of a set of sounds.)

STUDY	N/n	NUMBER OBSERVERS	A	B	C	D1	D2	E	MARK VI	VII	PNL	PNLC	ZWI
Berglund et al.	18/3*	30	4.6	4.6	4.6	4.6	4.6	4.6	3.8	3.9	5.6	5.6	3.7
Borsky	13/13*	319	3.6	3.0	2.8	3.3	3.5	3.3	3.0	3.0	3.8	4.2	3.4
Fishken	84/12*	12	3.5	3.7	3.7	4.5	4.5	4.2	4.2	4.2	3.8	3.6	2.8
	21/3*	8	4.5	4.6	4.6	4.4	4.4	4.4	4.4	5.4	3.4	3.5	3.7
Jahn	10/10	28	1.3	1.3	1.4	1.2	1.3	1.2	0.9	0.9	1.0	1.5	0.8
Kryter	17/17*	4-100	2.4	5.3	6.5	3.4	2.6	3.7	2.5	2.9	2.8	2.6	1.7
Kryter & Pearsons	9/9	13-19	3.5	4.8	5.4	2.8	3.1	2.8	2.1	1.9	2.1	2.2	3.7
Lubcke et al.	11/11	12	2.0	2.2	2.3	1.6	1.7	1.5	2.5	1.8	1.8	1.4	1.5
	20/20	12	2.3	2.1	2.2	2.6	2.8	2.6	2.1	2.0	2.2	2.3	1.6
Molino	18/5*	7	4.4	4.6	5.6	2.9	2.9	2.9	2.4	1.8	2.5	2.6	2.6
Pearsons & Bennett	30/30	20	4.3	4.5	4.7	3.5	3.7	3.3	2.8	2.8	2.9	2.2	3.7
	20/20	20	1.7	4.0	4.8	1.4	1.4	1.7	1.3	1.5	1.3	1.3	1.8
Pearsons et al.	108/54*	20	6.5	5.1	5.3	2.5	2.8	3.0	2.2	2.2	3.0	2.6	2.1
Pearsons & Wells	19/19*	20,30	2.8	3.4	3.6	1.8	1.8	1.9	2.4	2.3	2.5	2.7	2.6
Quietzsch	27/27	20	4.2	4.4	5.7	4.0	4.3	4.2	3.1	3.2	4.0	4.2	3.3
	10/10	20	3.8	6.3	7.0	3.3	2.9	3.8	2.5	2.5	2.6	2.8	2.5
Rademacher	24/24	20-25	2.2	2.6	3.2	1.8	2.0	1.9	1.6	1.7	1.6	1.7	1.6
Robinson & Bowsher	10/5*	558	1.9	2.8	3.1	1.4	1.5	1.9	1.2	1.6	1.1	1.4	0.9
Spiegel	20/20	10	4.7	6.2	6.8	4.2	4.0	4.2	2.4	1.9	3.2	3.7	2.4
	20/20	10	5.3	4.9	5.1	3.5	4.1	3.6	2.6	2.6	2.9	3.2	3.0
Wells (aircraft)	30/30	35	1.6	2.4	3.5	1.2	1.3	0.9	1.2	1.2	1.3	1.7	2.2
Wells (unpubl.)	33/33*	30	1.1	1.7	2.1	1.3	1.3	1.1	0.9	0.9	1.2	1.6	1.1
Wells 300	42/42	30	3.7	5.2	6.6	2.4	2.7	2.1	2.1	2.2	2.3	2.4	5.3
Wells 400	60/60	30	2.5	4.2	4.9	2.5	2.0	2.6	2.5	2.6	2.5	1.8	3.1
Wells UHV	25/25	31	1.5	0.9	1.4	1.3	1.5	1.3	1.1	1.0	1.3	1.4	0.9
Yaniv	11/11	10	1.6	2.4	4.2	2.2	2.3	1.6	---	2.6	4.6	4.9	2.0
	11/11	10	2.0	1.7	3.4	2.4	2.7	1.7	2.7	1.5	2.7	3.2	0.9
	11/11	10	2.6	1.2	2.8	2.9	3.3	2.1	1.7	1.4	2.7	3.1	1.4
Mean SD			3.08	3.58	4.19	2.66	2.75	2.65	2.30	2.27	2.60	2.69	2.37
SD of SDs			1.4	1.6	1.6	1.1	1.1	1.1	0.9	1.0	1.1	1.1	1.1

LEGEND:

N = number of conditions (e.g. different SPLs, instructions, tone-to-noise ratios)

n = number of different spectra

* = standard deviation based on average of two or more distinct sets of measurements

A,B,C = standard sound-level meter weightings

D1 = meter weighting adopted by IEC

D2 = weighting values suggested by K. Kryter

E = weighting values proposed for trial and study by ANSI

Mark VI = ANSI S 3.4 (R1972) procedure for the computation of noise

Mark VII = based on modification of Mark VI (S. S. Stevens, JASA, 1972, 51)

PNL = perceived noise level

PNLC = PNL with tone correction as per FAA36

ZWI = based on Zwicker's loudness calculation system. Program from E. Paulus and E. Zwicker, Acustica, 1972, 27. Free-field (FF) and diffuse-field (DF) values used as appropriate. For earphone listening, FF values used.

deviations from different portions of a single study were combined. For instance, standard deviations within a study were combined when "n" was smaller than 10. The studies by Berglund et al. (1976), Molino (1976), and Robinson and Bowsher (1961) fall into this category. We also combined standard deviations within a study when the sound spectra were fairly homogeneous as in Borsky (1974), Fishken (1971), Kryter (1959), and Wells (c.1970). Similarly, the standard deviations within a study were combined when the attribute judged and the spectra were the same but two different groups were used as in Pearsons et al. (1968) and Pearsons and Wells (1969). Large N therefore indicates the total number of experimental conditions for a given study or for a portion of the study. For a complete breakdown of the standard deviations within a study the reader is referred to the summary sheets and printouts in the Appendix.

The column labeled ZWI in Table II refers to calculated values based on Zwicker's system adjusted for either free-field or diffuse-field presentation. The breakdown of studies into these two categories is listed in Table I. For the purpose of this analysis the four studies that used earphones were placed into the free-field category.

In general, the magnitude of the standard deviations shown in Table II appear to be related to the complexity and heterogeneity of the stimuli. When the sound spectra are fairly homogeneous as in the studies by Rademacher (1959), Robinson and Bowsher (1961), and Wells (1970, c.1970, 1972) the standard deviations are quite small. By comparison, the introduction of multiple pure tones or wide variations in temporal patterns produces large increases in the magnitude of the standard deviations (e.g., Fishken, 1971, Pearsons and Bennett, part 1, 1969, Pearsons et al. 1968, Wells 300-400, 1969). The blank seen in the Mark-VI column for Yaniv's (1976) data results from a limitation of the Mark-VI calculation system for noises that contain energy peaks below 40-dB SPL in the frequency range below 100 Hz.

The overall summary presented in Table II reveals that the differences among the means and standard deviations of the standard deviations are quite small when compared across frequency weightings and calculation schemes. Among the frequency weightings, the B and C weightings produce the largest variability; the D and E weightings produce the smallest variability, while the A weighting produces an intermediate value. However, the magnitude of the differences, with the exception of the C weighting, is on the order of 1.0 dB. On the average, the standard deviation for the D and E weightings are only about a third of a decibel larger than those for three of the five calculation schemes. (The same picture emerges if instead of a simple mean of each column of standard deviations, we compute the RMS values by adding up the squared deviations, dividing by the total n, and taking the square root.)

In contrast to the larger group of experiments shown in Table II, in one group of five studies members of pairs of noises were subjectively matched to each other but no large group of sounds was matched to a common standard. This group of experiments was not amenable to computation of standard deviations. Parts of the Berglund et al. (1976) and Pearsons et al. (1968) studies in addition to the experiments of Copeland et al. (1960), Hillquist (1967) and Little (1961) fell into this category. Analyses of this group of studies are based on a very simple concept: If two sounds of a pair are judged subjectively equal with respect to either loudness or acceptability, does the weighting or calculation system predict this zero difference in perceived magnitude? In order to answer this question, mean differences between the calculated values of subjectively equal sounds were computed for each study.

Table III presents the results of the calculations of the absolute values of mean differences. The column labeled N/n does not have the same meaning as in Table II. The number of different sound spectra is again denoted by "n" but "N" represents the number of sound pairs within a given experiment rather than the number of experimental conditions. The value of N was used directly for a determination of average mean differences for a given experiment and for a specific weighting or calculation system. For example, the Berglund et al. (1976) experiment produced seven subjectively equal pairs of sounds but only two different sound spectra were involved. On the other hand, the Hillquist (1967) study resulted in 21 equally matched pairs but all 21 sounds had somewhat different spectra. Thus, in the Berglund et al. study, N is 7 and in the Hillquist study it is 21.

An explanation also appears in order for the Copeland et al. (1960) and Pearsons et al. (1968) analyses. In each study, the same sound spectra were presented to two groups of listeners with a different set of instructions. One group of listeners was asked to match the sound pairs in loudness and the other group was asked to match the pairs for equal disturbance or acceptability. Table III considers each series of mean differences separately.

TABLE III. MEAN DIFFERENCES (ABSOLUTE VALUES) WITHIN PAIRS OF SUBJECTIVELY EQUAL SOUNDS

STUDY	N/n	A	B	C	D1	D2	E	MARK VI	VII	PNL	PNLC	ZWI
Berglund et al.	7/2**	2.8	1.6	4.7	1.3	2.6	1.7	1.0	2.4	1.3	1.9	1.1
Copeland et al.	4/5**	1.5	3.9	5.2	0.9	0.7	1.5	1.0	1.3	0.9	0.8	1.3
	4/5*	1.6	4.9	6.2	1.8	0.9	2.5	2.0	2.3	1.8	1.6	1.0
Hillquist	21/21*	1.9	2.6	3.0	2.2	1.9	2.1	1.5	1.7	1.8	---	1.2
Little	1/2*	5.4	5.5	5.6	6.1	6.0	6.1	5.9	6.8	5.9	5.9	5.3
Pearsons et al.	10/10*	4.7	4.6	4.6	4.8	5.0	4.9	5.1	5.3	4.3	5.3	7.0
	10/10**	1.3	1.1	1.1	0.9	.9	1.0	1.5	1.2	0.6	1.3	2.2

N = number of pairs

n = number of different spectra

*Observers judged acceptability or disturbance of sound

**Observers judged loudness

In the study by Copeland et al. (1960), when listeners judged loudness the absolute mean differences between the calculated values were smaller than when they judged disturbance, but the difference is usually less than 1.0 dB.

The Pearsons et al. (1968) study yielded much larger differences between loudness and acceptability matches. The absolute mean differences between the calculated values of sound pairs are about 3 to 4 dB larger for acceptability than for loudness. The mean differences in the Pearsons et al. (1968) study for acceptability are about as large as those in the study by Little (1961) whose listeners judged the two jet sounds for equal annoyance.

Both the Little (1961) and Pearsons et al. (1968) studies involved judgments of auditory magnitudes other than loudness. Further, in contrast to the aircraft noises used by Copeland et al. (1960), Little (1961) and Pearsons et al. (1968) introduced tonal components into their stimuli. Although Table III includes few data, they do suggest that none of the evaluated frequency weighting or calculation schemes performs well when both the complexity of the judged attribute and the heterogeneity of the sound spectra are increased.

Table IV presents the mean differences in dB between calculated and measured loudness levels. Whereas the standard deviations provide information with respect to a calculation system's variability or reliability, the mean differences in Table IV tell us about the extent of the disparity between the perceived and predicted magnitudes. When a calculation system is evaluated, it is important to know not only how variable it is but also how well it predicts the perceived magnitude as reported by the typical human observer. The variability of a given system may be quite small, but it may predict perceived levels consistently different from what the average listener reports, thereby decreasing its validity or accuracy. If a frequency weighting or calculation system is to have validity or meaning in terms of the output of the human observer, then it is necessary to be concerned with not only the system's variability but also its ability to predict the judged levels. (Of course, if the error is a constant, correcting for it is a trivial matter, but as is shown below, the error is far from being a constant for any of the frequency weightings or calculation schemes.) For a discussion of the important distinction between variability or precision and validity or accuracy, see S. S. Stevens (1972).

TABLE IV. MEAN DIFFERENCES (dB) (CALCULATED MINUS OBSERVED LEVELS)

See Legend for Table II.

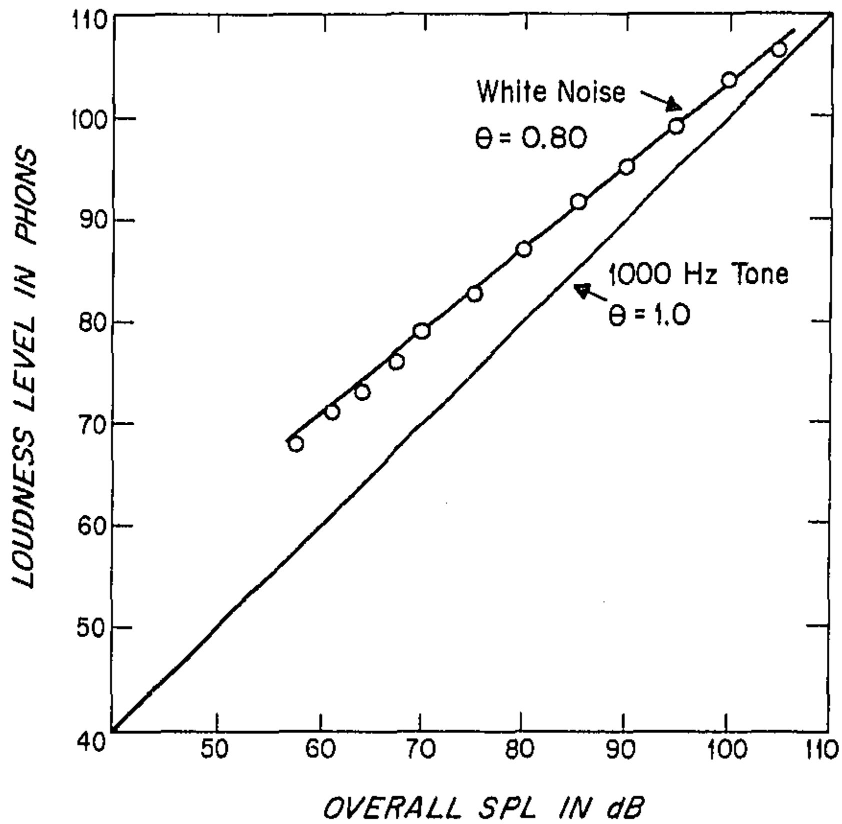
STUDY	N/n	A	B	C	D1	D2	E	MARK VI	MARK VII	PNL	PNLC	ZWI
Berglund et al.	18/3*	-12.9	-4.7	-2.2	-4.1	-6.7	-6.3	2.5	-6.0	-0.4	-0.6	8.6
Fishken	84/12*	-4.8	-5.1	-5.1	2.1	2.0	0.3	4.9	-1.7	5.5	10.7	7.8
	21/3*	-1.0	-1.7	-1.7	5.8	6.0	2.9	8.8	1.3	9.9	15.6	11.2
Jahn	10/10	-11.9	-10.8	-10.3	-5.1	-5.3	-7.7	-0.3	-7.8	1.1	2.3	5.1
Kryter & Pearsons	9/9	-8.9	-7.6	-7.0	-2.3	-2.2	-3.7	0.3	-7.3	2.1	5.3	4.1
Lübcke et al.	11/11	-18.8	-16.9	-16.0	-13.0	-13.3	-14.8	-8.6	-13.3	-9.4	-8.2	-2.4
	20/20	-17.3	-15.7	-14.9	-11.7	-11.8	-13.3	-6.2	-14.0	-5.2	-3.7	-0.7
Molino	18/5*	-6.5	-4.8	-3.1	-7.5	-1.0	-2.4	6.4	-1.0	5.1	6.3	12.3
Quietzsch	27/27	-14.6	-13.0	-11.6	-8.3	-8.6	-10.3	-3.5	-11.0	-2.5	0.5	1.8
	10/10	-13.0	-9.4	-7.8	-6.9	-7.5	-7.9	-1.4	-7.6	-2.9	-1.0	4.7
Rademacher	24/24	-8.8	-4.2	-2.4	-2.1	-3.0	-3.7	1.7	-5.3	3.9	6.3	8.0
Spiegel	20/20	-12.8	-10.9	-10.0	-6.7	-7.0	-7.6	-1.5	-9.4	-3.9	-1.8	1.0
	20/20	-11.9	-10.0	-9.0	-5.8	-6.2	-6.8	-2.8	-10.9	-2.3	1.0	0.7
Yaniv	11/11	-7.3	-3.9	-1.3	-1.7	-2.4	-3.6	-	-4.3	-1.5	-0.1	6.3
	11/11	-10.3	-6.9	-4.3	-4.7	-5.4	-6.6	0.2	-4.9	-0.9	0.5	6.5
	11/11	-11.8	-8.4	-5.8	-6.2	-6.8	-8.1	0.9	-6.3	-0.9	0.4	6.2
Mean of Mean diffs.		-10.8	-8.4	-7.0	-4.9	-5.0	-6.2	-0.13	-6.8	-0.1	2.1	5.1
SD of Means		4.53	4.36	4.63	4.68	4.84	4.55	4.54	4.29	4.69	5.70	4.16

Ten of the twenty studies shown in Table II (on variability) are represented in Table IV. The designation N/n has the same meaning as in Table II. Hence, individual portions of a given study were combined in the same manner and for the same reasons as in Table II. All of the ten studies involved matches against a known calibrated standard from which a loudness level could be determined. Except for the study by Berglund et al. (1976) which used a white-noise standard, the standard sound was either a 1000-Hz tone or an octave or 1/3-octave band of noise centered at 1000 Hz. The measured loudness levels for these studies are listed in the computer printouts in the Appendix.

The loudness levels of the white-noise standard in the Berglund et al. (1976) study were computed from the graph in Fig. 5 which shows how the loudness level of white noise depends on its overall SPL. Figure 5 covers a range from 56 to 105 dB SPL. The loudness levels for white noise were adopted from a graph by Scharf (in press) that shows the relationship between the loudness functions for white noise and a 1000-Hz tone.

According to Table IV, with the exception of the PNLC and Zwicker systems, all of the calculation and weighting schemes tend to underestimate perceived magnitude. The overall mean of the mean differences produces the largest discrepancy between calculated and measured loudness levels for the A, B, and C weightings and the smallest discrepancy for the Mark VI and PNL calculation schemes. We should note, however, that the means calculated for the Mark VII system were not adjusted for the 8-dB difference in loudness level produced by equally loud 1000- and 3000-Hz tones (Stevens, 1972). When this adjustment is made, the outcome of the Mark VI and Mark VII systems is about the same. Nevertheless, as pointed out with respect to Table II, the shortcoming of Mark VI is again apparent for the stimuli analyzed by Yaniv (1976), at 40 dB SPL. Whereas the mean of the mean differences shows a wide variation across frequency-weighting and calculation schemes, the standard deviation of the mean remains fairly constant. Moreover, the magnitude of the standard deviations across weighting and calculation schemes is quite large. It ranges from 4.2 dB for Zwicker's system to 5.7 dB for PNLC. We shall see in Table V that these large standard deviations may be due to the fact that four of the ten studies (Fishken (1971), Kryter and Pearsons (1963), Quietzsch (1955), and Spiegel (1960)) employed either artificial sounds including tonal components, or a wide assortment of sound spectra that were already shown in Table II to contribute heavily to overall variability.

FIGURE 5. LOUDNESS FUNCTION FOR WHITE NOISE



III ANALYSIS ACCORDING TO FIVE PARAMETERS

In this section subgroups of the 20 studies summarized in Table II are compared according to the categories delineated in section I. This type of analysis was performed to ascertain whether it would reveal more information about a specific weighting or calculation scheme than the general analysis. Table V shows the effect on standard deviation of four parameters. For each parameter, the unweighted mean of the relevant standard deviation is given. The fifth parameter, effect of sound pressure level on observed discrepancies between measurements and predictions, is graphically displayed in Figs. 6 to 11.

1. Attribute Judged

For this analysis the studies were subdivided into two broad categories according to whether listeners were asked to judge loudness or some other attribute of sounds such as noisiness, disturbance, acceptability, etc. Acceptability was chosen as the second broad category because acceptability was commonly used as a verbal description in the instructions presented to the listener. Nine studies were clearly classified in the loudness category and ten were placed into the acceptability category. Table V suggests that the relative reliability of the 11 schemes is the same for the two sets of studies. However, the standard deviations are larger when the listeners were asked to judge the loudness than when asked to judge the acceptability of noises. This difference is probably not meaningful. We believe that several of the studies in which loudness was judged happened to yield larger standard deviations not because of the judged attribute, but because of other factors such as greater heterogeneity of spectra (e.g., Quietzsch, 1955) or levels (e.g., Fishken, 1971).

2. Type of Noise

Part 2 of Table V provides an analysis of standard deviations according to type of noise. The studies in Table II were subdivided into six groups: aircraft, industrial, vehicle, household, artificial, and miscellaneous noises. A study was placed in a given category when most of the stimuli were of the same type. For example, the study by Kryter and Pearsons (1963) was placed into the artificial category even though two of the nine sounds were recorded aircraft noises. In addition, all of the studies that used single and multiple pure tones were classified as artificial. Only three studies did not fit easily into a

TABLE V. EFFECT ON STANDARD DEVIATION OF FOUR PARAMETERS (Standard Deviations in dB)

See Legend for Table II.

VARIABLE	No. of STUDIES/ SDs	A	B	C	D1	D2	E	VI	VII	PNL	PNLC	ZWI
1. Attribute Judged												
Loudness	9/15	3.3	3.5	4.2	3.1	3.2	3.0	2.6	2.5	3.0	3.2	2.3
Acceptability	10/12	2.9	3.7	4.3	2.3	2.3	2.3	2.0	2.0	2.3	2.2	2.6
2. Type of Noise												
Aircraft	7/8	2.0	3.0	3.5	1.9	1.8	2.0	1.5	1.6	1.9	2.0	1.6
Industrial	3/4	2.7	2.7	2.8	2.7	2.8	2.7	2.5	2.4	2.9	1.7	2.1
Vehicle	1/1	2.2	2.6	3.2	1.8	2.0	1.9	1.6	1.7	1.6	1.7	1.6
Household	1/3	2.1	1.8	3.5	2.5	2.8	1.8	2.2**	1.8	3.3	3.7	1.4
Artificial	6/9	4.3	4.8	5.2	3.4	3.5	3.4	2.8	2.9	3.1	2.8	3.3
Miscel.	3/4	3.5	4.1	4.9	2.9	2.9	3.1	2.3	2.2	2.6	2.8	2.3
3. Tonal Components												
Present	9/12	3.1	3.6	4.0	2.5	2.6	2.5	2.3	2.4	2.4	2.4	2.7
Absent	10/15	3.2	3.7	4.5	2.9	3.0	2.9	2.4	2.2	2.8	3.0	2.2
4. Mode of Sound Presentation												
Free Field	11/14	2.7	3.1	3.7	2.1	2.2	2.1	1.9	1.9	2.1	2.1	2.3
Diffuse Field	7/8	3.7	4.7	5.3	3.1	3.1	3.3	2.3	2.3	2.6	2.8	2.5
Earphones	3/6	3.1	3.1	3.9	3.5	3.6	3.1	3.4	3.2	3.8	4.0	2.4

** 2 Means

specific category and were placed into a miscellaneous classification. These studies included the five environmental noises used by Molino (1976), the 37 mixed group of noises used by Quietzsch (1955), and the 25 ultra-high voltage transmission-line noises used by Wells (1972).

The results in Part 2 of Table V confirm the conclusions drawn from the overall summary of standard deviations in Table II. First, regardless of type of noise the B and C weightings produce larger standard deviations than either the D and E weightings or the Mark VI, Mark VII, PNL, and Zwicker calculation schemes. Although the A weighting fares about the same as the D and E weightings for relatively homogeneous stimuli in the aircraft, industrial, and vehicle categories, it clearly becomes worse for both artificial and miscellaneous sounds. Second, the size of the standard deviations is related to the complexity and heterogeneity of the stimuli. The categories designated artificial and miscellaneous show the largest standard deviations across weighting and calculation schemes but within these categories Mark VI and Mark VII produce the smallest standard deviations. The system designated PNLC, which includes a correction for tonal components, does not reduce the variability of these data.

3. Tonal Components

Part 3 of Table V groups the studies according to the presence or absence of tonal components. (A study was classified as having tonal components according to the author's designation.) Broken down this way, the results suggest that those studies in which tones were absent tend to be more variable than those in which tones were present. This conclusion, however, may be a bit misleading because the dual grouping in Part 3 does not take into account the problem of stimulus complexity and heterogeneity as shown in Part 2. For instance, five of the nine studies involving tonal components used fairly homogeneous spectra whereas five of the ten studies that did not include tones employed widely disparate spectra. The study of Wells (1970) is an example of the former category and the studies of Quietzsch (1955) and Spiegel (1960) are examples of the latter category. Hence, a proper analysis of the effect of tonal components on standard deviations requires that the interaction with other stimulus features be taken into account.

4. Mode of Sound Presentation

Part 4 of Table V deals with the effect of mode of sound presentation on the standard deviations. The same studies were regrouped into three categories: free-field, diffuse-field, and earphone presentation. This breakdown reveals that, with the exception of Zwicker's system, all of the weighting and calculation systems result in the smallest standard deviations under free-field conditions. In a diffuse field, the standard deviations increase somewhat across calculation systems but the increase is smaller than across weighting schemes. On the other hand, when earphones were used the standard deviations are large for both the weighting and calculation schemes. Only Zwicker's system, which explicitly takes into account the mode of sound presentation, gives approximately the same standard deviations for all three modes.

5. Effect of Sound Pressure Level on Standard Deviation

The standard deviations for the A, D1, and E weightings are plotten in Figs. 6 through 8 as a function of SPL; those for Mark VI, PNL, and Zwicker are plotted in Figs. 9 through 11.

Figures 6 through 11 show that the A weighting produces the largest scatter of standard deviations and Mark VI produces the smallest scatter. Moreover, all three weighting schemes produce an increase in standard deviation with increases in SPL (e.g., Fishken, 1971; Molino, 1976; Yaniv, 1976). None of the calculation systems exhibits a clear cut level effect. The dependence of standard deviations on SPL is a basic weakness of the frequency-weighting schemes. It tends to obscure the consistent observation persistent in this report that the magnitude of the standard deviations is directly related to the interaction between the complexity of the judged attribute and the heterogeneity of the sound spectra. In homogeneous sound spectra (e.g., Robinson and Bowsher, 1961; Wells (UHV), 1972) and for judgments of loudness (Jahn, 1965/66), the standard deviations remain small and fairly constant regardless of overall SPL. However, the two studies by Wells (1969, c.1970) produce standard deviations that differ by 1 to 3 dB despite the fact that the measurements were obtained at about the same overall SPL of 80 dB. The 1970 Wells study (unfilled diamonds) used a fairly homogeneous sample of airplane noises and thereby yielded a consistently small standard deviation, whereas the 1969 Wells study (filled diamonds) introduced multiple pure tones into narrow- and broad-band noises and thereby substantially increased the standard deviations.

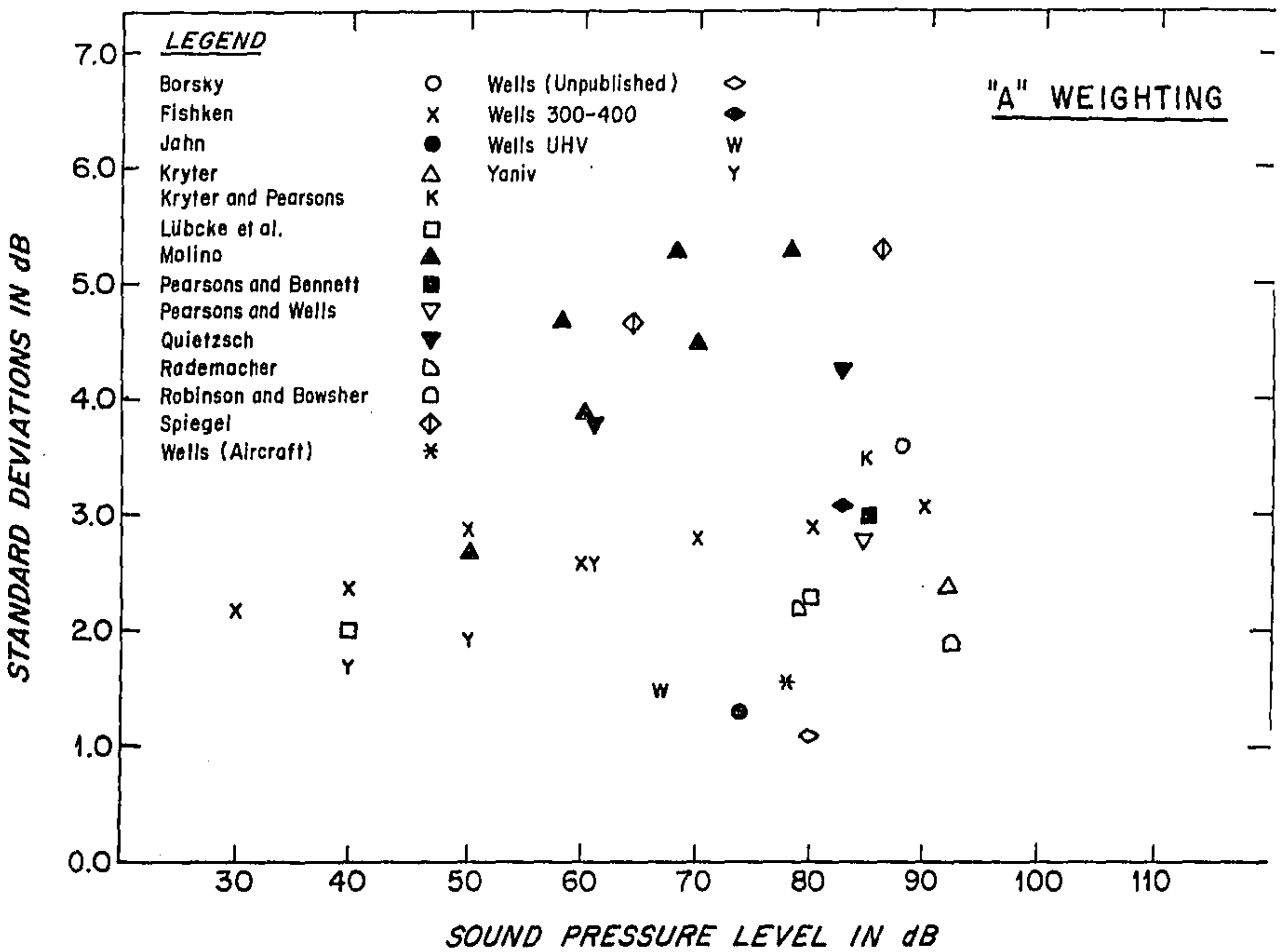


FIGURE 6. VARIABILITY OF A WEIGHTED LEVELS AS FUNCTION OF SPL

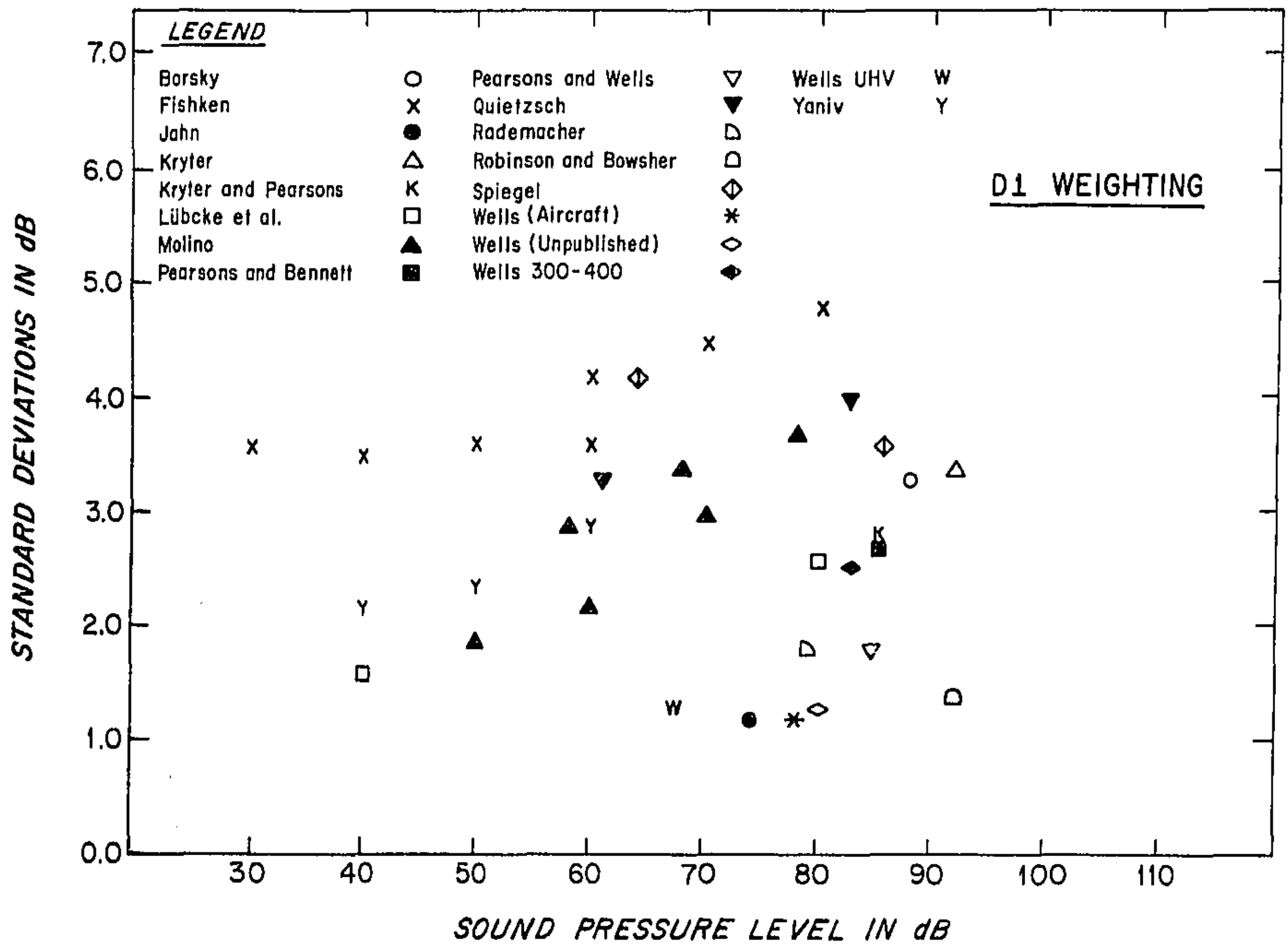


FIGURE 7. VARIABILITY OF D1 WEIGHTED LEVELS AS A FUNCTION OF SPL

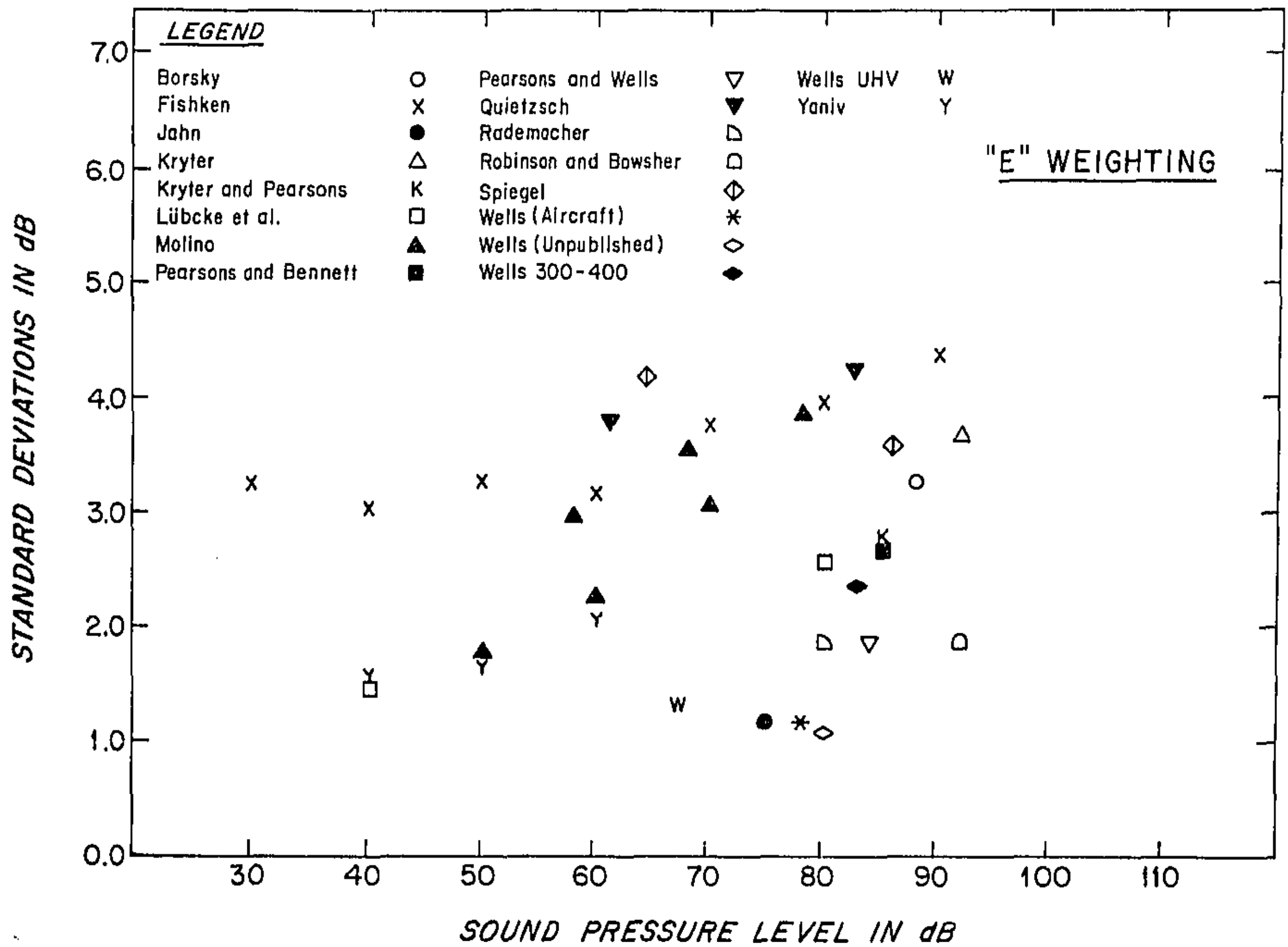


FIGURE 8. VARIABILITY OF E WEIGHTED LEVELS AS A FUNCTION OF SPL

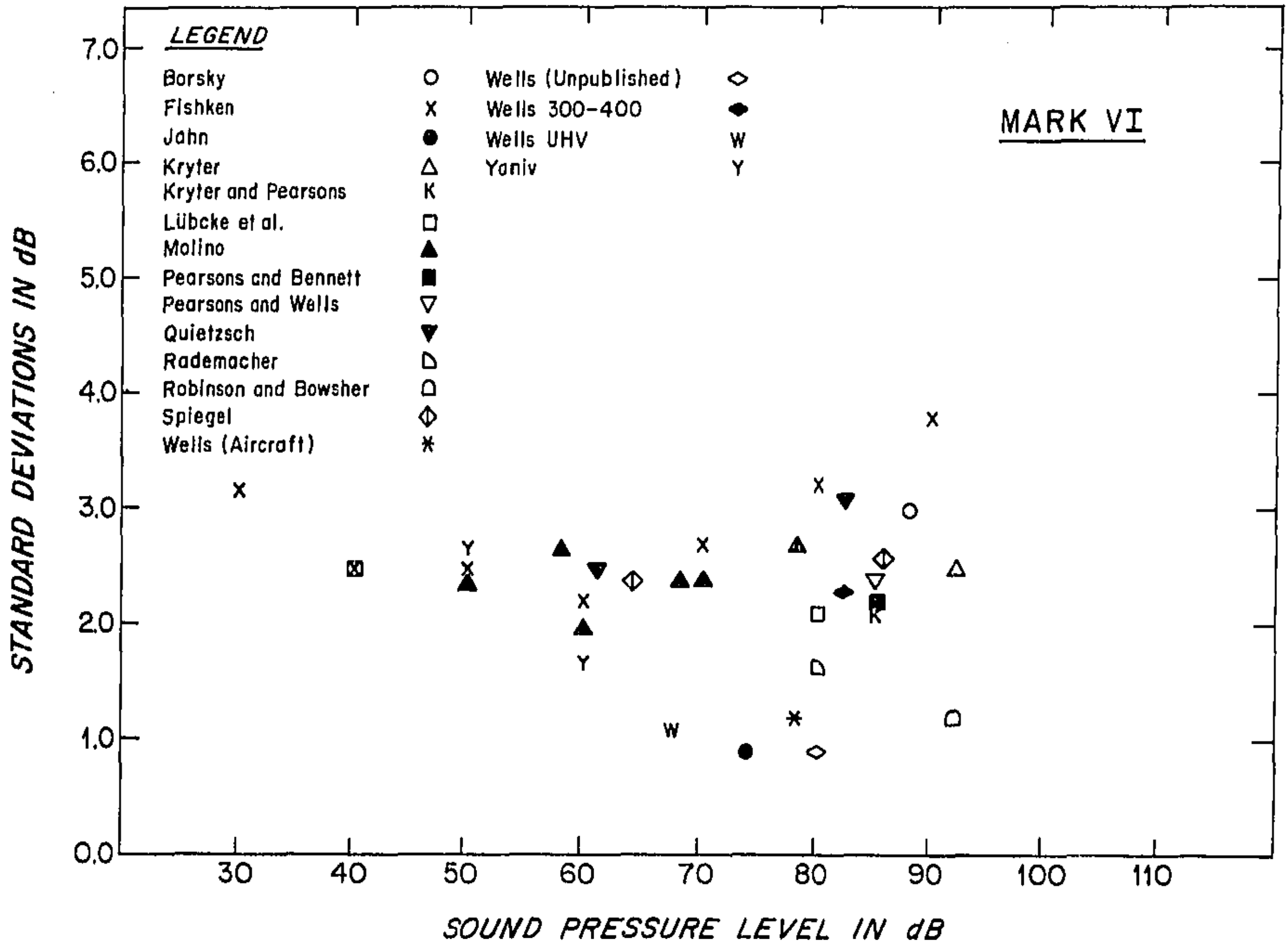


FIGURE 9. VARIABILITY OF LEVELS CALCULATED BY MARK VI AS A FUNCTION OF SPL

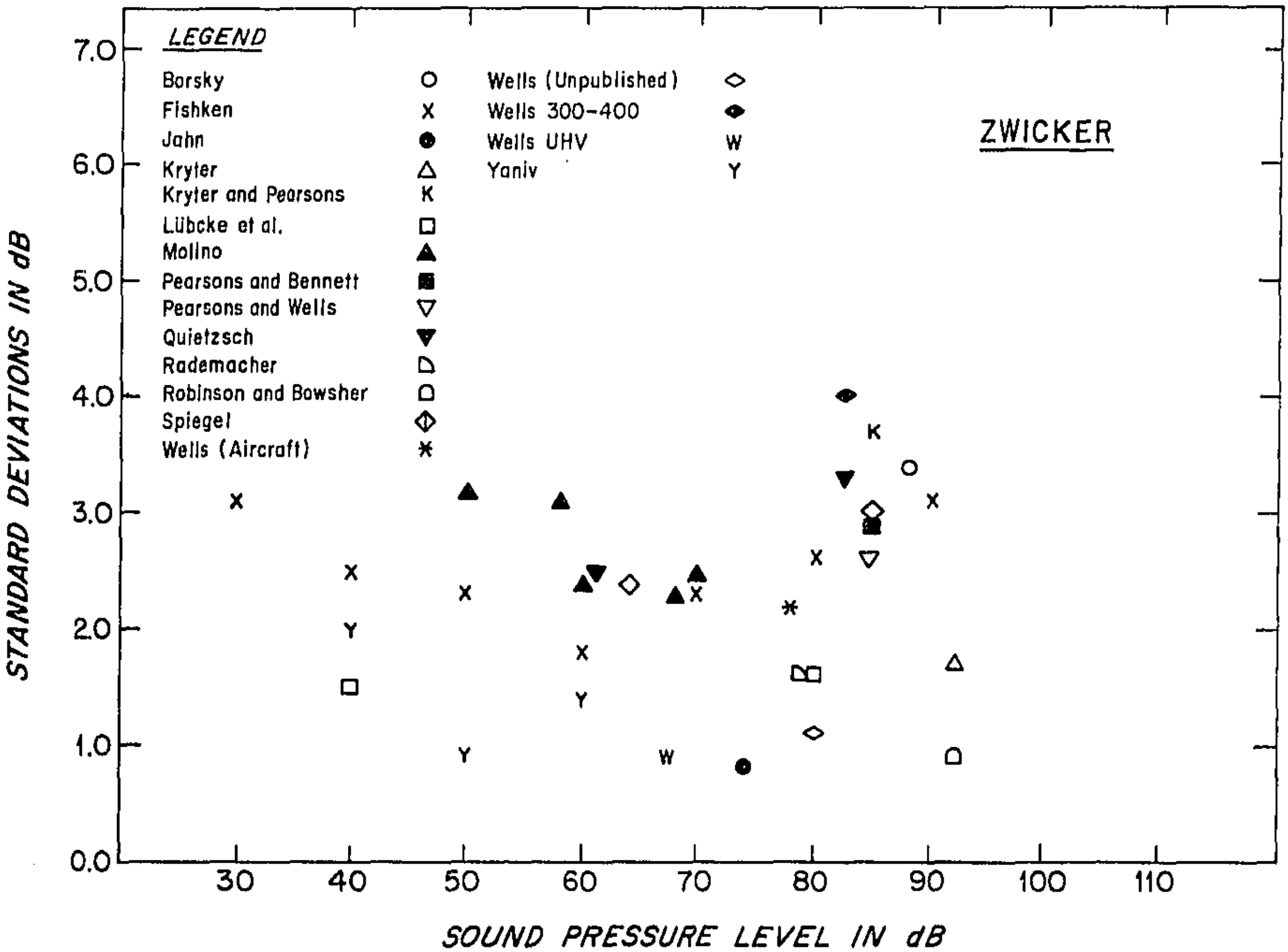


FIGURE 10. VARIABILITY OF LEVELS CALCULATED BY ZWICKER'S METHOD AS A FUNCTION OF SPL

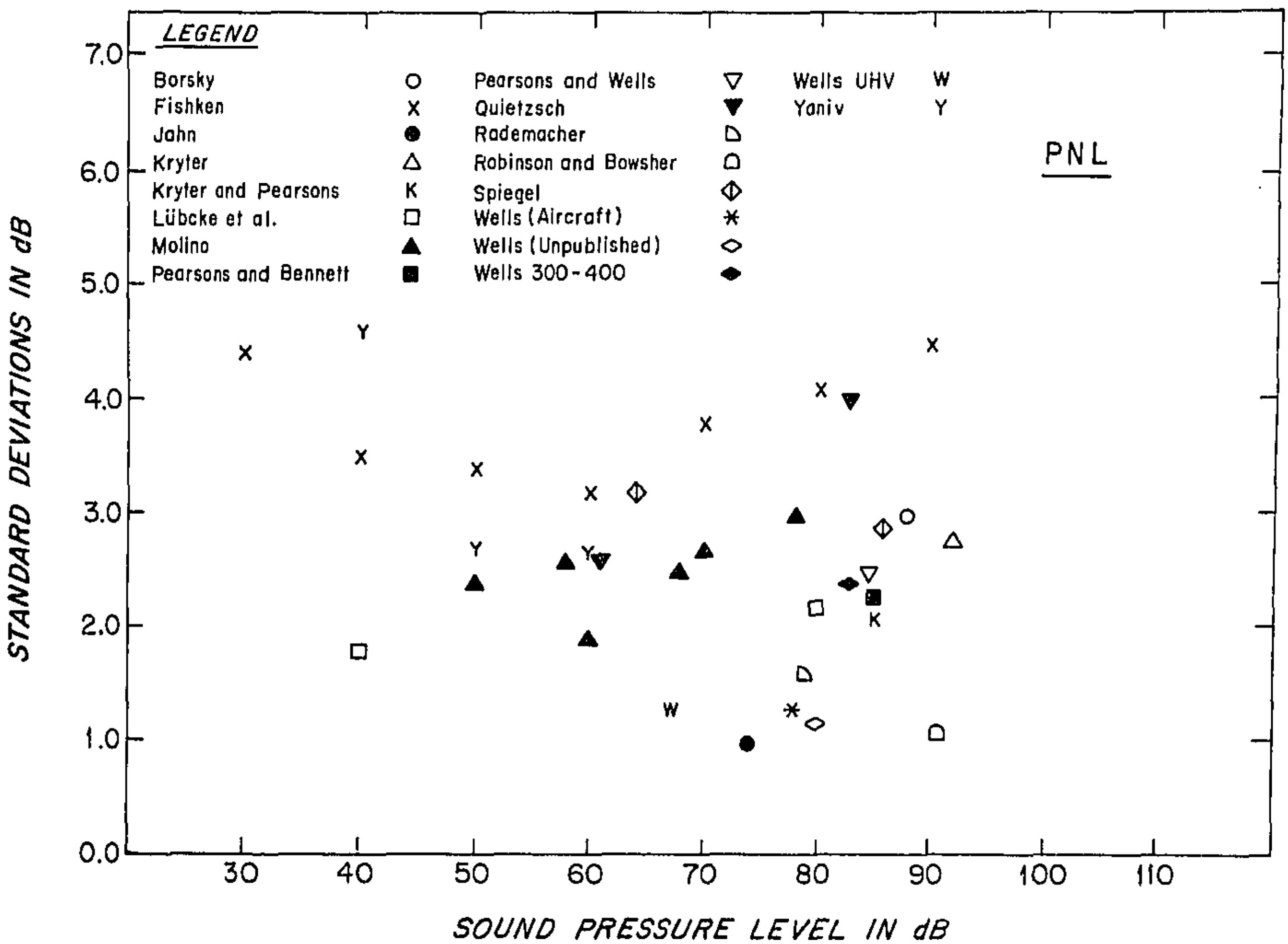


FIGURE 11. VARIABILITY OF LEVELS CALCULATED BY PNL METHOD AS A FUNCTION OF SPL

TABLE VI. EFFECT ON MEAN DIFFERENCES OF TWO PARAMETERS (Calculated minus observed levels in dB)

See Legend for Table II.

VARIABLE	No. of STUDIES/ MEANS	A	B	C	D1	D2	E	MARK VI	MARK VII	PNL	PNLC	ZWI
1. Type of Noise												
Aircraft	1/1	-12.8	-10.2	-8.7	-5.1	-5.5	-7.3	1.0	-6.5	1.4	-	6.1
Industrial	3/4	-15.0	-11.6	-9.6	-8.4	-9.4	-10.5	-3.1	-10.2	-3.6	-3.2	2.7
Vehicle	1/1	-8.8	-4.2	-2.4	-2.1	-3.0	-3.7	1.7	-5.3	3.9	6.3	8.0
Household	1/3	-9.8	-6.4	-3.8	-4.2	-4.9	-6.1	0.6**	-5.2	-1.1	0.3	6.3
Artificial	3/5	-7.9	-7.1	-6.6	-1.4	-1.5	-3.0	1.9	-5.6	2.3	5.8	9.5
Miscel.	2/3	-11.9	-9.1	-7.5	-5.3	-5.7	-6.9	0.5	-6.5	-0.1	2.0	6.3
2. Mode of Stimulus Presentation												
Free Field	4/5	-14.3	-12.1	-11.0	-8.0	-8.4	-10.0	-3.4	-10.3	-2.4	-0.6	2.4
Diffuse Field	4/5	-10.6	-8.5	-7.4	-4.5	-4.8	-5.7	0.2	-7.2	-0.4	2.0	4.6
Earphones	3/6	-8.0	-5.1	-2.7	-1.5	-2.2	-3.6	3.5	-3.7	2.0	4.4	7.8

**2 means

Groups of similar sounds or similar studies were also analyzed to determine whether the mean differences shown in Table IV depend on the type of sound or mode of stimulus presentation. Fewer studies than in Table V were available for this analysis. The results are shown in Table VI.

Part 1 of Table VI presents the mean differences for the same six categories of noise as used in Table V. The trend of the data is consistent with the overall analysis of mean differences in Table IV. Table VI shows that the largest discrepancy between calculated and measured loudness levels is for the A, B, and C weightings and the smallest discrepancy for the Mark VI and PNL calculation schemes. (Note that the Mark VII means are unadjusted values.) Furthermore, the mean difference produced by the various weighting and calculation schemes is clearly not a constant but rather varies substantially across types of noises. For example, the mean differences produced by the A weighting range from -8 dB for artificial noises to -15 dB for industrial noises. Similarly, the mean differences produced by the D1 weighting range from about -1.4 dB for artificial noises to -8.4 dB for industrial noises. Of the six weighting schemes the D1 weighting produces the smallest mean differences for the six types of noises. Too few studies were involved, however, to determine whether the mean differences between the D1, D2 and E weightings are meaningful. Equally important, insufficient data were available to assess the validity or accuracy of a specific system when multiple pure tones are introduced into a band of noise.

The effect of mode of presentation on mean differences is indicated in Part 2 of Table VI. These data show that none of the weighting schemes appears able to predict perceived levels in a free field. The mean differences between calculated and observed levels decrease somewhat across weighting schemes in a diffuse field. However, regardless of mode of presentation, the calculation systems appear to have greater validity than the weighting scheme. Mark VI and PNL predict perceived levels best in a diffuse field whereas Zwicker's system predicts perceived levels best in a free field.

IV SUMMARY AND CONCLUSIONS

This project was concerned with the ability of 11 frequency-weighting and calculation systems to predict the perceived magnitude of sounds. In general, with respect to both variability and mean differences between calculated and observed levels, the B and C frequency weightings fare less well than the D and E weightings and the five calculation schemes. The A weighting is less variable than either B or C, and more variable than D1 and E by less than a 1/2 dB. Further, the standard deviations produced by the frequency weightings tend to be level dependent, whereas those produced by the calculation systems are not. The level dependency is such that the expected error in the frequency weightings tends to increase with level, so that predictions are worse at the higher levels, which are of prime importance with respect to environmental sounds. The data also suggest that none of the frequency-weighting schemes is valid (without a correction) for free-field presentations, i.e., none gives a reading close to the judged level.

To determine whether the differences in standard deviations produced by the weighting and calculation schemes are indeed statistically significant, a preliminary analysis was carried out in which simple t-tests were performed between the mean standard deviations in Table II. These results are indicated in Table VII. A positive value in Table VII means that the weighting and calculation schemes listed horizontally in the row produce larger standard deviations than the weighting and calculation schemes listed in the vertical column. The opposite is true for a negative value. The number of asterisks indicates the level of statistical significance of the t-tests. No asterisk means the difference was not statistically significant. For example, the first line shows that the B and C weightings produce significantly larger standard deviations than the A weighting whereas the D1 and E weightings and the Mark VI, Mark VII, PNL and Zwicker calculation schemes produce significantly smaller standard deviations than the A weighting.

Table VII's important implications can be summarized as follows:

1) Of the six frequency-weighting schemes, the standard deviations produced by the A, D1, D2, and E weightings are significantly smaller than the standard deviations produced by the B and C weightings.

2) The standard deviations produced by the D1 and E weightings are not significantly different from each other but are significantly smaller than that produced by the A weighting.

3) The D2 weighting does not appear to be significantly better than either the D1 or E weightings. It is also not statistically different from the A weighting.

TABLE VII. DIFFERENCES[1] IN dB BETWEEN MEAN STANDARD DEVIATIONS IN TABLE II.

	B	C	D1	D2	E	VI	VII	PNL	PNLC	ZWI
A	.50*	1.11***	-.41*	-.33	-.43*	-.83***	-.81**	-.48*	-.38	-.71**
B		-.61***	-.91***	-.83**	-.93***	-1.31***	-1.31***	-.98**	-.89**	-1.21***
C			-1.52***	-1.44***	-1.54***	-1.89***	-1.92***	-1.59***	-1.50***	-1.82***
D1				.08	-.02	-.39**	-.40**	-.07	.02	-.30
D2					-.10	-.46***	-.48**	-.15	-.06	-.38*
E						-.38**	-.38**	-.05	.04	-.29
VI							-.04	.22*	.31*	.08
VII								.33*	.42*	.10
PNL									-.10	-.23
PNLC										-.32

Results of t-tests (N=28)

blank = not significant
* = significant at .05 or better
** = significant at .01 or better
*** = significant at .001 or better

[1]Standard deviation for a given calculation scheme listed in the row of this matrix is subtracted from the deviation for the calculation scheme, with which it is paired, listed in the column. Thus B minus A = .50, D1 minus A = -.41, etc. Thus, a positive value means the deviation listed in the column was larger than the deviation listed in the row, and a negative value means the opposite.

Legend:

A,B,C	standard sound-level meter weightings
D1	meter weighting adopted by IEC
D2	weighting values suggested by K. Kryter
E	weighting values proposed for trial and study by ANSI
Mark VI	ANSI S3.4 (R1972) procedure for the computation of the loudness of noise
Mark VII	based on modification of Mark VI (S. S. Stevens, JASA, 1972, 51)
PNL	perceived noise level
PNLC	PNL with tone correction as per FAA36
ZWI	based on Zwicker's loudness calculation system. Program from E. Paulus and E. Zwicker, Acustica, 1972, 27. Free-field (FF) and diffuse-field (DF) values used as appropriate.

4) Whereas the Mark VI, Mark VII, PNL, and Zwicker systems all exhibit significantly smaller standard deviations than the A, B, and C weightings, only Mark VI and Mark VII show significantly smaller standard deviations than the D1 and E weightings.

5) The standard deviations produced by PNL and PNLC are significantly larger at the 0.05 level than the standard deviations produced by Mark VI and Mark VII.

This analysis of standard deviations does not address itself to the important question of validity that was raised in the discussion of Tables IV and VI. The available evidence (e.g., Little, 1961; Pearsons et al., 1968) suggests that, when single and multiple tones are introduced into bands of noise at tone-to-noise ratios of +15 dB and greater, the sounds become more annoying than the perceived levels predicted by any frequency-weighting or calculation scheme. To help solve this problem, the extent of the disparity between calculated and perceived magnitudes needs to be measured with a known, calibrated standard.

Overall consideration of the results leads to the following conclusions:

1.) More data are needed to assess the contribution of pure tones in noise. Without tones, loudness and acceptability in this survey produce essentially the same results, but none of the frequency-weighting or calculation schemes performs well when the complexity of the judged attribute and the heterogeneity of the sound spectra are simultaneously increased.

2.) More research is also needed to assess adequately the effects of duration, especially durations longer than one second, and intermittency on perceived magnitude of noises.

3.) Additionally, a finer analysis of the present data is needed to evaluate the effects of type of spectra on both standard deviations and mean differences between calculated and observed levels. Such an analysis is necessary because noises of a given type, for example household and artificial sounds, can vary widely in spectra. This analysis requires a regrouping of studies across types of noises, and across investigations.

4.) To decrease the variability of matching data for broad-band noise, a calibrated broad-band noise should be used as a common standard. One such possibility is white noise for which many data are available; however, the more natural spectrum of pink noise may be a more suitable standard. More extensive laboratory measurements of the subjective magnitude of pink noise are needed before such a standard could be agreed upon.

Although the calculation schemes are clearly superior to the frequency weightings, we cannot conclude that a particular calculation scheme is preferable for predicting the subjective effects of noise; the differences among our measures of variability are so small (usually under 1dB) as to require a cost-benefit analysis far beyond the scope of this project. These differences may turn out to be larger and more meaningful when more data on the effects of tonal components are available for analysis, and a more detailed analysis of the effects of level and spectral shape can be performed.

With the exclusion of the B and C weightings, the differences among the other four frequency weightings that were examined are all less than 0.5 dB. The A weighting thus assesses subjective magnitude (with due allowance for its constant error--see Table IV) with nearly as little variability as more recently proposed weightings. To achieve a significant improvement in prediction of subjective magnitude from objective sound measuremnts, it will probably be necessary to use a calculation scheme. As additional information is accumulated, it should become possible to adopt a refined calculation system; eventually integrated circuitry will make it possible to incorporate such a system into a sound-level meter.

VI. REFERENCES AND BIBLIOGRAPHY

APRIL, 1977

CODES:

SUBJECTIVE DATA	OBJECTIVE DATA	TYPE OF SOUND	MODE OF PRESENTATION	MISCELLANEOUS
M = matching data	O = octave-band analysis	A = Aircraft	FF = Free Field	T = tonal components
E = estimations	T = third-octave analysis	V = Vehicle	DF = Diffuse Field	D = duration or intermittency
C = complaints	N = not in report	H = Household appliances	P = Earphones	F = non-auditory factors
N = not in report		S = Artificial sounds		C = calculation procedures review
		M = Miscellaneous		
		I = Industrial		

Blanks in a column mean we do not have the information.

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	#of Os	OBJ. DATA Anal	# &Type of Snd	MODE OF PRSNTN.	MISCEL.
Anderson, C.M.B., & Robinson, D. W.	The effect of interruption rate on the annoyance of an intermittent noise.	NPL Report 10-71, Ac 53	E	21	O	2, I	DF	D, F
Andrews, B., & Finch, D.M.	Truck noise measurement	Proc. Hgwy Research Brd 1951, 456-				V		
Aylor, D., & Marks, L.	Perception of noise transmitted through barriers	JASA, 1976, 59, 397-400	E		N	1, S	FF	F
Bauer, B., Torrick, E.L., & Allen, R.G..	The measurement of loudness	Arden Wrkshp 1971, JASA, 50,405	M		O		DF	C
Bauer, B., & Torrick, E.L.	Researches in loudness measurement	IEEE Trans (1966) 14, No.3	M	9-10	O	S	DF	C
Beranek, L.L.	Criteria for office quieting based on questionnaire rating studies	JASA, 1956 28, 833-52	E		O			F
Berglund, B., Berglund, U., & Lindvall, T.	Scaling loudness, noisiness and annoyance of community noises	JASA, 1976 60,1119-1125	M,E	30	T,O	7,A,I	P	
Berglund, B., Berglund, U., & Lindvall, T.	A study of response criteria in populations exposed to aircraft noise	J of S&V 1975, 41, 33-39.	E	1400-3200	N	145,A	DF	F
Bishop, D.E.	Judgments of the relative and absolute acceptability of aircraft noise	JASA,1966 40, 108-122	E		N	A	DF	F
Boeing Company	Development and validity of the noise unit called effective perceived noise level	Jan.,1968	E		N			T,D
Borsky, P.	A comparison of a laboratory and field study of annoyance and acceptability of aircraft noise exposures	NASA, 1976 1-67	E		T	A	DF	F

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	#Os	OBJ. DATA Anal	Snds	MODE OF PRSNTN.	MISCEL.
Borsky, P.	Annoyance and acceptability judgements of noise produced by three types of aircraft by residents living near JFK airport	NASA, 1974 1-50	E	319	T	18,A	DF	F
Borsky, P., & Leonard, S.	Annoyance judgments of aircraft with and without acoustically treated nacelles	Nat'l Aero & Sp. Admin., 1973	E	118	T	3,A	DF	F
Botsford, J.	Using sound levels to gauge human response to noise	J of S&V 1969, 16-28	N		O	I,M,V		C
Bowsher, J., Johnson, D., & Robinson, D.W.	A further experiment on Judging the Noisiness of Aircraft in Flight	Acustica, 1966, 17, 245-267	E	148	N	A	DF, FF	F
Broadbent, D.E., & Robinson, D.W.	Subjective measurements of the relative annoyance of simulated sonic bangs and aircraft noise	J of S&V 1964, 1, [illegible], 2, 162-174	E	79	O	3,A	DF	D
Bürck, W.	On the problem of annoyance caused by noise, its determination and its judgment with special reference to aircraft noise	Rhode & Schwarz-Mittelungen, 1965, 19, 199-205				A		D
Bryan, M.	A tentative criterion for acceptable noise levels in passenger vehicles	J of S&V 1976, 48, 525-535	E	3-4	O	4,V	DF	C
Cermak, G., & Cornillon, P.	Multidimensional analyses of judgments about traffic noise	JASA, 1976 59, 1412-20	E	20	O	13,V	FF	
Clark, W.	Reaction to aircraft noise	ASD Tech Rep 1961	M,C	48	O	A	P	
Clarke, F., & Kryter, K.	The methods of paired comparisons and magnitude estimation in judging the noisiness of aircraft	NASA, 1972	M,E	22	N	22,A	FF	

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	#Os	OBJ. DATA Anal	Snds	MODE OF PRSNTN.	MISCEL.
Copeland, W., Davidson, I., & Robinson, D.	A controlled experiment on the subjective effects of jet engine noise	J. Royal Aero. Soc., 1960,64,33-36	M	1,578	O	5,A	DF	C
Cops, A., Myncke, H., & van Paemel, O.	Subjective and objective measurements on the loudness level of impulsive noise signals	Cath U at Leuven,1971 1-81	M		N			D,C
Edwards, R.M.	A social survey to examine the variance of aircraft noise annoyance	J of S&V 1975, 41, 41-51	E,C		N	A		
Eldred, K.	Assessment of community noise	J of S&V 1975, 43, 137-146	N		N	M		C
Evans, M.J., & Tempest, W.	Some effects of infrasonic noise in transportation	J of S&V 1972,22, 19-24.	C	N	N	S	FF	T,F
Fidell, S., Pearsons, K., Grignetto, M., & Green, D.M.	The noisiness of impulsive sounds	JASA,1970 48,1304-1310	M	10,8	O	S	FF	D
Fishken, D.	Loudness summation between tones and noise	Unpub Doct Diss- Northeastern U,1971	M	I-12 II-8	T	13,S	P	T,C
Fletcher, J., & Gunn, W.	Annoyance of Aircraft Flyover Noise as a Function of the Presence of Strangers	Final Tech. Rep.NASA,1974	E	108	N	A	DF	F
Flynn, D., & Yaniv, S.	List of Household and Consumer Appliances	Unpub. NBS 1976	N		O	78,H		C
Ford, R. D., Hughes, G.M., & Saunders, D.J	The measurement of noise inside cars	App. Acous., 1970,3,69-84	E	12	N	6,V	DF	

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	SUBJ. DATA #Os	OBJ. DATA Anal	OBJ. DATA Snds	MODE OF PRSNTN.	MISCEL.
Fuller, H. C., & Robinson, D.W.	Subjective reactions to steady and varying noise environments	NPL Acous. Rep.1973	E		N		DF	D,F
Fuller, H.C., & Robinson, D.W.	Temporal variables in the assessment of an experimental noise environment	NPL Acous. Rep. 1975	E		N		DF	D
Goulet, P., & Northwood, T.D.	Subjective rating of broad-band noises containing pure tones	JASA, 1973 53, 356 (A)	M		T	S		T
Griffiths, I.D., & Langdon, F.J.	Subjective response to road traffic noise	J of S&V 1968, 8, 16-32	E,C	1200	N	V	DF	F,C
Gunn, W., & Fletcher, J.	The effect of number of flights prior to judgment on annoyance to aircraft flyover noise	Semi-Annu Status Rep. NASA, 1974	E		N	A	DF	D,F
Gunn, W., Shepherd, L.J., & Fletcher, J.	Effects of three activities on annoyance responses to recorded flyovers	NASA Rep. 1975	E	108	N	A	DF	
Hargest, T., & Pinker, R.	The influence of added narrow band noises and tones on the subjective response to shaped "white" noise	J.Roy.Aero. Soc. 1967,71 428-430.	E	800	N	S	DF	T
Hart, F.D., Reiter, W.F., & Royster, L.H.	A community noise problem resolution	Inter-Noise 1972, 44-48	E		O	4,I	FF	
Hecker, M., & Kryter, K.	Comparisons between subjective ratings of aircraft noise and various objective measures	Dept. Transp Tech Rep 1968 1-78			N	A	DF	C
Hillquist, R.	An experiment for relating objective and subjective assessments of truck tire noise	Soc. of Automotive Engnrs 1972	E	23	N	V	FF	
Hillquist, R.	Motorcycle noise tests	Unpub.1969	M	8	N	12,V	FF	

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	#Os	OBJ.DATA Anal	Snds	MODE OF PRSNTN.	MISCEL.
Hillquist, R.K.	Objective and subjective measurement of truck noise	J of S&V '67, 1, 8-14	M,E	20	N	100,V	FF	
Hintor, Keuser, & Sternfeld	Subjective response to synthesized flight noise signatures of several types of V/Stol Aircraft	Boeing Co. NTIS 1968	M	82	O	S	DF	
ISO/TC43/SC 1	Procedure for Describing Aircraft Noise Heard on the Ground	Draft Propos, 1973				A		T
ISO/TC43/SC1/SGA	Preliminary Report: International Round Robin Test on Measurements and Calculations on the Magnitude of Auditory Sensation of Sounds	1974, 1-49	M		T	16,S		T
Jahn, H.	Subjektive und Objektive Bewertung von Maschinengeräuschen	Acustica, '65, 16, 175-185	M	28	T	10,I	FF	C
Jenkins, M.A., & Pahl, J.	Measurement of freeway noise and community response	JASA, '75, 58 1222-1231	E,C	562	N	V	DF	
Johnson, D., & Robinson, D.	The subjective evaluation of sonic bangs	Acustica, '67, 18, 241-258	E	61	O	4,A	DF	D
Karplus, H., & Bonvallet, G.	A noise survey of manufacturing industries	Am.Ind.Hyg. Assoc. Quart. 1953, 14, 235-263.	N		O	I, 580		C
Kerrick, J.S., Nagel, D.C. & Bennett, R.L.	Multiple ratings of sound stimuli	JASA, 1969, 45 1014-1017	E		N			F
Kitamura, O., Sasaki, M., Saito, M.	On judging the noise from high speed road	6th Interntl C on Acous.'68, 28, 45-48.	E	10	N	V	DF	
Klimuhin, A.A., & Ossipov, G.L.	Measurement and evaluation of aircraft noise in flight	6th Interntl C on Acous.'68.	E		N	A	FF	

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	SUBJ. DATA #Os	OBJ. DATA Anal	OBJ. DATA Snds	MODE OF PRSNTN.	MISCEL.
Kryter, K.D.	Scaling human reactions to the sound from aircraft	JASA, 1959, 31,1415-1429	M	36,100 4-13	O	8,A	DF	C
Kryter, K.D.	Psychological reactions to aircraft noise	Science,1966, 151,1346-1355 No. 3716	M,E		N	A	DF,P	C
Kryter, K.D.	The meaning and measurement of perceived noise level	Noise Control 1960,6, 12-27 No. 5	M		O		DF,FF	C
Kryter, K.D., Johnson, P.J., & Young, J.R.	Judgment tests of flyover noise from various aircraft	NASA,1969				A		
Kryter, K.,& Pearsons, K.	Judged noisiness of a band of random noise containing an audible pure tone	JASA, 1965, 38, 106-112	M	20-21	O	5,S	P,FF	T,C
Kryter, K.D., & Pearsons, K.S.	Some effects of spectral content and duration on perceived noise level	JASA, 1963, 35, 866-883	M	13-19	O,T	13,S,A	DF,P	T,D,C
Langdon, L., Gabriel, R., & Creamer, L.	Judged acceptability of noise exposure during television viewing	JASA, 1974, 56, 510-515	E,C	80	T	1,S	FF	D
Little, J.W.	Human response to jet engine noise	Noise Control 1961, 7, 11-13	M	65	O	2,A	DF	T,C
Little, J.W., & Mabry, J.E.	Sound duration and its effects on judged annoyance	J of S&V, '69, 9, 247-262	C,M	94	N		P	D
Little, J.W., & Mabry, J.E.	Empirical comparisons of calculation procedures for estimating annoyance of jet aircraft flyovers	J of S&V. '69, 10,59-68.	M		N	A	DF	T,D

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	SUBJ. DATA #Os	OBJ. DATA Anal	OBJ. DATA Snds	MODE	MISCEL.
Lubcke, von E., Mittag, G., & Fort, F	Subjektive und Objective Bewertung von Maschinengeräuschen	Acustica, 1964 14, 105-114	M	10,12	T	20,I	FF,P	C
Meister, F.J.	Comparison of several sound-evaluation methods for aircraft noises	Luftfahrttechnik, 1961, 7, 178-181	N		O	A		
Mendel, M., Sussman, H., Merson, R., Naeser, M., & Minifie F.D.	Loudness judgments of speech and non-speech stimuli	JASA, 1969, 46 1556-1561.	E	17	N	3,S	DF	T
Mills, C.H.G.	The measurements of noise emitted by motor vehicles.	Motor Ind Res Assoc rep, 1960, 1060-3	M		N	V		
Molino, J.		Unpub., NBS 1976	M	7	T	5,M	DF	
Moreira, N., & Bryan, M.	Noise annoyance susceptibility	J of S&V, '72, 21, 449-462	E	34	N	3,V,A,I	DF	F
Mullen, J.L.	Assessment of annoyance due to varying noise levels with particular reference to aircraft noise	J of S&V, '71, 19, 287-298	N		N	A		D,C
Niese, H.	Beitrag zur Relation Zinschen Lautstärke und Lästigkeit von Beräuschen	Acustica, '65, 15, 236-243	M		T		DF	D
Niese, H.	Vorshlag für einen Lautstarkmesser zur gehorrichtigen Anzeige von Spitzenhaltigen Geräuschen bei beteiboger Schallfeldform	Elektroakust. 58, 66, 125-39	M		O	M	DF	
Notbolm, K.	Die Lautstärke von Impulsen unter Berücksichtigung der Hüllkurvenform und des Spektrums	Elektroakust. 70, 65-74.	M		N			

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	SUBJ. DATA #Os	OBJ. DATA Anal	OBJ. DATA Snds	MODE	MISCEL
Ollerhead, J.B.	Scaling aircraft noise perception	J of S&V '73, 3, 361-388	M	32	N	119,A	FF	T, D, C
Ollerhead, J.B.	Subjective evaluation of general aviation aircraft noise	Techn Rep Wyle Labs 68', 1-80	M		N	120,A	FF	D,C
Olynyk, D., & Northwood, T.D.	Subjective judgments of footstep-noise transmission through floors	JASA, '65, 38, 1035-1039	M		N	M		D
Parry, H.J., & Parry, J.K.	The interpretation and meaning of laboratory determinations of the effect of duration on the judged acceptability of noise	J of S&V, '72, 20, 51-57	N					D,C
Pearsons, K.S.	Assessment of the validity of pure tone corrections to perceived noise level	Bolt, Ber. & Newman, Inc 1968						T,D,C
Pearsons, K., & Bennet, R.	Effects of temporal and spectral combinations on the judged noisiness of aircraft sounds	JASA, 1971, 49, 1076-82 FAA report'69	M	20	T	70,S,A	FF	T,D
Pearsons, K.S., Bishop, D.E., & Horonjeff, R.D.	Judged noisiness of modulated and multiple tones in broad-band noise	JASA, '69, 45 747-50 NASA report '68	M	20	T	100,S	FF	T,D,C
Pearsons, K.S., & Wells, R.J.	Judged noisiness of sounds containing multiple pure tones	Paper Pres. 78th ASA, '69, JASA 47:89A (1970)	M	20,30	T	28,S	FF	T,C
Parera, T.B., Galanter, E., & Popper, R.	A comparison of psychophysical judgments of single and multiple stimuli	1976, unpubl.	E		N			D,F
Powell, C., & Rice, C.	Judgments of aircraft noise in a traffic noise background	J of S&V '75, 38, 39-50	E		N			F

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	SUBJ. DATA #Os	OBJ. DATA Anal	OBJ. DATA Snds	MODE	MISCEL
Quietzsch, G.	Objective and subjective loudness measurements	Acustica, 1955, 1-44	M	20	O	37,M	DF,FF	
Rademacher, H.J., & Venzke, G.	Die Subjektive und Objektive Bewertung des Schalleschutzes von Trennwänden und Decken	Acustica, 1959, 409-18	M		O	M	FF	
Rademacher, H.	Die Lautstärke von Kraftfahrzeuggeräuschen	Acustica, 1959, 93-108	M	20-25	O	24,V	FF	
Reichardt, W.	Lautstärke und Lästigkeit	Lärmbekämpfung 1966, 95-103	M					T,D
Reichardt, W.	Bemerkungen zu der Arbeit von E. Zwicker: Ein Beitrag zur Lautstärkemessung impulshaltiger Schalle	Acustica, '67 18, 118-121						D
Reichardt, W.	Subjective and objective measurement of the loudness level of single and repeated impulses	JASA, 1970, 47 1557-1562	M	50	N	M	P	D,F,C
Reichardt, W., Notbolm, K., & Jursch, H.	Verbesserung des Lautstärkeberechnungsverfahrens nach Niese	Acustica, '69 21, 134-143	N		N			C
Rice, C.G., & Zepler, E.E.	Loudness and pitch sensation of an impulsive sound of very short duration	Jof S&V, '67, 5, 285-289	M		T			D
Robinson, D.W.	Recent advances in the subjective measurement of noise	4th Intrntl C Acous. 1962	M		N			C
Robinson, D.W., & Bowsher, J.M.	A subjective experiment with helicopter noises	J. Roy. Aero. Soc., 1961, 65, 635-637	M	558	T	5,A	DF	C
Robinson, D.W., Copeland, W.C., & Rennie, A.J.	Motor vehicle noise measurement	Engineer, 1961 211, 493	E	19	N	225V	FF	

AUTHOR(S)	TITLE	SOURCE	SUBJ. Meth	DATA #Os	OBJ. Anal	DATA Snds	MODE	MISCEL
Rosinger, G., Nixon, C., & Gierke, H.	Quantification of the noisiness of approaching and receding sounds	JASA, 1970, 48 843-855	M	24	N	9,S	FF	
Rule, S.J.	Effect of instructional set on responses to complex sounds	JEP, 1964, 67 215-220	N		O	S		T
Rule, S., & Little, J.	The design and construction of an annoyance scale for jet engine noise	Boeing Company 1963	E		N	A		T
Rule, S., & Little, J.	Effect of a composite instructional set on responses to complex sounds	J. Exper. Psyc. 1966, 71, 200-2	N			S		F
Rylander, R., Sörensen, S., & Kajland, A.	Annoyance reactions from aircraft exposure	J of S&V, 1972 24, 419-444	E		N	A	DF	F
Rylander, R., Sörensen, S., Alexander, A., & Gilbert, P.H.	Determinants for aircraft noise annoyance - A comparison between French and Scandinavian data	J of S&V, 1973	C	100	N	A	DF	
Scharf, B.	Loudness and noisiness - same or different?	Inter-noise, 1974	M		N		DF,FF,P	D
Shepherd, K.	Annoyance due to noise from off-road vehicles	Proc., 1st Interntl C on Noise -Recr. off-road Veh.	C	309	N	7,V	DF	
Shepherd, L.J., & Sutherland, W.W.	Relative annoyance and loudness judgments of various simulated sonic boom waveforms	NASA, 1968, 1192				S		D
Shipton, M.S., Evans, D.H., & Robinson, D.W.	An investigation of the loudness of noises with impulsive characteristics	NPL Acoust. Rep., 1971 1-11						D

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	SUBJ. DATA #Os	OBJ. DATA Anal	OBJ. DATA Snds	MODE	MISCEL
Spiegel, M.	Prüfung verschiedener Lautstärkeberechnungsmethoden bei diffuser Beschallung	1960	M		T		DF	
Stevens, S.S.	Perceived level of noise by by Mark VII and decibels (E)	JASA, 1972 51, 575-601	M		T	M	DF,FF,P	D,C
Sutherland, L.S., Lee, M.C., & Burke, R.E.	Annoyance, loudness and measurement of impulsive noise sources	Wyle Res. Rep. WR 76-77	M		T		FF	D,C
Tempest, W.	Loudness and annoyance due to low frequency sound	Acustica, 1973, 29, 205-209	E,C	3	O	9,V,I	DF	F
Tempest, W., & Bryan, M.	Low frequency sound measurement in vehicles	App. Acoust. 1973, 5, 133-39	N		O	4,V		
Webster, J.C., & Lepor, M.	Noise, you can get used to it	JASA, 1969, 45 751-757, 330(A)	E,C		O	M	DF	F
Wells, R.J.	Jury ratings of complex aircraft noise spectra vs. calculated ratings	JASA, 1971, 49: 100 (A)	M		T	30,A	FF	T
Wells, R.J.	A new method for computing the annoyance of steady state noise versus perceived noise level and other subjective measures	ASA, 1969	M		T	102,S	FF	T
Wells, R.J.	Noise complain potential: ambient noise versus intrusive noise	7th Intrntl C Acoust., Budapest, 1971	E		N		FF	C
Wells, R.J.	A subjective study of ultra high voltage transmission line noise	Arden Hse., 1972	M		T	25, UHV	FF	T
Wells, R.J.		Unpub., 1970	M		T	33,A	FF	

AUTHOR(S)	TITLE	SOURCE	SUBJ. DATA Meth	#Os	OBJ. DATA Anal	Snds	MODE	MISCEL
Williams, C.E., Stevens, K. N., & Klatt, M.	Judgments of the acceptability of aircraft noise in the presence of speech	J of S&V., 1969 9, 263-275				A		F
Yaniv, S.	Equal loudness contours for household appliances	unpubl., NBS 1976	M	10	T	11,H	P	C
Zepler, E.E., & Harel, J.R.P.	The loudness of sonic booms and other impulsive sounds	J of S&V., 1965 2, 249-256				A		D
Zepler, E.E., Sullivan., Rice, Griffin, Oldman, Dickinson, Shepherd, Ludlow, & Large	Human response to transportation noise and vibration	J of S&V., 1973 28, 375-401	E,M		N	V,A	FF	
Zwicker, E.	Ein Beitrag zur Unterscheidung von Lautstärke und Lästigkeit	Acustica, 1966 17, 22-25	M					D,F
ADDENDUM								
Berglund, B., Berglund, U. and Lindvall, T.	Scaling loudness, noisiness and annoyance of aircraft sounds	JASA, '75, 57, 930-934.	E	28	T	14,A	P	
Scharf, B.	Loudness. In E.C. Carterette and M.P. Friedman (Eds.) Handbook of Perception. Vol. 4. Hearing. New York: Academic Press, in press.		N		N			

APPENDIX (Contains information on each study examined and on individual noises within each study.)

SOURCE

Author(s): Berglund, B., Berglund, U., and Lindvall, T.

Title: Scaling loudness, noisiness, and annoyance of community noises.

Reference: JASA, 1976, 60, 1119-1125.

STIMULI

Number and type of noises: 3 noises - Jackhammer, piledriver, and aircraft, plus a white noise 20 - 20,000 Hz wide

Levels: 58 - 103 dB SPL overall

Mode of presentation: Earphones - listening to tape recorded sounds

Analysis: One octave and third octave

JUDGMENTS

Attribute judged: Loudness

Psychophysical procedure: Loudness matching using the white noise as standard (white noise varied)

Number of observers: 30

OTHER

Special features: Some of the same stimuli were also used to obtain magnitude estimation functions for loudness, annoyance, and noisiness.

Comments: Loudness levels were determined by comparing, over the experimental stimulus range covered, the white noise loudness function of Scharf (in press) against the standard 1000-Hz loudness function.

BERGLUND ET AL 1976 NOISE 1 AT 83 DB SPL NBS + STAT 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	83.0	78.7	81.3	82.8	86.4	86.0	84.2	91.1	83.4	93.1	93.1	96.6	97.2	89.

BERGLUND ET AL 1976 NOISE 1 AT 80 DB SPL NBS + STAT 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	80.0	75.7	78.3	79.8	83.4	83.0	81.2	88.5	80.8	90.1	90.1	94.0	94.6	87.0

BERGLUND ET AL 1976 NOISE 1 AT 67.5 DB SPL NBS + STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	67.5	63.2	65.8	67.3	70.9	70.5	68.7	77.6	70.2	77.3	77.3	82.7	83.3	77.0

BERGLUND ET AL 1976 NOISE 1 AT 57.5 DB SPL NBS + STAT 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	57.5	53.2	55.8	57.3	60.9	60.5	58.7	68.5	61.4	67.0	67.0	73.1	73.8	68.5

JNG ET AL. NOISES 1+6, LEVEL 1 NBS+STATS 3-9-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	96.6	84.2	91.8	96.2	92.0	90.2	90.2	97.1	89.7	99.3	100.5	103.1	103.7	87.0
6	99.1	78.8	90.4	98.3	89.2	85.0	86.3	95.1	86.1	96.2	96.7	101.0	101.8	87.0

'LUNG ET AL. NOISES 1+6, LEVEL 2 NBS+STATS 3-9-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	91.6	79.2	86.8	91.2	87.0	85.2	85.2	92.5	84.7	94.2	95.3	98.8	99.4	83.5
6	96.1	75.8	87.4	95.3	86.2	82.0	83.3	92.2	83.0	93.2	93.7	98.3	99.1	83.5

RLUNG ET AL. NOISES 1+6 , LEVEL 3 NBS+STATS 3-9-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	82.6	70.2	77.8	82.2	78.0	76.2	76.2	84.7	76.5	84.7	85.9	90.9	91.5	79.5
6	87.1	66.8	78.4	86.3	77.2	73.0	74.3	83.7	73.9	83.2	83.7	90.1	90.9	79.5

RGLUND ET AL. 1976 NOISE 1 + 6 LEVEL 4 NBS + STATS 3-8-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	75.6	63.2	70.8	75.2	71.0	69.2	69.2	78.5	70.2	77.1	78.2	84.5	85.1	77.0
6	81.1	60.8	72.4	80.3	71.2	67.0	68.3	77.8	67.9	76.3	76.8	84.4	85.3	77.0

RLUNG ET AL. NOISES 1+6, LEVEL 5 NBS+STATS 3-9-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	70.6	58.2	65.8	70.2	66.0	64.2	64.2	73.7	65.6	71.6	72.8	79.7	80.4	74.[illegible]
6	77.1	56.8	68.4	76.3	67.2	63.0	64.3	73.9	63.9	71.6	72.1	80.6	81.5	74.0

RLUNG ET AL. NOISES 1+6, LEVEL 6 NBS+STATS 3-9-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	68.6	56.2	63.8	68.2	64.0	62.2	62.2	71.8	63.8	69.5	70.6	77.8	78.5	71.5
6	73.1	52.8	64.4	72.3	63.2	59.0	60.3	69.8	60.0	67.0	67.5	76.5	77.5	71.5

RGLUND ET AL 1976, NOISES 1 + 6, LEVEL 7 NBS + STATS 3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	64.6	52.2	59.8	64.2	60.0	58.2	58.2	67.7	63.0	65.1	66.2	73.8	74.5	68.5
6	69.1	48.8	60.4	68.3	59.2	55.0	56.3	65.4	55.9	62.1	62.6	72.4	73.4	68.5

SOURCE

Author(s): Borsky, P.

Title: Annoyance and acceptability judgments of noise produced by three types of aircraft by residents living near JFK airport.

Reference: NASA report, 1974, 1-50.

STIMULI

Number and type of noises: Three aircraft noises studied at three different approach and departure distances.

Levels: 75 - 100 dB SPL overall

Mode of presentation: laboratory living room (diffuse field)

Analysis: Third octave

JUDGMENTS

Attribute judged: Annoyance

Psychophysical procedure: 0 - 4 rating scale

Number of observers: 319

OTHER

Special features:

Comments:

BORSKY GROUP 1 BY ANNOYANCE NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E#	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	89.8	75.5	82.7	88.9	82.3	80.2	80.7	87.5	79.8	88.4	92.8	95.0	95.8
4	88.0	71.9	01.7	87.3	80.6	77.7	78.9	85.9	77.4	86.8	91.3	91.0	91.7
7	86.2	70.7	78.0	85.4	79.3	77.5	76.5	86.1	76.8	86.6	88.8	92.7	93.3
8	83.8	70.4	76.1	83.0	78.4	77.2	75.4	83.1	74.7	84.7	91.3	90.9	91.3
11	83.4	70.0	78.2	82.9	77.3	75.1	76.1	81.0	73.4	81.0	86.0	86.3	87.4
14	86.2	79.4	82.3	85.8	86.1	85.3	83.4	90.0	82.5	92.8	97.4	97.3	97.6
17	88.0	76.4	81.9	87.1	84.6	83.5	81.8	88.6	80.5	91.2	97.9	95.3	95.8
MEAN LEVEL	86.5	73.4	80.1	85.8	81.2	79.5	79.0	86.0	77.9	87.4	92.2	92.6	93.3
RANGE	6.4	9.4	6.6	6.0	8.8	10.2	8.0	9.0	9.1	11.8	11.9	11.0	1C.2
SD,N-1	2.33	3.64	2.63	2.24	3.26	3.71	3.09	3.13	3.24	3.95	4.32	3.65	3.48

BORSKY GROUP 2 BY ANNOYANCE NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKD
2	84.9	65.6	75.8	83.8	74.9	71.3	72.4	80.5	71.5	79.8	84.5	87.8	88.
5	80.3	64.8	72.6	79.3	72.0	69.5	70.3	77.4	69.4	76.4	80.9	84.6	85.
9	74.9	57.8	66.9	73.9	66.4	63.6	64.2	72.4	64.2	70.1	74.6	79.6	80.
12	79.6	63.7	73.5	78.9	72.4	69.6	70.8	75.8	67.5	75.3	80.5	80.8	81.
15	80.8	67.0	74.3	79.9	73.6	71.4	72.3	78.0	70.3	77.6	83.4	84.6	85.
18	82.7	67.9	75.9	81.9	75.2	72.8	73.7	79.3	71.2	79.3	86.0	86.5	87.
MEAN LEVEL	80.5	64.5	73.2	79.6	72.4	69.7	70.6	77.2	69.0	76.4	81.6	84.0	84.
RANGE	10.0	10.1	9.0	9.9	8.8	9.2	9.5	8.1	7.3	9.7	11.4	8.2	8.
SD,N-1	3.35	3.59	3.34	3.35	3.21	3.22	3.37	2.85	2.76	3.56	4.03	3.21	3.

SOURCE

Author(s): Copeland, W.C.T., Davidson, I.M., Hargest, T. J. and Robinson, D. W.

Title: A controlled experiment on the subjective effects of jet engine noise.

Reference: J. Royal Aeronautical Soc., 1960, 64, 33-36.

STIMULI

Number and type of noises: Five jet engine noises

Levels: OASPL's of reference stimuli ranged from 90 - 103 dB

Mode of presentation: Loudspeakers in a small, soundproofed cinema. Diffuse field.

Analysis: One octave (frequencies adjusted).

JUDGMENTS

Attribute judged: loudness and disturbance

Psychophysical procedure: paired comparisons

Number of observers: 1,578

OTHER

Special features:

Comments: Loudness and disturbance produce very similar results.

COPELAND ET AL NBS+STATS 3-3-77

NO.	0-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	103.0	91.5	99.7	102.7	99.0	96.9	98.0	102.0	95.8	104.8	107.7	105.8	106.6
2	97.3	95.2	96.7	97.2	101.1	101.0	99.0	104.2	97.7	107.4	110.8	109.7	110.3
3	102.9	97.3	101.6	102.9	101.9	101.5	101.4	106.2	100.4	108.8	112.2	110.7	111.4
4	93.8	91.5	92.7	93.6	98.8	98.7	96.6	102.4	95.6	105.5	108.8	107.5	108.2
5	89.5	88.3	88.6	89.2	96.6	96.4	93.9	99.3	92.3	102.4	105.8	104.3	104.8
MEAN LEVEL	97.3	92.7	95.8	97.1	99.5	98.9	97.8	102.8	96.4	105.8	109.0	107.6	108.3
RANGE	13.5	9.0	13.0	13.7	5.3	5.1	7.5	6.9	8.1	8.8	12.2	10.7	11.4
SD,N-1	5.84	3.54	5.26	5.90	2.10	2.30	2.81	2.58	2.96	2.47	2.52	2.66	2.68

SOURCE

Author(s): Fishken, D.

Title: Loudness summation between tones and noise

Reference: Unpublished doctoral dissertation, Northeastern University, 1971.

STIMULI

Number and type of noises: Six broadband noise with single and two tone components added

Levels: Three T/N ratios: -5, +5, +15 dB
seven SPLs from 30 - 90 dB overall

Mode of presentation: earphones

Analysis: Third octave

JUDGMENTS

Attribute judged: Loudness

Psychophysical procedure: Adjustment using a counterbalanced procedure

Number of observers: Exp. I - 12 Os; Exp. II - 8 Os.

OTHER

Special features: Single and multiple tonal components - 63 sound combinations studied in both Exps. I and II.

Comments: Loudness levels determined by loudness matches between broadband noise and a 1000-Hz tone. Comparison sound used for this study was a band of noise about two octaves wide centered at 1000 Hz.

FISHKEN EXP 1 AT 30 DB SPL NBS + STATS 3-7-77

NO.	O-A	A	B	C	D1	D2	E*	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKUF	LL
1	30.1	29.8	29.6	29.7	38.2	38.1	35.9	37.6	35.4	38.9	43.3	43.0	43.6	30.
2	30.6	28.5	30.3	30.5	34.6	34.6	33.2	32.9	32.4	34.1	40.8	39.1	39.7	24.
3	30.9	27.8	30.6	30.9	31.4	31.6	31.4	31.1	28.4	30.6	37.3	33.2	34.5	22.
4	29.8	30.2	29.4	29.4	38.1	38.1	35.8	38.0	35.3	38.8	42.1	42.8	43.6	31.
5	29.8	30.0	29.7	29.7	34.3	34.3	32.7	35.5	31.6	33.4	39.7	38.8	40.1	31.
6	30.4	31.1	29.8	29.7	40.4	40.3	38.0	42.0	37.9	42.3	45.6	43.1	43.3	31.
7	30.4	31.1	29.8	29.7	40.4	[illegible]	38.0	42.0	37.9	42.3	45.6	43.1	43.3	30.
8	31.5	32.4	30.8	30.7	42.3	42.[illegible]	39.9	43.4	37.6	43.9	49.0	41.1	40.6	30.
9	31.9	32.9	31.2	31.1	42.9	42.6	40.5	43.2	34.9	43.0	49.7	38.7	37.7	30.
10	29.8	30.2	29.4	29.4	38.1	38.	35.8	38.0	35.3	38.8	42.1	42.8	43.6	32.
11	29.8	30.0	29.7	29.7	34.3	34.3	32.7	35.5	31.6	33.4	39.7	38.8	40.1	31.
12	29.9	29.9	29.9	29.9	30.8	30.	30.4	34.0	27.2	29.6	36.2	32.9	35.2	29.
MEAN LEVEL	30.4	30.3	30.0	30.0	37.2	37.1	35.4	37.8	33.8	37.4	42.6	39.8	40.4	
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	12.3	10.7	14.3	13.5	10.2	9.1	
SD,N-1	.70	1.42	.58	.59	4.06	3.99	3.33	4.16	3.57	5.03	4.27	3.65	3.26	
MEAN DIFF	.8	.7	.4	.4	7.6	7.5	5.7	8.1	4.2	7.8	13.0	10.2	10.8	
RANGE	10.7	7.2	10.8	11.1	10.9	10.8	8.9	8.7	10.3	13.4	12.3	11.3	9.6	
SD,N-1	3.24	2.23	3.25	3.35	3.55	3.55	3.29	3.18	3.25	4.36	4.06	3.09	2.82	

FISHKEN EXP 1 AT 40 DB SPL NBS + STATS 3-7-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L
1	40.1	39.8	39.6	39.7	48.2	48.1	45.9	52.5	46.9	51.7	56.1	56.2	56.7	47
2	40.6	38.5	40.3	40.5	44.6	44.6	43.2	48.9	44.0	47.4	54.0	52.5	53.2	43
3	40.9	37.8	40.6	40.9	41.4	41.6	41.4	45.1	40.1	43.9	50.6	46.0	47.1	41
4	39.8	40.2	39.4	39.4	48.1	48.1	45.8	52.3	46.7	51.6	54.9	56.0	56.7	47
5	39.8	40.0	39.7	39.7	44.3	44.3	42.7	50.0	43.5	46.6	53.0	52.2	53.3	45
6	40.4	41.1	39.8	39.7	50.4	50.3	48.0	54.7	48.3	54.4	57.7	56.1	56.5	41
7	40.4	41.1	39.8	39.7	50.4	50.3	48.0	54.7	48.3	54.4	57.7	56.1	56.5	46
8	41.5	42.4	40.8	40.7	52.3	52.2	49.9	54.8	47.7	55.1	60.3	53.6	53.5	45
9	41.9	42.9	41.2	41.1	52.9	52.8	50.5	53.0	45.4	53.8	60.5	49.8	49.1	43
10	39.8	40.2	39.4	39.4	48.1	48.1	45.8	52.3	46.7	51.6	54.9	56.0	56.7	45
11	39.8	40.0	39.7	39.7	44.3	44.3	42.7	50.0	43.5	46.6	53.0	52.2	53.3	44
12	39.9	39.9	39.9	39.9	40.8	40.8	40.4	46.7	39.4	43.1	49.7	45.5	47.5	40
MEAN LEVEL	40.4	40.3	40.0	40.0	47.2	47.1	45.4	51.2	45.0	50.0	55.2	52.7	53.4	
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	9.7	8.9	12.0	10.8	10.7	9.6	
SD,N-1	.69	1.42	.58	.59	4.05	3.99	3.33	3.17	3.02	4.28	3.43	3.84	3.63	
MEAN DIFF	-4.0	-4.1	-4.4	-4.4	2.8	2.7	.9	6.8	.6	5.6	10.8	8.3	8.9	
RANGE	7.9	7.5	8.3	8.3	10.0	9.9	9.2	8.8	8.2	11.2	9.6	9.3	9.4	
SD,N-1	2.70	2.47	2.75	2.79	3.48	3.44	3.13	2.54	2.24	3.52	3.18	2.51	2.44	

FISHKEN EXP 1 AT 50 DB SPL NBS + STATS 3-7-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	
1	50.1	49.8	49.6	49.7	58.2	58.1	55.9	62.8	56.3	62.4	66.8	67.3	67.9	5
2	50.6	48.5	50.3	50.5	54.6	54.6	53.2	59.9	53.5	58.5	65.1	64.0	64.7	5
3	50.9	47.8	50.6	50.9	51.4	51.6	51.4	56.5	49.8	55.3	62.0	58.1	59.0	5
4	49.8	50.2	49.4	49.4	58.1	58.1	55.8	62.7	56.1	62.3	65.7	67.1	67.8	5
5	49.8	50.0	49.7	49.7	54.3	54.3	52.7	60.7	53.1	57.9	64.2	63.7	64.8	5
6	50.4	51.1	49.8	49.7	60.4	60.3	58.0	64.7	57.3	65.0	68.3	67.3	67.6	5
7	50.4	51.1	49.8	49.7	60.4	60.3	58.0	64.7	57.3	65.0	68.3	67.3	67.6	5
8	51.5	52.4	50.8	50.7	62.3	62.2	59.9	64.9	56.7	65.7	70.9	65.0	65.0	5
9	51.9	52.9	51.2	51.1	62.9	62.8	60.5	62.9	55.0	64.5	71.2	61.2	60.6	55
10	49.8	50.2	49.4	49.4	58.1	58.1	55.8	62.7	56.1	62.3	65.7	67.1	67.8	58
11	49.8	50.0	49.7	49.7	54.3	54.3	52.7	60.7	53.1	57.9	64.2	63.7	64.8	56
12	49.9	49.9	49.9	49.9	50.8	50.8	50.4	57.7	49.2	54.6	61.2	57.5	59.3	50
MEAN LEVEL	50.4	50.3	50.0	50.0	57.2	57.1	55.4	61.7	54.5	60.9	66.1	64.1	64.7	
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	8.4	8.1	11.1	10.0	9.8	8.9	
SD,N-1	.69	1.42	.58	.60	4.05	3.99	3.33	2.73	2.76	3.95	3.14	3.54	3.39	
MEAN DIFF	-6.0	-6.1	-6.4	-6.4	.8	.7	-1.0	5.3	-1.9	4.5	9.7	7.7	8.3	
RANGE	9.2	8.8	9.6	9.6	10.1	10.0	9.1	8.6	7.6	10.4	9.5	9.3	9.0	
SD,N-1	2.89	2.90	2.96	2.97	3.58	3.54	3.25	2.50	2.11	3.35	3.13	2.26	2.31	

FISHKEN EXP 1 AT 60 DB SPL NBS + STATS 3-7-77

NO.	O-A	A	B	C	D1	D2	E#	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	60.1	59.8	59.6	59.7	68.2	68.1	65.9	72.0	65.0	72.6	77.0	77.3	77.8	68.[illegible]
2	60.6	58.5	60.3	60.5	64.6	64.6	63.2	69.3	62.3	68.9	75.5	74.4	75.0	67.3
3	60.9	57.8	60.6	60.9	61.4	61.6	61.4	66.3	58.8	65.9	72.6	69.1	69.8	63.[illegible]
4	59.8	60.2	59.4	59.4	68.1	68.1	65.8	72.0	64.9	72.6	75.9	77.1	77.7	69.[illegible]
5	59.8	60.0	59.7	59.7	64.3	64.3	62.7	70.1	61.9	68.3	74.6	74.0	75.1	65.8
6	60.4	61.1	59.8	59.7	70.4	70.3	68.0	74.0	66.1	75.2	78.5	77.2	77.6	64.6
7	60.4	61.1	59.8	59.7	70.4	70.3	68.0	74.0	66.1	75.2	78.5	77.2	77.6	68.4
8	61.5	62.4	60.8	60.7	72.3	72.2	69.9	74.1	65.9	76.0	81.1	75.4	75.2	67.6
9	61.9	62.9	61.2	61.1	72.9	72.8	70.5	72.3	64.4	74.8	81.5	72.1	71.5	65.2
10	59.8	60.2	59.4	59.4	68.1	68.1	65.8	72.0	64.9	72.6	75.9	77.1	77.7	70.0
11	59.8	60.0	59.7	59.7	64.3	64.3	62.7	70.1	61.9	68.3	74.6	74.0	75.1	66.8
12	59.9	59.9	59.9	59.9	60.8	60.8	60.4	67.5	58.2	65.2	71.8	68.5	70.1	62.2
MEAN LEVEL	60.4	60.3	60.0	60.0	67.2	67.1	65.4	71.1	63.3	71.3	76.5	74.4	75.0	
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	7.8	7.9	10.8	9.7	8.8	8.0	
SD,N-1	.69	1.42	.58	.60	4.05	3.99	3.33	2.54	2.74	3.82	3.02	3.13	2.99	
MEAN DIFF	-6.1	-6.2	-6.5	-6.5	.7	.6	-1.1	4.6	-3.1	4.8	10.0	8.0	8.5	
RANGE	8.1	7.5	8.3	8.5	10.4	10.3	9.5	7.4	6.6	9.1	10.4	6.5	6.7	
SD,N-1	2.63	2.56	2.68	2.71	3.56	3.52	3.19	2.21	1.99	3.22	3.08	1.75	1.72	

FISHKEN EXP1 AT 70 DB SPL NBS + STATS 3-7-77

NO.	D-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	70.1	69.8	69.6	69.7	78.2	78.1	75.9	81.1	73.6	82.7	87.1	86.6	87.1	76.
2	70.6	68.5	70.3	70.5	74.6	74.6	73.2	78.4	71.0	79.0	85.7	83.9	84.5	76.
3	70.9	67.8	70.6	70.9	71.4	71.6	71.4	75.4	67.9	76.1	82.8	79.1	79.6	72.
4	69.8	70.2	69.4	69.4	78.1	78.1	75.8	81.0	73.5	82.7	86.0	86.4	87.1	77.
5	69.8	70.0	69.7	69.7	74.3	74.3	72.7	79.1	70.6	78.4	84.8	83.6	84.6	75.
6	70.4	71.1	69.8	69.7	80.4	80.3	78.0	82.9	74.9	85.2	88.6	86.6	86.9	73.
7	70.4	71.1	69.8	69.7	80.4	80.3	78.0	82.9	74.9	85.2	88.6	86.6	86.9	77.
8	71.5	72.4	70.8	70.7	82.3	82.2	79.9	83.1	75.3	86.0	91.2	85.3	85.0	76.
9	71.9	72.9	71.2	71.1	82.9	82.8	80.5	81.5	74.0	84.9	91.6	82.2	81.7	74.
10	69.8	70.2	69.4	69.4	78.1	78.1	75.8	81.0	73.5	82.7	86.0	86.4	87.1	81.
11	69.8	70.0	69.7	69.7	74.3	74.3	72.7	79.1	70.6	78.4	84.8	83.6	84.6	77.
12	69.9	69.9	69.9	69.9	70.8	70.8	70.4	76.5	67.3	75.4	82.1	78.6	80.1	73.
MEAN LEVEL	70.4	70.3	70.0	70.0	77.2	77.1	75.4	80.2	72.2	81.4	86.6	84.1	84.6	
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	7.7	8.0	10.6	9.5	8.0	7.3	
SD,N-1	.69	1.42	.58	.60	4.05	3.99	3.33	2.51	2.73	3.76	2.97	2.86	2.71	
MEAN DIFF	-5.7	-5.8	-6.1	-6.1	1.1	1.0	-.7	4.1	-3.8	5.3	10.5	8.0	8.5	
RANGE	10.2	9.7	10.3	10.6	12.2	12.1	11.7	9.9	9.4	11.4	12.6	8.6	7.8	
SD,N-1	2.85	2.76	2.85	2.88	4.15	4.12	3.76	2.74	2.83	3.81	3.61	2.32	2.14	

FISHKEN EXP 1 AT 80 DB SPL NBS + STATS 3-7-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	80.1	79.8	79.6	79.7	88.2	88.1	85.9	90.0	82.6	92.8	97.2	95.6	96.1	87.
2	80.6	78.5	80.3	80.5	84.6	84.6	83.2	87.2	80.1	89.1	95.7	93.0	93.6	86.
3	80.9	77.8	80.6	80.9	81.4	81.6	81.4	84.4	77.3	86.2	92.9	88.5	89.1	82.
4	79.8	80.2	79.4	79.4	88.1	88.1	85.8	89.9	82.5	92.7	96.0	95.4	96.1	87.
5	79.8	80.0	79.7	79.7	84.3	84.3	82.7	88.1	79.6	88.5	94.8	92.7	93.8	85.
6	80.4	81.1	79.8	79.7	90.4	90.3	88.0	92.1	84.7	95.3	98.6	95.6	95.9	82.
7	80.4	81.1	79.8	79.7	90.4	90.3	88.0	92.1	84.7	95.3	98.6	95.6	95.9	87.
8	81.5	82.4	80.8	80.7	92.3	92.2	89.9	92.6	85.2	96.0	101.2	94.5	94.1	87.
9	81.9	82.9	81.2	81.1	92.9	92.8	90.5	91.3	84.0	94.9	101.6	91.6	91.1	83.
10	79.8	80.2	79.4	79.4	88.1	88.1	85.8	89.9	82.5	92.7	96.0	95.4	96.1	91.
11	79.8	80.0	79.7	79.7	84.3	84.3	82.7	88.1	79.6	88.5	94.8	92.7	93.8	88.
12	79.9	79.9	79.9	79.9	80.8	80.8	80.4	85.6	76.6	85.5	92.1	88.0	89.6	85.

	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF
MEAN LEVEL	80.4	80.3	80.0	80.0	87.2	87.1	85.4	89.3	81.6	91.5	96.6	93.2	93.7
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	8.2	8.6	10.5	9.5	7.6	7.0
SD,N-1	.69	1.42	.58	.60	4.05	3.99	3.33	2.63	2.92	3.73	2.95	2.72	2.55

	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF
MEAN DIFF	-5.8	-5.8	-6.2	-6.1	1.0	1.0	-.8	3.1	-4.6	5.3	10.5	7.1	7.6
RANGE	10.5	10.5	10.6	10.9	13.3	13.2	12.5	11.1	11.1	12.3	13.4	9.9	8.7
SD,N-1	2.96	2.85	2.93	2.96	4.44	4.41	4.03	3.18	3.45	4.08	3.86	2.61	2.36

FISHKEN EXP 1 AT 90 DB SPL NBS + STATS 3-7-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L
1	90.1	89.8	89.6	89.7	98.2	98.1	95.9	99.5	92.6	102.8	107.2	104.3	104.8	97
2	90.6	88.5	90.3	90.5	94.6	94.6	93.2	96.6	90.1	99.1	105.6	101.9	102.5	95
3	90.9	87.8	90.6	90.9	91.4	91.6	91.4	94.0	87.4	96.2	102.9	97.7	98.5	93
4	89.8	90.2	89.4	89.4	98.1	98.1	95.8	99.5	92.5	102.7	106.1	104.2	104.8	97
5	89.8	90.0	89.7	89.7	94.3	94.3	92.7	97.6	89.5	98.6	104.9	101.6	102.6	95
6	90.4	91.1	89.8	89.7	100.4	100.3	98.0	101.9	95.0	105.3	108.6	104.4	104.6	92
7	90.4	91.1	89.8	89.7	100.4	100.3	98.0	101.9	95.0	105.3	108.6	104.4	104.6	97
8	91.5	92.4	90.8	90.7	102.3	102.2	99.9	102.9	95.6	106.0	111.2	103.6	103.3	98
9	91.9	92.9	91.2	91.1	102.9	102.8	100.5	101.9	94.2	104.9	111.6	101.9	10[illegible].4	93
10	89.8	90.2	89.4	89.4	98.1	98.1	95.8	99.5	92.5	102.7	106.1	104.2	104.8	102
11	89.8	90.0	89.7	89.7	94.3	94.3	92.7	97.6	89.5	98.6	104.9	101.6	102.6	99
12	89.9	89.9	89.9	89.9	90.8	90.8	90.4	95.4	86.6	95.5	102.2	97.1	98.7	96
MEAN LEVEL	90.4	90.3	90.0	90.0	97.2	97.1	95.4	99.0	91.7	101.5	106.7	102.2	102.7	
RANGE	2.1	5.1	1.8	1.7	12.1	12.0	10.1	8.9	9.0	10.5	11.6	7.3	6.3	
SD,N-1	.69	1.42	.58	.60	4.05	3.99	3.33	2.85	3.04	3.71	2.93	2.58	2.34	
MEAN DIFF	-6.2	-6.2	-6.6	-6.5	.6	.6	-1.2	2.5	-4.8	4.9	10.1	5.6	6.1	
RANGE	10.7	11.3	10.5	10.6	14.8	14.7	13.5	12.5	12.7	14.0	14.1	11.5	10.1	
SD,N-1	3.20	3.10	3.15	3.18	4.81	4.78	4.37	3.78	3.98	4.45	4.18	3.09	2.80	

FISHKEN EXP II S/N=-5 DB NBS + STATS 3-8-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	
1	91.3	91.8	90.8	90.8	99.4	99.6	97.1	101.8	94.3	104.7	108.1	105.3	105.8	9
2	81.0	81.4	80.4	80.4	89.1	89.3	86.9	91.7	83.8	94.3	97.7	96.5	97.1	8
3	70.8	71.2	70.3	70.3	79.0	79.1	76.8	82.7	74.8	83.9	87.3	87.4	88.0	7
4	60.9	61.3	60.4	60.4	69.0	69.1	66.8	73.8	66.4	73.8	77.5	78.2	78.8	6
5	51.0	51.3	50.4	50.4	59.0	59.1	56.8	64.5	57.7	63.5	67.3	68.4	69.1	5
6	41.4	41.7	40.9	40.9	49.3	49.4	47.0	54.7	48.6	53.3	57.6	57.7	58.4	4
7	32.0	32.3	31.6	31.6	39.8	39.9	37.4	41.9	38.3	41.5	46.2	45.3	45.9	2
MEAN LEVEL	61.2	61.6	60.7	60.7	69.2	69.4	67.0	73.0	66.3	73.6	77.4	77.0	77.6	
RANGE	59.3	59.5	59.2	59.2	59.6	59.7	59.7	59.9	56.0	63.2	61.9	60.0	59.9	
SD,N-1	21.35	21.43	21.33	21.32	21.50	21.50	21.50	21.02	19.71	22.53	22.06	21.37	21.33	
MEAN DIFF	-5.4	-5.0	-5.9	-5.9	2.6	2.8	.4	6.4	-.3	7.0	10.8	10.4	11.0	
RANGE	11.6	11.5	11.8	11.8	11.3	11.2	11.1	10.9	15.1	7.8	9.1	10.8	10.9	
SD,N-1	4.26	4.19	4.28	4.29	4.09	4.09	4.06	4.22	5.66	2.99	3.39	3.82	3.86	

FISHKEN EXP II S/N= 5 DB NBS + STATS 3-8-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWLKDF	LL
8	92.8	93.4	92.6	92.6	100.2	100.3	96.9	102.3	94.5	105.4	111.9	104.0	104.4	95.
9	82.1	82.5	81.9	81.9	89.3	89.4	86.2	91.8	83.6	94.7	101.2	94.9	95.4	85.
10	71.7	72.0	71.4	71.4	78.8	78.9	75.8	82.2	73.7	84.2	90.7	85.7	86.2	75.
11	61.9	62.1	61.6	61.6	68.8	69.0	65.9	73.3	65.0	74.1	80.7	76.3	76.9	64.
12	52.1	52.2	51.8	51.9	58.9	59.0	55.9	64.1	56.3	63.8	70.4	66.4	66.9	54.
13	43.2	43.3	42.9	43.0	49.8	50.0	46.8	54.6	47.9	53.9	60.6	55.9	56.5	42.
14	34.4	34.6	34.2	34.2	41.1	41.2	38.0	43.3	37.9	43.9	50.6	44.3	44.7	24.
MEAN LEVEL	62.6	62.9	62.3	62.4	69.6	69.7	66.5	73.1	65.5	74.3	80.9	75.4	75.8	
RANGE	58.4	58.8	58.4	58.4	59.1	59.1	58.9	59.0	56.6	61.5	61.3	59.7	59.7	
SD,N-1	21.05	21.23	21.05	21.03	21.32	21.32	21.26	20.81	19.98	22.08	22.02	21.35	21.33	
MEAN DIFF	-.6	-.3	-.9	-.8	6.4	6.5	3.3	9.9	2.3	11.1	17.7	12.2	12.6	
RANGE	13.7	13.6	13.8	13.8	13.3	13.3	13.2	12.8	15.6	10.7	10.9	11.6	11.6	
SD,N-1	4.91	4.82	4.92	4.93	4.73	4.73	4.71	4.54	5.61	3.82	3.85	3.87	3.86	

FISHKEN EXP II S/N= +15 DB NBS + STATS 3-8-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
15	93.4	94.0	93.3	93.2	100.5	100.7	96.9	100.9	92.7	103.9	110.6	101.5	101.7	93.
16	82.6	83.1	82.5	82.5	89.5	89.6	86.0	89.9	81.7	93.1	99.8	92.1	92.4	84.
17	72.1	72.5	71.9	72.0	78.9	79.0	75.4	80.0	71.5	82.5	89.2	82.5	82.9	74.
18	62.3	62.6	62.2	62.2	68.9	69.0	65.5	71.1	62.5	72.4	79.1	73.0	73.3	62.
19	52.6	52.7	52.4	52.5	59.0	59.1	55.7	61.6	53.6	62.1	68.7	62.6	63.1	50.
20	43.8	43.9	43.6	43.7	50.2	50.3	46.8	52.4	44.9	52.5	59.1	52.6	52.8	38.
21	35.2	35.3	35.0	35.0	41.6	41.7	38.2	42.7	34.6	42.8	49.5	42.0	42.1	25.
MEAN LEVEL	63.1	63.4	63.0	63.0	69.8	69.9	66.4	71.2	63.1	72.8	79.4	72.3	72.6	
RANGE	58.2	58.7	58.3	58.2	58.9	59.0	58.7	58.2	58.1	61.1	61.1	59.5	59.6	
SD.N-1	20.99	21.19	21.00	20.98	21.28	21.27	21.18	20.69	20.54	22.00	22.00	21.43	21.45	
MEAN DIFF	1.9	2.2	1.7	1.7	8.5	8.7	5.1	10.0	1.8	11.5	18.2	11.1	11.4	
RANGE	12.6	12.3	12.6	12.5	12.2	12.2	12.3	12.2	12.6	9.8	9.8	9.0	6.9	
SD.N-1	4.47	4.35	4.46	4.48	4.29	4.29	4.34	4.52	4.76	3.40	3.40	3.51	3.45	

SOURCE

Author(s): Hillquist, R.

Title: Objective and subjective measurement of truck noise

Reference: J. Sound and Vibration, 1967, 1, 8-14.

STIMULI

Number and type of noises: 100 trucks

Levels: 80 - 105 dB SPL overall

Mode of presentation: Free Field

Analysis: One octave

JUDGMENTS

Attribute judged: Preference

Psychophysical procedure: Ranking in order of decreasing preference from 1 - 100 and paired comparisons

Number of observers: 20

OTHER

Special features: Energy concentrated below 1000 Hz.

Comments: No choice (equal preference) votes were allowed.

HILQUISTTRUCK NOISES 1-25 NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	80.8	74.0	78.0	80.5	78.8	78.1	77.5	85.2	77.6	85.5	87.1	91.6	92.5
2	80.4	76.2	78.7	80.2	80.2	79.8	78.8	86.6	78.5	86.9	88.5	92.6	93.5
3	86.0	76.2	82.4	85.8	82.3	80.7	81.0	88.2	80.2	89.0	90.6	94.0	94.8
4	82.7	77.5	80.9	82.5	81.5	81.1	80.7	87.5	79.8	88.0	89.5	93.7	94.6
5	86.3	77.7	83.4	86.1	83.4	82.0	82.3	88.6	81.1	89.8	91.3	94.7	95.5
6	84.0	75.9	81.5	83.8	81.6	80.4	80.6	87.3	79.6	88.2	89.6	93.0	93.6
7	85.6	75.9	81.5	85.2	81.4	80.1	80.4	87.4	79.8	88.1	89.5	93.8	94.7
8	85.9	78.5	82.7	85.6	83.2	82.3	82.0	89.0	81.4	89.8	91.4	95.6	96.4
9	90.3	77.5	85.9	90.0	85.2	83.0	83.7	90.5	82.4	91.8	93.4	96.3	97.0
10	85.5	78.2	82.5	85.3	83.4	82.6	81.9	88.9	81.4	90.4	92.1	95.6	96.3
11	92.3	78.1	88.2	92.0	87.1	84.2	85.5	91.0	82.9	92.4	93.8	95.8	96.4
12	85.7	79.0	83.3	85.6	83.6	82.7	82.6	89.1	81.5	89.8	91.2	95.2	96.1
13	84.4	79.6	82.9	84.4	84.0	83.5	82.9	89.5	81.9	90.6	92.4	95.8	96.6
14	90.4	78.1	86.5	90.2	85.8	83.5	84.4	90.9	83.0	92.3	93.6	96.0	96.7
15	88.0	80.4	85.7	87.9	85.6	84.5	84.8	90.3	83.2	91.9	93.3	96.1	96.9
16	86.7	79.2	83.7	86.4	84.2	83.4	83.1	89.7	82.2	90.8	92.4	96.3	97.1
17	83.9	79.5	82.4	83.8	83.7	83.3	82.5	89.4	81.6	90.5	92.0	95.7	96.5
18	90.5	80.5	87.0	90.3	86.6	85.0	85.4	91.7	84.0	93.2	94.8	97.6	98.3
19	86.5	80.6	84.3	86.4	85.5	84.8	84.0	90.7	83.1	92.4	94.0	97.1	97.9
20	87.9	78.4	84.0	87.6	83.9	82.6	82.7	89.7	81.8	90.8	92.3	96.2	96.9
21	89.1	81.6	86.4	88.9	86.5	85.6	85.6	91.6	84.1	92.9	94.8	98.0	98.7
22	89.8	81.7	86.4	89.5	86.6	85.7	85.6	91.7	84.5	93.4	95.1	98.4	99.3
23	93.9	80.0	89.9	93.7	88.9	86.1	87.4	92.9	85.1	94.6	95.9	97.3	97.8
24	90.7	80.8	87.3	90.5	87.0	85.4	85.8	92.1	84.5	93.7	95.2	97.8	98.5
25	89.3	82.0	86.6	89.1	86.7	85.8	85.7	91.6	84.2	93.1	94.8	96.1	98.9

HILQUISTTRUCK NOISES 1-25 NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKD
MEAN LEVEL	87.1	78.7	84.1	86.8	84.3	83.0	83.1	89.6	82.0	90.8	92.3	95.7	96.
RANGE	13.5	8.0	11.9	13.5	10.1	8.0	9.9	7.7	7.5	9.1	8.8	6.8	6.
SD,N-1	3.40	2.06	2.89	3.39	2.44	2.13	2.40	1.90	1.95	2.30	2.30	1.80	1.

HILQUIST TRUCK NOISES 26-50 NBS+STATS 3-2-77

NO.	D-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	85.1	81.2	83.5	84.9	84.9	84.6	83.7	90.8	82.5	91.6	93.3	96.9	97.8
2	92.2	81.1	88.5	92.0	87.9	85.9	86.5	92.9	85.2	94.5	96.0	98.5	99.2
3	87.2	81.4	85.2	87.0	85.8	85.2	84.9	91.1	83.7	92.3	94.3	97.7	98.4
4	92.6	85.5	90.0	92.4	90.1	89.4	89.5	95.0	87.7	96.7	98.5	100.9	101.7
5	95.2	84.3	91.8	95.0	91.1	89.2	90.1	95.2	88.0	97.2	98.8	100.1	100.8
6	88.2	82.1	85.8	88.0	86.3	85.7	85.4	91.7	84.2	93.0	94.6	98.2	99.1
7	94.1	84.4	91.1	93.9	90.6	88.9	89.6	94.6	87.5	96.6	98.1	99.8	100.6
8	88.9	82.6	87.0	88.7	87.5	86.6	86.6	92.5	85.3	94.4	96.6	98.8	99.6
9	86.5	79.4	84.0	86.3	84.7	83.9	83.5	90.2	82.9	91.5	93.2	96.9	97.6
10	97.8	83.6	93.7	97.6	92.7	89.7	91.1	95.9	88.4	97.9	99.3	100.0	100.5
11	88.4	81.0	86.2	88.3	86.5	85.4	85.5	91.2	84.1	93.0	94.5	97.0	97.8
12	92.5	80.0	88.6	92.3	88.0	85.7	86.4	93.0	85.1	94.6	96.3	98.3	98.9
13	89.0	83.5	87.2	88.9	87.9	87.4	86.9	92.6	85.4	94.3	96.3	99.0	99.8
14	94.5	81.6	90.6	94.3	89.8	87.3	88.3	94.0	86.4	95.9	97.8	98.9	99.5
15	88.6	82.5	86.6	88.5	87.0	86.5	86.2	92.2	84.9	93.7	95.8	98.3	99.1
16	89.2	81.6	85.5	88.8	86.1	85.4	85.0	91.7	84.0	93.0	94.8	98.5	99.4
17	94.4	82.0	90.3	94.1	89.6	87.3	88.1	94.5	86.8	96.3	98.0	100.0	100.6
18	93.0	85.9	91.3	92.9	91.4	90.4	90.7	95.6	88.9	98.0	100.0	100.9	101.6
19	92.7	84.2	89.6	92.5	89.6	88.3	88.4	94.3	87.0	96.2	97.9	100.3	101.0
20	97.0	85.7	93.5	96.8	92.8	90.7	91.6	96.7	89.6	98.9	100.5	101.2	101.9
21	94.4	84.2	90.7	94.1	90.5	88.8	89.1	95.4	87.9	97.4	99.8	101.5	102.1
22	94.8	85.3	91.5	94.5	91.2	89.7	90.0	95.8	88.7	98.0	99.7	101.6	102.3
23	93.0	87.1	91.2	92.8	91.7	91.0	90.9	96.2	89.3	98.5	100.6	102.3	103.1
24	92.5	80.4	86.5	91.8	85.9	84.1	84.6	91.7	83.7	92.9	94.2	98.2	99.1
25	96.4	79.4	88.6	95.6	87.8	84.7	85.7	93.6	85.1	95.0	96.4	99.4	100.3

HILQUIST TRUCK NOISES 26-50 NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
MEAN LEVEL	91.9	82.8	88.7	91.7	88.7	87.3	87.5	93.5	86.1	95.3	97.0	99.3	100.1
RANGE	12.7	7.7	10.2	12.7	8.1	7.1	8.1	6.5	7.1	7.4	7.4	5.4	5.5
SD,N-1	3.46	2.16	2.88	3.41	2.45	2.20	2.47	1.91	2.12	2.26	2.30	1.52	1.52

HILQUIST TRUCK NOISES 51-75 NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	99.5	86.2	95.7	99.3	94.7	92.1	93.3	97.9	90.8	100.1	101.9	101.6	102.1
2	98.9	86.5	94.8	98.6	94.0	91.6	92.5	98.3	91.1	100.5	102.2	103.6	104.3
3	96.6	85.6	91.3	96.0	91.2	89.7	89.9	96.1	89.0	98.2	100.0	102.7	103.6
4	93.5	87.0	91.1	93.3	91.5	90.8	90.7	95.9	89.1	98.3	100.1	102.3	103.1
5	95.2	87.5	93.1	95.1	93.2	92.1	92.4	97.5	91.1	100.2	102.7	103.1	103.8
6	98.1	87.6	94.6	97.9	94.3	92.4	92.8	98.5	91.5	100.9	102.8	103.8	104.4
7	93.7	87.9	91.8	93.6	92.7	92.0	91.6	97.0	90.3	99.5	101.6	103.4	104.1
8	98.5	89.8	95.8	98.2	95.8	94.6	94.9	99.9	93.6	102.8	104.6	105.1	105.8
9	92.6	89.1	91.3	92.5	93.0	92.9	91.8	97.1	90.0	99.7	101.7	103.4	104.1
10	96.7	85.1	91.6	96.1	91.2	89.6	90.2	95.7	88.8	98.1	99.5	102.0	102.9
11	92.8	88.5	91.1	92.6	92.7	92.5	91.4	96.7	89.5	99.4	101.5	103.3	104.0
12	95.6	90.3	94.3	95.5	94.6	94.0	94.0	98.2	91.7	100.8	102.7	104.0	104.9
13	97.4	86.5	93.4	97.1	93.2	91.4	91.6	97.9	90.7	100.2	102.1	103.6	104.2
14	97.5	85.4	92.1	96.9	91.9	90.1	90.3	96.9	89.7	99.1	101.1	103.3	104.1
15	97.5	85.4	92.4	97.0	92.1	90.3	90.7	96.5	89.7	98.9	100.8	102.8	103.6
16	98.3	89.4	95.7	98.1	95.5	94.1	94.6	99.3	93.0	102.1	104.1	104.4	105.1
17	94.1	90.2	93.1	94.0	93.6	93.4	93.1	97.9	91.0	99.8	101.8	103.4	104.3
18	97.5	90.7	95.8	97.4	95.8	94.8	95.1	99.2	93.1	102.0	103.8	104.2	105.0
19	96.6	87.7	93.6	96.4	93.6	92.2	92.6	97.9	91.4	100.5	102.2	103.5	104.3
20	98.9	88.8	95.4	98.7	95.1	93.5	93.8	99.3	92.4	101.7	103.8	104.6	105.2
21	96.1	89.6	94.3	96.0	94.7	93.8	93.8	98.8	92.3	101.5	103.5	104.5	105.2
22	98.0	89.9	95.5	97.8	95.7	94.5	94.8	99.8	93.3	102.6	104.6	105.2	105.9
23	95.3	89.3	93.3	95.2	94.0	93.4	93.0	98.2	91.6	100.7	102.7	104.5	105.2
24	99.0	91.2	96.8	98.9	96.7	95.6	96.0	100.2	94.1	103.0	105.0	105.2	106.0
25	96.1	85.8	92.8	95.9	92.4	90.7	91.4	96.3	89.5	98.6	100.4	101.8	102.5

HILQUIST TRUCK NOISES 51-75 NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
MEAN LEVEL	96.6	88.0	93.6	96.3	93.7	92.5	92.7	97.9	91.1	100.4	102.3	103.6	104.3
RANGE	6.9	6.1	5.7	6.8	5.5	6.0	6.1	4.5	5.3	4.9	5.5	5.2	6.0
SD,N-1	2.01	1.87	1.75	1.99	1.55	1.69	1.70	1.31	1.53	1.45	1.52	1.01	1.01

HILQUIST TRUCK NOISES 76-100NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKUF
1	95.9	88.5	93.3	95.7	93.5	92.6	92.7	98.0	91.4	100.6	102.2	103.9	104.7
2	98.2	90.7	96.0	98.0	96.0	95.0	95.4	100.0	93.7	102.8	104.5	105.1	106.[illegible]
3	97.0	89.4	93.8	96.8	94.2	93.2	92.9	98.9	91.7	101.1	103.0	105.2	106.0
4	95.8	88.4	92.5	95.5	93.6	92.8	92.0	98.1	90.9	101.0	103.1	104.6	105.3
5	100.6	93.1	99.2	100.6	99.2	97.9	98.6	101.7	95.[illegible]	104.6	106.5	105.1	105.8
6	96.3	90.4	94.0	96.1	95.0	94.5	93.9	98.8	92.[illegible]	101.5	103.9	105.3	106.0
7	98.5	92.2	96.5	98.3	96.7	96.2	96.1	101.1	94.4	103.3	105.4	106.7	107.1
8	102.1	93.9	100.2	102.0	99.9	98.6	99.3	103.3	97.3	106.2	107.9	107.0	107.8
9	101.9	92.5	99.4	101.8	99.0	97.4	98.2	101.8	95.8	104.6	106.3	105.6	106.4
10	99.8	92.4	97.7	99.7	97.6	96.6	96.9	100.8	94.8	103.6	105.4	105.9	106.6
11	96.4	89.9	93.2	96.0	95.3	94.8	93.5	99.3	92.3	102.7	104.8	106.0	106.7
12	96.3	92.3	94.8	96.1	96.8	96.6	95.2	100.5	93.6	103.7	105.9	106.5	107.2
13	100.3	92.6	98.2	100.1	98.3	97.1	97.6	102.2	96.0	105.1	106.7	107.0	107.8
14	98.9	92.6	97.2	98.8	97.6	96.8	96.8	101.5	95.4	104.4	106.6	106.9	107.6
15	95.6	91.1	93.9	95.4	95.6	95.3	94.3	99.4	92.5	102.4	104.8	105.9	106.6
16	100.4	92.5	98.3	100.3	98.3	97.1	97.4	102.0	95.9	104.9	107.1	106.8	107.5
17	98.6	91.8	96.3	98.4	96.7	95.9	95.8	100.8	94.2	103.2	105.4	106.5	107.3
18	100.6	93.0	98.8	100.5	98.7	97.5	98.1	102.1	96.0	105.0	106.4	106.2	107.1
19	102.2	94.5	100.4	102.2	100.2	99.0	99.6	103.8	97.8	106.7	108.2	107.7	108.5
20	98.5	94.7	97.4	98.4	98.5	98.1	97.5	102.6	95.5	104.6	106.6	107.8	108.6
21	99.8	94.4	98.7	99.7	98.9	98.3	98.5	102.5	96.2	105.1	107.3	107.5	108.3
22	105.1	97.9	103.8	105.1	103.6	102.4	103.1	106.1	100.6	109.0	110.9	108.9	109.8
23	105.1	98.0	103.8	105.1	103.6	102.5	103.1	106.1	100.5	108.9	110.7	108.8	109.7
24	99.6	94.4	98.5	99.6	98.9	98.4	98.4	102.7	96.5	105.4	107.8	107.9	108.7
25	99.3	90.3	96.6	99.2	96.3	94.8	95.5	99.9	93.6	102.6	104.4	104.6	105.5

HILQUIST TRUCK NOISES 76-100NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
MEAN LEVEL	99.3	92.5	97.3	99.2	97.7	96.8	96.8	101.4	95.0	104.1	106.1	106.4	107.1
RANGE	9.5	9.6	11.3	9.7	10.1	9.9	11.1	8.1	9.7	9.0	10.9	8.9	9.8
SD,N-1	2.66	2.43	3.02	2.73	2.60	2.48	2.86	2.13	2.51	2.16	2.11	1.29	1.3

Evaluation of Data on Subjective Effects of Noise
B. Scharf, R. Hellman, J. Bauer
EPA Contract WA 76-E213

SOURCE

Author(s): Jahn, M.

Title: Subjektive und objektive berwertung von Maschinengeräuschen

Reference: Acustica, 1965/1966, 16, 175-185.

STIMULI

Number and type of noises: Ten machine noises

Levels: Overall SPLs constant at 74 dB

Mode of presentation: Free field

Analysis: Third octave, one octave

JUDGMENTS

Attribute judged: Loudness

Psychophysical procedure: Tracking - the standard sound was a noise band 200 Hz wide centered on 1000 Hz

Number of observers: 28

OTHER

Special features:

Comments: The standard sound was varied.

JAHN THIRD OCTAVE NOISES - NBS + STATS 2-28-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKLF	LL
1	74.4	71.6	73.0	74.2	79.3	79.0	76.4	84.2	76.7	85.6	87.3	89.7	90.3	85.
2	74.2	73.7	74.0	74.1	79.1	79.1	76.8	84.1	76.7	85.5	86.5	89.8	90.6	83.
3	73.8	73.5	73.0	73.3	81.0	81.0	78.8	85.9	77.9	86.7	87.7	90.8	91.5	85.
4	74.2	71.9	73.6	74.2	78.0	77.8	75.7	83.4	76.0	84.7	85.7	89.0	89.7	84.
5	74.3	70.7	72.9	74.1	77.8	77.4	75.3	83.1	75.5	84.1	85.7	88.8	89.4	84.
6	74.2	74.3	73.7	73.8	81.9	81.8	79.3	85.8	78.2	87.6	87.6.	90.9	91.6	85.
7	74.0	71.4	73.1	73.9	78.9	78.5	75.8	83.3	75.2	85.3	88.5	88.0	88.4	83.
8	74.4	69.8	73.3	74.4	75.4	74.9	73.8	80.8	74.2	81.6	82.2	87.1	87.7	81.
9	73.2	72.6	72.9	73.1	78.5	78.4	75.8	83.3	75.8	84.7	84.7	88.8	89.5	84.
10	74.0	73.4	73.5	73.9	80.2	80.1	77.2	84.9	77.0	86.6	88.9	90.1	90.6	85.
MEAN LEVEL	74.1	72.3	73.3	73.9	79.0	78.8	76.5	83.9	76.3	85.2	86.5	89.3	89.9	
RANGE	1.2	4.5	1.1	1.3	6.5	6.9	5.5	5.1	4.0	6.0	6.7	3.6	3.9	
SD,N-1	.36	1.47	.38	.42	1.83	1.94	1.63	1.48	1.23	1.66	2.00	1.21	1.25	
MEAN DIFF	-10.1	-11.9	-10.8	-10.3	-5.1	-5.3	-7.7	-.3	-7.8	1.1	2.3	5.1	5.8	
RANGE	4.2	4.6	4.3	4.6	3.4	3.5	3.4	2.4	2.5	2.5	4.8	2.6	2.8	
SD,N-1	1.33	1.30	1.32	1.43	1.22	1.31	1.22	.92	.89	1.04	1.51	.84	.93	

SOURCE

Author(s): Kryter, K. D.

Title: Scaling human reactions to the sound from aircraft.

Reference: J. Acoust. Soc. Amer., 1959, 31, 1415-1429.

STIMULI

Number and type of noises: Eight aircraft noises judged in various combinations.

Levels: EXP. I - 85-96 dB SPL overall; EXP. II - 80-95 dB SPL overall;
EXP. III - 85-103 dB SPL overall

Mode of presentation: via loudspeaker in conference room (diffuse field)

Analysis: one octave (frequencies adjusted)

JUDGMENTS

Attribute judged: Acceptability and disturbance

Psychophysical procedure: adjustment and paired comparisons

Number of observers: EXP. I - 36; EXP. II - 100; EXP. III - 4-13

OTHER

Special features:

Comments: EXP. I used four "indoor" filtered aircraft noises.
EXP. II used seven "indoor" filtered aircraft noises.
EXP. III used six unfiltered aircraft noises.

KRYTER EXPER1 NBS+STATS 3-3-77

	NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKOF
Super Const.	1	94.0	81.7	89.5	93.6	88.8	86.8	87.7	92.1	85.0	94.1	99.5	97.6	98.3
DC 7	2	96.0	82.8	91.9	95.6	91.1	88.7	89.9	93.2	86.6	95.8	100.3	97.7	98.3
CARAV.	3	88.0	82.9	86.1	87.8	86.3	85.9	85.8	91.3	83.7	92.4	98.7	97.7	98.6
COMET	4	85.0	80.3	83.3	84.8	84.9	84.7	83.6	89.3	82.1	91.4	98.1	96.7	97.2
MEAN LEVEL		90.7	81.9	87.7	90.4	87.7	86.5	86.8	91.5	84.3	93.4	99.2	97.4	98.1
RANGE		11.0	2.6	8.6	10.8	6.2	4.0	6.3	3.9	4.5	4.4	2.2	1.0	1.4
SD,N-1		5.11	1.20	3.77	5.01	2.74	1.67	2.65	1.64	1.91	1.92	.99	.49	.59

KRYTER EXPER.2 NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDI
1	94.0	80.1	88.8	93.3	88.1	85.7	86.9	91.0	83.9	93.3	98.4	96.2	97.1
2	95.1	83.5	92.2	94.9	91.6	89.4	90.6	92.6	86.0	95.3	99.3	96.6	97.2
3	86.5	76.9	83.5	86.2	83.1	81.6	82.2	87.7	80.2	89.3	95.2	93.6	94.4
4	84.0	76.8	81.7	83.8	81.8	80.9	81.0	86.7	79.5	88.0	94.7	93.5	94.3
5	79.5	77.7	78.8	79.4	82.5	82.5	80.5	87.6	80.0	89.2	92.5	94.2	94.9
6	80.0	78.0	79.2	79.9	83.2	83.2	81.0	88.2	80.4	90.0	93.3	94.6	95.2
7	79.5	76.5	78.6	79.4	81.2	81.1	79.7	86.6	79.3	87.6	90.8	93.5	94.2
MEAN LEVEL	85.5	78.5	83.3	85.3	84.5	83.5	83.1	88.6	81.3	90.4	94.9	94.6	95.3
RANGE	15.6	7.0	13.6	15.5	10.4	8.5	10.9	6.0	6.7	7.7	8.5	3.1	3.0
SD,N-1	6.70	2.53	5.34	6.55	3.84	3.08	4.04	2.29	2.59	2.85	3.08	1.31	1.2

KRYTER EXPER 3 NBS+STATS 3-11-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	100.0	91.9	97.6	99.9	97.6	96.5	96.8	101.7	95.5	104.5	107.9	107.1	107.9
2	103.0	92.4	100.3	102.9	99.7	97.7	98.8	102.5	96.3	105.3	107.7	106.2	107.0
3	93.0	88.2	91.0	92.8	92.8	92.6	91.3	97.3	90.0	100.2	103.2	103.5	104.1
4	89.0	87.3	88.3	88.9	91.9	92.0	89.9	95.8	88.3	98.6	101.8	102.3	102.8
5	85.0	84.9	84.6	84.7	91.9	91.8	89.4	94.7	87.4	97.4	100.7	100.5	101.2
6	88.0	86.3	87.5	87.9	91.6	91.6	89.7	95.3	88.3	98.0	101.4	101.9	102.7
MEAN LEVEL	93.0	88.5	91.5	92.8	94.3	93.7	92.6	97.9	91.0	100.7	103.8	103.6	104.3
RANGE	18.0	7.5	15.7	18.2	8.1	6.1	9.4	7.8	8.9	7.9	7.9	7.1	7.9
SD,N-1	7.13	3.03	6.15	7.16	3.48	2.69	4.09	3.39	3.93	3.43	3.22	2.57	2.64

SOURCE

Author(s): Kryter, K. D. and Pearsons, KS

Title: Some effects of spectral content and duration on perceived noise level.

Reference: JASA, 1963,35, 866-883.

STIMULI

Number and type of noises: EXP.II -nine noises -.several noise bands that varied in width and spectral distribution of energy plus engine and aircraft noises

Levels: 79-92 dB SPL overall

Mode of presentation: Loudspeaker in semi-diffuse room.

Analysis: third octave - standard frequencies

JUDGMENTS

Attribute judged: noisiness (acceptability)

Psychophysical procedure: adjustment

Number of observers: 13 - 19

OTHER

Special features: Duration was held constant at 4 secs.

Comments: In EXP.II an octave band 600-1200 Hz wide was used as a standard. Hence, despite the fact that Os were asked to judge the noisiness of sounds, it was possible to perform a statistical analysis in terms of both noisiness and loudness.

KRYTER+PEARSON 1963 NBS+STATS 3-3-77

	NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L
	1	91.8	81.5	89.8	91.8	89.2	87.1	88.3	90.1	83.5	92.8	95.9	92.2	92.9	90
	2	90.1	89.9	90.1	90.1	90.7	90.8	90.4	93.6	85.3	93.8	95.6	95.8	97.6	90
	3	78.6	79.6	78.0	77.9	89.5	89.3	86.6	87.2	80.3	90.8	96.8	88.8	88.2	90
	4	79.1	78.6	76.8	76.7	86.4	87.1	86.6	89.7	80.7	89.4	96.0	86.5	87.9	90
	5	80.6	80.5	80.2	80.3	87.5	87.5	85.3	90.7	83.2	93.0	95.8	96.3	97.0	90
	6	81.5	82.2	80.7	80.6	91.1	91.2	89.2	92.8	85.1	94.8	98.2	95.8	96.4	90
	7	82.8	78.7	81.6	82.8	82.7	82.4	81.8	88.1	80.9	89.1	90.9	94.4	95.2	90
	8	87.3	78.7	84.7	87.1	84.4	82.9	83.5	88.9	81.6	90.7	92.6	94.2	95.0	90
	9	80.1	79.8	79.3	79.7	87.9	87.7	84.9	91.4	83.4	94.1	95.8	96.0	96.6	90
MEAN LEVEL		83.5	81.1	82.4	83.0	87.7	87.3	86.3	90.3	82.7	92.1	95.3	93.3	94.1	
RANGE		13.2	11.3	13.3	15.1	8.4	8.8	8.6	6.4	5.0	5.7	7.3	9.8	9.7	
SD,N-1		4.95	3.54	4.84	5.42	2.83	3.06	2.75	2.10	1.87	2.13	2.19	3.51	3.67	
MEAN DIFF		-6.5	-8.9	-7.6	-7.0	-2.3	-2.7	-3.7	.3	-7.3	2.1	5.3	3.3	4.1	
RANGE		13.2	11.3	13.3	15.1	8.4	8.8	8.6	6.4	5.0	5.7	7.3	9.8	9.7	
SD,N-1		4.95	3.54	4.84	5.42	2.83	3.06	2.75	2.10	1.87	2.13	2.19	3.51	3.67	

SOURCE

Author(s): Little, J. W.

Title: Human response to jet engine noises.

Reference: Noise Control 1961, 7, 11-13.

STIMULI

Number and type of noises: two jet engine noises

Levels: 94 and 99 dB SPL overall

Mode of presentation: via loudspeakers in a large demonstration room

Analysis: one octave (non-standard frequencies)

JUDGMENTS

Attribute judged: annoyance

Psychophysical procedure: paired comparisons

Number of observers: 65

OTHER

Special features: tone correction procedure proposed

Comments: Little introduced the 1/24 octave-band analysis which revealed the effect of tone spikes in the 1200-2400 Hz frequency range.

LITTLE JET NOISES NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	99.2	98.9	98.5	98.9	105.6	105.6	103.1	108.5	101.9	111.4	114.7	112.6	113.3
2	93.6	93.5	93.0	93.3	99.5	99.6	97.0	102.6	95.1	105.5	108.8	107.4	108.0
MEAN LEVEL	96.4	96.2	95.8	96.1	102.6	102.6	100.1	105.5	98.5	108.4	111.8	110.0	110.6
RANGE	5.6	5.4	5.5	5.6	6.1	6.0	6.1	8.5	6.8	11.4	14.7	12.6	13.3
SD,N-1	4.03	3.81	3.88	3.97	4.26	4.21	4.35	4.22	4.75	4.16	4.16	3.72	3.71

SOURCE

Author(s): Lübcke, E., Mittag, G., and Port, E.

Title: Subjektive und objektive Bewertung von Maschinengeräuschen.

Reference: Acustica, 1964, 14, 105-114.

STIMULI

Number and type of noises: 21 machine noises

Levels: 40 and 80 dB SPL overall

Mode of presentation: free field (Stuttgart), earphones (Berlin)

Analysis: third octave

JUDGMENTS

Attribute judged: loudness

Psychophysical procedure: tracking - 1/3 octave band 900-1050 Hz wide used as the standard

Number of observers: 10 (Berlin); 12 (Stuttgart)

OTHER

Special features:

Comments: Noises measured at SPLs of 40 and 80 dB in Stuttgart and at 80 dB SPL only in Berlin. The standard sound was varied.

LUBCKE,MITTAG,+PORT 40 DB SPL NBS +STATS 3-1-77

NO.	0-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKUF	
1	40.0	38.8	39.7	39.9	43.4	43.5	41.5	48.4	43.4	47.3	47.3	54.4	55.5	5
2	39.5	35.2	38.3	39.4	39.7	39.4	38.6	42.6	39.9	42.8	44.2	50.6	51.6	5
3	39.6	40.0	39.1	39.1	47.3	47.3	44.7	52.9	46.4	51.1	52.6	56.3	57.2	5
4	40.1	35.1	38.1	39.9	41.8	41.4	39.6	44.4	41.3	45.6	47.1	52.2	53.1	5
5	40.0	37.3	39.2	39.9	41.7	41.5	40.2	47.2	41.4	45.1	46.7	53.0	54.3	5
6	40.0	37.5	39.3	39.9	42.1	42.0	40.6	46.6	41.9	45.9	46.6	53.4	54.6	5
7	40.1	34.8	38.3	40.0	41.0	40.4	39.2	44.0	39.4	43.7	45.8	51.6	52.8	5
8	39.8	37.4	38.6	39.6	44.6	44.4	42.3	49.5	44.9	49.0	49.6	55.1	56.2	5
9	39.7	36.9	38.6	39.6	41.7	41.6	40.1	47.6	41.8	45.4	46.8	53.2	54.6	5
10	40.2	33.7	38.4	40.1	40.4	39.7	38.9	42.1	39.5	43.4	45.2	50.4	51.5	5
11	39.6	38.4	38.6	38.9	44.9	44.9	43.2	52.4	45.7	49.3	50.7	55.6	56.9	5
MEAN LEVEL	39.9	36.8	38.8	39.7	42.6	42.4	40.8	47.1	42.3	46.2	47.5	53.3	54.4	
RANGE	.7	6.3	1.6	1.2	7.6	7.9	6.1	10.8	7.0	8.3	8.4	5.9	5.7	
SD,N-1	.23	1.91	.51	.38	2.23	2.40	1.92	3.63	2.46	2.65	2.48	1.96	1.98	
MEAN DIFF	-15.8	-18.8	-16.9	-16.0	-13.0	-13.3	-14.8	-8.6	-13.3	-9.4	-8.2	-2.4	-1.3	
RANGE	6.9	6.0	6.7	7.5	4.7	5.1	4.4	6.9	6.0	5.6	4.8	4.8	4.7	
SD,N-1	2.14	2.04	2.17	2.31	1.57	1.70	1.52	2.49	1.77	1.77	1.43	1.51	1.49	

LUBCKE, MITTAG + PORT AT 80 DB SPL NBS + STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L[illegible]
1	80.0	78.8	79.7	79.9	83.4	83.5	81.5	88.1	80.7	89.7	89.7	94.2	95.0	95.
2	79.9	78.5	79.3	79.8	83.8	83.7	81.6	88.7	81.1	90.6	93.0	94.7	95.5	97.
3	80.1	75.9	79.1	80.1	81.8	81.3	79.9	86.9	79.3	88.5	90.3	92.8	93.4	93.
4	79.5	75.2	78.3	79.4	79.7	79.4	78.6	86.2	78.5	86.5	87.9	91.8	92.5	93.
5	79.9	74.8	78.8	79.9	79.6	79.0	78.7	85.2	78.0	86.1	87.2	91.1	91.9	92.
6	79.6	80.0	79.1	79.1	87.3	87.3	84.7	90.4	82.5	92.6	94.8	95.5	96.1	96.
7	80.3	75.6	78.4	80.1	82.0	81.5	79.8	87.2	79.8	88.8	90.3	93.3	94.0	91.
8	80.0	78.9	79.8	79.9	82.1	82.2	80.8	87.9	79.8	88.3	89.6	93.1	94.0	91.
9	80.0	77.3	79.2	79.9	81.7	81.5	80.2	87.9	80.0	88.3	89.8	93.4	94.3	94.
10	80.0	77.5	79.3	79.9	82.1	82.0	80.6	87.5	80.1	88.6	89.3	93.7	94.5	93.
11	79.8	78.4	78.9	79.3	85.0	85.0	83.2	91.1	82.3	91.4	92.5	95.7	96.6	98.
12	80.1	77.2	79.3	80.0	82.0	81.9	80.6	87.9	80.6	89.1	90.4	94.0	94.9	95.
13	80.1	74.8	78.3	80.0	81.0	80.4	79.2	87.0	79.3	87.9	89.9	92.9	93.7	95.
14	79.6	78.8	79.0	79.2	85.5	85.5	83.4	90.4	82.4	91.8	92.3	95.7	96.5	97.
15	79.8	77.4	78.6	79.6	84.6	84.4	82.3	89.5	81.9	91.4	91.9	95.1	95.8	97.0
16	84.0	83.8	82.8	83.1	92.6	92.9	91.4	96.2	87.8	97.6	98.9	99.0	99.6	96.0
17	79.7	76.9	78.6	79.6	81.7	81.6	80.1	88.6	80.4	88.7	90.1	94.1	95.0	95.5
18	80.2	73.7	78.4	80.1	80.4	79.7	78.9	86.4	79.0	87.5	89.3	92.3	93.0	94.5
19	80.0	77.4	79.5	80.0	81.3	81.3	80.4	87.2	79.4	87.7	90.1	93.3	94.2	96.0
20	79.8	78.7	78.9	79.4	85.6	85.7	84.1	91.3	82.7	91.7	95.0	96.0	96.9	96.0
MEAN LEVEL	80.1	77.5	79.2	79.9	83.2	83.0	81.5	88.6	80.8	89.6	91.1	94.1	94.9	
RANGE	4.5	10.1	4.5	4.0	13.0	13.9	12.8	11.0	9.8	11.5	11.7	7.9	7.9	
SD,N-1	.94	2.23	.97	.81	3.04	3.23	2.92	2.44	2.15	2.62	2.73	1.78	1.79	
MEAN DIFF	-14.7	-17.3	-15.7	-14.9	-11.7	-11.8	-13.3	-6.2	-14.0	-5.2	-3.7	-.7	.1	
RANGE	7.5	8.6	7.4	7.8	11.3	11.7	11.2	9.0	8.4	9.9	8.8	5.7	5.6	
SD,N-1	2.14	2.25	2.08	2.21	2.61	2.75	2.60	2.08	1.95	2.22	2.28	1.59	1.58	

LUBCKE ET AL 15 BERLIN NOISES (EARPHONES) 80 DB 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L
1	80.0	78.8	79.7	79.9	83.4	83.5	81.5	88.1	80.7	89.7	89.7	94.2	95.0	91
2	79.9	78.5	79.3	79.8	83.8	83.7	81.6	88.7	81.1	90.6	93.0	94.7	95.5	92
3	80.1	75.9	79.1	80.1	81.8	81.3	79.9	86.9	79.3	88.5	90.3	92.8	93.4	92
4	79.5	75.2	78.3	79.4	79.7	79.4	78.6	86.2	78.5	86.5	87.9	91.8	92.5	91
5	79.9	74.8	78.8	79.9	79.6	79.0	78.7	85.2	78.0	86.1	87.2	91.1	91.9	92.
6	79.6	80.0	79.1	79.1	87.3	87.3	84.7	90.4	82.5	92.6	94.8	95.5	96.1	91.
7	80.3	75.6	78.4	80.1	82.0	81.5	79.8	87.2	79.8	88.8	90.3	93.3	94.0	90.
8	80.0	78.9	79.8	79.9	82.1	82.2	80.8	87.9	79.8	88.3	89.6	93.1	94.0	91.
9	80.0	77.3	79.2	79.9	81.7	81.5	80.2	87.9	80.0	88.3	89.8	93.4	94.3	94.
10	80.0	77.5	79.3	79.9	82.1	82.0	80.6	87.5	80.1	88.6	89.3	93.7	94.5	95.
11	79.8	76.4	78.9	79.3	85.0	85.0	83.2	91.1	82.3	91.4	92.5	95.7	96.6	94.
12	80.1	77.2	79.3	80.0	82.0	81.9	80.6	87.9	80.6	89.1	90.4	94.0	94.9	93.
13	80.1	74.8	78.3	80.0	81.0	80.4	79.2	87.0	79.3	87.9	89.9	92.9	93.7	93.
14	79.6	76.8	79.0	79.2	85.5	85.5	83.4	90.4	82.4	91.8	92.3	95.7	96.5	94.
20	79.8	76.7	78.9	79.4	85.6	85.7	84.1	91.3	82.7	91.7	95.0	96.0	96.9	96.
MEAN LEVEL	79.9	77.4	79.0	79.7	82.8	82.7	81.1	88.2	80.5	89.3	90.8	93.9	94.7	
RANGE	.8	5.2	1.5	1.0	7.7	8.3	6.1	6.1	4.7	6.5	7.8	4.9	5.0	
SD,N-1	.21	1.70	.45	.34	2.23	2.39	1.93	1.81	1.47	1.94	2.28	1.47	1.50	
MEAN DIFF	-12.9	-15.4	-13.8	-13.1	-10.0	-10.1	-11.7	-4.6	-12.3	-3.5	-2.0	1.1	1.9	
RANGE	6.0	7.2	5.9	6.2	8.7	9.3	7.6	6.4	5.9	7.5	9.0	5.4	5.2	
SD,N-1	1.66	2.14	1.68	1.75	2.38	2.51	2.05	1.81	1.68	2.13	2.34	1.65	1.62	

SOURCE

Author(s): Molino, J.

Title: NBS Study

Reference: Unpublished, 1976

STIMULI

Number and type of noises: five noises - octave band at 1 KHz, computer noise, ambient, Phi and cafeteria noise

Levels: Standard stimuli set at 3 OASPLs: 50, 60, and 70 dB.

Mode of presentation: Loudspeaker, reverberant room

Analysis: Third octave

JUDGMENTS

Attribute judged: loudness

Psychophysical procedure: tracking

Number of observers: 7

OTHER

Special features: Small corrections were made to the loudness levels to adjust for the difference between the observed matches and those of the ideal average listener.

Comments: Two standards used for the analysis: 1) Octave-band noise centered at 1 KHz
2) Phi noise

Loudness levels determined from matches to the octave-band noise. For this evaluation we assumed that at the same overall SPL an octave-band noise is as loud as a tone at 1000 Hz.

MUL :O OCTAVE AT 50 DB NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E*	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	
1	58.5	46.9	52.5	57.7	54.3	53.2	52.3	62.7	55.3	60.5	62.3	69.0	69.9	5[illegible]
2	45.3	43.6	43.6	44.7	50.6	50.7	48.9	57.9	51.9	56.1	57.7	62.2	63.3	5[illegible]
3	50.0	50.0	50.0	50.0	51.7	52.0	50.6	57.7	50.9	54.6	54.6	60.0	61.4	5[illegible]
4	48.3	43.7	46.6	48.2	49.3	48.9	47.8	56.4	50.7	54.8	56.0	62.9	63.9	5[illegible]
5	45.3	44.4	44.4	44.9	51.5	51.6	49.6	58.9	52.8	57.4	58.7	62.6	63.6	5[illegible]
MEAN LEVEL	49.5	45.7	47.4	49.1	51.5	51.3	49.8	58.7	52.3	56.7	57.9	63.4	64.4	
RANGE	13.2	6.4	8.9	13.0	5.0	4.3	4.5	6.3	4.6	5.9	7.7	9.0	8.5	
SD,N-1	5.43	2.75	3.76	5.32	1.85	1.59	1.72	2.39	1.87	2.41	2.94	3.37	3.24	
MEAN DIFF	-.5	-4.3	-2.6	-.9	1.5	1.3	-.2	8.7	2.3	6.7	7.9	13.4	14.4	
RANGE	13.2	6.4	8.9	13.0	5.0	4.3	4.5	6.3	4.6	5.9	7.7	9.0	8.5	
SD,N-1	5.43	2.75	3.76	5.32	1.85	1.59	1.72	2.39	1.87	2.41	2.94	3.37	3.24	

MOLINO OCTAVE AT 60 DB NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	65.0	53.4	59.0	64.3	60.9	59.8	58.9	69.5	61.5	67.6	69.5	75.8	76.7	60.
2	53.8	52.1	52.1	53.2	59.1	59.2	57.4	66.7	59.8	65.2	66.8	71.5	72.4	60.
3	60.0	60.0	60.0	60.0	61.7	62.0	60.6	67.3	59.5	65.0	65.0	70.2	71.5	60.
4	55.1	50.5	53.4	55.0	56.1	55.7	54.6	64.1	57.9	62.3	63.5	70.3	71.3	60.
5	51.8	50.9	50.9	51.4	58.0	58.1	56.1	65.7	58.7	64.3	65.6	69.7	70.6	60.
MEAN LEVEL	57.1	53.4	55.1	56.8	59.1	58.9	57.5	66.7	59.5	64.9	66.1	71.5	72.5	
RANGE	13.2	9.5	9.1	12.9	5.6	6.3	6.0	5.4	3.6	5.3	6.0	6.1	6.1	
SD,N-1	5.35	3.88	4.15	5.28	2.24	2.28	2.34	1.99	1.35	1.93	2.24	2.50	2.42	
MEAN DIFF	-2.9	-6.6	-4.9	-3.2	-.9	-1.1	-2.5	6.7	-.5	4.9	6.1	11.5	12.5	
RANGE	13.2	9.5	9.1	12.9	5.6	6.3	6.0	5.4	3.6	5.3	6.0	6.1	6.1	
SD,N-1	5.35	3.88	4.15	5.28	2.24	2.28	2.34	1.99	1.35	1.93	2.24	2.50	2.42	

MOLINO OCTAVE AT 70 DB NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	
1	74.2	62.6	68.2	73.5	70.1	69.0	68.1	78.0	69.8	77.3	79.2	84.7	85.4	7
2	63.3	61.6	61.6	62.7	68.6	68.7	66.9	75.7	68.0	75.2	76.8	80.8	81.7	7
3	70.0	70.0	70.0	70.0	71.7	72.0	70.6	76.4	68.1	75.2	75.2	79.8	81.0	7
4	62.6	58.0	60.9	62.5	63.6	63.2	62.1	71.6	64.8	70.1	71.4	77.9	78.7	7
5	61.7	[illegible]	60.8	61.3	67.9	68.0	66.0	75.1	67.3	74.6	76.0	79.6	80.3	7
MEAN LEVEL	66.[illegible]	62.6	64.3	66.0	68.4	68.2	66.7	75.4	67.6	74.5	75.7	80.5	81.4	
RANGE	12	12.0	9.2	12.2	8.1	8.8	8.5	6.4	5.0	7.2	7.8	6.8	6.7	
SD,N-1	5.49	4.48	4.44	5.42	3.04	3.15	3.12	2.37	1.82	2.65	2.84	2.54	2.48	
MEAN DIFF	-3.6	-7.4	-5.7	-4.0	-1.6	-1.8	-3.3	5.4	-2.4	4.5	5.7	10.5	11.4	
RANGE	12.5	12.0	9.2	12.2	8.1	8.8	8.5	6.4	5.0	7.2	7.8	6.8	6.7	
SD,N-1	5.49	4.48	4.44	5.42	3.04	3.15	3.12	2.37	1.82	2.65	2.84	2.54	2.48	

MOLINO PHI AT 58 DB NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF
1	64.9	53.3	58.9	64.2	60.8	59.7	58.8	69.4	61.4	67.5	69.4	75.7	76.6
2	49.8	48.1	48.1	49.2	55.1	55.2	53.4	62.6	56.2	60.9	62.5	67.2	68.3
3	60.0	60.0	60.0	60.0	61.7	62.0	60.6	67.3	59.5	65.0	65.0	70.2	71.5
4	55.0	50.4	53.3	54.9	56.0	55.6	54.5	64.0	57.8	62.1	63.4	70.2	71.1
5	51.1	50.2	50.2	50.7	57.3	57.4	55.4	65.0	58.1	63.6	64.9	69.0	69.9
MEAN LEVEL	56.2	52.4	54.1	55.8	58.2	58.0	56.5	65.7	58.6	63.8	65.0	70.5	71.5
RANGE	15.1	11.9	11.9	15.0	6.6	6.8	7.2	6.8	5.2	6.6	6.9	8.5	8.3
SD,N-1	6.31	4.65	5.24	6.29	2.91	2.85	3.03	2.68	1.97	2.57	2.64	3.18	3.11
MEAN DIFF	-1.8	-5.6	-3.9	-2.2	.2	0.0	-1.5	7.7	.6	5.8	7.0	12.5	13.5
RANGE	15.1	11.9	11.9	15.0	6.6	6.8	7.2	6.8	5.2	6.6	6.9	8.5	8.3
SD,N-1	6.31	4.65	5.24	6.29	2.91	2.85	3.03	2.68	1.97	2.57	2.64	3.18	3.11

MOLINO PHI AT 68 DB NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKOF	L
1	71.5	59.9	65.5	70.8	67.4	66.3	65.4	75.5	67.4	74.5	76.3	82.1	82.9	68
2	59.8	58.1	58.1	59.2	65.1	65.2	63.4	72.5	65.0	71.5	73.2	77.5	78.4	68
3	70.0	70.0	70.0	70.0	71.7	72.0	70.6	76.4	68.1	75.2	75.2	79.8	81.0	68
4	61.6	57.0	59.9	61.5	62.6	62.2	61.1	70.6	63.9	69.1	70.3	76.9	77.8	66
5	59.3	58.4	58.4	58.9	65.5	65.6	63.6	72.8	65.2	72.1	73.4	77.2	78.1	68
MEAN LEVEL	64.4	60.7	62.4	64.1	66.4	66.2	64.8	73.6	65.9	72.5	73.7	78.7	79.6	
RANGE	12.2	13.0	11.9	11.9	9.1	9.8	9.5	5.8	4.2	6.1	6.0	5.2	5.1	
SD,N-1	5.86	5.32	5.19	5.86	3.38	3.55	3.58	2.35	1.76	2.46	2.29	2.23	2.25	
MEAN DIFF	-3.6	-7.3	-5.6	-3.9	-1.6	-1.8	-3.2	5.6	-2.1	4.5	5.7	10.7	11.6	
RANGE	12.2	13.0	11.9	11.9	9.1	9.8	9.5	5.8	4.2	6.1	6.0	5.2	5.1	
SD,N-1	5.86	5.32	5.19	5.86	3.38	3.55	3.58	2.35	1.76	2.46	2.29	2.23	2.25	

MOLINO PHI AT 78 DB NBS+STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	(
1	80.5	68.9	74.5	79.8	76.4	75.3	74.4	83.6	75.4	83.9	85.8	90.4	91.1	7
2	69.8	68.1	68.1	69.2	75.1	75.2	73.4	81.7	73.6	81.8	83.5	86.9	87.7	7
3	79.0	79.0	79.0	79.0	80.7	81.0	79.6	84.3	75.8	84.4	84.4	88.0	69.2	7
4	69.4	64.8	67.7	69.3	70.4	70.0	68.9	77.7	70.7	77.2	78.4	84.3	85.1	7
5	71.0	70.1	70.1	70.6	77.2	77.3	75.3	83.4	75.2	84.1	85.5	88.2	68.9	7
MEAN LEVEL	73.9	70.2	71.9	73.6	75.9	75.7	74.3	82.1	74.1	82.3	83.5	87.6	88.4	
RANGE	11.1	14.2	11.3	10.6	10.3	11.0	10.7	6.6	5.1	7.2	7.4	6.1	6.0	
SD,N-1	5.37	5.31	4.80	5.35	3.74	3.96	3.85	2.65	2.10	3.02	2.97	2.23	2.22	
MEAN DIFF	-4.1	-7.8	-6.1	-4.4	-2.1	-2.3	-3.7	4.1	-3.9	4.3	5.5	9.6	1[illegible].4	
RANGE	11.1	14.2	11.3	10.6	10.3	11.0	10.7	6.6	5.1	7.2	7.4	6.1	6.[illegible]	
SD,N-1	5.37	5.31	4.80	5.35	3.74	3.96	3.85	2.65	2.10	3.02	2.97	2.23	2.22	

SOURCE

Author(s): Pearsons, K.S., and Bennett, R. L.

Title: The effects of temporal and spectral combinations on the judged noisiness of aircraft sounds.

Reference: FAA report, 1969. Also, JASA, 1971, 49, 1076-1082.

STIMULI

Number and type of noises: 70 recordings of simulated and real aircraft spectra with and without tonal components.

Levels: 64-91 dB SPL overall

Mode of presentation: free field

Analysis: third octave

JUDGMENTS

Attribute judged: noisiness (acceptability)

Psychophysical procedure: PEST

Number of observers: 20

OTHER

Special features:

Comments:

EXP.I: duration 10 dB down from Max. was constant at 10 sec. Five spectra and six temporal patterns were used in 30 different combinations. Two spectra contained single pure tones.

EXP.II: Both duration and type of spectra were varied in 20 different combinations. Durations 10 dB down from Max. ranged from 1-100 secs. Some spectra contained single pure tones.

EXP.III: Twenty real aircraft sounds that varied in spectra, duration and temporal patterns.

PEARSONS+BENNETTEST1 NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	82.7	82.3	82.7	82.7	84.7	85.1	83.5	88.0	80.0	89.7	90.3	93.1	94.[illegible]
2	78.0	78.8	77.2	77.1	87.9	87.8	85.5	88.4	80.8	90.7	91.8	91.5	91.[illegible]
3	80.8	74.4	79.1	80.8	79.4	78.7	78.8	85.0	77.7	85.7	90.5	91.2	91.9
4	71.1	72.1	70.4	70.3	82.0	81.9	79.5	82.7	74.9	85.5	90.7	84.5	84.[illegible]
5	78.2	74.1	75.1	77.7	82.5	82.4	80.4	87.9	79.6	89.0	89.5	93.1	93.7
6	82.9	82.5	82.8	82.9	84.9	85.3	83.7	88.5	80.2	89.8	90.5	93.3	94.3
7	76.7	77.5	75.9	75.8	86.7	86.6	84.2	87.0	79.5	89.5	90.7	90.3	90.5
8	80.0	73.7	78.3	79.9	78.5	77.9	78.0	84.4	77.0	85.0	89.8	90.2	90.9
9	71.0	72.0	70.4	70.3	81.9	81.8	79.5	82.7	74.8	85.5	90.8	84.3	83.9
10	77.7	71.8	73.7	77.1	80.2	80.0	78.1	86.2	77.9	86.9	87.5	91.6	92.2
11	81.4	80.9	81.3	81.3	83.4	83.7	82.1	86.9	78.8	88.3	88.9	91.9	92.9
12	75.1	75.9	74.4	74.3	85.1	85.0	82.6	85.6	78.1	88.0	88.9	88.8	89.2
13	80.0	73.5	78.1	79.9	78.3	77.6	77.7	84.2	76.8	84.7	89.4	90.0	90.7
14	71.1	72.1	70.5	70.4	82.0	81.9	79.6	82.9	75.0	85.7	90.8	84.7	84.3
15	77.8	72.8	74.3	77.3	81.1	81.0	79.0	86.9	78.6	87.6	88.2	92.3	92.9
16	80.8	80.3	80.7	80.8	82.8	83.2	81.5	86.4	78.5	87.9	88.4	91.5	92.5
17	75.6	76.4	74.8	74.7	85.6	85.5	83.1	86.0	78.6	88.5	89.6	89.3	89.6
18	80.2	74.0	78.6	80.2	78.8	78.2	78.3	84.7	77.3	85.2	90.1	90.5	91.3
19	69.0	70.0	68.4	68.3	79.9	79.8	77.5	80.8	72.8	83.4	88.9	82.4	82.0
20	76.8	72.2	73.5	76.3	80.6	80.4	78.4	86.3	78.1	87.2	87.2	91.6	92.2
21	81.1	80.6	81.0	81.0	83.1	83.4	81.8	86.7	78.7	88.0	88.6	91.7	92.7
22	76.6	77.4	75.8	75.7	86.5	86.4	84.1	87.0	79.6	89.5	90.7	90.2	90.5
23	79.4	74.3	78.0	79.3	78.5	78.0	77.8	84.8	76.9	84.8	89.6	90.6	91.5
24	69.5	70.5	68.9	68.8	80.4	80.3	78.0	81.2	73.3	83.9	89.3	82.9	82.5
25	78.6	73.5	75.2	78.1	81.8	81.6	79.7	87.6	79.3	88.5	89.2	92.9	93.5
26	77.8	77.4	77.7	77.8	79.8	80.2	78.6	84.2	76.2	85.1	85.8	89.3	90.3
27	73.2	74.1	72.5	72.4	83.2	83.1	80.8	83.9	76.4	86.0	87.0	87.1	87.5
28	72.9	66.4	71.2	72.8	71.4	70.7	70.8	77.8	70.6	77.4	82.3	83.6	84.3

PEARSONS+BENNETTEST1 NBS+STATS 3-3-77

	NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
	29	65.6	66.6	64.9	64.9	76.5	76.4	74.0	77.9	69.7	80.1	85.2	79.2	70.9
	30	74.0	68.1	70.1	73.4	76.4	76.2	74.2	82.8	74.8	83.1	83.6	88.3	88.9
MEAN LEVEL		76.5	74.5	75.2	76.1	81.5	81.3	79.7	84.9	77.0	86.3	88.8	89.1	89.5
RANGE		17.3	16.1	17.9	18.0	16.5	17.1	14.7	10.7	11.1	13.3	9.5	14.1	15.4
SD,N-1		4.42	4.27	4.53	4.67	3.51	3.71	3.25	2.81	2.76	2.94	2.21	3.74	4.14

PEARSONS+BENNETT TEST2 NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	86.1	79.0	81.6	85.5	87.3	87.0	85.2	92.6	84.6	94.6	94.6	98.3	98.9
2	90.3	83.4	88.4	90.2	89.0	88.2	88.2	92.9	86.2	95.2	100.8	99.4	100.6
3	88.0	81.0	86.1	87.9	86.6	85.8	85.8	90.9	83.9	92.6	98.4	97.2	97.6
4	83.6	76.5	81.6	83.5	82.0	81.2	81.2	87.0	79.6	88.0	93.5	93.1	93.7
5	82.0	75.5	77.7	81.4	84.0	83.7	81.8	89.6	81.2	91.0	91.0	94.9	95.5
6	82.1	75.2	80.3	82.0	80.7	79.9	80.0	85.8	78.5	86.7	92.3	92.0	92.6
7	81.8	75.0	79.9	81.7	80.5	79.8	79.7	85.8	78.4	86.6	92.2	91.9	92.5
8	82.1	75.0	77.6	81.5	83.3	83.0	81.2	89.1	80.9	90.4	90.4	94.8	95.4
9	78.8	71.9	76.9	78.7	77.5	76.7	76.7	82.9	75.7	83.4	89.0	89.1	89.7
10	78.0	71.0	76.1	77.9	76.6	75.8	75.8	82.2	74.9	82.5	88.1	88.3	88.9
11	73.6	66.5	71.6	73.5	72.0	71.2	71.2	78.1	70.9	77.6	83.1	84.0	84.7
12	78.5	71.4	73.9	77.9	79.8	79.5	77.7	85.9	77.8	86.7	88.2	91.4	92.0
13	75.5	68.3	73.5	75.4	73.9	73.1	73.1	79.8	72.7	79.7	85.3	85.9	86.5
14	75.4	68.4	73.4	75.3	73.9	73.2	73.1	80.1	73.0	80.0	83.9	86.3	86.9
15	73.6	66.5	69.1	73.0	74.8	74.5	72.7	81.7	73.6	81.7	81.7	87.2	87.8
16	71.8	64.9	69.9	71.7	70.5	69.7	69.7	76.5	69.6	76.1	81.7	82.6	83.3
17	67.0	60.0	65.1	66.9	65.6	64.8	64.8	72.2	65.2	71.0	76.6	77.9	78.6
18	64.1	57.0	62.1	64.0	62.5	61.7	61.7	69.2	62.4	67.6	73.1	74.9	75.6
19	88.6	82.3	86.9	88.5	87.5	86.8	86.5	91.9	85.1	93.9	95.1	98.1	98.7
20	75.3	68.2	73.3	75.2	73.7	72.8	72.9	79.5	72.4	79.3	84.8	85.5	86.2
MEAN LEVEL	78.8	71.8	76.3	78.6	78.1	77.4	77.0	83.7	76.3	84.2	88.2	89.6	90.3
RANGE	26.2	26.4	26.3	26.2	26.5	26.5	26.5	23.7	23.8	27.6	27.7	24.5	24.4
SD,N-1	6.97	7.07	6.94	6.95	7.33	7.41	7.14	6.69	6.52	7.76	7.02	6.76	6.72

PEARSONS+BENNETT TEST3 NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	79.7	77.6	78.8	79.6	83.8	83.7	81.5	88.8	81.1	90.4	90.9	94.7	95.3
2	78.2	75.7	77.3	78.1	82.5	82.3	80.0	87.4	79.5	89.5	91.3	93.0	93.5
3	74.7	75.3	74.1	74.2	84.6	84.2	81.1	86.2	78.3	88.8	91.2	89.9	90.2
4	75.7	76.3	75.2	75.3	85.0	84.7	81.3	87.0	78.9	89.8	91.2	90.7	90.8
5	75.6	76.1	75.1	75.2	84.4	84.2	81.0	87.2	79.1	89.9	92.4	91.1	91.4
6	78.2	78.5	77.5	77.8	87.0	86.8	83.4	89.2	81.2	92.2	94.3	92.6	92.9
7	78.2	75.6	76.8	77.9	83.8	83.6	81.5	88.6	80.5	90.3	90.8	93.6	94.2
8	83.7	77.5	82.0	83.6	82.8	82.1	81.7	87.8	80.8	89.0	90.3	94.0	94.7
9	85.5	77.7	83.1	85.4	83.2	82.3	82.3	88.2	80.8	89.5	91.0	93.9	94.5
10	88.0	81.9	86.5	87.9	86.7	86.0	86.1	91.1	84.1	93.1	93.1	96.8	97.6
11	86.4	79.4	83.8	86.2	83.7	82.9	83.1	89.2	81.6	90.3	91.7	94.8	95.7
12	86.2	77.3	83.8	86.1	83.6	82.1	82.6	88.8	81.0	90.4	91.3	93.9	94.6
13	82.8	79.1	81.6	82.7	84.4	84.2	82.7	89.9	82.3	91.6	93.2	95.9	96.6
14	82.2	78.2	81.0	82.1	83.3	83.0	81.6	88.4	80.9	90.2	91.3	94.4	95.0
15	87.5	80.2	85.8	87.4	85.7	84.6	85.0	89.8	82.6	91.7	92.2	94.9	95.6
16	83.6	77.0	81.3	83.5	84.2	83.5	82.1	88.9	81.4	91.0	92.9	95.0	95.4
17	82.5	77.5	81.1	82.4	81.8	81.4	80.9	86.7	79.5	87.7	88.5	92.6	93.3
18	90.5	79.1	87.5	90.4	86.7	84.6	85.7	90.6	83.0	92.2	92.9	94.2	94.8
19	86.2	79.4	84.3	86.1	85.1	84.2	83.9	90.3	82.9	91.7	92.4	96.0	96.7
20	87.0	79.2	84.9	86.9	84.9	83.7	84.0	89.6	82.1	91.1	92.3	94.6	95.3
MEAN LEVEL	82.6	77.9	81.1	82.4	84.4	83.7	82.6	88.7	81.1	90.5	91.8	93.8	94.4
RANGE	15.8	6.6	13.4	16.2	5.2	5.4	6.1	4.9	5.8	5.4	5.8	6.9	7.4
SD,N-1	4.66	1.71	4.02	4.76	1.41	1.35	1.67	1.34	1.51	1.32	1.28	1.77	1.92

SOURCE

Author(s): Pearsons, K.S., Bishop, D.E. and Horonjeff, R.D.

Title: Judged noisiness of modulated and multiple tones in broad-band noise.

Reference: JASA, 1969, 45, 742-750. Also NASA report, 1968.

STIMULI

Number and type of noises: over 100 - octave band noises plus tones, single and multiple tones in broad-band noise, and single tones

Levels: 59-110 dB SPL overall

Mode of presentation: free field

Analysis: third octave

JUDGMENTS

Attribute judged: Test I - loudness and noisiness or acceptability
Tests II and III - acceptability

Psychophysical procedure: constant stimuli - standard sounds were either a jet, Noy, or octave-band noise

Number of observers: Test I - two groups of 20 Os each
Tests II and III - 20 Os each

OTHER

Special features:

Comments: Tests conducted with stimuli containing relatively strong discrete frequency components, i.e., S/N at + 25 dB as measured in 1/3 octave bands.

PEARSON ET AL. SER=I, INST=L, NOISE=NOY 3-8-77

NO.	0-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDI
2	90.1	81.6	88.8	90.1	88.6	87.2	87.9	90.9	83.4	93.1	96.4	93.8	94.[illegible]
3	88.0	84.6	87.6	88.0	87.7	87.9	88.0	92.9	85.4	94.4	101.1	95.8	96.7
4	87.4	87.1	87.3	87.4	87.4	87.3	87.3	93.8	84.4	93.4	100.1	95.1	97.[illegible]
5	82.9	83.0	82.4	82.7	89.7	89.7	86.0	92.5	83.7	95.1	101.8	94.5	94.[illegible]
6	76.4	75.6	75.2	75.9	85.4	85.2	83.0	88.3	79.8	90.6	96.2	90.7	90.7
MEAN LEVEL	85.0	82.4	84.2	84.8	87.7	87.5	86.4	91.7	83.3	93.3	99.1	94.0	94.7
RANGE	13.7	11.5	13.6	14.2	4.3	4.5	5.0	5.5	5.6	4.5	5.6	5.1	6.3
SD,N-1	5.45	4.31	5.62	5.67	1.59	1.61	2.06	2.16	2.11	1.72	2.64	1.99	2.5

PEARSON ET AL. SER=IIC, INST=A, NOISE=NOY 3-8-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
2	80.1	71.6	78.8	80.1	78.6	77.2	77.9	81.5	73.4	82.9	86.2	84.7	85.3
3	73.5	70.1	73.1	73.5	73.2	73.4	73.5	79.6	71.1	79.6	86.3	82.5	83.6
4	66.9	66.6	66.8	65.9	66.9	66.8	66.8	74.8	64.6	72.4	79.1	75.7	77.6
5	62.4	62.5	61.9	62.2	69.2	69.2	65.5	73.8	64.2	74.3	81.0	75.1	75.5
6	58.9	58.1	57.7	58.4	67.9	67.7	65.5	72.4	63.3	72.8	78.4	73.7	74.0
MEAN LEVEL	68.4	65.8	67.6	68.2	71.1	70.9	69.8	76.4	67.3	76.4	82.2	78.3	79.2
RANGE	21.2	13.5	21.1	21.7	11.7	10.4	12.4	9.1	10.1	10.5	7.9	11.0	11.3
SD,N-1	8.53	5.53	8.48	8.71	4.80	4.33	5.60	3.93	4.58	4.62	3.83	4.91	4.98

SOURCE

Author(s): Pearsons, K. S. and Wells, R.J.

Title: Judged noisiness of sounds containing multiple pure tones.

Reference: Paper presented at 78th ASA, 1969

STIMULI

Number and type of noises: 28 broadband and multiple tone stimuli (19 used in analyses)

Levels: GE: 78-92 dB SPL overall; BBN: 81-90 dB SPL overall

Mode of presentation: free field

Analysis: third octave

JUDGMENTS

Attribute judged: noisiness

Psychophysical procedure: adjustment - standard stimulus was a broadband noise. The comparison sounds were varied.

Number of observers: two groups: BBN - 20
GE - 30

OTHER

Special features: multiple tonal components

Comments: The stimuli were constructed sounds that were representative of high by-pass ratio turbofan engine noises. GE and BBN data were in good agreement.

PEARSONS &
WELLS, 1969 (BBN) NOISE 1-19

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	88.7	88.4	88.1	88.6	93.1	93.3	90.5	96.7	88.4	99.1	99.1	101.8	102.4
2	87.5	87.1	86.7	87.3	91.9	92.1	89.3	95.8	87.4	98.1	98.1	101.0	101.6
3	86.1	85.5	85.3	85.9	90.3	90.4	87.7	94.4	85.9	96.5	97.1	99.7	100.4
4	86.0	85.7	85.3	85.8	90.7	90.8	88.0	94.5	86.0	96.7	96.7	99.8	100.4
5	85.8	85.0	85.0	85.7	89.1	89.2	86.9	93.6	84.8	95.1	95.6	99.1	99.8
6	86.7	86.2	85.9	86.5	91.3	91.5	88.7	95.2	86.8	97.5	96.5	100.7	101.3
7	86.0	85.5	85.2	85.8	90.5	90.7	87.9	94.6	86.1	96.8	96.8	100.0	100.6
8	90.3	87.9	89.3	90.2	91.7	92.2	90.3	97.6	89.3	99.9	103.2	102.3	103.2
9	87.1	85.2	86.2	86.9	89.2	89.6	87.4	95.0	86.5	97.2	100.2	99.8	100.7
10	87.2	85.1	86.2	87.0	89.0	89.5	87.4	94.9	86.4	97.1	100.3	99.8	100.6
11	83.0	82.8	82.2	82.7	90.2	89.9	86.8	92.8	85.2	95.9	99.0	97.7	98.0
12	82.4	82.3	81.6	82.1	89.8	89.5	86.4	92.5	84.9	95.6	98.3	97.3	97.6
13	81.5	81.5	80.8	81.2	89.3	89.0	85.9	91.9	84.2	95.0	98.2	96.4	96.8
14	83.8	84.1	83.0	83.3	91.8	91.9	89.5	94.5	86.3	96.5	99.9	98.7	98.9
15	81.7	82.0	80.9	81.2	89.7	89.7	87.2	92.5	84.2	94.4	97.5	96.9	97.1
16	81.4	81.7	80.6	80.9	89.5	89.5	87.0	92.3	83.9	94.1	97.5	96.6	96.8
17	82.4	82.6	81.4	81.8	91.5	91.3	88.5	92.7	85.2	95.7	97.7	97.0	97.3
18	82.4	82.7	81.4	81.8	91.5	91.3	88.4	92.6	85.2	95.6	97.6	97.0	97.3
19	80.9	81.2	79.9	80.3	89.9	89.7	86.8	91.2	83.6	94.1	96.2	95.7	95.9
MEAN LEVEL	84.8	84.3	84.0	84.5	90.5	90.6	87.9	94.0	85.8	96.4	98.3	98.8	99.3
RANGE	9.4	7.2	9.4	9.9	4.1	4.3	4.6	6.4	5.7	5.8	7.6	6.6	7.3
SD,N-1	2.82	2.22	2.83	2.96	1.18	1.22	1.27	1.72	1.49	1.58	1.77	1.95	2.16

PEARSONS &
WELLS GE NOISES NBS STATS 3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKD
1	90.8	90.5	90.2	90.6	95.3	95.4	92.7	98.6	90.8	101.4	101.4	104.0	104.
2	84.4	83.8	83.6	84.2	89.5	89.5	86.8	92.9	85.0	95.2	95.2	99.1	99.[illegible]
3	84.1	83.4	83.2	83.8	89.0	89.1	86.4	92.7	84.6	94.8	94.8	98.8	99.[illegible]
4	84.5	84.0	83.8	84.3	89.8	89.8	87.2	93.1	85.1	95.2	96.5	99.3	99.[illegible]
5	83.2	82.5	82.3	83.0	87.9	88.0	85.3	91.8	83.5	93.8	95.0	97.9	98.5
6	83.9	83.5	83.4	83.8	89.1	89.1	86.5	92.6	84.6	95.0	96.1	98.7	99.3
7	83.5	82.9	82.8	83.3	88.5	88.5	85.9	92.1	84.1	94.3	95.5	98.3	98.9
8	92.2	89.1	91.3	92.1	92.7	93.0	91.9	98.1	90.5	100.5	103.2	103.7	104.6
9	87.8	87.0	87.2	87.6	90.8	91.5	88.7	96.7	88.1	98.9	102.8	100.6	101.4
10	88.3	87.5	87.8	88.2	91.4	92.1	89.3	97.2	88.6	99.5	103.4	101.1	101.9
11	85.1	85.6	84.7	84.9	92.9	92.7	89.5	95.0	87.7	98.4	101.9	99.4	99.6
12	83.1	83.5	82.7	82.9	91.0	90.8	87.6	93.3	85.8	96.5	100.3	97.8	98.0
13	83.0	83.2	82.5	82.8	90.4	90.2	87.0	92.9	85.4	96.0	99.6	97.7	97.9
14	81.6	82.3	81.1	81.2	90.1	90.1	87.6	92.3	84.1	94.3	98.1	96.6	96.7
15	78.7	79.3	78.1	78.2	87.1	87.2	84.7	89.7	81.3	91.4	95.1	94.0	94.1
16	78.2	78.8	77.7	77.8	86.6	86.6	84.0	89.0	80.6	90.7	94.0	93.6	93.7
17	83.7	84.4	83.0	83.1	93.1	92.9	90.2	93.7	86.2	96.6	98.3	97.8	98.0
18	78.8	79.5	78.1	78.2	88.2	88.1	85.4	89.2	81.6	91.9	92.8	93.5	93.7
19	77.9	78.6	77.2	77.3	87.3	87.2	84.6	88.3	80.7	90.9	92.3	92.6	92.9
MEAN LEVEL	83.8	83.6	83.2	83.5	90.0	90.1	87.4	93.1	85.2	95.5	97.7	98.1	98.6
RANGE	14.3	11.9	14.1	14.8	8.7	8.8	8.7	10.3	10.2	10.7	11.1	11.4	11.7
SD,N-1	3.95	3.30	3.95	4.09	2.32	2.36	2.43	2.97	3.01	3.15	3.62	3.13	3.35

SOURCE

Author(s): Quietzsch, G.

Title: Objektive und Subjektive Lautstärkemessungen.

Reference: Acustica, 1955, Akust.Beih. 1, 49-66.

STIMULI

Number and type of noises: 37 noises recorded from a variety of sources

Levels: 47 - 98 dB SPL overall

Mode of presentation: 27 noises in free field; 10 noises through loudspeakers in diffuse field

Analysis: one octave

JUDGMENTS

Attribute judged: loudness

Psychophysical procedure: constant stimuli or adjustment
Standard: 1 KHz tone or a band of noise 900-1120 Hz wide

Number of observers: 20

OTHER

Special features:

Comments: Observers varied only the loudness of the 1 KHz tone or the narrow band of noise. The SPLs of the 37 comparison stimuli remained fixed.

QUIETZSCH NOISES FREE FIELD NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
2	98.5	89.4	92.6	97.5	93.7	93.2	92.2	98.5	91.3	101.4	104.1	105.6	106.4	98.
3	82.5	76.9	81.3	82.4	83.6	83.5	82.0	88.8	81.0	90.6	93.1	95.4	96.0	88.
5	97.1	93.1	95.2	96.8	99.2	99.1	97.4	103.5	96.7	106.5	109.8	109.2	110.0	103.
7	86.3	78.6	81.7	85.7	83.9	83.5	81.8	89.9	81.8	91.7	94.4	96.8	97.4	91.
9	82.9	82.5	82.3	82.7	88.1	88.2	85.4	92.0	84.0	94.4	97.7	97.8	98.4	92.
10	92.0	89.6	90.4	91.6	96.2	96.1	93.8	99.9	92.9	102.9	106.2	105.8	106.4	101.
11	95.5	94.1	95.0	95.4	100.0	100.0	97.9	103.2	96.6	106.3	109.6	108.7	109.5	105.0
12	77.5	67.6	73.4	77.0	73.3	72.0	72.3	80.4	72.9	79.8	82.0	86.8	87.7	84.5
14	69.9	69.7	69.6	69.7	75.4	75.4	73.2	79.8	72.9	80.4	83.3	86.1	86.9	82.0
15	98.6	87.6	95.0	98.3	94.6	92.8	93.5	99.1	92.5	101.8	105.1	104.6	105.4	103.0
17	69.8	69.1	69.4	69.7	73.4	73.6	71.2	79.4	71.5	80.0	82.2	85.0	85.7	83.0
18	95.8	92.6	95.0	95.8	97.5	97.4	96.0	101.6	94.7	104.6	108.0	107.3	106.0	105.5
19	61.5	60.6	61.0	61.3	66.1	66.3	64.2	72.3	65.9	72.0	74.5	78.4	79.3	76.0
20	94.7	88.0	92.1	94.4	94.4	93.8	92.8	98.8	92.1	101.7	105.0	105.3	106.0	104.0
21	94.1	68.2	83.2	92.8	82.2	76.7	78.4	87.1	76.9	87.6	90.5	94.2	94.9	92.0
22	61.9	60.6	60.7	61.6	68.0	67.8	65.1	73.8	66.4	73.5	75.9	79.4	80.0	78.0
23	63.6	61.0	61.8	63.2	67.9	67.9	66.0	75.3	67.7	74.2	76.8	80.8	81.7	80.5
26	62.1	61.7	60.9	61.6	70.1	69.9	67.2	74.8	67.2	74.9	77.5	79.9	80.4	79.5
27	65.5	63.1	63.4	65.0	69.2	69.2	67.1	75.9	68.5	75.1	77.8	82.1	83.0	82.0
28	74.7	74.7	73.0	72.9	83.1	83.6	82.7	85.7	77.0	86.2	89.6	86.0	87.0	82.0
29	71.0	71.0	71.0	71.0	74.4	74.7	72.4	78.8	70.9	79.7	83.1	84.0	84.6	86.0
30	55.6	56.5	55.2	55.2	63.9	63.9	61.0	66.2	59.3	66.2	72.8	69.8	70.1	69.0
31	54.9	54.6	54.1	54.5	61.7	61.6	58.8	67.0	60.3	66.4	68.3	72.5	73.2	73.5
32	52.8	52.3	52.5	52.8	56.3	56.6	54.0	62.4	55.2	61.8	64.9	67.4	68.1	71.0
33	70.5	71.3	70.4	70.3	76.6	76.9	73.5	79.4	71.1	81.1	84.8	83.4	83.7	86.0
36	65.9	65.3	65.5	65.6	69.7	70.1	69.2	77.1	69.1	75.7	78.7	81.7	83.0	87.0
37	75.2	75.0	73.3	73.2	83.2	83.9	83.2	86.0	77.0	86.3	89.6	85.3	86.5	87.5

QUIETZSCH NOISES FREE FIELD NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF
MEAN LEVEL	76.7	73.2	74.8	76.2	79.5	79.2	77.5	84.3	76.8	85.3	88.4	89.6	90.4
RANGE	45.8	41.8	42.7	45.5	43.7	43.4	43.9	41.1	41.5	44.7	44.9	41.8	41.9
SD,N-1	15.01	12.77	13.99	14.97	12.67	12.52	12.90	12.07	12.17	13.41	13.46	12.51	12.52
MEAN DIFF	-11.1	-14.6	-13.0	-11.6	-8.3	-8.6	-10.3	-3.5	-11.0	-2.5	.5	1.8	2.5
RANGE	23.2	16.5	16.1	22.2	18.4	18.5	18.5	13.6	12.9	15.5	15.9	12.9	12.4
SD,N-1	5.83	4.15	4.39	5.69	4.00	4.25	4.21	3.07	3.16	4.04	4.24	3.28	3.23

QUIETZSCH NOISES NBS+STATS 3-11-77

NO.	O-A	A	B	C	D1	D2	E#	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	75.0	65.6	72.1	74.8	71.6	70.2	70.9	76.4	69.2	75.9	78.[illegible]	31.8	62.7	74.
4	54.8	50.0	53.8	54.7	54.1	53.9	53.7	61.0	54.7	59.0	61.3	65.9	66.9	60.
6	53.0	43.6	50.1	52.8	49.6	48.2	48.9	54.2	48.5	52.2	53.6	59.5	60.7	53.
8	53.8	49.1	52.9	53.8	53.1	52.8	52.8	59.4	53.3	57.5	59.3	63.9	65.0	60.
13	49.2	42.9	47.7	49.1	47.5	46.8	47.2	52.2	47.3	50.7	52.0	57.4	58.7	53.
16	48.9	37.7	45.4	48.7	45.0	43.1	43.8	46.9	42.2	46.6	48.1	54.5	55.4	49.
24	49.1	44.7	47.7	49.1	49.2	48.9	47.9	56.0	50.1	54.5	55.9	62.2	63.1	61.
25	57.3	57.2	56.5	56.7	65.0	65.1	63.1	71.3	63.9	69.9	72.5	75.7	76.5	74.
34	51.9	52.1	50.6	50.5	60.5	60.8	59.4	66.4	58.6	64.5	67.0	68.3	69.3	66.
35	47.4	42.6	44.5	46.9	49.9	49.7	47.8	56.9	50.8	55.2	56.8	62.5	63.4	62.
MEAN LEVEL	54.0	48.5	52.1	53.7	54.6	54.0	53.6	60.1	53.9	58.6	60.5	65.2	66.2	
RANGE	27.6	27.9	27.6	27.9	26.6	27.1	27.1	29.5	27.0	29.3	30.4	27.3	27.3	
SD,N-1	7.99	8.19	7.96	8.03	8.52	8.70	8.47	9.01	8.12	9.07	9.55	8.32	8.23	
MEAN DIFF	-7.5	-13.0	-9.4	-7.8	-6.9	-7.5	-7.9	-1.4	-7.6	-2.9	-1.0	3.7	4.7	
RANGE	17.7	11.0	15.6	18.1	9.7	8.5	11.1	7.5	6.7	8.7	9.7	7.3	7.3	
SD,N-1	6.72	3.76	6.27	6.99	3.32	2.90	3.77	2.50	2.53	2.58	2.83	2.48	2.52	

SOURCE

Author(s): Rademacher, H.

Title: Die Lautstärke von Kraftfahrzeuggeräuschen.

Reference: Acustica, 1959, 9, 93-108

STIMULI

Number and type of noises: 24 motorcycle noises

Levels: 71-87 dB SPL overall

Mode of presentation: outdoors in open air (free field)

Analysis: one octave (non-standard frequencies)

JUDGMENTS

Attribute judged: loudness and annoyance

Psychophysical procedure: category estimations of loudness and a rating scale from 1-8.

Number of observers: 20 - 25

OTHER

Special features:

Comments: Loudness and annoyance produce very similiar results.

RADEMACHER NOISES NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	81.0	77.2	80.4	81.0	82.2	82.3	81.2	86.6	79.2	87.8	89.9	92.8	93.3	83.
2	79.1	76.2	78.3	79.0	82.6	82.4	80.5	87.2	79.9	88.9	91.6	93.7	94.3	83.
3	84.1	78.7	82.8	84.1	84.8	84.2	83.3	88.5	81.6	90.5	92.5	95.8	96.3	86.
4	87.2	80.1	85.0	87.0	86.2	85.4	84.9	90.6	83.5	92.3	94.5	97.4	97.8	86.
5	88.9	80.3	85.9	88.7	87.1	86.1	85.5	91.3	84.4	93.4	95.6	98.5	98.9	89.
6	83.7	79.6	81.9	83.6	85.1	84.8	83.2	89.6	82.3	91.6	93.9	96.7	97.2	89.
7	89.6	81.7	87.8	89.6	88.0	86.9	87.2	91.4	84.6	93.7	95.9	97.4	97.8	88.
8	83.0	82.2	82.3	82.8	90.2	89.9	87.1	92.5	85.1	95.3	98.4	98.4	98.6	88.
9	91.0	86.1	89.4	90.9	92.7	92.3	90.8	95.9	89.0	99.0	101.5	102.8	103.1	96.
10	95.8	90.1	94.7	95.8	94.9	94.5	94.6	98.2	91.9	100.7	102.8	103.0	103.6	96.
11	89.6	85.2	87.7	89.5	92.8	92.4	90.2	95.9	88.9	99.0	102.0	102.3	102.5	96.
12	94.6	89.8	93.6	94.5	94.5	94.2	93.9	98.3	92.0	100.9	103.3	103.8	104.3	96.
13	82.0	79.5	81.1	81.8	87.8	87.4	85.0	90.0	82.5	92.7	95.6	96.1	96.2	89.
14	89.4	80.9	86.9	89.3	87.3	86.2	86.2	91.6	84.8	93.8	95.8	98.1	98.5	89.
15	84.4	79.7	83.0	84.3	86.2	85.7	84.2	89.7	82.6	92.0	94.6	96.9	97.2	91.
16	91.9	78.6	87.4	91.6	86.9	84.7	85.3	91.6	84.1	93.4	95.6	97.2	97.6	91.
17	87.4	79.5	85.3	87.3	86.2	85.0	84.8	90.5	83.4	92.6	94.8	97.1	97.5	90.0
18	92.0	79.9	88.3	91.8	87.5	85.4	86.4	91.0	84.2	93.1	95.1	96.3	96.9	90.0
19	86.2	83.3	85.1	86.0	91.2	90.9	88.5	94.0	86.7	96.9	100.0	100.0	100.2	94.0
20	94.2	85.6	90.9	93.9	91.3	90.4	90.2	95.8	89.2	98.1	100.5	102.5	103.0	94.0
21	84.7	70.3	80.0	84.4	79.4	76.8	77.6	84.8	76.6	85.5	87.0	90.2	90.6	83.0
22	78.9	72.7	77.4	78.8	78.2	77.6	77.3	83.5	76.3	84.1	86.5	89.6	90.1	83.0
23	87.0	81.6	84.8	86.8	87.1	86.7	85.4	91.0	84.1	93.4	96.7	98.6	99.0	91.0
24	92.8	83.0	90.6	92.8	90.4	88.6	89.3	94.0	87.1	96.5	98.3	99.3	99.8	91.0

RADEMACHER NOISES NBS STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF
MEAN LEVEL	87.4	80.9	85.4	87.3	87.5	86.7	85.9	91.4	84.3	93.6	95.9	97.7	98.1
RANGE	16.9	19.8	17.3	17.0	16.7	17.7	17.3	14.8	15.7	16.8	16.8	14.2	14.2
SD,N-1	4.85	4.56	4.55	4.84	4.31	4.52	4.36	3.81	4.10	4.35	4.48	3.71	3.70
MEAN DIFF	-2.2	-8.8	-4.2	-2.4	-2.1	-3.0	-3.7	1.7	-5.3	3.9	6.3	8.0	8.4
RANGE	9.8	6.9	8.7	9.8	7.0	8.2	6.0	5.9	5.9	6.3	6.9	5.5	5.6
SD,N-1	3.19	2.15	2.64	3.18	1.77	2.02	1.90	1.63	1.68	1.62	1.65	1.63	1.67

SOURCE Author(s): Robinson, D. W. and Bowsher, J. M.

Title: A subjective experiment with helicopter noises.

Reference: J. Royal Aeron. Soc., 1961, 65, 635-637.

STIMULI

Number and type of noises: five helicopter and jet noises

Levels: 88 - 97 dB SPL overall

Mode of presentation: Loudspeaker listeining in a moderately reverberant room (diffuse field).

Analysis: third octave

JUDGMENTS

Attribute judged: Loudness and disturbance

Psychophysical procedure: paired comparisons

Number of observers: 558

OTHER

Special features:

Comments: loudness and disturbance produce very similar results.

ROBINSON + BOWSHER EQUALLY DISTURB NBS STATS 3-1-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	93.3	87.6	91.2	93.2	92.1	91.6	90.9	97.1	89.8	99.3	101.0	103.3	104.0
2	96.9	91.2	95.2	96.7	95.3	95.2	95.1	99.6	93.4	102.3	103.8	104.5	105.3
3	88.7	85.7	87.4	88.5	91.7	91.6	89.7	95.8	88.7	98.9	100.0	101.9	102.4
4	95.5	89.4	93.4	95.4	94.4	93.7	93.1	97.9	91.2	100.8	101.7	104.2	104.7
5	91.0	89.2	90.4	90.9	94.3	94.4	92.0	97.6	90.1	100.4	102.6	103.4	103.7
MEAN LEVEL	93.1	88.6	91.5	93.0	93.6	93.3	92.1	97.6	90.7	100.3	101.8	103.5	104.0
RANGE	8.2	5.5	7.8	8.2	3.6	3.6	5.4	3.8	4.7	3.4	3.8	4.5	5.3
SD,N-1	3.31	2.09	2.98	3.31	1.56	1.64	2.08	1.36	1.78	1.34	1.45	1.01	1.09

ROBINSON+BOWSHER EQUALLY LOUD NBS + STAT 3-1-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	93.3	87.6	91.2	93.2	92.1	91.6	90.9	97.1	89.8	99.3	101.0	103.3	104.0
2	95.7	90.0	94.0	95.5	94.1	94.0	93.9	98.4	92.2	101.1	102.6	103.5	104.3
3	88.6	85.6	87.3	88.4	91.6	91.5	89.6	95.7	88.6	98.8	99.9	101.8	102.3
4	94.1	88.0	92.0	94.0	93.0	92.3	91.7	96.6	89.8	99.3	100.3	103.0	103.5
5	90.7	88.9	90.1	90.6	94.0	94.1	91.7	97.3	89.8	100.1	102.3	103.1	103.5
MEAN LEVEL	92.5	88.0	90.9	92.4	93.0	92.7	91.5	97.0	90.0	99.7	101.2	102.9	103.5
RANGE	7.1	4.4	6.7	7.1	2.5	2.6	4.3	2.7	3.6	2.3	2.7	3.5	4.3
SD,N-1	2.82	1.66	2.48	2.82	1.11	1.26	1.57	.99	1.28	.89	1.18	.65	.74

SOURCE

Author(s): Spiegel, M.

Title: Prüfung verschiedener Lautstärkeberechnungsmethoden bei diffuser Beschallung.

Reference: Unpublished (apparently), 1960

STIMULI

Number and type of noises: 20 noises, type of sound unspecified

Levels: Overall = 45-67 dB SPL; LL = 64 phons
Overall = 70-84 dB SPL; LL = 85.5 phons

Mode of presentation: Diffuse Field

Analysis: third octave

JUDGMENTS

Attribute judged: Loudness

Psychophysical procedure: Adjustment-Matching noises in loudness to a critical band of noise centered on 1 kHz. (Noises Varied)

Number of observers: 10

OTHER

Special features:

Comments:

SPIEGEL AT 64PHONS NBS STATS 3-1-77

NO.	O-A	A	B	C	D1	D2	E#	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L
1	66.7	55.1	64.2	66.7	63.4	61.1	62.4	64.2	55.6	63.0	64.2	66.2	66.6	64
2	58.4	57.9	58.4	58.4	58.8	59.1	58.6	63.4	55.6	61.0	62.5	65.6	67.5	64
3	51.4	51.9	50.2	50.1	61.4	61.5	59.8	63.4	56.2	63.2	64.3	62.8	63.4	64
4	66.1	54.3	63.6	66.0	62.9	60.3	61.8	63.3	54.6	62.7	64.1	65.9	66.3	64
5	59.8	59.9	59.8	59.8	60.5	60.6	60.0	65.1	55.9	62.3	63.9	64.9	67.0	64
6	56.6	57.2	55.5	55.4	66.8	66.9	65.4	67.7	59.4	68.0	70.7	65.1	65.4	64
7	47.3	45.4	46.4	47.0	52.3	52.3	50.6	60.5	53.8	57.8	59.0	64.6	65.5	64
8	48.4	47.9	46.2	46.1	56.1	56.5	55.7	62.9	54.2	58.2	60.6	60.1	61.5	64
9	59.0	47.4	55.2	58.7	54.5	52.6	53.5	60.6	53.1	58.2	61.5	64.5	65.6	64
10	49.1	48.9	49.1	49.1	51.7	51.9	50.3	59.2	52.2	56.3	60.0	63.3	64.6	64
11	56.4	56.1	56.4	56.4	56.5	56.7	56.5	62.3	53.1	59.0	61.1	62.3	64.5	64
12	63.1	49.3	57.6	62.7	58.3	57.0	57.2	66.6	57.7	63.3	69.9	69.2	70.1	64
13	47.9	47.5	45.8	45.7	55.4	55.8	55.0	63.6	54.2	58.5	59.1	61.0	62.1	64
14	54.9	53.7	54.8	54.9	54.5	54.9	54.9	59.8	52.7	57.5	61.1	61.9	64.0	64
15	53.4	53.8	53.4	53.4	57.0	57.2	55.1	63.7	55.5	60.8	62.4	66.4	67.5	64
16	48.8	46.5	48.0	48.6	55.1	54.8	52.3	59.8	53.7	59.2	60.5	63.7	64.0	64
17	45.5	41.9	42.5	44.4	49.8	50.0	49.5	58.5	50.9	53.1	54.2	57.7	59.0	64.
18	58.6	52.0	57.2	58.6	56.8	56.0	56.6	60.6	54.2	58.5	59.6	64.8	66.2	64.
19	47.2	47.8	46.5	46.4	55.7	55.7	53.6	61.6	53.7	59.1	61.1	63.0	63.7	64.
20	52.6	50.4	51.1	51.9	59.2	59.5	58.4	63.4	55.9	61.9	64.3	64.5	65.4	54.
MEAN LEVEL	54.6	51.2	53.1	54.0	57.3	57.0	56.4	62.5	54.6	60.1	62.2	63.9	65.0	
RANGE	21.2	18.0	21.7	22.3	17.0	16.9	15.9	9.2	8.5	14.9	16.5	11.5	11.1	
SD,N-1	6.44	4.72	6.17	6.84	4.19	3.97	4.22	2.44	1.94	3.22	3.66	2.53	2.43	
MEAN DIFF	-9.4	-12.8	-10.9	-10.0	-6.7	-7.0	-7.6	-1.5	-9.4	-3.9	-1.8	-.1	1.0	
RANGE	21.2	18.0	21.7	22.3	17.0	16.9	15.9	9.2	8.5	14.9	16.5	11.5	11.1	
SD,N-1	6.44	4.72	6.17	6.84	4.19	3.97	4.22	2.44	1.94	3.22	3.66	2.53	2.43	

SPIEGEL AT 85.PHONS NBS + STATS 3-2-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	LL
1	81.2	69.6	78.7	81.2	77.9	75.6	76.9	77.7	70.1	79.1	81.9	80.2	80.5	85.
2	83.9	83.4	83.9	83.9	84.3	84.6	84.1	86.1	78.5	86.8	88.9	88.9	90.6	85.
3	75.4	75.9	74.2	74.1	85.4	85.5	83.8	84.8	77.7	87.6	90.7	85.5	86.0	85.
4	82.6	70.8	80.1	82.5	79.4	76.8	78.3	79.0	71.6	81.0	87.6	82.3	82.7	85.
5	82.8	82.9	82.8	82.8	83.5	83.6	83.0	85.7	77.2	85.5	87.9	86.4	88.5	85.
6	75.6	76.2	74.5	74.4	85.8	85.9	84.4	84.5	77.0	87.2	92.1	82.9	83.1	85.
7	69.3	67.4	68.4	69.0	74.3	74.3	72.6	81.1	73.4	80.8	82.0	86.2	87.0	85.
8	70.0	69.5	67.8	67.7	77.6	78.0	77.2	82.7	73.6	80.9	83.7	82.1	83.3	85.
9	78.7	67.2	75.0	78.4	74.4	72.5	73.4	79.8	71.6	80.0	83.7	84.1	84.8	85.
10	75.6	75.4	75.6	75.6	78.2	78.4	76.8	83.7	75.4	83.5	87.2	88.9	89.9	85.
11	79.9	79.6	79.8	79.9	79.9	80.1	79.9	83.1	74.6	82.7	85.3	84.0	86.3	85.
12	82.0	65.4	76.4	81.6	75.2	72.0	73.5	77.1	68.7	77.1	81.2	80.5	81.1	85.
13	71.9	71.5	69.8	69.7	79.4	79.8	79.0	84.7	75.5	82.9	86.3	83.6	84.7	85.
14	80.1	78.8	80.0	80.1	79.8	80.2	80.1	83.2	75.8	84.0	89.9	87.1	88.8	85.
15	78.4	78.8	78.4	78.4	82.0	82.2	80.1	85.6	77.0	86.1	88.4	89.6	90.6	85.
16	73.8	71.5	73.0	73.6	80.1	79.8	77.3	82.7	75.4	84.8	86.1	87.9	88.1	85.
17	70.5	66.9	67.5	69.4	74.8	75.1	74.5	83.3	73.4	80.7	83.0	84.3	85.2	85.
18	80.6	74.0	79.2	80.6	78.8	78.0	76.6	81.4	74.2	82.5	85.2	85.7	87.0	85.
19	72.7	73.3	72.0	71.9	81.2	81.2	79.1	83.9	75.8	84.9	88.8	86.8	87.5	85.
20	75.1	72.9	73.6	74.4	81.7	82.0	80.9	84.1	76.0	85.2	89.8	86.5	87.4	85.
MEAN LEVEL	77.0	73.6	75.5	76.5	79.7	79.3	78.7	82.7	74.6	83.2	86.5	85.2	86.2	
RANGE	14.6	18.0	16.4	16.2	11.5	13.9	11.8	9.0	9.8	10.5	10.9	9.4	10.1	
SD,N-1	4.62	5.28	4.85	5.13	3.46	4.09	3.55	2.60	2.59	2.90	3.17	2.72	2.95	
MEAN DIFF	-8.5	-11.9	-10.0	-9.0	-5.8	-6.2	-6.8	-2.8	-10.9	-2.3	1.0	-.3	.7	
RANGE	14.6	18.0	16.4	16.2	11.5	13.9	11.8	9.0	9.8	10.5	10.9	9.4	10.1	
SD,N-1	4.62	5.28	4.85	5.13	3.46	4.09	3.55	2.60	2.59	2.90	3.17	2.72	2.95	

SOURCE

Author(s): Wells, R. J.

Title: Jury ratings of complex aircraft noise spectra versus calculated ratings.

Reference: Paper presented at 80th Meeting of ASA, November, 1970

STIMULI

Number and type of noises: 30 Jet Aircraft sounds: 15 actual engine noises
15 filtered engine noises

Levels: 73-83 dB SPL overall

Mode of presentation: Free Field

Analysis: third octave

JUDGMENTS

Attribute judged: Annoyance

Psychophysical procedure: Adjustment - standard only adjusted

Number of observers: 35

OTHER

Special features: Noises contained single and multiple tonal components.

Comments: RC filter depressed the high frequency region, centered at about 3000 Hz, by as much as 15 decibels.

WELLS,1970 NOISES 1-30

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	77.1	75.8	76.0	76.8	82.8	82.7	80.4	87.8	79.9	89.4	91.0	93.5	94.1
2	77.8	74.6	75.7	77.4	81.7	81.7	79.9	88.0	79.7	88.6	89.7	93.4	94.1
3	74.8	73.5	73.2	74.2	81.7	81.7	79.6	86.8	78.4	88.1	89.6	91.5	92.1
4	77.4	74.5	75.0	76.8	82.5	82.5	80.6	88.0	79.6	89.3	90.8	93.2	93.9
5	74.8	75.1	74.2	74.4	81.8	82.1	79.5	86.4	77.5	87.5	90.9	90.7	91.4
6	77.5	78.0	77.1	77.2	83.5	84.1	81.1	88.6	79.4	90.1	94.1	92.1	92.7
7	77.9	77.7	77.2	77.6	83.8	83.9	81.6	88.4	80.2	89.9	91.3	93.9	94.6
8	76.2	76.2	75.4	75.8	83.2	83.2	80.1	88.0	79.0	89.8	93.6	91.3	91.9
9	73.8	74.3	72.8	72.9	83.2	83.1	80.6	85.6	77.5	87.8	90.2	88.8	89.3
10	73.4	74.0	72.5	72.4	82.5	82.6	80.3	85.2	77.0	87.0	89.8	88.2	88.8
11	72.8	73.2	71.7	71.7	82.1	82.0	79.7	85.1	77.1	87.0	89.0	88.4	89.0
12	72.6	73.3	71.9	71.9	83.0	82.6	79.6	85.2	77.4	87.9	91.9	87.8	88.1
13	72.6	72.9	71.3	71.3	81.2	81.5	80.2	85.4	76.8	86.4	88.9	87.3	88.0
14	74.6	73.4	72.9	73.8	80.7	80.9	79.1	87.2	78.0	87.0	89.8	91.0	91.8
15	77.7	72.7	73.9	77.0	81.2	81.0	78.9	87.1	78.5	87.8	89.6	91.8	92.5
16	80.4	74.8	77.6	80.1	80.6	80.4	79.2	87.9	80.1	88.4	89.7	93.9	94.7
17	83.1	74.8	79.2	82.7	81.1	80.7	80.1	89.0	80.7	88.7	88.7	94.5	95.4
18	79.9	73.1	76.1	79.4	80.6	80.5	79.3	88.0	79.5	88.4	89.8	93.2	93.9
19	82.7	73.8	78.1	82.2	81.2	80.8	79.9	88.6	80.1	88.9	90.1	94.2	95.1
20	76.0	73.4	73.9	75.5	79.9	80.1	78.1	86.5	77.9	87.1	90.2	91.5	92.3
21	78.2	75.7	76.1	77.8	81.4	81.8	79.5	88.3	79.1	89.4	93.1	92.8	93.5
22	77.6	73.6	75.2	77.2	79.3	79.2	77.8	87.1	78.5	86.7	88.0	92.3	93.2
23	79.4	74.3	76.3	79.0	81.1	81.0	79.0	88.3	79.2	89.3	93.0	92.6	93.4
24	74.0	72.3	71.6	72.9	80.7	80.8	79.2	86.6	77.2	86.2	88.4	89.2	90.0
25	73.0	72.4	71.1	71.4	80.4	80.6	79.4	86.7	77.2	85.3	88.0	88.3	89.2
26	72.6	71.8	70.7	71.1	80.1	80.2	78.7	86.0	76.7	85.6	87.4	88.6	89.4
27	73.3	71.9	71.3	72.3	80.7	80.6	78.5	85.7	77.3	87.2	90.4	89.4	90.1
28	73.3	72.5	71.3	71.6	80.4	80.8	79.9	86.4	77.0	86.2	88.6	88.3	89.3

WELLS,1970 NOISES 1-30

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
29	78.5	72.9	74.7	77.7	79.7	79.7	78.9	88.7	79.1	87.1	89.6	92.1	93.1
30	83.2	71.6	77.7	82.7	79.8	78.9	78.4	88.1	79.2	87.2	88.3	92.7	93.5
MEAN LEVEL	76.5	73.9	74.4	75.8	81.4	81.4	79.6	87.2	78.5	87.8	90.1	91.2	92.0
RANGE	10.6	6.4	8.5	11.6	4.5	5.2	3.8	3.9	4.0	4.8	6.7	7.2	7.4
SD,N-1	3.24	1.59	2.44	3.52	1.23	1.30	.86	1.19	1.20	1.32	1.68	2.22	2.27

Evaluation of Data on Subjective Effects of Noise
B. Scharf, R. Hellman, J. Bauer
EPA Contract WA 76-E213

SOURCE

Author(s): Wells, R. J.

Title:

Reference: Unpublished (about 1970)

STIMULI

Number and type of noises: 33 aircraft

Levels: 74-86 dB

Mode of presentation: free field (?)

Analysis: third octave

JUDGMENTS

Attribute judged: annoyance

Psychophysical procedure: adjustment

Number of observers: approximately 30

OTHER

Special features: spectra in 3 graphs; each group has equally annoying spectra

Comments:

WELLS,UNPUBL 1 NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKO
1	86.0	77.5	82.6	85.7	83.5	82.5	82.2	89.9	82.5	90.7	90.7	96.3	97.[illegible]
2	78.4	76.7	77.0	77.8	83.8	84.0	82.3	90.5	81.6	90.7	91.5	94.6	95.[illegible]
3	81.0	77.3	78.7	80.4	84.1	84.2	82.9	91.5	82.5	91.3	91.3	95.8	96.[illegible]
4	81.7	77.4	79.9	81.5	83.5	83.2	81.9	90.0	82.2	91.2	91.2	95.8	96.[illegible]
5	80.8	76.4	78.9	80.6	83.2	83.1	81.8	89.9	81.7	90.6	91.5	95.1	95.[illegible]
6	78.5	76.9	77.2	78.0	83.6	83.9	82.2	90.7	81.7	90.9	92.0	94.7	95.[illegible]
7	82.8	78.1	80.8	82.6	84.0	83.7	82.4	90.6	82.8	91.5	91.5	96.5	97.[illegible]
8	76.8	75.8	75.7	76.4	82.1	82.2	80.4	87.9	79.4	88.2	91.8	92.8	93.[illegible]
9	79.7	76.5	78.5	79.5	82.9	82.8	81.0	88.4	80.9	89.7	90.8	94.5	95.1
10	76.3	76.7	75.6	75.7	85.8	85.7	83.2	89.1	80.9	91.4	94.2	92.7	93.[illegible]
11	79.6	79.3	79.1	79.3	85.5	85.5	83.1	89.5	81.8	91.6	93.2	95.4	96.1
MEAN LEVEL	80.1	77.1	78.6	79.8	83.8	83.7	82.1	89.8	81.6	90.7	91.8	94.9	95.7
RANGE	9.7	3.5	7.0	10.0	3.7	3.5	2.8	3.6	3.4	3.4	3.5	3.8	4.3
SD,N-1	2.77	.93	2.13	2.86	1.06	1.11	.85	1.04	.97	.98	1.04	1.25	1.3

WELLS,UNPUBL 2 NBS+STATS 3-3-77

NO.	0-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	77.8	76.5	77.6	77.8	80.8	80.9	79.3	86.1	78.5	86.8	89.3	91.9	92.7
2	76.0	75.9	75.1	75.5	84.0	84.0	81.4	87.6	79.2	89.3	91.5	92.0	92.5
3	77.9	78.2	77.8	77.8	82.8	82.8	80.6	87.2	78.6	87.9	91.0	91.3	92.2
4	77.6	77.9	77.5	77.5	82.5	82.5	80.3	86.9	78.3	87.5	90.6	91.0	91.9
5	74.7	75.2	74.2	74.2	83.5	83.4	81.1	87.3	79.1	89.4	92.3	90.9	91.5
6	74.6	75.1	74.1	74.1	83.5	83.4	81.1	87.2	79.0	89.3	92.6	90.9	91.4
7	75.0	74.5	74.4	74.5	81.0	81.0	79.4	86.5	78.3	86.7	88.2	91.3	92.3
8	75.0	74.4	74.3	74.5	81.3	81.3	79.6	86.3	78.4	87.2	88.3	91.3	92.3
9	75.1	75.3	74.2	74.3	84.6	84.5	82.6	88.4	80.1	90.4	92.9	91.0	91.6
10	74.8	75.2	73.9	73.9	84.6	84.6	82.5	88.1	79.8	90.2	93.5	90.3	90.6
11	76.2	76.8	75.6	75.7	86.7	86.2	83.0	88.8	80.9	91.6	96.5	91.4	91.6
12	79.8	75.7	77.7	79.5	81.8	81.7	80.2	88.4	80.6	89.3	89.3	94.4	95.2
MEAN LEVEL	76.2	75.9	75.5	75.8	83.1	83.0	80.9	87.4	79.2	88.8	91.3	91.5	92.2
RANGE	5.2	3.8	3.9	5.6	5.9	5.3	3.7	2.7	2.6	4.9	8.3	4.1	4.4
SD,N-1	1.69	1.23	1.62	1.88	1.74	1.63	1.27	.87	.92	1.57	2.43	1.03	1.[illegible]

WELLS,UNPUBL 3 NBS+STATS 3-3-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKD[illegible]
1	77.1	77.7	76.3	76.3	86.2	86.1	83.8	88.6	80.8	90.6	90.6	93.0	93.[illegible]
2	77.8	78.4	77.2	77.2	86.0	86.0	83.4	88.5	80.7	91.0	93.8	92.8	93.[illegible]
3	78.1	78.4	77.5	77.6	86.2	86.1	83.3	89.4	81.3	91.7	93.6	93.9	94.[illegible]
4	76.3	76.6	76.0	76.0	83.3	83.2	80.9	87.1	79.2	88.6	90.0	92.1	93.[illegible]
5	79.3	78.4	79.0	79.2	83.3	83.3	81.5	87.7	80.3	89.1	92.2	93.7	94.[illegible]
6	76.9	77.5	76.4	76.5	84.8	84.8	81.7	88.8	80.2	90.9	95.0	92.0	92.7
7	76.8	75.6	75.4	76.1	83.3	83.5	81.6	88.8	80.2	89.3	91.5	92.9	93.7
8	74.1	74.6	73.3	73.3	83.7	83.6	81.4	87.4	79.2	89.5	92.5	90.4	90.9
9	76.9	76.4	75.7	76.0	84.6	84.7	82.8	89.4	80.9	90.6	92.1	93.4	94.2
10	77.0	76.2	75.9	76.3	83.7	83.8	81.9	89.1	80.6	90.0	92.0	93.7	94.5
MEAN LEVEL	77.0	77.0	76.3	76.4	84.5	84.5	82.2	88.5	80.3	90.1	92.3	92.8	93.5
RANGE	5.2	3.8	5.7	5.9	2.9	2.9	2.9	2.3	2.1	3.1	5.0	3.5	3.7
SD,N-1	1.33	1.32	1.50	1.48	1.24	1.20	1.00	.83	.70	.99	1.51	1.05	1.1[illegible]

SOURCE

Author(s): Wells, R. J.

Title: A new method for computing the annoyance of steady state noise versus perceived noise level and other subjective measures.

Reference: Paper presented at 77th Meeting of ASA, 1969.

STIMULI

Number and type of noises: 119 broad-band noises with tones, pure tones, octave bands, etc. (plus one standard noise)

Levels: 70-95 dB

Mode of presentation: anechoic room (Free Field)

Analysis: third octave

JUDGMENTS

Attribute judged: annoyance

Psychophysical procedure: adjustment; all sounds adjusted to match 16-noy contour noise

Number of observers: 30

OTHER

Special features: single and multiple tonal components

Comments:
- 12500-Hz tone and 1/10th octave band omitted from analysis
- some sounds with significant energy greater than 10,000 Hz should be omitted

WELLS 300 SERIES NOISES 1-20 NBS+STATS 3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKD
1	93.6	65.6	82.9	92.5	81.6	75.6	77.5	82.7	70.5	84.4	86.8	90.2	90.[illegible]
2	89.8	71.2	84.4	89.5	82.8	79.1	80.7	82.7	74.6	84.7	89.0	87.0	87.[illegible]
3	83.4	78.4	82.8	83.4	82.9	83.1	83.0	82.9	77.3	85.6	88.8	84.0	84.[illegible]
4	81.5	80.7	81.5	81.5	81.1	81.6	81.6	84.5	76.4	84.8	88.6	86.0	87.[illegible]
5	85.2	74.8	83.3	85.2	82.8	80.6	81.8	82.3	75.5	84.9	88.1	84.9	85.4
6	80.1	81.1	80.1	80.0	85.4	86.2	82.4	85.3	76.6	88.1	92.1	85.2	85.4
7	72.7	73.9	72.3	72.2	84.1	83.6	80.2	81.8	75.1	85.8	92.5	81.6	80.6
8	73.8	73.9	72.1	72.0	82.2	83.1	82.3	83.9	75.3	84.1	90.4	79.5	81.1
9	71.6	69.1	67.3	67.2	75.1	74.7	75.4	81.2	69.3	76.5	83.2	68.6	70.9
10	90.0	71.7	84.6	89.7	83.2	79.4	81.1	83.1	75.0	84.9	89.5	87.6	87.7
11	85.6	74.6	83.3	85.5	82.6	80.4	81.7	81.8	74.8	83.5	86.8	84.5	85.0
12	83.2	78.6	82.6	83.2	82.7	82.6	82.8	82.4	76.4	84.5	88.1	85.1	86.2
13	83.0	81.9	82.9	83.0	82.6	83.0	83.0	84.6	77.2	85.4	89.3	88.2	90.1
14	80.5	81.4	80.5	80.4	85.6	86.1	82.7	85.5	76.9	88.0	91.3	87.5	87.8
15	79.4	80.5	79.3	79.2	86.7	87.0	83.0	85.1	76.8	88.0	93.9	86.6	86.2
16	74.0	75.1	73.6	73.5	84.8	84.5	81.2	82.0	74.8	85.8	92.4	84.9	84.1
17	74.3	74.3	72.5	72.4	82.6	83.3	82.6	83.9	75.7	84.9	91.5	80.2	81.7
18	86.6	74.9	83.4	86.4	82.7	80.5	81.6	86.8	78.8	88.1	88.1	90.9	91.7
19	86.8	74.2	82.4	86.4	81.8	79.6	80.5	87.4	79.4	88.4	88.4	92.9	93.7
20	81.9	79.6	81.3	81.8	82.0	82.1	81.6	88.2	80.0	88.5	88.5	93.4	94.4
MEAN LEVEL	81.9	75.8	79.7	81.3	82.8	81.8	81.3	83.9	75.8	85.4	89.4	85.4	86.2
RANGE	22.0	16.3	17.3	25.3	11.6	12.3	7.6	7.0	10.7	12.0	10.7	24.8	23.5
SD,N-1	6.20	4.43	5.09	6.78	2.32	3.20	1.90	2.00	2.54	2.67	2.47	5.41	5.23

HELLS,300 SERIES NOISES 21-42 NBS+STATS 3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	79.5	76.3	78.0	79.3	80.4	80.4	79.0	87.3	79.4	87.5	87.5	93.4	94.3
2	74.5	74.4	73.9	74.2	81.4	81.4	78.7	85.7	78.0	87.2	87.2	91.2	91.8
3	77.6	74.3	75.9	77.4	79.6	79.5	77.7	86.3	78.7	86.8	86.8	92.4	93.2
4	93.0	74.5	87.6	92.7	86.1	82.3	84.0	86.4	78.4	88.4	92.1	90.3	90.4
5	80.0	76.0	80.3	80.8	80.4	80.8	80.5	80.7	74.8	83.2	86.2	81.7	82.6
6	82.0	81.1	82.0	82.0	81.6	82.1	82.1	85.1	77.1	85.5	89.5	86.7	88.6
7	84.4	73.5	82.4	84.4	81.8	79.4	80.8	80.8	73.7	83.3	86.8	83.7	84.3
8	90.7	71.7	85.1	90.4	83.5	79.7	81.3	83.6	75.4	85.6	89.8	87.5	87.6
9	83.4	78.9	82.9	83.4	83.0	83.2	83.1	83.5	77.7	86.0	90.0	84.9	85.9
10	79.6	78.8	79.6	79.6	79.0	79.6	79.6	82.5	74.2	82.6	88.2	83.3	85.5
11	86.2	75.0	84.0	86.1	83.3	81.0	82.3	83.1	76.2	85.6	89.7	85.8	86.4
12	76.2	77.2	76.2	76.1	81.2	82.2	78.4	81.8	72.6	84.3	90.5	80.8	81.4
13	77.6	78.7	77.5	77.4	85.0	85.2	81.2	83.9	75.8	87.1	90.3	85.2	84.9
14	71.1	72.3	70.7	70.6	82.7	82.1	78.7	80.2	73.4	84.2	90.8	80.2	79.0
15	80.5	81.4	80.5	80.4	85.3	86.1	82.6	86.4	77.6	89.0	92.3	86.6	87.1
16	73.3	74.5	73.2	73.1	81.2	81.3	77.3	80.5	72.1	83.7	88.3	79.5	79.2
17	74.0	75.2	73.7	73.6	85.2	84.7	81.3	83.0	76.3	86.9	93.6	84.1	83.2
18	74.3	74.3	72.5	72.4	82.5	83.4	82.7	84.9	76.3	85.1	91.0	80.4	81.9
19	74.1	73.0	71.2	71.1	79.6	80.1	80.6	85.2	75.5	81.8	87.0	73.9	76.6
20	71.5	71.4	69.6	69.5	79.1	80.4	79.8	82.0	73.2	82.0	86.7	75.8	77.8
21	75.3	73.9	72.1	72.0	80.6	81.0	81.4	85.9	76.4	82.8	89.1	76.5	78.9
22	80.9	69.6	75.7	80.3	76.1	74.7	74.6	84.0	76.5	83.2	83.2	90.3	91.2
MEAN LEVEL	79.1	75.3	77.5	78.5	81.7	81.4	80.3	83.8	75.9	85.1	88.9	84.3	85.1
RANGE	21.9	11.8	18.0	23.2	10.0	11.4	9.4	7.1	7.3	7.2	10.4	19.5	17.7
SD,N-1	5.86	3.07	5.13	6.35	2.42	2.39	2.22	2.15	2.04	2.11	2.41	5.40	5.14

WELLS P400 SERIES NOISES 1-30 NBS+STATS3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	81.8	70.5	78.4	81.5	78.1	76.0	76.9	85.0	76.0	85.8	88.2	90.2	91.0
2	81.5	72.4	77.6	81.0	77.7	77.3	77.1	85.6	77.0	86.2	88.5	90.7	91.6
3	86.6	70.1	81.0	86.2	79.9	76.8	77.9	87.1	77.6	87.7	90.4	91.8	92.4
4	77.4	71.1	73.4	76.9	75.9	76.1	73.6	84.0	74.2	84.4	89.0	88.3	89.2
5	76.6	66.7	71.3	76.0	75.1	74.2	72.2	82.2	73.4	82.9	87.8	87.6	88.2
6	79.0	72.5	75.1	78.5	74.9	74.5	74.5	84.2	74.7	83.4	88.9	88.9	90.1
7	79.3	68.4	73.9	78.7	75.0	74.3	73.9	84.4	75.3	83.4	86.2	89.4	90.4
8	79.1	69.3	73.5	78.2	75.5	74.5	74.9	86.6	75.4	83.7	86.6	88.3	89.4
9	73.8	69.4	70.2	73.3	76.0	76.0	72.5	81.8	71.9	82.7	88.8	85.2	85.8
10	82.7	71.1	77.9	82.2	77.9	76.2	76.5	85.7	77.3	86.0	87.0	91.5	92.4
11	81.6	72.3	77.4	81.2	77.9	77.0	76.7	85.8	78.0	85.9	86.7	91.9	92.9
12	83.3	71.8	78.5	82.9	78.5	76.9	77.0	86.7	78.1	86.8	87.9	92.1	93.0
13	80.7	71.6	76.7	80.3	77.5	76.6	76.0	85.4	77.5	85.4	87.0	91.3	92.2
14	81.6	71.5	77.1	81.1	77.9	76.7	76.4	85.7	77.9	85.4	87.2	91.8	92.6
15	82.0	73.2	78.1	81.6	78.5	77.5	77.4	86.5	78.5	86.0	87.6	92.4	93.3
16	81.1	71.7	77.3	80.7	77.7	76.6	76.6	85.8	77.9	85.2	86.1	91.4	92.4
17	81.2	71.8	77.3	80.8	77.9	76.7	76.8	87.0	77.9	85.3	86.2	91.4	92.3
18	79.1	69.9	74.9	78.6	76.1	75.2	74.4	84.1	75.9	84.2	86.8	89.8	90.6
19	82.3	71.3	80.1	82.2	79.5	77.2	78.5	82.8	74.0	84.0	87.4	87.0	87.7
20	77.9	71.8	76.3	77.7	76.4	76.6	76.3	82.5	74.1	83.1	86.5	86.3	87.2
21	85.9	67.5	80.2	85.5	78.7	75.1	76.6	83.9	74.2	84.5	87.8	88.5	89.0
22	71.8	68.4	68.7	71.3	72.6	73.4	69.9	79.4	63.9	79.5	86.1	82.5	83.4
23	68.7	61.0	63.6	68.1	70.6	69.8	67.0	76.2	67.0	76.5	83.2	80.6	81.1
24	74.7	70.5	72.1	74.3	71.6	71.7	71.7	80.3	70.2	78.9	85.6	84.0	85.4
25	73.3	62.1	67.0	72.5	69.2	69.1	68.7	79.5	69.5	77.7	81.0	83.3	84.5
26	75.8	67.5	69.9	74.6	73.5	72.8	73.3	84.7	72.8	81.0	84.4	84.7	85.8
27	69.9	69.5	68.5	69.5	76.2	76.2	72.3	78.4	68.6	80.0	86.6	80.1	80.4
28	80.1	68.2	75.6	79.7	75.4	73.5	74.0	83.4	74.5	83.5	85.2	88.9	89.8

WELLS P400 SERIES NOISES 1-30 NBS+STATS3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
29	80.2	69.9	75.5	79.6	75.6	74.8	74.6	84.0	75.6	84.0	85.8	89.6	90.6
30	85.0	70.1	79.3	84.5	78.4	75.9	76.6	86.6	77.1	86.9	88.6	91.5	92.3
MEAN LEVEL	79.1	69.8	74.9	78.6	76.2	75.2	74.7	83.8	74.7	83.7	86.8	88.4	89.2
RANGE	17.9	12.2	17.4	18.1	10.7	8.4	11.5	10.9	11.5	11.2	9.4	12.3	12.9
SD,N-1	4.44	2.78	4.30	4.53	2.61	2.12	2.79	2.77	3.21	2.79	1.84	3.55	3.60

WELLS 400 SERIES NOISES 31-60 NBS+STATS 3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
1	78.9	68.6	73.4	78.3	74.3	73.6	72.4	82.9	73.8	82.8	86.3	88.3	89.2
2	79.3	67.6	73.5	78.7	74.8	73.5	72.7	82.5	74.5	82.7	86.4	88.9	89.7
3	80.2	70.6	75.2	79.7	75.1	74.0	74.0	84.2	75.3	83.2	86.5	89.6	90.6
4	79.7	67.7	73.9	79.1	74.3	73.0	72.9	82.9	74.7	81.7	83.5	88.9	89.8
5	81.4	69.3	75.4	80.7	75.8	74.3	74.5	85.8	76.0	83.3	85.2	89.9	90.9
6	75.2	68.1	70.6	74.7	74.8	74.5	71.6	81.7	72.1	82.3	88.0	85.9	86.6
7	74.3	73.3	74.1	74.2	73.7	74.3	74.2	80.8	71.3	80.0	86.6	83.1	84.7
8	68.5	66.3	67.0	68.2	74.2	73.7	71.0	79.9	71.3	80.8	86.0	84.4	84.9
9	77.1	70.3	75.3	77.0	75.8	74.7	74.7	83.2	74.7	83.6	86.2	86.7	89.5
10	71.0	68.4	70.1	70.9	72.5	72.2	71.0	79.1	70.1	78.2	83.2	84.4	85.2
11	74.0	72.4	73.5	74.0	74.3	74.5	73.9	83.1	73.8	82.4	87.3	87.0	88.2
12	69.7	68.1	68.3	69.4	77.1	76.6	73.6	81.8	73.2	83.3	88.5	85.8	86.2
13	76.8	69.7	74.9	76.7	76.0	75.0	74.6	83.3	74.8	83.7	86.3	88.8	89.5
14	75.5	67.0	73.6	75.5	74.4	72.9	72.9	79.2	70.3	79.6	85.1	85.2	85.7
15	80.5	71.5	76.7	80.2	76.0	74.7	75.3	83.7	74.8	82.9	87.6	88.7	89.8
16	80.2	69.0	75.9	79.8	76.8	75.3	75.0	82.9	74.8	83.6	88.8	88.9	89.5
17	81.4	70.2	78.9	81.3	78.3	76.0	77.3	83.3	74.4	84.3	86.8	87.4	88.0
18	79.0	68.8	76.6	78.9	76.2	74.2	75.2	81.8	72.7	82.4	87.3	86.9	87.6
19	75.9	75.0	75.9	75.9	75.4	76.0	75.9	82.0	73.0	81.6	87.0	84.3	85.8
20	73.1	71.2	72.6	73.1	75.4	75.2	73.8	81.0	73.4	81.9	86.9	87.1	87.8
21	77.4	71.8	76.0	77.4	76.1	75.2	75.4	82.5	74.3	83.0	85.7	87.7	88.6
22	73.6	72.1	73.3	73.6	73.4	73.7	73.4	80.6	71.6	79.9	84.8	84.2	85.5
23	71.0	70.5	70.8	70.9	74.8	74.9	73.0	81.6	73.0	80.8	85.3	86.1	86.9
24	66.8	67.8	66.4	66.4	77.9	77.4	74.0	79.3	71.2	81.7	87.8	81.4	81.4
25	72.0	69.7	70.9	71.9	76.7	76.5	74.1	81.7	74.2	82.5	85.5	88.1	88.6
26	68.2	68.8	67.8	67.9	78.4	77.8	74.6	80.2	72.1	82.5	88.5	83.3	83.5
27	81.7	71.5	78.7	81.5	78.0	76.1	77.1	82.7	74.6	83.2	88.1	87.9	88.9
28	81.3	70.1	78.2	81.1	77.8	75.8	76.7	83.1	74.9	83.4	88.0	87.7	86.4

WELLS 400 SERIES NOISES 31-60 NBS+STATS 3-10-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWKFF	ZWKDF
29	85.8	74.9	83.8	85.8	83.2	80.8	82.2	85.1	77.0	86.9	90.2	86.2	88.7
30	84.8	74.1	82.8	84.8	82.2	79.9	81.2	84.6	76.4	86.3	90.6	88.1	86.9
MEAN LEVEL	76.5	70.1	74.1	76.2	76.1	75.2	74.6	82.2	73.6	82.5	86.8	86.8	87.6
RANGE	19.0	8.7	17.4	19.4	10.7	8.6	11.2	6.7	6.9	8.7	7.4	8.5	9.5
SD,N-1	4.97	2.29	4.12	4.96	2.33	1.91	2.48	1.70	1.76	1.80	1.79	2.18	2.26

SOURCE

Author(s): Wells, R. J.

Title: A subjective study of ultra high voltage transmission line noise.

Reference: Paper presented at the Second Arden House Workshop on Noise Control Engineering, January 1972.

STIMULI

Number and type of noises: 25 ultra high voltage transmission line noise

Levels: 58 - 78 dB SPL overall

Mode of presentation: free field

Analysis: third octave

JUDGMENTS

Attribute judged: annoyance

Psychophysical procedure: adjustment - broadband pink noise matched to various transmission line noises

Number of observers: 31

OTHER

Special features: spectral energy peaks in frequencies below 250 Hz

Comments: decibel levels are unspecified

WELLS UHV NOISES NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	
1	60.3	54.8	57.8	59.9	62.6	62.3	61.2	71.3	63.0	68.5	71.0	75.5	76.3	5
2	60.0	50.7	56.3	59.7	58.7	57.9	57.2	67.8	59.7	64.[illegible]	66.8	72.0	72.9	5
3	76.3	73.8	73.9	75.4	81.4	81.6	80.4	88.7	79.2	87.2	89.5	91.6	92.5	7
4	67.6	63.2	64.7	67.0	70.7	70.7	69.5	79.4	70.3	76.7	79.1	82.7	83.6	6
5	66.2	63.3	63.5	65.4	70.9	71.0	69.5	78.9	70.0	76.7	78.4	82.4	83.2	6
6	77.6	76.2	75.7	76.4	83.6	83.8	82.6	90.6	81.2	89.3	91.9	93.4	94.4	7
7	63.5	59.2	60.9	63.0	66.9	66.8	65.4	75.4	66.9	72.9	75.0	79.2	80.1	5
8	71.1	65.1	67.9	70.7	72.6	72.5	71.5	81.0	72.0	78.8	81.5	85.0	85.8	6
9	57.5	54.5	54.8	56.6	62.1	62.2	61.1	71.4	62.5	67.4	69.8	73.7	74.7	5
10	74.2	73.0	72.8	73.3	79.9	80.1	78.8	87.3	78.1	86.1	87.9	90.9	91.9	7
11	72.8	70.1	70.6	72.0	76.9	77.0	75.9	85.2	75.9	83.2	85.6	88.7	89.7	6
12	58.8	57.2	56.7	57.6	64.5	64.8	63.6	73.7	64.7	70.0	72.5	76.0	77.0	5
13	71.9	69.9	70.1	71.2	76.7	76.8	75.2	84.4	75.4	82.7	85.0	88.4	89.3	6
14	73.1	71.2	71.3	72.4	78.2	78.3	76.9	85.7	76.6	84.3	86.4	89.5	90.4	6
15	77.9	76.3	76.3	77.1	83.6	83.7	82.3	90.2	81.0	89.5	92.2	93.9	94.8	7
16	75.5	72.8	73.3	74.9	79.9	79.9	78.5	86.8	77.8	85.8	88.6	91.2	92.1	6
17	74.3	66.9	70.9	74.0	74.8	74.4	73.2	81.7	73.4	80.8	83.7	87.0	87.8	6
18	73.7	73.3	72.4	72.7	81.8	81.8	79.9	86.4	77.7	86.8	89.3	90.3	91.0	7
19	74.3	72.7	72.8	73.6	80.9	80.9	79.2	86.6	77.9	86.6	89.3	90.7	91.5	7
20	65.5	63.7	63.3	64.4	70.9	71.2	70.1	79.7	70.4	77.2	78.5	82.3	83.3	6
21	62.4	61.4	61.0	61.6	66.3	68.5	66.9	76.8	68.2	74.1	75.1	80.2	81.2	5
22	69.1	67.5	67.4	68.4	74.6	74.7	73.1	82.1	73.3	80.4	83.0	86.0	86.9	6
23	78.6	73.1	75.5	78.2	80.7	80.6	79.4	87.8	78.6	86.6	89.4	92.0	92.7	7
24	64.1	60.5	61.7	63.7	66.9	67.0	65.5	75.7	67.4	73.1	75.4	80.3	81.2	5
25	68.4	64.8	65.9	67.9	72.2	72.2	70.7	80.3	71.4	78.2	80.5	84.1	84.9	6

WELLS UHV NOISES NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF
MEAN LEVEL	69.4	66.2	67.1	68.7	73.6	73.6	72.3	81.4	72.5	79.5	81.8	85.1	86.0
RANGE	21.1	25.6	21.5	21.6	24.9	25.9	25.4	22.8	21.5	25.3	25.4	21.9	21.9
SD,N-1	6.45	7.26	6.65	6.43	7.24	7.33	7.22	6.34	6.10	7.28	7.40	6.43	6.42
MEAN DIFF	5.1	1.9	2.8	4.4	9.3	9.3	8.0	17.1	8.2	15.2	17.5	20.8	21.7
RANGE	4.7	6.6	3.4	5.4	6.3	7.1	6.2	4.7	4.5	6.0	6.1	5.1	5.1
SD,N-1	1.22	1.48	.88	1.43	1.31	1.49	1.32	1.07	.95	1.34	1.36	.91	.94

SOURCE

Author(s): Yaniv, S.

Title: Equal loudness contours for household appliances.

Reference: Unpublished, 1976

STIMULI

Number and type of noises: 11 Household appliances

Levels: standard stimuli set at three overall SPLs; 40, 50, and 60 dB.

Mode of presentation: Earphones

Analysis: third octave

JUDGMENTS

Attribute judged: Loudness

Psychophysical procedure: Adjustment - 1/3 octave band of noise at 1000 Hz served as a common reference to determine the loudness levels of the appliances.

Number of observers: 10

OTHER

Special features:

Comments: Both the comparison noises and the 1/3 octave band of noise were used as standard stimuli.

YANIV (ELCHA) 11 NOISES AT 40 DB SPL, NBS + STATS 3-15-77

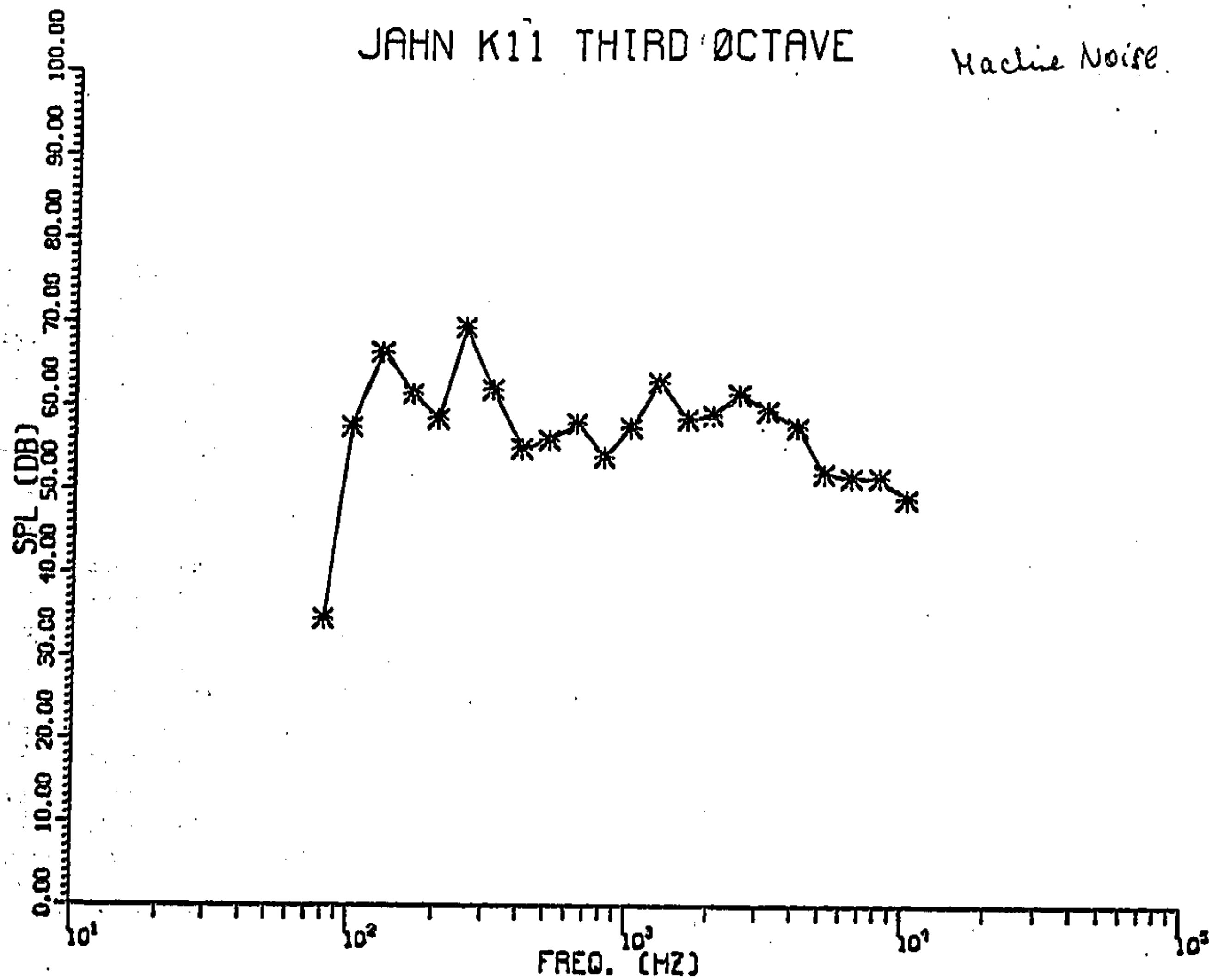
NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	L
1	40.0	31.7	36.2	39.2	36.2	35.4	35.5	31.3	34.4	36.1	36.8	44.4	46.2	40
2	39.9	40.6	39.7	39.7	47.4	47.3	43.6	49.7	44.9	50.2	51.9	52.7	53.1	46
4	40.0	30.8	35.3	39.0	36.5	35.6	34.7	30.6	33.1	36.6	39.5	44.8	46.0	37
5	39.9	26.0	33.9	38.8	33.4	31.2	31.8	0.0	25.7	25.4	26.5	38.2	39.8	33.
6	40.0	40.5	39.7	39.8	46.8	46.8	43.3	50.7	45.3	50.9	52.4	53.7	54.2	46
7	40.0	36.2	38.7	39.9	41.9	41.7	39.7	44.9	41.6	45.8	48.5	51.7	52.6	43.
8	40.0	30.4	33.9	38.7	34.7	34.1	33.4	30.3	32.9	34.4	35.6	43.6	45.3	39.
9	39.9	37.2	39.4	39.9	41.7	41.6	40.2	44.5	41.1	44.5	46.1	51.4	52.3	46.
10	39.9	34.0	37.7	39.6	39.3	38.9	37.7	38.9	37.9	41.7	42.5	48.9	50.0	43.
11	40.0	26.1	32.8	39.2	32.6	30.8	30.8	0.0	26.6	25.9	26.9	38.6	40.5	34.
12	39.9	34.1	37.6	39.7	38.7	38.3	37.5	38.7	36.9	40.5	40.5	49.0	50.3	38.
MEAN LEVEL	40.0	33.4	36.8	39.4	39.0	38.3	37.1	32.7	36.4	39.3	40.7	47.0	48.2	
RANGE	.1	14.6	6.9	1.2	14.8	16.5	12.8	50.7	19.6	25.5	25.9	15.5	14.4	
SD,N-1	.03	5.03	2.54	.45	5.01	5.62	4.32	17.68	6.63	8.61	8.89	5.46	5.00	
MEAN DIFF	-.8	-7.3	-3.9	-1.3	-1.7	-2.4	-3.6	-8.0	-4.3	-1.5	-.1	6.3	7.5	
RANGE	12.5	4.6	7.0	11.6	5.7	6.4	4.8	39.2	7.2	13.5	14.0	6.6	6.1	
SD,N-1	4.55	1.61	2.42	4.21	2.16	2.27	1.64	13.66	2.62	4.59	4.91	2.03	1.81	

YANIV (ELCHA) 11 NOISES AT 50 DB SPL NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E≠	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKOF	
1	50.0	41.7	46.2	49.2	46.2	45.4	45.6	51.2	47.3	50.0	50.7	58.1	59.4	5
2	49.9	50.6	49.7	49.7	57.4	57.3	53.6	61.3	54.3	61.0	62.8	64.2	64.7	5
4	50.0	40.8	45.3	49.0	46.5	45.6	44.7	52.1	46.4	50.7	53.5	58.7	59.7	5
5	49.9	36.1	43.9	48.8	43.5	41.4	41.9	44.4	41.5	44.1	45.2	53.4	54.7	4
6	50.0	50.5	49.7	49.8	56.8	56.8	53.3	62.0	55.0	61.6	63.1	65.2	65.7	5
7	50.0	46.2	48.7	49.9	51.9	51.7	49.7	58.7	52.5	57.4	60.2	63.8	64.6	5
8	50.0	40.4	43.9	48.7	44.7	44.2	43.5	50.8	45.9	48.5	49.8	58.0	59.3	5
9	49.9	47.2	49.4	49.9	51.7	51.6	50.2	58.2	52.7	56.2	57.8	63.2	64.1	5
10	49.9	44.0	47.7	49.6	49.3	48.9	47.7	55.7	50.1	54.5	55.2	61.7	62.6	5
11	50.0	36.1	42.8	49.2	42.7	40.9	40.9	44.0	41.5	43.9	44.8	54.5	55.8	4
12	49.9	44.1	47.6	49.7	48.7	48.3	47.5	55.2	49.7	53.6	53.6	61.9	63.0	5
MEAN LEVEL	50.0	43.4	46.8	49.4	49.0	48.4	47.1	54.0	48.8	52.9	54.2	60.3	61.2	
RANGE	.1	14.5	6.9	1.2	14.7	16.4	12.7	18.0	13.5	17.7	18.3	11.8	11.0	
SD,N-1	.03	5.02	2.54	.45	4.99	5.58	4.30	6.12	4.72	6.06	6.36	3.98	3.72	
MEAN DIFF	-3.8	-10.3	-6.9	-4.3	-4.7	-5.4	-6.6	.2	-4.9	-.9	.5	6.5	7.5	
RANGE	10.4	6.6	5.7	9.5	8.1	8.4	5.9	8.8	4.3	8.6	9.5	3.0	3.1	
SD,N-1	3.84	2.02	1.67	3.44	2.40	2.66	1.69	2.71	1.47	2.72	3.19	.85	.81	

YANIV (ELCHA) 11 NOISES AT 60 DB SPL NBS + STATS 3-15-77

NO.	O-A	A	B	C	D1	D2	E*	MK6	MK7	PNL	PNLC	ZWCKFF	ZWCKDF	I
1	60.0	51.7	56.2	59.2	56.2	55.4	55.6	64.2	57.7	61.7	62.4	69.5	70.6	6
2	59.9	60.6	59.7	59.7	67.4	67.3	63.6	71.0	63.0	71.4	73.1	74.4	74.8	6
4	60.0	50.8	55.3	59.0	56.5	55.6	54.7	64.5	57.5	62.3	65.1	70.1	70.9	6
5	59.9	46.1	53.9	58.8	53.5	51.4	51.9	60.9	53.3	57.6	58.7	65.9	66.9	6
6	60.0	60.5	59.7	59.8	66.8	66.8	63.3	71.6	63.7	71.9	73.4	75.4	75.8	6
7	60.0	56.2	58.7	59.9	61.9	61.7	59.7	68.8	61.5	68.0	70.7	74.3	75.0	6
8	60.0	50.4	53.9	58.7	54.7	54.2	53.5	64.1	56.7	60.6	61.8	69.6	70.7	6
9	59.9	57.2	59.4	59.9	61.7	61.6	60.2	68.2	61.7	66.8	68.4	73.6	74.4	6
10	59.9	54.0	57.7	59.6	59.3	58.9	57.7	67.0	60.1	65.4	66.2	72.5	73.3	6
11	60.0	46.1	52.8	59.2	52.7	50.9	50.9	60.3	53.3	56.8	57.8	67.1	68.2	5
12	59.9	54.1	57.6	59.7	58.7	58.3	57.5	67.0	60.0	64.7	64.7	72.8	73.7	6
MEAN LEVEL	60.0	53.4	56.8	59.4	59.0	58.4	57.1	66.1	59.0	64.3	65.7	71.4	72.2	
RANGE	.1	14.5	6.9	1.2	14.7	16.4	12.7	11.3	10.4	15.1	15.6	9.5	8.9	
SD,N-1	.03	5.02	2.54	.45	4.99	5.58	4.30	3.72	3.57	5.04	5.35	3.13	2.95	
MEAN DIFF	-5.3	-11.8	-8.4	-5.8	-6.2	-6.8	-8.1	.9	-6.3	-.9	.4	6.2	7.0	
RANGE	9.2	8.5	4.2	8.7	9.6	9.9	7.4	5.5	4.4	7.8	8.4	4.3	4.4	
SD,N-1	3.13	2.64	1.18	2.77	2.89	3.29	2.08	1.66	1.39	2.69	3.13	1.41	1.38	


JAHN K11 THIRD ØCTAVE
Machine Noise
SPL (DB)
0.00
10.00
20.00
30.00
40.00
50.00
60.00
70.00
80.00
90.00
100.00
FREQ. (HZ)
10^1
10^2
10^3
10^4
10^5

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	58.5	67.5JAH30C 1
63.0	65.0	61.0	59.5	64.0	58.5	62.5	56.5	59.0	57.0	58.5	61.0JAH30C 1
63.5	62.5	57.5	54.5	55.0	52.0	49.5	0.0	0.0	0.0		JAH30C 1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	29.5	44.5	50.5JAH30C 2
54.0	51.5	57.0	59.5	64.5	61.0	63.0	65.0	66.5	65.5	61.5	62.0JAH30C 2
63.5	59.0	56.5	56.0	54.5	52.0	46.5	0.0	0.0	0.0		JAH30C 2
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	46.0	52.0JAH30C 3
57.5	60.5	59.0	58.0	58.0	60.5	58.0	60.0	62.0	62.0	61.5	63.0JAH30C 3
64.0	62.5	61.0	63.5	60.0	58.0	61.0	0.0	0.0	0.0		JAH30C 3
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	47.0	59.5JAH30C 4
59.5	62.0	61.5	64.5	66.5	65.5	64.5	60.5	61.5	60.0	56.5	59.5JAH30C 4
62.5	59.5	53.5	50.5	50.5	47.5	46.5	0.0	0.0	0.0		JAH30C 4
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.5	57.5	66.5JAH30C 5
61.5	58.5	69.5	62.0	55.0	56.0	58.0	54.0	57.5	63.0	58.5	59.0JAH30C 5
61.5	53.5	57.5	52.0	51.5	51.5	49.0	0.0	0.0	0.0		JAH30C 5
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	42.0	48.5JAH30C 6
51.0	56.0	59.0	59.0	59.5	59.5	60.0	60.0	63.0	64.0	63.0	63.0JAH30C 6
66.0	64.0	62.5	61.5	60.0	59.0	57.5	0.0	0.0	0.0		JAH30C 6
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	34.0	50.5	54.5JAH30C 7
58.0	56.5	70.5	60.5	59.0	60.0	59.0	56.0	60.0	59.0	57.5	58.0JAH30C 7
66.5	55.5	51.0	53.0	44.5	40.0	34.0	0.0	0.0	0.0		JAH30C 7
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	35.0	48.0	60.0JAH30C 8
61.0	68.0	67.5	63.5	65.5	63.5	61.0	57.5	58.5	59.5	56.0	56.5JAH30C 8
57.5	54.0	48.5	45.5	44.0	40.0	37.0	0.0	0.0	0.0		JAH30C 8
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	31.0	41.0	51.5JAH30C 9
54.5	56.5	56.0	60.0	62.5	63.0	64.0	60.0	62.5	63.5	62.5	63.5JAH30C 9
63.0	58.0	55.0	52.0	52.0	49.0	43.0	0.0	0.0	0.0		JAH30C 9
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	58.0	48.0JAH30C10
57.0	63.0	60.5	59.0	57.5	62.5	62.0	60.5	62.5	65.0	62.5	63.0JAH30C10
65.5	61.5	59.0	54.0	53.5	51.0	47.0	0.0	0.0	0.0		JAH30C10

JAHN

TECHNICAL REPORT DATA
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1. REPORT NO. EPA 550-9-77-101	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Comarison of Various Methods for Predicting the Loudness and Acceptability of Noise.		5. REPORT DATE August 1977
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) B. Scharf, R. Hellman, J. Bauer		8. PERFORMING ORGANIZATION REPORT NO.
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16. ABSTRACT

The objective of this investigation was to compare commonly employed frequency weightings and calculation rating schemes with respect to their ability to predict the subjective effect of sound. This report presents the results of a detailed examination of 23 studies in which listeners judged either the loudness or acceptability of sound. These studies included data available from both the laboratory and the field, and encompassed a wide variety of natural and simulated noise stimuli. The following parameters were examined: (1) subjective attribute judged, (2) type of noise, (3) presence or absence of tonal components, (4) mode of sound presentation, and (5) effect of sound pressure level on observed discrepancies between measurements and predictions. Included in this analysis are computations of absolute mean differences between subjectively equal sounds, mean differences between calculated and measured levels, and standard deviations for each frequency-weighting and calculation system.

Among the overall findings were that:

a. the standard deviations produced by the A, D1, D2, and E frequency weighting schemes are significantly smaller than the standard deviations produced by the B and C weightings.

(Continued)

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Noise, Annoyance, Loudness, Subjective Response, Noise Ratings		

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(Continued)

b. the standard deviations produced by the D1 and E weightings are not significantly different from each other but are significantly smaller than that produced by the A weighting.

c. the D2 weighting does not appear to be significantly better than either the D1 or E weightings, nor is it statistically different from the A weighting.

d. only the Mark VI and Mark VII calculation systems show significantly smaller standard deviations than the D1 and E weightings, although the Mark VI, Mark VII, PNL, and Zwicker systems all exhibit significantly smaller standard deviations than the A, B, and C weightings.

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