Comparative Annoyance of "Approaching" versus "Receding" Sound Sources

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Citation: The Journal of the Acoustical Society of America **45**, 330 (1969); doi: 10.1121/1.1971992
View online: https://doi.org/10.1121/1.1971992
View Table of Contents: https://asa.scitation.org/toc/jas/45/1
Published by the Acoustical Society of America

or 4000-Hz tone. Tone-to-noise ratios measured 25, 10, and 5 dB in ⅓-oct bands. All stimuli were of triangular time patterns and included durations of 4, 12, and 32 sec. Tests were also conducted to investigate the effect of varying the time at which the level of the tone reached its maximum value relative to the time at which the level of the broadband noise reached its maximum value. Various measures were employed in the analysis of the judgment results; these included the over-all sound-pressure level (SPL), *A*-weighted SPL, *N*-weighted SPL, and perceived noise level with and without tone and duration corrections. The results of the tests indicate that the perceived noise level with tone and duration corrections provides better agreement with subjective judgments of acceptability than do the other measures that were investigated. [This work was supported by the National Aeronautics and Space Administration.]

2:45

X2. Laboratory Facility for Annoyance Rating Studies. FRANKLIN D. HART, *Department of Mechanical and Aerospace Engineering* AND RICHARD G. PEARSON (nonmember), *Departments of Industrial Engineering and Psychology, North Carolina State University, Raleigh, North Carolina 27607.*—A study relating the individual characteristics of people and their subjective evaluation of annoyance to different noise stimuli is described. Particular attention is given to a description of the environmental facility and the speaker system that was designed and constructed for purposes of the study. The results of a series of pilot studies to establish a rating scale and suitable exposure levels are presented. PNdB levels are compared with the mean annoyance ratings obtained in the facility based on data from 166 test subjects. The tests were conducted under two room conditions that are categorized as acoustically soft and acoustically hard. Results show that the effect of environmental condition on individual annoyance ratings was small in comparison to the frequency characteristics of the noise stimuli. [This work is sponsored by NASA, Langley Research Center.]

3:00

X3. Comparative Annoyance of "Approaching" versus "Receding" Sound Sources. CHARLES W. NIXON AND H. E. VON GIERKE, *Aerospace Medical Research Laboratories, Wright-Patterson Air Force Base, Ohio* AND GEORGE ROSINGER (nonmember), *Battelle Memorial Institute, Columbus, Ohio.*—Sound sources that continuously increase in frequency and/or intensity over a period of several seconds may be perceived by observers as approaching entities, whereas the converse is true for sources with decreasing signal characteristics. The comparative annoyance of such sounds signaling "approaching" and "receding" sources was evaluated by means of paired-comparison judgments of several signals of 15 sec duration that continuously varied in both frequency (from 600 to 1200 or 1200 to 600 Hz) and intensity (from 70 to 100 or 100 to 70 dB). Findings clearly demonstrate that signals characterized as approaching entities were judged more annoying than all other signals assuming constant average intensity and frequency content over the signal duration. Increasing intensity influenced judgments of annoyance to a greater extent than did frequency changes. Rank order or annoyance corresponded to the hypothesis that the "approaching" characteristics of a sound source contribute significantly to its judged annoyance. The importance of these findings for the evaluation of aircraft flyover noises is discussed.

3:15

X4. On Estimating Noisiness of Aircraft Sounds. ROBERT W. YOUNG, *Naval Undersea Warfare Center, San Diego, California 92132* AND ARNOLD PETERSON, *General Radio Company, West Concord, Massachusetts 01781.*—Published results of judgment tests that have been cited [K. D. Kryter, J. Acoust. Soc. Amer. 43, 344–361 (1968)] in support of calculated perceived noise level as the most accurate predictor of the "noisiness" of aircraft noise have been reanalyzed with small corrections known to be appropriate for the measuring instruments used. Application of standard statistical procedures indicates that the minor differences among *A*-weighted sound level, calculated loudness level, calculated perceived noise level, and *D*- (formerly *N*-) weighted level, in their correlation with judged noisiness, are not statistically significant. Only the *B* and *C* levels are clearly inferior as predictors of noisiness.

3:30

X5. Noise, You Get Used to It. J. C. WEBSTER, *Naval Electronics Laboratory Center* AND M. LEPOR, *Naval Undersea Warfare Center San Diego, California.*—On the basis of several Laboratory studies, noise levels of 64 dB SIL (based on the octaves centered at 500, 1000, and 2000 Hz), or 71 dBA, were proposed as the criteria levels for acceptable voice communications. Two validation surveys were undertaken where ambient-noise levels were measured and subjective questionnaires were completed in various ship's spaces. When asked to rate a space along a five-point scale of noisiness (VERY QUIET, QUIET, MODERATELY NOISY, VERY NOISY, and INTOLERABLY NOISY), responses tended to center on MODERATELY NOISY regardless of objective noise level (SIL, LA, PNL, LC, LL), confirming the remark, "You get used to it." When asked to give binary judgments on whether (1) normal speech was affected, (2) work was affected, (3) the space was acceptable, or (4) the environment was loud (and/or noisy, and/or annoying), *vice* very loud (and/or very noisy, and/or very annoying), the following results were obtained: 80% thought that neither speech nor work was affected (and the space was acceptable) at an SIL of 67 dB (68 dB) or 73 dBA (74 dBA); 20% would accept higher noise levels, but 20% also said levels this high did affect speech and work and made the space "uncomfortable" and the noise "loud."

3:45

X6. Adaption of Current Auditory Damage-Risk Criteria for use in Aerospace Operations. DONALD C. GASAWAY, AND HARRELL C. SUTHERLAND (nonmember), *USAF School of Aerospace Medicine, Brooks Air Force Base, Texas 78235.*—The need for valid and realistic auditory-risk criteria for use in identifying and determining potentially hazardous noise encountered during ground and airborne areospace operations is discussed. The noises encountered during military operations are multifarious and complex. The set of criteria proposed by Working Group 46 of the National Research Council's Committee on Hearing, Bioacoustics and Biomechanics has been modified so that the criteria used in assessing wide-band and narrow-band continuous and intermittent-type noise can be more easily accomplished. The authors have devised an auditory-risk calculator that facilitates and simplifies the task of assessing wide-band and narrow-band noise exposures. In addition, a simple chart has been prepared for use in evaluating intermittent-type noises. Examples of noise exposures encountered in ground and airborne aerospace operations are illustrated, and applications of the three basic types of auditory risk criteria are demonstrated. Desirable and undersirable features of older and newer types of criteria are discussed. The spectrum of criteria is reviewed and specific features of auditory risk criteria required in aerospace operations are identified and discussed.

4:00

X7. Characteristics of Noise Generated by Secondary and Auxiliary Aircraft Systems. DONALD C. GASAWAY,